

DEPARTMENT OF VETERANS AFFAIRS
JOHN D. DINGELL MEDICAL CENTER
DETROIT, MICHIGAN

**EMERGENCY ROOM
EXPANSION
Vol. 1 – Divisions 0 thru 14**

VA Project No.: 553-303a
C2AE Project No.: 11-0049

100% BID DOCUMENTS

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March 28, 2014

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SECTION 01 00 00 - GENERAL REQUIREMENTS

1.1 GENERAL INTENTION

- A. Contractor shall completely prepare site for building operations, including demolition and removal of existing structures, and furnish labor and materials and perform work for John D. Dingell VAMC Emergency Room Expansion as required by drawings and specifications.
- B. Offices of C2AE, 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.
- C. Before placement and installation of work subject to tests by testing laboratory retained by Department of Veterans Affairs, the Contractor shall notify the COR in sufficient time to enable testing laboratory personnel to be present at the site in time for proper taking and testing of specimens and field inspection. Such prior notice shall be not less than three work days unless otherwise designated by the COR.
- D. All employees of general contractor and subcontractors shall comply with VA security management program and obtain permission of the VA police, be identified by project and employer, and restricted from unauthorized access.
- E. Prior to commencing work, general contractor shall provide proof that a OSHA 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.
 - 1. Training:
 - a. 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.
 - b. Superintendents of the general contractor shall have the 30-hour OSHA certified Construction Safety course and /or other relevant competency training, as determined by VA CP with input from the ICRA team.
 - c. Submit training records of all such employees for approval before the start of work.

1.2 STATEMENT OF BID ITEM(S)

- A. BID ITEM 1, BASE BID: Furnish all labor, material, equipment, and supervision to construct the Emergency Department addition and renovations of the existing building as shown on the construction documents.
 - 1. Estimated Completion Time: 545 calendar days from receipt of Notice to Proceed.
- B. BID ITEM 2, DEDUCTIVE ALTERNATE NO. 1: Delete all labor, material, equipment, and supervision to delete the Emergency Department entrance vestibule and canopy as shown on the construction documents.
 - 1. Estimated Completion Time: 515 calendar days from receipt of Notice to Proceed.
- C. BID ITEM 3, DEDUCTIVE ALTERNATE NO. 2: Delete all labor, material, equipment, and supervision to renovate the Registration area as shown on the construction documents.
 - 1. Estimated Completion Time: 400 calendar days from receipt of Notice to Proceed.
- D. If bid deductive is retained: A single award will be made on Item No. 1, but in the event the offer exceeds the funds available, a single award will be made on Item No. 2, in that order, based on available funding. Offerors should quote a price on each item listed.

1.3 SOLE SOURCE ITEMS

- A. The Government has approved the use of the following sole source items. Contractor is to provide the items specified. No substitutions are permitted. Additional items may be listed in individual sections within the specifications.
 - 1. Section 08 71 00 – Door Hardware (lock and latchsets): Yale.
 - 2. Section 14 92 00 – Pneumatic Tube System: Swisslog.
 - 3. Section 22 62 00 – Vacuum Systems: Chemtron.
 - 4. Section 22 63 00 – Medical Gas Systems: Chemtron.
 - 5. Section 23 09 23 – Direct-Digital Control System for HVAC: Siemens.
 - 6. Section 26 22 00 – Dry-Type Transformers: Siemens.
 - 7. Section 26 24 11 – Distribution Switchboards: Siemens.
 - 8. Section 26 24 16 – Electrical Panelboards: Siemens.
 - 9. Section 26 24 19 – Motor Control Centers: Siemens.
 - 10. Section 26 29 11 – Low-Voltage Motor Starters: Siemens.
 - 11. Section 26 29 21 – Low-Voltage Disconnect Switches: Siemens.
 - 12. Section 26 36 23 – Automatic Transfer Switches: ASCO Power Technologies.
 - 13. Section 26 43 13 – Transient-Voltage Surge Suppression: Siemens.

14. Section 27 52 23– Nurse Call and Code Blue Systems: Rauland-Borg.
15. Section 28 31 00 – Fire Detection and Alarm: Simplex Grinnell.

1.4 SPECIFICATIONS AND DRAWINGS FOR CONTRACTOR

- A. Copies of the construction documents may be made by the Contractor, at Contractor's expense from electronic files.

1.5 CONSTRUCTION SECURITY REQUIREMENTS

- A. Security Plan:
 1. The security plan defines both physical and administrative security procedures that will remain effective for the entire duration of the project.
 2. The General Contractor is responsible for assuring that all sub-contractors working on the project and their employees also comply with these regulations.
- B. Security Procedures:
 1. General Contractor's employees shall not enter the project site without appropriate badge. They may also be subject to inspection of their personal effects when entering or leaving the project site.
 2. For working outside the "regular hours" (7:00 am – 4:00 pm) 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 COR or 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. Guards:
 1. The General Contractor shall provide unarmed guards at the project site after construction hours.
 2. The guard shall have communication devices to report events as directed by VA police.
- D. Key Control:
 1. The General Contractor shall provide duplicate keys and lock combinations to the COR for the purpose of security inspections of every area of project including tool boxes and parked machines and take any emergency action.

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

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".
 - a. Sensitive Information: VA sensitive information is all Department data, on any storage media or in any form or format, which requires protection due to the risk of harm that could result from inadvertent or deliberate disclosure, alteration, or destruction of the information. The term includes information whose improper use or disclosure could adversely affect the ability of an agency to accomplish its mission, proprietary information, records about individuals requiring protection under various confidentiality provisions such as the Privacy Act and the HIPAA Privacy rule, and information that can be withheld under the Freedom of Information Act. Examples of VA sensitive information include the following: individually-identifiable medical, benefits, and personnel information; financial, budgetary, research, quality assurance; confidential commercial, critical infrastructure, investigatory, and law enforcement information; information that is confidential and privileged in litigation such as information protected by the deliberative process privilege, attorney work-product privilege, and the attorney client privilege; and other information which, if released, could result in violation of law or harm or unfairness to any individual or group, or could adversely affect the national interest or the conduct of federal programs.
2. The General Contractor is responsible for safekeeping of all drawings, project manual and other project information. This information shall be shared only with those with a specific need to accomplish the project.
3. Certain documents, sketches, videos or photographs and drawings shall be marked "Law Enforcement Sensitive" or "Sensitive Unclassified". Secure such information in separate containers and limit the access to only those who will need it for the project. Return the information to the Contracting Officer upon request.
4. These security documents shall not be removed or transmitted from the project site without the written approval of Contracting Officer.
5. All paper waste or electronic media such as CD's and diskettes shall be shredded and destroyed.
6. Notify Contracting Officer and Site Security Officer immediately when there is a loss or compromise of "sensitive information".

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

F. Motor Vehicle Restrictions:

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

1.6 FIRE SAFETY

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

1. American Society for Testing and Materials (ASTM):
E84-2009 Surface Burning Characteristics of Building Materials
2. National Fire Protection Association (NFPA):
10-2010 Standard for Portable Fire Extinguishers
30-2008 Flammable and Combustible Liquids Code
51B-2009 Standard for Fire Prevention During Welding, Cutting and
Other Hot Work
70-2011 National Electrical Code
241-2009 Standard for Safeguarding Construction, Alteration, and
Demolition Operations
3. Occupational Safety and Health Administration (OSHA):
29 CFR 1926 Safety and Health Regulations for Construction

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- B. Fire Safety Plan: Establish and maintain a fire protection program in accordance with 29 CFR 1926. Prior to start of work, prepare a plan detailing project-specific fire safety measures, including periodic status reports, and submit to COR and Facility Safety Manager 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, and use of VAMC equipment. Documentation shall be provided to the COR that individuals have undergone contractor's safety briefing.
- C. Site and Building Access: Maintain free and unobstructed access to facility emergency services and for fire, police and other emergency response forces in accordance with NFPA 241.
- D. Separate temporary facilities, such as trailers, storage sheds, and dumpsters, from existing buildings and new construction by distances in accordance with NFPA 241. For small facilities with less than 6 m (20 feet) exposing overall length, separate by 3m (10 feet).
- E. Temporary Construction Partitions:
1. Install and maintain temporary construction partitions to provide smoke-tight separations between construction areas and 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, 3/4-hour fire/smoke rated doors with self-closing devices.
 2. Install one-hour fire-rated 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 COR and Facility Safety Manager.

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- H. Egress Routes for Construction Workers: Maintain free and unobstructed egress. Inspect daily. Report findings and corrective actions weekly to COR and Facility Safety Manager.
 - 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. Do not charge wet standpipes subject to freezing until weather protected.
 - L. Sprinklers: Install, test and activate new automatic sprinklers prior to removing existing sprinklers.
 - M. Existing Fire Protection: Do not impair automatic sprinklers, smoke and heat detection, and fire alarm systems, except for portions immediately under construction, and temporarily for connections. Provide fire watch for impairments more than 4 hours in a 24-hour period. Request interruptions in accordance with Article, OPERATIONS AND STORAGE AREAS, and coordinate with COR and Facility Safety Manager. All existing or temporary fire protection systems (fire alarms, sprinklers) located in construction areas shall be tested as coordinated with the medical center. Parameters for the testing and results of any tests performed shall be recorded by the medical center and copies provided to the COR.
 - N. Smoke Detectors: Prevent accidental operation. Remove temporary covers at end of work operations each day. Coordinate with COR and Facility Safety Manager.
 - O. Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with COR and Facility Safety Manager. Obtain permits from facility Safety Manager at least 48 hours in advance.
 - P. Fire Hazard Prevention and Safety Inspections: Inspect entire construction areas weekly. Coordinate with, and report findings and corrective actions weekly to COR and Facility Safety Manager.
 - Q. Smoking: Smoking is prohibited in and adjacent to construction areas inside existing buildings and additions under construction. In separate and detached buildings under construction, smoking is prohibited except in designated smoking rest areas.
 - R. Dispose of waste and debris in accordance with NFPA 241. Remove from buildings daily.
 - S. Perform other construction, alteration and demolition operations in accordance with 29 CFR 1926.

- T. If required, submit documentation to the COR that personnel have been trained in the fire safety aspects of working in areas with impaired structural or compartmentalization features.
- U. Equipment Fueling: Aboveground storage tanks (AST) containing flammable or combustible liquids are not permitted within the construction site. Contractor will refuel heavy equipment off-site since AST fuel tank is prohibited by regulations and there is not sufficient room on-site to perform a direct fuel transfer from a tanker truck into heavy equipment.

1.7 OPERATIONS AND STORAGE AREAS

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

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- G. Execute work so as to interfere as little as possible with normal functioning of Medical Center as a whole, including operations of utility services, fire protection systems and any existing equipment, and with work being done by others. Use of equipment and tools that transmit vibrations and noises through the building structure, are not permitted in buildings that are occupied, during construction, jointly by patients or medical personnel, and Contractor's personnel, except as permitted by COR where required by limited working space.
1. Do not store materials and equipment in other than assigned areas.
 2. Schedule delivery of materials and equipment to immediate construction working areas within buildings in use by Department of Veterans Affairs in quantities sufficient for not more than two work days. Provide unobstructed access to Medical Center areas required to remain in operation.
 3. Where access by Medical Center personnel to vacated portions of buildings is not required, storage of Contractor's materials and equipment will be permitted subject to fire and safety requirements.
- H. Utilities Services: Where necessary to cut existing pipes, electrical wires, conduits, and cables of utility services, or of fire protection systems or communications systems (except telephone), they shall be cut and capped at suitable places where shown; or, in absence of such indication, where directed by COR. All such actions shall be coordinated with the Utility Company involved:
1. Whenever it is required that a connection fee be paid to a public utility provider for new permanent service to the construction project, for such items as water, sewer, electricity, gas or steam, payment of such fee shall be the responsibility of the Government and not the Contractor.
- I. Phasing: To insure such executions, Contractor shall furnish the COR with a schedule of approximate phasing dates on which the Contractor intends to accomplish work in each specific area of site, building or portion thereof. In addition, Contractor shall notify the COR two weeks in advance of the proposed date of starting work in each specific area of site, building or portion thereof. Arrange such phasing dates to insure accomplishment of this work in successive phases mutually agreeable to Medical Center Director, COR and Contractor. Details of phasing are shown on the Phasing Plans on Sheet G-200 of the drawings.
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.

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2. Immediate areas of alterations not mentioned in preceding Subparagraph 1 will be temporarily vacated while alterations are performed.
- 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 COR.
- 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 Fire Department or Company (Department of Veterans Affairs or municipal) whichever will be required to respond to an alarm from Contractor's employee or watchman.
- 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, and cables of utility services or of fire protection systems and communications systems (including telephone), they shall be cut and capped at suitable places where shown; or, in absence of such indication, where directed by COR.
1. No utility service such as water, gas, steam, sewers or electricity, or fire protection systems and communications systems may be interrupted without prior approval of COR. Electrical work shall be accomplished with all affected circuits or equipment de-energized. When an electrical outage cannot be accomplished, work on any energized circuits or equipment shall not commence without the Medical Center Director's prior knowledge and written approval. Refer to specification Sections 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, 27 05 11 REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS and 28 05 11, REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY INSTALLATIONS for additional requirements.
 2. Contractor shall submit a request to interrupt any such services to COR, in writing, 48 hours in advance of proposed interruption. Request shall state reason, date, exact time of, and approximate duration of such interruption.
 3. Contractor will be advised (in writing) of approval of request, or of which other date and/or time such interruption will cause least inconvenience to operations of Medical Center. Interruption time approved by Medical Center may occur at other than Contractor's normal working hours.

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4. Major interruptions of any system must be requested, in writing, at least 15 calendar days prior to the desired time and shall be performed as directed by the COR.
 5. In case of a contract construction emergency, service will be interrupted on approval of COR. Such approval will be confirmed in writing as soon as practical.
 6. Whenever it is required that a connection fee be paid to a public utility provider for new permanent service to the construction project, for such items as water, sewer, electricity, gas or steam, payment of such fee shall be the responsibility of the Government and not the Contractor.
- 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.
- 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 COR.
- O. Coordinate the work for this contract with other construction operations as directed by COR. This includes the scheduling of traffic and the use of roadways, as specified in Article, USE OF ROADWAYS.

1.8 ALTERATIONS

- A. Survey: Before any work is started, the Contractor shall make a thorough survey with the COR areas of buildings in which alterations occur and areas which are anticipated routes of access, and furnish a report, signed by both, to the Contracting Officer. This report shall list by rooms and spaces:
1. Existing condition and types of resilient flooring, doors, windows, walls and other surfaces not required to be altered throughout affected areas of building.
 2. Existence and conditions of items such as plumbing fixtures and accessories, electrical fixtures, equipment, venetian blinds, and shades required by drawings to be either reused or relocated, or both.
 3. Shall note any discrepancies between drawings and existing conditions at site.

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4. Shall designate areas for working space, materials storage and routes of access to areas within buildings where alterations occur and which have been agreed upon by Contractor and COR.
 - B. Any items required by drawings to be either reused or relocated or both, found during this survey to be nonexistent, or in opinion of COR to be in such condition that their use is impossible or impractical, shall be furnished and/or replaced by Contractor with new items in accordance with specifications which will be furnished by Government. Provided the contract work is changed by reason of this subparagraph B, the contract will be modified accordingly, under provisions of clause entitled "DIFFERING SITE CONDITIONS" (FAR 52.236-2) and "CHANGES" (FAR 52.243-4 and VAAR 852.236-88).
 - C. Re-Survey: Thirty days before expected partial or final inspection date, the Contractor and COR together shall make a thorough re-survey of the areas of buildings involved. They shall furnish a report on conditions then existing, of resilient flooring, doors, windows, walls and other surfaces as compared with conditions of same as noted in first condition survey report:
 1. Re-survey report shall also list any damage caused by Contractor to such flooring and other surfaces, despite protection measures; and, will form basis for determining extent of repair work required of Contractor to restore damage caused by Contractor's workmen in executing work of this contract.
 - D. Protection: Provide the following protective measures:
 1. Wherever existing roof surfaces are disturbed they shall be protected against water infiltration. In case of leaks, they shall be repaired immediately upon discovery.
 2. Temporary protection against damage for portions of existing structures and grounds where work is to be done, materials handled and equipment moved and/or relocated.
 3. Protection of interior of existing structures at all times, from damage, dust and weather inclemency. Wherever work is performed, floor surfaces that are to remain in place shall be adequately protected prior to starting work, and this protection shall be maintained intact until all work in the area is completed.

1.9 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.

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- B. Establish and maintain a dust control program as part of the contractor's infection preventive measures in accordance with the guidelines provided by ICRA Group. Prior to start of work, prepare a plan detailing project-specific dust protection measures, including periodic status reports, and submit to COR and Facility ICRA team for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
1. All personnel involved in the construction or renovation activity shall be educated and trained in infection prevention measures established by the medical center.
- C. Medical Center Infection Control personnel shall monitor for airborne disease (e.g. aspergillosis) as appropriate during construction. A baseline of conditions may be established by the medical center prior to the start of work and periodically during the construction stage to determine impact of construction activities on indoor air quality. In addition:
1. The COR and VAMC Infection Control personnel shall review pressure differential monitoring documentation to verify that pressure differentials in the construction zone and in the patient-care rooms are appropriate for their settings. The requirement for negative air pressure in the construction zone shall depend on the location and type of activity. Upon notification, the contractor shall implement corrective measures to restore proper pressure differentials as needed.
 2. In case of any problem, the medical center, along with assistance from the contractor, shall conduct an environmental assessment to find and eliminate the source.
- D. In general, following preventive measures shall be adopted during construction to keep down dust and prevent mold.
1. Dampen debris to keep down dust and provide temporary construction partitions in existing structures where directed by COR. Blank off ducts and diffusers to prevent circulation of dust into occupied areas during construction.
 2. Do not perform dust producing tasks within occupied areas without the approval of the COR. For construction in any areas that will remain jointly occupied by the medical Center and Contractor's workers, the Contractor shall:
 - a. Provide dust proof one-hour fire-rated temporary drywall construction barriers to completely separate construction from the operational areas of the hospital in order to contain dirt debris and dust. Barriers shall be sealed and made presentable on hospital occupied side. Install a self-closing rated door in a metal frame, commensurate with the partition, to allow worker access. Maintain negative air at all times. A fire retardant polystyrene, 6-mil thick or greater plastic barrier meeting local fire codes may be used where dust control is the only hazard, and an agreement is reached with the COR and Medical Center.

- b. HEPA filtration is required where the exhaust dust may reenter the breathing zone. Contractor shall verify that construction exhaust to exterior is not reintroduced to the medical center through intake vents, or building openings. Install HEPA (High Efficiency Particulate Accumulator) filter vacuum system rated at 95% capture of 0.3 microns including pollen, mold spores and dust particles. Insure continuous negative air pressures occurring within the work area. HEPA filters should have ASHRAE 85 or other prefilter to extend the useful life of the HEPA. Provide both primary and secondary filtrations units. Exhaust hoses shall be heavy duty, flexible steel reinforced and exhausted so that dust is not reintroduced to the medical center.
- c. Adhesive Walk-off/Carpet Walk-off Mats, minimum 600mm x 900mm (24" x 36"), shall be used at all interior transitions from the construction area to occupied medical center area. These mats shall be changed as often as required to maintain clean work areas directly outside construction area at all times.
- d. Vacuum and wet mop all transition areas from construction to the occupied medical center at the end of each workday. Vacuum shall utilize HEPA filtration. Maintain surrounding area frequently. Remove debris as they are created. Transport these outside the construction area in containers with tightly fitting lids.
- e. The contractor shall not haul debris through patient-care areas without prior approval of the COR and the Medical Center. When, approved, debris shall be hauled in enclosed dust proof containers or wrapped in plastic and sealed with duct tape. No sharp objects should be allowed to cut through the plastic. Wipe down the exterior of the containers with a damp rag to remove dust. All equipment, tools, and materials transported through occupied areas shall be made free from dust and moisture by vacuuming and wipe down.
- f. Using a HEPA vacuum, clean inside the barrier and vacuum ceiling tile prior to replacement. Any ceiling access panels opened for investigation beyond sealed areas shall be sealed immediately when unattended.
- g. 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.
- h. At completion, remove construction barriers and ceiling protection carefully, outside of normal work hours. Vacuum and clean all surfaces free of dust after the removal.

E. Final Cleanup:

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

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

1.10 DISPOSAL AND RETENTION

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

1. Reserved items which are to remain property of the Government are noted on drawings or in specifications as items to be stored. Items that remain property of the Government shall be removed or dislodged from present locations in such a manner as to prevent damage which would be detrimental to re-installation and reuse. Store such items where directed by COR.
2. Items not reserved shall become property of the Contractor and be removed by Contractor from Medical Center.
3. Items of portable equipment and furnishings located in rooms and spaces in which work is to be done under this contract shall remain the property of the Government. When rooms and spaces are vacated by the Department of Veterans Affairs during the alteration period, such items which are NOT required by drawings and specifications to be either relocated or reused will be removed by the Government in advance of work to avoid interfering with Contractor's operation.
4. PCB Transformers and Capacitors: The Contractor shall be responsible for disposal of the Polychlorinated Biphenyl (PCB) transformers and capacitors. The transformers and capacitors shall be taken out of service and handled in accordance with the procedures of the Environmental Protection Agency (EPA) and the Department of Transportation (DOT) as outlined in Code of Federal Regulation (CFR), Titled 40 and 49 respectively. The EPA's Toxic Substance Control Act (TSCA) Compliance Program Policy Nos. 6-PCB-6 and 6-PCB-7 also apply. Upon removal of PCB transformers and capacitors for disposal, the "originator" copy of the Uniform Hazardous Waste Manifest (EPA Form 8700-22), along with the Uniform Hazardous Waste Manifest Continuation Sheet (EPA Form 8700-22A) shall be returned to the Contracting Officer who will annotate the contract file and transmit the Manifest to the Medical Center's Chief.
 - a. Copies of the following listed CFR titles may be obtained from the Government Printing Office:

40 CFR 261 Identification and Listing of Hazardous Waste
40 CFR 262 Standards Applicable to Generators of Hazardous Waste
40 CFR 263 Standards Applicable to Transporters of Hazardous Waste

40 CFR 761	PCB Manufacturing, Processing, Distribution in Commerce, and use Prohibitions
49 CFR 172	Hazardous Material tables and Hazardous Material Communications Regulations
49 CFR 173	Shippers - General Requirements for Shipments and Packaging
49 CRR 173	Subpart A General
49 CFR 173	Subpart B Preparation of Hazardous Material for Transportation
49 CFR 173	Subpart J Other Regulated Material; Definitions and Preparation
TSCA	Compliance Program Policy Nos. 6-PCB-6 and 6-PCB-7

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

- A. The Contractor shall preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass) on or adjacent to the work site which are not to be removed and which do not unreasonably interfere with the work required under this contract. The Contractor shall only remove trees when specifically authorized to do so, and shall avoid damaging vegetation that will remain in place. If any limbs or branches of trees are broken during contract performance, or by the careless operation of equipment, or by workmen, the Contractor shall trim those limbs or branches with a clean cut and paint the cut with a tree-pruning compound as directed by the Contracting Officer.
- B. The Contractor shall protect from damage all existing improvements and utilities at or near the work site and on adjacent property of a third party, the locations of which are made known to or should be known by the Contractor. The Contractor shall repair any damage to those facilities, including those that are the property of a third party, resulting from failure to comply with the requirements of this contract or failure to exercise reasonable care in performing the work. If the Contractor fails or refuses to repair the damage promptly, the Contracting Officer may have the necessary work performed and charge the cost to the Contractor.
- C. Refer to Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS, for additional requirements on protecting vegetation, soils and the environment. Refer to Articles, "Alterations", "Restoration", and "Operations and Storage Areas" for additional instructions concerning repair of damage to structures and site improvements.

- D. Refer to FAR clause 52.236-7, "Permits and Responsibilities," which is included in General Conditions. A National Pollutant Discharge Elimination System (NPDES) permit is required for this project. The Contractor is considered an "operator" under the permit and has extensive responsibility for compliance with permit requirements. VA will make the permit application available at the (appropriate medical center) office. The apparent low bidder, contractor and affected subcontractors shall furnish all information and certifications that are required to comply with the permit process and permit requirements. Many of the permit requirements will be satisfied by completing construction as shown and specified. Some requirements involve the Contractor's method of operations and operations planning and the Contractor is responsible for employing best management practices. The affected activities often include, but are not limited to the following:
1. Designating areas for equipment maintenance and repair;
 2. Providing waste receptacles at convenient locations and provide regular collection of wastes;
 3. Locating equipment wash down areas on site, and provide appropriate control of wash-waters;
 4. Providing protected storage areas for chemicals, paints, solvents, fertilizers, and other potentially toxic materials; and
 5. Providing adequately maintained sanitary facilities.

1.12 RESTORATION

- A. Remove, cut, alter, replace, patch and repair existing work as necessary to install new work. Except as otherwise shown or specified, do not cut, alter or remove any structural work, and do not disturb any ducts, plumbing, steam, gas, or electric work without approval of the COR. Existing work to be altered or extended and that is found to be defective in any way, shall be reported to the COR before it is disturbed. Materials and workmanship used in restoring work, shall conform in type and quality to that of original existing construction, except as otherwise shown or specified.
- B. Upon completion of contract, deliver work complete and undamaged. Existing work (walls, ceilings, partitions, floors, mechanical and electrical work, lawns, paving, roads, walks) 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, of utility services or of fire protection systems and communications systems (including telephone) which are indicated on drawings and which are not scheduled for discontinuance or abandonment.

- D. Expense of repairs to such utilities and systems not shown on drawings or locations of which are unknown will be covered by adjustment to contract time and price in accordance with clause entitled "CHANGES" (FAR 52.243-4 and VAAR 852.236-88) and "DIFFERING SITE CONDITIONS" (FAR 52.236-2).

1.13 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 the Architect-Engineer.
- 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 will be made available for inspection by bidders upon request to the Engineering Officer at the VA Medical Center and shall be considered part of the contract documents.
- D. Government does not guarantee that other materials will not be encountered nor that proportions, conditions or character of several materials will not vary from those indicated by explorations. Bidders are expected to examine site of work and logs of borings; and, after investigation, decide for themselves character of materials and make their bids accordingly. Upon proper application to Department of Veterans Affairs, bidders will be permitted to make subsurface explorations of their own at site.

1.14 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. The Contractor shall certify that the land surveyor or civil engineer is not one who is a regular employee of the Contractor, and that the land surveyor or civil engineer has no financial interest in this contract.

1.15 LAYOUT OF WORK

- A. The Contractor shall lay out the work from Government established base lines and bench marks, indicated on the drawings, and shall be responsible for all measurements in connection with the layout. The Contractor shall furnish, at Contractor's own expense, all stakes, templates, platforms, equipment, tools, materials, and labor required to lay out any part of the work. The Contractor shall be responsible for executing the work to the lines and grades that may be established or indicated by the Contracting Officer. The Contractor shall also be responsible for maintaining and preserving all stakes and other marks established by the Contracting Officer until authorized to remove them. If such marks are destroyed by the Contractor or through Contractor's negligence before their removal is authorized, the Contracting Officer may replace them and deduct the expense of the replacement from any amounts due or to become due to the Contractor.
- 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 COR before any work (such as footings, floor slabs, columns, walls, utilities and other major controlling features) is placed.
- D. During progress of work, and particularly as work progresses 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 COR before any major items of concrete work are placed. In addition, Contractor shall furnish to the COR certificates from a registered land surveyor or registered civil engineer that the following work is complete in every respect as required by contract drawings.
 - 1. Lines 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 COR.
- 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".

1.16 AS-BUILT DRAWINGS

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

1.17 USE OF ROADWAYS

- A. For hauling, use only established public roads and roads on Medical Center property and, when authorized by the COR, such temporary roads which are necessary in the performance of contract work. Temporary roads shall be constructed by the Contractor at Contractor's expense. When necessary to cross curbing, sidewalks, or similar construction, they must be protected by well-constructed bridges.
- B. When new permanent roads are to be a part of this contract, Contractor may construct them immediately for use to facilitate building operations. These roads may be used by all who have business thereon within zone of building operations.
- C. When certain buildings (or parts of certain buildings) are required to be completed in advance of general date of completion, all roads leading thereto must be completed and available for use at time set for completion of such buildings or parts thereof.

1.18 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 COR. If the equipment is not installed and maintained in accordance with the following provisions, the COR will withdraw permission for use of the equipment.
 2. Electrical installations used by the equipment shall be completed in accordance with the drawings and specifications to prevent damage to the equipment and the electrical systems, i.e. transformers, relays, circuit breakers, fuses, conductors, motor controllers and their overload elements shall be properly sized, coordinated and adjusted. Voltage supplied to each item of equipment shall be verified to be correct and it shall be determined that motors are not overloaded. The electrical equipment shall be thoroughly cleaned before using it and again immediately before final inspection including vacuum cleaning and wiping clean interior and exterior surfaces.
 3. Units shall be properly lubricated, balanced, and aligned. Vibrations must be eliminated.
 4. Automatic temperature control systems for preheat coils shall function properly and all safety controls shall function to prevent coil freeze-up damage.
 5. The air filtering system utilized shall be that which is designed for the system when complete, and all filter elements shall be replaced at completion of construction and prior to testing and balancing of system.
 6. All components of heat production and distribution system, metering equipment, condensate returns, and other auxiliary facilities used in temporary service shall be cleaned prior to use; maintained to prevent corrosion internally and externally during use; and cleaned, maintained and inspected prior to acceptance by the Government. Boilers, pumps, feed water heaters and auxiliary equipment must be operated as a complete system and be fully maintained by operating personnel. Boiler water must be given complete and continuous chemical treatment.
- B. Prior to final inspection, 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

- A. Use of existing elevators for handling building materials and Contractor's personnel will be permitted subject to following provisions:
 - 1. Contractor makes all arrangements with the COR for use of elevators. The COR will ascertain that elevators are in proper condition. Personnel for operating elevators will not be provided by the Department of Veterans Affairs.
 - 2. Contractor covers and provides maximum protection of following elevator components:
 - a. Entrance jambs, heads soffits and threshold plates.
 - b. Entrance columns, canopy, return panels and inside surfaces of car enclosure walls.
 - c. Finish flooring.
 - 3. Government will accept hoisting ropes of elevator and rope of each speed governor if they are worn under normal operation. However, if these ropes are damaged by action of foreign matter such as sand, lime, grit, or stones, during temporary use, they shall be removed and replaced by new hoisting ropes.
 - 4. If brake lining of elevators are excessively worn or damaged during temporary use, they shall be removed and replaced by new brake lining.
 - 5. All parts of main controller, starter, relay panel, or selector, worn or damaged during temporary use shall be removed and replaced with new parts, if recommended by elevator inspector after elevator is released by Contractor.
 - 6. Place elevator in condition equal, less normal wear, to that existing at time it was placed in service of Contractor as approved by Contracting Officer.

1.20 TEMPORARY TOILETS

- A. Provide where directed, (for use of all Contractor's workmen) ample temporary sanitary toilet accommodations with suitable sewer and water connections; or, when approved by COR, provide suitable dry closets where directed. Keep such places clean and free from flies, and all connections and appliances connected therewith are to be removed prior to completion of contract, and premises left perfectly clean.
- B. Contractor may have for use of Contractor's workmen, such toilet accommodations as may be assigned to Contractor by Medical Center. Contractor shall keep such places clean and be responsible for any damage done thereto by Contractor's workmen. Failure to maintain satisfactory condition in toilets will deprive Contractor of the privilege to use such toilets.

1.21 AVAILABILITY AND USE OF UTILITY SERVICES

- A. The Government shall make all reasonably required amounts of utilities available to the Contractor from existing outlets and supplies, as specified in the contract. The amount to be paid by the Contractor for chargeable electrical services shall be the prevailing rates charged to the Government. The Contractor shall carefully conserve any utilities furnished without charge.
- B. The Contractor, at Contractor's expense and in a workmanlike manner satisfactory to the Contracting Officer, shall install and maintain all necessary temporary connections and distribution lines. Before final acceptance of the work by the Government, the Contractor shall remove all the temporary connections, distribution lines, and associated paraphernalia.
- C. 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.
- D. Electricity (for Construction and Testing): Furnish all temporary electric services.
 - 1. Obtain electricity by connecting to the Medical Center electrical distribution system. The Contractor shall meter and pay for electricity required for electric cranes and hoisting devices, electrical welding devices and any electrical heating devices providing temporary heat. Electricity for all other uses is available at no cost to the Contractor.
- E. Water (for Construction and Testing): Furnish temporary water service.
 - 1. Obtain water by connecting to the Medical Center water distribution system. Provide reduced pressure backflow preventer at each connection. Water is available at no cost to the Contractor.
 - 2. Maintain connections, pipe, fittings and fixtures and conserve water-use so none is wasted. Failure to stop leakage or other wastes will be cause for revocation (at COR's discretion) of use of water from Medical Center's system.
 - 3. Contractor to provide VA with water use activities (>1,000 gallons) and their estimated volumes prior to start of project.
- F. Steam: Furnish steam system for testing required in various sections of specifications.
 - 1. Obtain steam for testing by connecting to the Medical Center steam distribution system. Steam is available at no cost to the Contractor.

- 2. Maintain connections, pipe, fittings and fixtures and conserve steam-use so none is wasted. Failure to stop leakage or other waste will be cause for revocation (at COR's discretion), of use of steam from the Medical Center's system.
- G. Fuel: Natural and LP gas and burner fuel oil required for boiler cleaning, normal initial boiler-burner setup and adjusting, and for performing the specified boiler tests will be furnished by the Government. Fuel required for prolonged boiler-burner setup, adjustments, or modifications due to improper design or operation of boiler, burner, or control devices shall be furnished by the Contractor at Contractor's expense.

1.22 NEW TELEPHONE EQUIPMENT

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

1.23 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. 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.

1.24 INSTRUCTIONS

- A. Contractor shall furnish Maintenance and Operating manuals and verbal instructions when required by the various sections of the specifications and as hereinafter specified.
- B. Manuals: Maintenance and operating manuals (four copies each) for each separate piece of equipment shall be delivered to the COR coincidental with the delivery of the equipment to the job site. Manuals shall be complete, detailed guides for the maintenance and operation of equipment. They shall include complete information necessary for starting, adjusting, maintaining in continuous operation for long periods of time and dismantling and reassembling of the complete units and sub-assembly components. Manuals shall include an index covering all component parts clearly cross-referenced to diagrams and illustrations. Illustrations shall include "exploded" views showing and identifying each separate item. Emphasis shall be placed on the use of special tools and instruments. The function of each piece of equipment, component, accessory and control shall be clearly and thoroughly explained. All necessary precautions for the operation of the equipment and the reason for each precaution shall be clearly set forth. Manuals must reference the exact model, style and size of the piece of equipment and system being furnished. Manuals referencing equipment similar to but of a different model, style, and size than that furnished will not be accepted.
- C. Instructions: Contractor shall provide qualified, factory-trained manufacturers' representatives to give detailed instructions to assigned Department of Veterans Affairs personnel in the operation and complete maintenance for each piece of equipment. All such training will be at the job site. These requirements are more specifically detailed in the various technical sections. Instructions for different items of equipment that are component parts of a complete system, shall be given in an integrated, progressive manner. All instructors for every piece of component equipment in a system shall be available until instructions for all items included in the system have been completed. This is to assure proper instruction in the operation of inter-related systems. All instruction periods shall be at such times as scheduled by the COR and shall be considered concluded only when the COR is satisfied in regard to complete and thorough coverage. The Department of Veterans Affairs reserves the right to request the removal of, and substitution for, any instructor who, in the opinion of the COR, does not demonstrate sufficient qualifications in accordance with requirements for instructors above.

1.25 GOVERNMENT-FURNISHED PROPERTY

- A. The Government shall deliver to the Contractor, the Government-furnished property shown on the drawings.
- B. Equipment furnished by Government to be installed by Contractor will be furnished to Contractor at the Medical Center.

- C. Contractor shall be prepared to receive this equipment from Government and store or place such equipment not less than 90 days before Completion Date of project.
- D. Storage space for equipment will be provided by the Government and the Contractor shall be prepared to unload and store such equipment therein upon its receipt at the Medical Center.
- E. Notify Contracting Officer in writing, 60 days in advance, of date on which Contractor will be prepared to receive equipment furnished by Government. Arrangements will then be made by the Government for delivery of equipment.
 - 1. Immediately upon delivery of equipment, Contractor shall arrange for a joint inspection thereof with a representative of the Government. At such time the Contractor shall acknowledge receipt of equipment described, make notations, and immediately furnish the Government representative with a written statement as to its condition or shortages.
 - 2. Contractor thereafter is responsible for such equipment until such time as acceptance of contract work is made by the Government.
- F. Equipment furnished by the Government will be delivered in a partially assembled (knock down) condition in accordance with existing standard commercial practices, complete with all fittings, fastenings, and appliances necessary for connections to respective services installed under contract. All fittings and appliances (i.e., couplings, ells, tees, nipples, piping, conduits, cables, and the like) necessary to make the connection between the Government furnished equipment item and the utility stub-up shall be furnished and installed by the contractor at no additional cost to the Government.
- G. Completely assemble and install the Government furnished equipment in place ready for proper operation in accordance with specifications and drawings.
- H. Furnish supervision of installation of equipment at construction site by qualified factory trained technicians regularly employed by the equipment manufacturer.

1.26 RELOCATED ITEMS

- A. Contractor shall disconnect, dismantle as necessary, remove and reinstall in new location, all existing equipment and items indicated by symbol "R" or otherwise shown to be relocated by the Contractor.
- B. Perform relocation of such equipment or items at such times and in such a manner as directed by the COR.
- C. Suitably cap existing service lines, such as steam, condensate return, water, drain, gas, air, vacuum and/or electrical, whenever such lines are disconnected from equipment to be relocated. Remove abandoned lines in finished areas and cap as specified herein before under paragraph "Abandoned Lines".

- D. Provide all mechanical and electrical service connections, fittings, fastenings and any other materials necessary for assembly and installation of relocated equipment; and leave such equipment in proper operating condition.
- E. Contractor shall employ services of an installation engineer, who is an authorized representative of the manufacturer of this equipment to supervise assembly and installation of existing equipment, required to be relocated.
- F. All service lines such as noted above for relocated equipment shall be in place at point of relocation ready for use before any existing equipment is disconnected. Make relocated existing equipment ready for operation or use immediately after reinstallation.

1.27 CONSTRUCTION SIGN

- A. Provide a Construction Sign where directed by the COR. 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 COR.
- D. Detail Drawing of construction sign showing required legend and other characteristics of sign is shown on the drawings.

1.28 SAFETY SIGN

- A. Provide a Safety Sign where directed by COR. 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 COR.
- D. Standard Detail Drawing Number SD10000-02(Found on VA TIL) of safety sign showing required legend and other characteristics of sign is shown on the drawings.
- E. Post the number of accident free days on a daily basis.

1.29 PHOTOGRAPHIC DOCUMENTATION

- A. During the construction period through completion, provide photographic documentation of construction progress and at selected milestones.
- B. Photographic documentation elements:
 - 1. Before construction, the building pad, adjacent streets, roadways, parkways, driveways, curbs, sidewalks, landscaping, adjacent utilities and adjacent structures surrounding the building pad and site shall be documented. Overlapping photographic techniques shall be used to insure maximum coverage. Indexing and navigation accomplished through interactive architectural drawings. If site work or pad preparation is extensive, this documentation may be required immediately before construction and at several pre-determined intervals before building work commences.
 - 2. Construction progress for all trades shall be tracked at pre-determined intervals, but not less than once every thirty (30) calendar days ("Progressions"). Progression documentation shall track both the exterior and interior construction of the building. Exterior Progressions shall track 360 degrees around the site and each building. Interior Progressions shall track interior improvements beginning when stud work commences and continuing until Project completion.
 - 3. As-built condition of pre-slab utilities and site utilities shall be documented prior to pouring slabs, placing concrete and/or backfilling. This process shall include all underground and in-slab utilities within the building(s) envelope(s) and utility runs in the immediate vicinity of the building(s) envelope(s). This may also include utilities enclosed in slab-on-deck in multi-story buildings. Overlapping photographic techniques shall be used to insure maximum coverage. Indexing and navigation accomplished through interactive site utility plans.
 - 4. As-built conditions of mechanical, electrical, plumbing and all other systems shall be documented post-inspection and pre-insulation, sheet rock or dry wall installation. This process shall include all finished systems located in the walls and ceilings of all buildings at the Project. Overlapping photographic techniques shall be used to insure maximum coverage. Indexing and navigation accomplished through interactive architectural drawings.
 - 5. As-built conditions of exterior skin and elevations shall be documented with an increased concentration of digital photographs as directed by the COR in order to capture pre-determined focal points, such as waterproofing, window flashing, radiused steel work, architectural or Exterior Insulation and Finish Systems (EIFS) detailing. Overlapping photographic techniques shall be used to insure maximum coverage. Indexing and navigation accomplished through interactive elevations or elevation details.
 - 6. As-built finished conditions of the interior of each building including floors, ceilings and walls shall be documented at certificate of occupancy or equivalent, or just prior to occupancy, or both, as directed by the COR. Overlapping photographic techniques shall be used to insure maximum coverage. Indexing and navigation accomplished through interactive architectural drawings.

7. Miscellaneous events that occur during any Contractor site visit, or events captured by the Department of Veterans Affairs independently, shall be dated, labeled and inserted into a Section in the navigation structure entitled "Slideshows," allowing this information to be stored in the same "place" as the formal scope.
 8. Monthly (29 max) exterior progressions (360 degrees around the project) and slideshows (all elevations and building envelope). The slideshows allow for the inclusion of Department of Veterans Affairs pictures, aerial photographs, and timely images which do not fit into any regular monthly photopath.
 9. Weekly (21 Max) Site Progressions - Photographic documentation capturing the project at different stages of construction. These progressions shall capture underground utilities, excavation, grading, backfill, landscaping and road construction throughout the duration of the project.
 10. Regular (8 max) interior progressions of all walls of the entire project to begin at time of substantial framed or as directed by the COR through to completion.
 11. Detailed Exact-Built of all Slabs for all project slab pours just prior to placing concrete or as directed by the COR.
 12. Detailed Interior exact built overlapping photos of the entire building to include documentation of all mechanical, electrical and plumbing systems in every wall and ceiling, to be conducted after rough-ins are complete, just prior to insulation and or drywall, or as directed by COR.
 13. Finished detailed Interior exact built overlapping photos of all walls, ceilings, and floors to be scheduled by COR prior to occupancy.
- C. Upon completion of the project, final copies of the documentation (the "Permanent Record") with the indexing and navigation system embedded (and active) shall be provided in an electronic media format, typically a DVD or external hard-drive. Permanent Record shall have Building Information Modeling (BIM) interface capabilities. On-line access terminates upon delivery of the Permanent Record.

1.30 FINAL ELEVATION DIGITAL IMAGES

- A. A minimum of four (4) images of each elevation shall be taken with a minimum 6 MP camera, by a professional photographer with different settings to allow the COR to select the image to be printed. All images are provided to the COR on a CD.
- B. Photographs shall be taken upon completion, including landscaping. They shall be taken on a clear sunny day to obtain sufficient detail to show depth and to provide clear, sharp pictures. Pictures shall be 400 mm x 500 mm (16 by 20 inches), printed on regular weight paper, matte finish archival grade photographic paper and produced by a RA4 process from the digital image with a minimum 300 PPI. Identifying data shall be carried on label affixed to back of photograph without damage to photograph and shall be similar to that provided for final construction photographs.

- C. Furnish six (6) 400 mm x 500 mm (16 by 20 inch) color prints of the following buildings constructed under this project (elevations as selected by the COR from the images taken above). Photographs shall be artistically composed showing full front elevations. All images shall become property of the Government. Each of the selected six prints shall be place in a frame with a minimum of 2 inches of appropriate matting as a border. Provide a selection of a minimum of 3 different frames from which the COR will select one style to frame all six prints. Photographs with frames shall be delivered to the COR in boxes suitable for shipping.

END OF SECTION 01 00 00

SECTION 01 01 10 - FIRE SAFETY SECTION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section covers safety precautions required by all contractor personnel to safeguard patients, visitors, and Department of Veterans Affairs' employees.

1.2 RELATED SECTION

- A. Section 01 00 00 - GENERAL REQUIREMENTS

1.3 APPLICABLE PUBLICATIONS






- A. NFPA standard No. 241 - Safeguarding Construction, Alteration, and Demolition Operations.
- B. NFPA Standard No. 51B - Fire Protection in use of cutting and welding Processes.
- C. NFPA Standard No. 101 - Life Safety Code (Current Edition)
- D. OSHA Regulations 29CFR1926 - Construction Industry Standards.
 - 1. Sub-part P- Fire Protection and Prevention
 - 2. Sub-part J- welding and Cutting

PART 2 - PRODUCTS

2.1 PRODUCTS

- A. Table F-1 indicates which fire extinguishers are required for various combustible materials.

Table F-1: FIRE EXTINGUISHERS DATA

TYPE OF AGENT	Multi-Purpose Dry Chemical Monoammonium Phosphate	Regular Dry Chemical Sodium Phosphate	Halon 1211 Bromochlorodifluoromethane	Carbon Dioxide (CO2)	Water
Each class of fire calls for the right kind of extinguisher. Using the wrong extinguisher is dangerous and may do more harm than good. For your own protection, you should know the classes of fire, the different types of extinguishers, how to use them and why.					
Fires in ordinary combustible materials - paper, wood, and many plastics. Quenching by water or insulating by Multi-Purpose (ABC), dry chemical is effective.	Yes-excellent; Adheres to burning materials and forms a coating which will smother the fire and minimize reflash.	No	Yes-excellent; Halon 1211 leaves no residue. May not normally affect equipment.	No	Yes; Water saturates materials and prevents rekindling.
Fires in flammable liquids such as gasoline, oils, grease, tars, paints, lacquers and flammable gases. Multi-Purpose (ABC), Regular Dry Chemical, Halon 1211, and Carbon Dioxide agents smother these fires.	Yes-excellent; Dry chemical agent smothers fire. Screen of agent shields user from heat.	Yes-excellent; Dry chemical agent smothers fire. Screen of agent shields user from heat.	Yes-excellent; Halon 1211 leaves no residue. May not normally affect equipment.	Yes-excellent; Carbon Dioxide leaves no residue, may not normally affect or damage equipment.	No; Water will spread flammable liquids and not put it out.
Fires in electrical equipment.. Motors, generators, switches and appliances. Where a non conducting extinguishing agent Multi-Purpose (ABC), Regular Dry Chemical, Halon 1211 or Carbon Dioxide is required.	Yes-excellent; Dry chemical agent is non-conductive. Screen of agent shields user from heat.	Yes-excellent; Dry chemical agent is non-conductive. Screen of agent shields user from heat.	Yes-excellent; Halon 1211 is a non-conductor, leaves no residue, may not normally affect or damage electrical equipment.	Yes-excellent; Carbon Dioxide is a non-conductor, leaves no residue, may not normally affect or damage electrical equipment.	No; Water is a conductor, should never be used on live electrical fires.
Range:	5 to 20 feet	5 to 20 feet	8 to 18 feet	3 to 8 feet	Up to 40 feet
Discharge Time:	10 to 25 seconds	10 to 25 seconds	8 to 18 seconds; depending on size	8 to 30 seconds	Up to 60 seconds

PART 3 - EXECUTION

3.1 GENERAL

- A. Construction offices and trailers used as storage are required to a located minimum distance from permanent structures. Veterans Administration approval of location does not relieve the contractor at this ultimate responsibility of meeting OSHA and NFPA Regulation.
- B. Contractor is required to obtain a permit from the office of the Chief Engineer prior to start of each hot work operation or if the fire alarm needs to be shutdown. The following form is acceptable for obtaining approval and may be reproduced at contractor's expense. Other form must be submitted for approval by the Contracting Officer's Representative (COR) prior to use.
- C. The following checklist is provided to the contractor as a quick reference only. NFPA 513 should be consulted for official requirements for protection of the area.

3.2 OBTAINING A PERMIT

- A. Bring filled in permit to the project COR.
- B. After receiving their signature, make a copy of the permit at the FMS copier.
- C. This copy must be posted at the Work Permit Bulletin Board located in FMS Office area.
- D. When the work is completed or the permit expires, the original permit and the copy of the permit must be signed off, remove the signed copy of the permit from the board and place the copy in the closed permit mailbox, below the bulletin board. The original permit will be returned to the general contractor for filing.

END OF SECTION 01 01 10

HOT WORK PERMIT			
BEFORE INITIATING HOT WORK, ENSURE PRECAUTIONS ARE IN PLACE! MAKE SURE AN APPROPRIATE FIRE EXTINGUISHER IS READILY AVAILABLE!			
This Hot Work Permit is required for any operation involving open flames or producing heat and/or sparks. This includes, but is not limited to: Brazing, Cutting, Grinding, Soldering, Thawing Pipe, Torch-Applied Roofing ² , and Cadwelding.			
INSTRUCTIONS A. Verify precautions listed at right (or do not proceed with the work). B. Complete and retain this permit.		Required Precautions Checklist <input type="checkbox"/> Available sprinklers, hose streams, and extinguishers are in service/operable. <input type="checkbox"/> Hot work equipment in good repair. <input type="checkbox"/> Confined space entry permit when required. <input type="checkbox"/> Lockout/tagout required. <input type="checkbox"/> Ensure all conditions are safe and remain unchanged. <input type="checkbox"/> Work not conducted on pipes or other metal in contact with combustible material if close enough to cause ignition by conduction.	
HOT WORK BEING DONE BY: <input type="checkbox"/> EMPLOYEE <input type="checkbox"/> CONTRACTOR _____		Requirements within 35 ft. (10 m) of work: <input type="checkbox"/> Flammable liquids, dust, lint, and oil deposits removed. <input type="checkbox"/> Explosive atmosphere in area eliminated. <input type="checkbox"/> Floors swept clean. <input type="checkbox"/> Combustible floors wet down, covered with damp sand or fire resistant sheets. <input type="checkbox"/> Remove other combustibles where possible. Otherwise protect with fire resistant tarpaulins or welding screens. <input type="checkbox"/> All wall and floor openings covered. <input type="checkbox"/> Fire resistant tarpaulins suspended beneath work.	
DATE: 	TIME: 	Work on walls or ceilings/enclosed equipment: <input type="checkbox"/> Construction is noncombustible and without combustible covering insulation. <input type="checkbox"/> Combustibles are moved 30 feet away from any wall (both sides). <input type="checkbox"/> Danger does not exist by conduction of heat into another area. <input type="checkbox"/> Enclosed equipment cleaned of all combustibles. <input type="checkbox"/> Containers purged of all flammable liquids/ vapors. (verified by gas detection instrument).	
BUILDING - FLOOR - LOCATION: 		Fire watch/hot work monitor: Name: _____ <input type="checkbox"/> Fire watch will be provided during and for 30 minutes after work including any breaks. <input type="checkbox"/> Fire watch is supplied with suitable extinguishers. <input type="checkbox"/> Fire watch is trained in use of this equipment and sounding alarms. <input type="checkbox"/> Fire watch may be required for adjoining areas above, and below.	
TYPE OF WORK / JOB: 		<input type="checkbox"/> Ample ventilation to remove smoke/vapor from work area.	
PERSON PERFORMING HOT WORK: 		FINAL CHECK-UP (PERMIT REQUESTER) Work area and all adjacent areas to which sparks and heat might have spread (including floors above and below and on opposite sides of walls) were inspected thirty (30) minutes after the work was completed and were found fire safe.	
PHONE NUMBER: 		SIGNATURE: _____ Time: _____	
PERMIT NO.: 	PROJECT NO.: 		
VAMC USE BELOW THIS LINE			
I verify the above location has been examined, the precautions checked on the Required Precautions Checklist have been taken to prevent fire, and permission is authorized for work.			
SIGNATURE: _____			
PERMIT EXPIRES: 	Date: 	Time: 	
FIRE WATCH REQUIRED: <input type="checkbox"/> YES <input type="checkbox"/> NO		FIRE ALARM SHUTDOWN REQUIRED: <input type="checkbox"/> YES <input type="checkbox"/> NO	
THIS PERMIT IS GOOD FOR ONE SHIFT ONLY IF ALARM SOUNDS, THIS PERMIT IS VOID, MUST HAVE NEW PERMIT ISSUED			
Notes: 1. When used in accordance with NFPA 51B, this permit is to be used for, but not limited to, the following: welding, cutting, grinding, open-flame soldering, and thawing pipe. 2. Torch applied roofing is exempt from NFPA 51B per 1-2.3.			

SECTION 01 01 20 - INFECTION CONTROL

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the control of environmental infection control and risk assessment that the Contractor shall consider for construction & renovation projects in the medical facility. It includes Precautionary management of, Inspections and non-invasive activities, small scale, short duration activities that create minimal dust. Major demolition and construction projects that generate a moderate to high levels of dust. Movement of materials and equipment, and resources that are encountered or generated by the Contractor. The Contractor is obligated to consider the specified control measures with the costs included within the various contract items of work. An Infection Control Risk Assessment Matrix of Precautions for construction and renovation for activities follows:
- B. Infection Control Risk and damage is defined as the presence of chemical, physical, or biological elements or agents which:
1. Adversely affect human health or welfare,
 2. Unfavorably alter ecological balances of importance to human life,
- C. Using the following table, identify the Patient Risk Groups that will be affected. If more than one risk group will be affected, select the higher risk group:

Low Risk	Medium Risk	High Risk	Highest Risk
<ul style="list-style-type: none">Office areas	<ul style="list-style-type: none">CardiologyEchocardiographyEndoscopyNuclear MedicinePhysical TherapyRadiology/MRIRespiratory Therapy	<ul style="list-style-type: none">CCUEmergency RoomLabor & DeliveryLaboratories (specimen)Newborn NurseryOutpatient SurgeryPediatricsPharmacyPost Anesthesia Care UnitSurgical Units	<ul style="list-style-type: none">Any area caring for immuno-compromised patientsBurn UnitCardiac Cath LabCentral Sterile SupplyIntensive Care UnitsMedical UnitNegative pressure isolation roomsOncologyOperating rooms including C-section rooms

TYPE A	Inspection and Non-Invasive Activities. Includes, but is not limited to: <ul style="list-style-type: none"> ▪ Removal of ceiling tiles for visual inspection limited to 1 tile per 50 square feet ▪ Painting (but not sanding) ▪ Wall covering, electrical trim work, minor plumbing, and activities which do not generate dust or require cutting of walls or access to ceilings other than for visual inspection
TYPE B	Small scale, short duration activities which create minimal dust Includes, but is not limited to: <ul style="list-style-type: none"> ▪ Installation of telephone and computer cabling ▪ Access to chase spaces ▪ Cutting of walls or ceiling where dust migration can be controlled
TYPE C	Work that generates a moderate to high level of dust or requires demolition or removal of any fixed building components or assemblies Includes, but is not limited to: <ul style="list-style-type: none"> ▪ Sanding of walls for painting or wall covering ▪ Removal of floor coverings, ceiling tiles and casework ▪ New wall construction ▪ Minor duct work or electrical work above ceilings ▪ Major cabling activities ▪ Any activity that cannot be completed within a single work shift
TYPE D	Major demolition and construction projects Includes, but is not limited to: <ul style="list-style-type: none"> ▪ Activities which require consecutive work shifts ▪ Requires heavy demolition or removal of a complete cabling system ▪ New construction

D. Match the Patient Risk Group with Construction Project Type on the following matrix to define the level of infection control activities required.

1. Patient Risk Group (Low, Medium, High, Highest) with the planned ...
2. Construction Project Type (A, B, C, D) on the following matrix, to find the ...
3. Class of Precautions (I, II, III or IV) or level of infection control activities required.
 - a. Infection Control approval will be required when the Construction Activity and Risk Level indicate that Class III or Class IV control procedures are necessary. Contact the VA Project engineer and the infection control officer before proceeding.

IC Matrix - Class of Precautions: Construction Project by Patient Risk

Patient Risk Group	TYPE A	TYPE B	TYPE C	TYPE D
LOW Risk Group	I	II	II	III/IV
MEDIUM Risk Group	I	II	III	IV
HIGH Risk Group	I	II	III/IV	IV
HIGHEST Risk Group	II	III/IV	III/IV	IV

Description of Required Infection Control Precautions by Class

CLASS I	<ol style="list-style-type: none"> 1. Execute work by methods to minimize raising dust from construction operations. 2. Immediately replace a ceiling tile displaced for visual inspection. 	
CLASS II	<ol style="list-style-type: none"> 1. Provide active means to prevent airborne dust from dispersing into atmosphere. 2. Water mist work surfaces to control dust while cutting. 3. Seal unused doors with duct tape. 4. Block off and seal air vents. 5. Place dust mat at entrance and exit of work area 6. *Remove or isolate HVAC system in areas where work is being performed. 	<ol style="list-style-type: none"> 1. Wipe work surfaces with disinfectant. 2. Contain construction waste before transport in tightly covered containers. 3. Wet mop and/or vacuum with HEPA filtered vacuum before leaving work area. 4. Remove isolation of HVAC system in areas where work is being performed.

CLASS III	<ol style="list-style-type: none"> 1. *Remove or Isolate HVAC system in area where work is being done to prevent contamination of duct system. 2. Complete all critical barriers i.e. gypboard, plywood, plastic, to seal area from non-work area or implement control cube method (cart with plastic covering and sealed connection to work site with HEPA vacuum for vacuuming prior to exit) before construction begins. 3. Maintain negative air pressure within work site utilizing HEPA equipped air filtration units. 4. Contain construction waste before transport in tightly covered containers. 5. Cover transport receptacles or carts. Tape covering unless solid lid. * Use window for negative HEPA air exhaust when accessible. Obtain V.A, COR approval for exhausting in existing exhaust ductwork. 	<ol style="list-style-type: none"> 1. Do not remove barriers from work area until completed project is inspected by the owner's Safety Department and Infection Control Department and thoroughly cleaned by the owner's Environmental Services Department. 2. Remove barrier materials carefully to minimize spreading of dirt and debris associated with construction. 3. Vacuum work area with HEPA filtered vacuums. 4. Wet mop area with disinfectant. 5. Remove isolation of HVAC system in areas where work is being performed.
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CLASS IV	<ol style="list-style-type: none"> 1. Isolate HVAC system in area where work is being done to prevent contamination of duct system. 2. Complete all critical barriers i.e. gypboard, plywood, plastic, to seal area from non-work area or implement control cube method (cart with plastic covering and sealed connection to work site with HEPA vacuum for vacuuming prior to exit) before construction begins. 3. Maintain negative air pressure within work site utilizing HEPA equipped air filtration units. 4. Seal holes, pipes, conduits, and punctures appropriately. 5. Construct anteroom and require all personnel to pass through this room so they can be vacuumed using a HEPA vacuum cleaner before leaving work site or they can wear cloth or paper coveralls that are removed each time they leave the work site. 6. All personnel entering work site are required to wear shoe covers. Shoe covers must be changed each time the worker exits the work area. 7. Do not remove barriers from work area until completed project is inspected by the owner's Safety Department and Infection Control Department and thoroughly cleaned by the owner's Environmental Services Department. 	<ol style="list-style-type: none"> 1. Remove barrier material carefully to minimize spreading of dirt and debris associated with construction. 2. Contain construction waste before transport in tightly covered containers. 3. Cover transport receptacles or carts. Tape covering unless solid lid 4. Vacuum work area with HEPA filtered vacuums. 5. Wet mop area with disinfectant. 6. Remove isolation of HVAC system in areas where work is being performed.
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- E. Identify the area surrounding the project area, assessing potential impact.
- F. Identify specific site of activity e.g., patient rooms, medication room.
- G. Identify issues related to: ventilation, plumbing, electrical in terms of the occurrence of probable outages.
- H. Identify containment measures, using prior assessment. What types of barriers? (e.g., solids wall barriers); Will HEPA filtration be required?
 - 1. Renovation/construction area shall be isolated from the occupied areas during construction and shall be negative with respect to surrounding areas.
- I. Consider potential risk of water damage. Is there a risk due to compromising structural integrity? (e.g., wall, ceiling, roof)

- J. Work hours: Can or will the work be done during non-patient care hours?
- K. Do plans allow for adequate number of isolation/negative airflow rooms?
- L. Does the infection control staff agree with the minimum number of sinks for this project? (Verify against AIA Guidelines for types and area)
- M. Does the infection control staff agree with the plans relative to clean and soiled utility rooms?
- N. Plan to discuss the following containment issues with the project team. e.g., traffic flow, housekeeping, debris removal (how and when).

Unit Below	Unit Above	Lateral	Lateral	Behind	Front
Risk Group	Risk Group	Risk Group	Risk Group	Risk Group	Risk Group

- O. Apply Life Safety and standards (APIC) and the following criteria would need to be assured in order to maintain the supply air side open during Class 4 construction activity:
1. The air supply is 100% fresh air and the site and adjacent areas can be kept under negative pressure at all times.
 2. There is no re circulated air in this section
 3. There is no duct work involved in this section of the demolition
 4. The site can never be positive to the adjacent areas (i.e. keep the negative air machines on at all times or for 1-2 hours post site work until the negative action can be maintained.
 5. A log is maintained to document that the negative pressure is checked and has been maintained during those hours when the negative air machines are turned off. (An alarmed device is recommended for this purpose and should be maintained and monitored by the construction personnel).

PART 2 - PRODUCTS, MATERIALS AND EQUIPMENT

2.1 MATERIALS AND EQUIPMENT

A. GENERAL REQUIREMENTS

1. All materials shall be delivered in their original package, container or bundle bearing the name of the manufacturer and the brand name (where applicable). When transporting new materials & equipment through the hospital use 4 mil Poly sheeting encasing materials, tools and equipment or use a totally enclosed cart.

2. Store all materials subject to damage off the ground, away from wet or damp surfaces and under cover sufficient enough to prevent damage or contamination. Flammable materials cannot be stored inside buildings. Replacement materials shall be stored outside of the regulated/work area until construction is completed.
3. The Contractor shall not block or hinder use of buildings by patients, staff, and visitors to the VA in partially occupied buildings by placing materials/equipment in any unauthorized place.
4. The Competent Person shall inspect for damaged, deteriorating or previously used materials. Such materials shall not be used and shall be removed from the worksite and disposed of properly.
5. Demolition materials must be transported in totally enclosed containers.
 - a. Demolition on above ground floors may use a window debris chute to convey materials to an enclosed dumpster that provides dust and noise control. The contractor is responsible to maintain the original appearance of the building fascia.

B. NEGATIVE PRESSURE FILTRATION SYSTEM

1. The Contractor shall provide enough negative air machines to completely exchange the regulated area air volume 4 actual times per hour. The Competent Person shall determine the number of units needed for each regulated area by dividing the cubic feet in the regulated area by 15 and then dividing that result by the actual cubic feet per minute (cfm) for each unit to determine the number of units needed to effect 4 air changes per hour. Provide a standby unit in the event of machine failure and/or emergency in an adjacent area.

C. DESIGN AND LAYOUT

1. Infection Control Design Data
 - a. Before start of work submit the design and layout of the regulated area and the negative air machines, type of construction barriers to be used. The submittal shall indicate the number of, location of and size of negative air machines and exhaust route & location of the windows to be used. The point(s) of exhaust, air flow within the regulated area, anticipated negative pressure differential, and supporting calculations for sizing shall be provided. In addition, submit the following:
 - 1) Product Data for Negative Air Machine
 - a) Manufacturer's information on the negative air machine(s).
 - 2) Infection Control Power Supply
 - a) Method of supplying power to the units and designation/location of the panels.

- 3) Product Data for Pressure Differential Measuring Device
 - a) Description of testing method(s) for correct air volume and pressure differential. Provide manufacturer's product data on the pressure differential measuring device used.
- 4) Product Data for Generator and Switch
- 5) Shop Drawing of Generator and Switch Schematic
 - a) If auxiliary power supply is to be provided for the negative air machines, provide a schematic diagram of the power supply and manufacturer's data on the generator and switch.
 - b) Location of isolation negative air pressure monitor.

D. NEGATIVE AIR MACHINES

1. Negative Air Machine Cabinet: The cabinet shall be constructed of steel or other durable material capable of withstanding potential damage from rough handling and transportation. The width of the cabinet shall be less than 30" in order to fit in standard doorways. The cabinet must be factory sealed to prevent dust from being released during use, transport, or maintenance. Any access to and replacement of filters shall be from the inlet end. The unit must be on casters or wheels.
2. Negative Air Machine Fan: The rating capacity of the fan must be the air moving capacity under actual operating conditions. Manufacturer's typically use "free-air" (no resistance) conditions when rating fans. The fan must be a centrifugal type fan.
3. Negative Air Machine Final Filter:
 - a. When exhausting directly to the outside from a window or penetration the filter shall be a minimum MERV 8 pleated filter media completely sealed on all edges within a structurally rigid frame.
 - b. When exhausting to an exhaust duct: the final filter shall be a HEPA filter. The filter media must be completely sealed on all edges within a structurally rigid frame. The filter shall align with a continuous flexible gasket material in the negative air machine housing to form an air tight seal. Each HEPA filter shall be individually tested and certified by the manufacturer to have an efficiency of not less than 99.97% when challenged with 0.3 µm dioctylphthalate (DOP) particles. Testing shall have been done in accordance with Military Standard MIL-STD-282 and Army Instruction Manual 136-300-175A. Each filter must bear a UL586 label to indicate ability to perform under specified conditions. Each filter shall be marked with the name of the manufacturer, serial number, air flow rating, efficiency and resistance, and the direction of test air flow.

4. Negative Air Machine Pre-filters: The pre-filters, which protect the final HEPA filter by removing larger particles, are required to prolong the operating life of the HEPA filter. Two stages of pre-filtration are required. A first stage pre-filter shall be a low efficiency type for particles 10 m or larger. A second stage pre-filter shall have a medium efficiency effective for particles down to 5 m or larger. Pre-filters shall be installed either on or in the intake grid of the unit and held in place with a special housing or clamps.
5. Negative Air Machine Safety and Warning Devices: An electrical/ mechanical lockout must be provided to prevent the fan from being operated without a HEPA filter. Units must be equipped with an automatic shutdown device to stop the fan in the event of a rupture in the HEPA filter or blockage in the discharge of the fan. Warning lights are required to indicate normal operation; too high a pressure drop across filters; or too low of a pressure drop across filters.
6. Negative Air Machine Electrical: All electrical components shall be approved by the National Electrical Manufacturer's Association (NEMA) and Underwriter's Laboratories (UL). Each unit must be provided with overload protection and the motor, fan, fan housing, and cabinet must be grounded.

E. PRESSURE DIFFERENTIAL

1. The fully operational negative air system within the regulated area shall continuously maintain a pressure differential of -0.02" water column. Before any disturbance of any material or building system, this shall be demonstrated to the VA by use of a pressure differential meter/manometer as required by OSHA 29 CFR 1926.1101(e)(5)(i). The Competent Person shall be responsible for providing and maintaining the negative pressure and air changes as required by OSHA and this specification.

F. TESTING THE SYSTEM

1. The negative pressure system must be tested before any disturbance. After the regulated area has been completely prepared, the decontamination units set up, and the negative air machines installed, start the units up one at a time. Demonstrate and document the operation and testing of the negative pressure system to the VA using smoke tubes and a negative pressure gauge. Testing must also be done at the start of each work shift.

G. DEMONSTRATION OF THE NEGATIVE AIR PRESSURE SYSTEM

1. The demonstration of the operation of the negative pressure system to the COR and VA shall include, but not be limited to, the following:
 - a. Contractor to install negative air isolation monitoring stations at the sites access doors or at opposite sides of the construction area check with COR for # of units and location.
 - b. Curtains of the decontamination units move in toward regulated area.
 - c. Use smoke tubes to demonstrate air is moving air across all areas in which work is to be done.

- d. Plastic barriers and sheeting move lightly in toward the regulated area.

H. USE OF SYSTEM DURING CONSTRUCTION OPERATIONS

1. Start units before beginning any disturbance occurs. After work begins, the units shall run continuously, maintaining 4 actual air changes per hour at a negative pressure differential of 5.0 Pa (-0.02") water column, for the duration of the work until a final visual clearance and final air clearance has been completed.
2. The negative air machines shall not be shut down for the duration of the project unless authorized by the VA, in writing.
3. Construction work shall begin at a location closest from the units and proceed away from them. If an electric failure occurs, the Competent Person shall stop all work and not resume until power is restored and all units necessary are operating properly again.
4. The negative air machines shall continue to run after all work is completed and until a final visual clearance and a final air, clearance has been completed for that regulated area.

2.2 CONTAINMENT BARRIERS AND COVERINGS IN THE REGULATED AREA

A. GENERAL

1. Seal off the perimeter to the regulated area to completely isolate the regulated area from adjacent spaces. All surfaces in the regulated area must be covered to prevent contamination and to facilitate clean-up. Should adjacent areas become contaminated, immediately stop work and clean up the contamination at no additional cost to the Government.

B. CONTROLLING ACCESS TO THE REGULATED AREA

1. Access to the regulated area is allowed only through the personnel decontamination facility (PDF). All other means of access shall be eliminated and OSHA warning signs posted as required by OSHA. If the regulated area is adjacent to or within view of an occupied area, provide a visual barrier of opaque fire retardant poly sheeting at least 4 mils thick to prevent building occupant observation. If the adjacent area is accessible to the public, the barrier must be solid and capable of withstanding the negative pressure.

C. CRITICAL BARRIERS

1. Completely separate the regulated area from adjacent areas using fire retardant poly at least 4 mils thick and duct tape. Individually seal with two layers of 6 mil poly and duct tape all HVAC openings, cap off exhaust into the regulated area. Individually seal all lighting fixtures, clocks, doors, windows, convectors, speakers, or any other objects in the regulated area. Use care with hot/warm surfaces, see Fig 1.

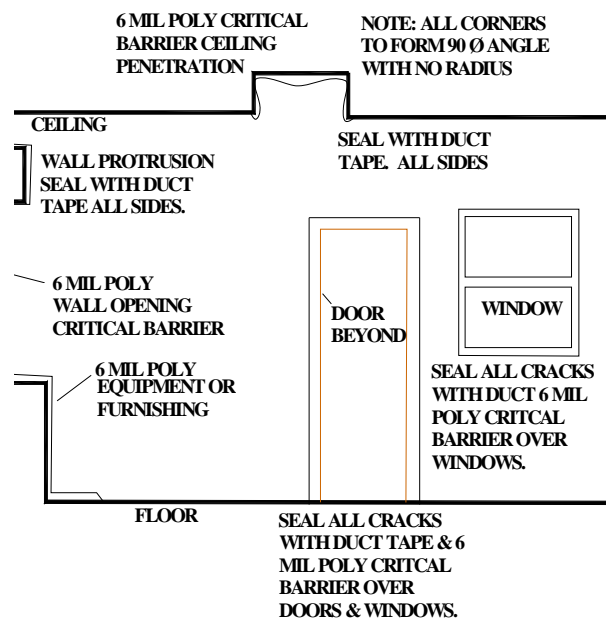
D. PRIMARY BARRIERS

1. Temporary Construction Partitions:
 - a. Install and maintain temporary construction partitions to provide separations between construction areas and adjoining areas. Construct partitions of gypsum board or treated plywood (flame spread rating of 25 or less in accordance with ASTM E84) on one side of wood or metal steel studs. Seal with one layers of 4 mil poly for a vapor barrier under gypsum or plywood. Extend the Poly through suspended ceilings to floor slab or roof. Seal penetrations at door openings; install tight-fitting VA supplied construction doors with self-closing devices see fig. 2 for barrier construction.

E. CONTRACTOR SPILL RESPONSE KIT

1. The kit should include the following:
 - a. Shop Vacuum.
 - b. Multi-Purpose Spill Control Sorbents to absorb nonaggressive liquids up to 30 gallons.
 - c. Sorbents pillows.
 - d. Pipe leak clamps for copper & steel pipe in sufficient size range and quantity base on project piping scope.
 - e. Bucket & mop and water resistant duct tape.

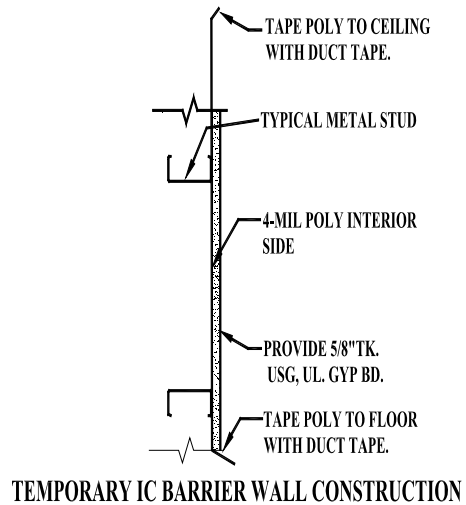
FIG. 1



CRITICAL BARRIER PREP INSTALLATION

NOT TO SCALE

FIG. 2



INFECTION CONTROL CONSTRUCTION PERMIT					PERMIT NO:	
Location of Construction:			Project Start Date:			
Project Coordinator:			Estimated Duration:			
Contractor Performing Work:			Permit Expiration Date:			
Supervisor:			Telephone:			
YES	NO	CONSTRUCTION ACTIVITY	YES	NO	INFECTION CONTROL RISK GROUP	
		TYPE A: Inspection, non-invasive activity			GROUP 1: Low Risk	
		TYPE B: Small scale, short duration, moderate to high levels			GROUP 2: Medium Risk	
		TYPE C: Activity generates moderate to high levels of dust, requires Lures eater 1 work shift for completion			GROUP 3: Medium/High Risk	
		TYPE D: Major duration and construction activities requiring consecutive work shifts			GROUP 4: Highest Risk	
CLASS I		1. Execute work by methods to minimize raising dust from construction operations. 2. Immediately replace any ceiling tile displaced for visual inspection. 3. Minor demolition for remodeling.				
CLASS II		1. Provides active means to prevent air-borne dust from dispersing into atmosphere. 2. Water mist work surfaces to control dust while cutting. 3. Seal unused doors with duct tape. 4. Block off and seal air vents. 5. Wipe surfaces with disinfectant. 6. Contain construction waste before transport in tightly covered containers. 7. Wet mop and/or vacuum with HEPA filtered equipment before leaving work area. 8. Place dust mat at entrance and exit of work area. 9. Remove or isolate HVAC system in areas where work is being performed.				
CLASS III		1. Obtain infection control permit before construction. 2. Isolate HVAC system in area where work is being done to prevent contamination of the duct system. 3. Complete all critical barriers or implement control cube method before construction begins. 4. Maintain negative air pressure within work site utilizing HEPA equipped air filtration units. 5. Do not remove barriers from work area until completed project is thoroughly cleaned by Environmental Services Department. 6. Vacuum work with HEPA filtered vacuums. 7. Wet mop with disinfectant. 8. Remove barrier materials carefully to minimize spreading of dirt and debris associated with construction. 9. Contain construction waste before transport in tightly covered containers.				
Date						
Initial						
CLASS IV		1. Obtain infection control permit before construction. 2. Isolate HVAC system in area where work is being done to prevent contamination of the duct system. 3. Complete all critical barriers or implement control cube method before construction begins. 4. Maintain negative air pressure within work site utilizing HEPA equipped air filtration units. 5. Seal holes, pipes, conduits, and punctures appropriately. 6. Construct anteroom and require all personnel to pass through this room so they can be vacuumed using a HEPA vacuum cleaner before leaving the work site or they can wear cloth. 7. All personnel entering work site are required to wear shoe covers. 8. Do not remove barriers from work area until completed project is thoroughly cleaned by Env.Services Dept. 9. Vacuum work with HEPA filtered vacuums. 10. Wet mop with disinfectant. 11. Remove barrier materials carefully to minimize spreading of dirt and debris associated with construction. 12. Contain construction waste before transport in tightly covered containers. 13. Cover transport receptacles or carts. Tape covering. paper coveralls that are removed each time they leave the work site. 14. Remove or isolate HVAC system in area where work is being done.				
Date						
Initial						

Emergency Room Expansion
John D. Dingell Medical Center
Detroit, Michigan
VA Project No. 553-303a

C2AE © Project # 11-0049
100% Bid Documents

Additional Requirements:	
Exceptions/Additions to this Permit:	
Permit Requested By:	Permit Authorized By:
Date:	Date:

END OF SECTION 01 01 20

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

PART 1 - GENERAL

1.1 GENERAL INTENTION

- A. For the purposes of this contract, samples, test reports, certificates, and manufacturers' literature and data shall also be subject to the previously referenced requirements. The following text refers to all items collectively as SUBMITTALS.
- B. Submit for approval, all of the items specifically mentioned under the separate sections of the specification, with information sufficient to evidence full compliance with contract requirements. Materials, fabricated articles and the like to be installed in permanent work shall equal those of approved submittals. After an item has been approved, no change in brand or make will be permitted unless:
 - 1. Satisfactory written evidence is presented to, and approved by Contracting Officer, that manufacturer cannot make scheduled delivery of approved item or;
 - 2. Item delivered has been rejected and substitution of a suitable item is an urgent necessity or;
 - 3. Other conditions become apparent which indicates approval of such substitute item to be in best interest of the Government.
- C. Forward submittals in sufficient time to permit proper consideration and approval action by Government. Time submission to assure adequate lead time for procurement of contract - required items. Delays attributable to untimely and rejected submittals will not serve as a basis for extending contract time for completion.
- D. Submittals will be reviewed for compliance with contract requirements by Architect-Engineer, and action thereon will be taken by COR on behalf of the Contracting Officer.
- E. 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.
- F. 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 therefore by Contracting Officer, there will be an adjustment in contract price and time.

-
- G. 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.
- H. 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.
1. Submit samples in quadruplicate. Submit shop drawings, schedules, manufacturers' literature and data, and certificates in quadruplicate, except where a greater number is specified.
 2. Submittals will receive consideration only when covered by a transmittal letter signed by Contractor. Letter shall be sent via first class mail or FAX and shall contain the list of items, name of Medical Center, name of Contractor, contract number, applicable specification paragraph numbers, applicable drawing numbers (and other information required for exact identification of location for each item), manufacturer and brand, ASTM or Federal Specification Number (if any) and such additional information as may be required by specifications for particular item being furnished. In addition, catalogs shall be marked to indicate specific items submitted for approval.
 - a. 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.
 - b. Each sample, certificate, manufacturers' literature and data shall be labeled to indicate the name and location of the Medical Center, name of Contractor, manufacturer, brand, contract number and ASTM or Federal Specification Number as applicable and location(s) on project.
 - c. Required certificates shall be signed by an authorized representative of manufacturer or supplier of material, and by Contractor.
 3. In addition to complying with the applicable requirements specified in the preceding Article, 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.
 - a. 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.
 - b. Certificates shall also set forth a list of comparable projects upon which the laboratory has performed similar functions during past three years.

-
- c. Samples and laboratory tests shall be sent directly to approved commercial testing laboratory.
 - d. Contractor shall send a copy of transmittal letter to both COR and to Architect-Engineer simultaneously with submission of material to a commercial testing laboratory.
 - e. Contractor shall forward a copy of transmittal letter to COR simultaneously with submission to a commercial testing laboratory. Laboratory test reports shall be sent directly to COR for appropriate action.
 - f. 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.
 - g. Laboratory test reports shall also include a recommendation for approval or disapproval of tested item.
 4. 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.
 5. Approved samples will be kept on file by the COR at the site until completion of contract, at which time such samples will be delivered to Contractor as Contractor's property. Where noted in technical sections of specifications, approved samples in good condition may be used in their proper locations in contract work. At completion of contract, samples that are not approved will be returned to Contractor only upon request and at Contractor's expense. Such request should be made prior to completion of the contract. Disapproved samples that are not requested for return by Contractor will be discarded after completion of contract.
 6. 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.
 - a. For each drawing required, submit one legible photographic paper or vellum reproducible.
 - b. Reproducible shall be full size.
 - c. Each drawing shall have marked thereon, proper descriptive title, including Medical Center location, project number, manufacturer's number, reference to contract drawing number, detail Section Number, and Specification Section Number.
 - d. 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.
 - e. Submit drawings, ROLLED WITHIN A MAILING TUBE, fully protected for shipment.
 - f. One reproducible print of approved or disapproved shop drawings will be forwarded to Contractor.

- g. When work is directly related and involves more than one trade, shop drawings shall be submitted to Architect-Engineer under one cover.
- I. Samples (except laboratory samples), shop drawings, test reports, certificates and manufacturers' literature and data, shall be submitted for approval to:

C2AE
648 Monroe Avenue NW, Suite 210
Grand Rapids, MI 49503
- J. At the time of transmittal to the Architect-Engineer, the Contractor shall also send a copy of the complete submittal directly to the COR.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 33 23

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. Availability of specifications listed in the GSA Index of Federal Specifications, Standards and Commercial Item Descriptions FPMR PART 101-29, refer to FAR Provision FAR 52.211-1 in the Instructions, Conditions and Other Statements to Bidders/Offerors Section.
 2. Availability for examination of specifications not listed in the GSA Index of Federal Specifications, Standards and Commercial Item Descriptions refer to FAR Provision FAR 52.211-4 in the Instructions, Conditions and Other Statements to Bidders/Offerors Section.
 3. Availability of specifications not listed in the GSA Index of Federal Specifications, Standards and Commercial Item Descriptions refer to FAR Provision FAR 52.211-3 in the Instructions, Conditions and Other Statements to Bidders/Offerors Section.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 42 19

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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
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1.3 REQUIREMENTS

- A. Accreditation Requirements: Construction materials testing laboratories must be accredited by a laboratory accreditation authority and will be required to submit a copy of the Certificate of Accreditation and Scope of Accreditation. The laboratory's scope of accreditation must include the appropriate ASTM standards (i.e.; E 329, C 1077, D 3666, D3740, A 880, E 543) listed in the technical sections of the specifications. Laboratories engaged in Hazardous Materials Testing shall meet the requirements of OSHA and EPA. The policy applies to the specific laboratory performing the actual testing, not just the "Corporate Office."
- B. Inspection and Testing: Testing laboratory shall inspect materials and workmanship and perform tests described herein and additional tests requested by COR. When it appears materials furnished, or work performed by Contractor fail to meet construction contract requirements, Testing Laboratory shall direct attention of COR to such failure.
- C. Written Reports: Testing laboratory shall submit test reports to COR, Contractor, unless other arrangements are agreed to in writing by the COR. Submit reports of tests that fail to meet construction contract requirements on colored paper.
- D. Verbal Reports: Give verbal notification to COR immediately of any irregularity.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EARTHWORK

- A. General: The Testing Laboratory shall provide qualified personnel, materials, equipment, and transportation as required to perform the services identified/required herein, within the agreed to schedule and/or time frame. The work to be performed shall be as identified herein and shall include but not be limited to the following:
1. Observe fill and subgrades during proof-rolling to evaluate suitability of surface material to receive fill or base course. Provide recommendations to the COR regarding suitability or unsuitability of areas where proof-rolling was observed. Where unsuitable results are observed, witness excavation of unsuitable material and recommend to COR extent of removal and replacement of unsuitable materials and observe proof-rolling of replaced areas until satisfactory results are obtained.
 2. Provide part time observation of fill placement and compaction and field density testing in building areas and provide part time observation of fill placement and compaction and field density testing in pavement areas to verify that earthwork compaction obtained is in accordance with contract documents.
 3. Provide supervised geotechnical technician to inspect excavation, subsurface preparation, and backfill for structural fill.
- B. Testing Compaction:
1. Determine maximum density and optimum moisture content for each type of fill, backfill and subgrade material used, in compliance with ASTM D698 and/or ASTM D1557.
 2. Make field density tests in accordance with the primary testing method following ASTM D2922 wherever possible. Field density tests utilizing ASTM D1556 shall be utilized on a case by case basis only if there are problems with the validity of the results from the primary method due to specific site field conditions. Should the testing laboratory propose these alternative methods, they should provide satisfactory explanation to the COR before the tests are conducted.
 - a. Building Slab Subgrade: At least one test of subgrade for every 185 m² (2000 square feet) of building slab, but in no case fewer than three tests. In each compacted fill layer, perform one test for every 185 m² (2000 square feet) of overlaying building slab, but in no case fewer than three tests.
 - b. Foundation Wall Backfill: One test per 30 m (100 feet) of each layer of compacted fill but in no case fewer than two tests.
 - c. Pavement Subgrade: One test for each 335 m² (400 square yards), but in no case fewer than two tests.
 - d. Curb, Gutter, and Sidewalk: One test for each 90 m (300 feet), but in no case fewer than two tests.

- e. Trenches: One test at maximum 30 m (100 foot) intervals per 1200 mm (4 foot) of vertical lift and at changes in required density, but in no case fewer than two tests.
 - f. Footing Subgrade: At least one test for each layer of soil on which footings will be placed. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with related tested subgrade when acceptable to COR. In each compacted fill layer below wall footings, perform one field density test for every 30 m (100 feet) of wall. Verify subgrade is level, all loose or disturbed soils have been removed, and correlate actual soil conditions observed with those indicated by test borings.
- C. 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 COR.

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.
- B. Submit laboratory test report of topsoil to COR.

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.
 - 2. Make a minimum of three field density tests on each day's final compaction on each aggregate course in accordance with AASHTO T191.
 - 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 COR with concurrence of Contracting Officer and perform periodic inspections thereafter as determined by COR.
 2. Periodically inspect and test batch proportioning equipment for accuracy and report deficiencies to COR.
 3. Sample and test mix ingredients as necessary to insure compliance with specifications.
 4. Sample and test aggregates daily and as necessary for moisture content. Test the dry rodded weight of the coarse aggregate whenever a sieve analysis is made, and when it appears there has been a change in the aggregate.
 5. Certify, in duplicate, ingredients and proportions and amounts of ingredients in concrete conform to approved trial mixes. When concrete is batched or mixed off immediate building site, certify (by signing, initialing or stamping thereon) on delivery slips (duplicate) that ingredients in truck-load mixes conform to proportions of aggregate weight, cement factor, and water-cement ratio of approved trial mixes.
- B. Field Inspection and Materials Testing:
 1. Provide a technician at site of placement at all times to perform concrete sampling and testing.
 2. Review the delivery tickets of the ready-mix concrete trucks arriving on-site. Notify the Contractor if the concrete cannot be placed within the specified time limits or if the type of concrete delivered is incorrect. Reject any loads that do not comply with the Specification requirements. Rejected loads are to be removed from the site at the Contractor's expense. Any rejected concrete that is placed will be subject to removal.

3. Take concrete samples at point of placement in accordance with ASTM C172. Mold and cure compression test cylinders in accordance with ASTM C31. Make at least three cylinders for each 40 m³ (50 cubic yards) or less of each concrete type, and at least three cylinders for any one day's pour for each concrete type. Label each cylinder with an identification number. COR may require additional cylinders to be molded and cured under job conditions.
4. Perform slump tests in accordance with ASTM C143. Test the first truck each day, and every time test cylinders are made. Test pumped concrete at the hopper and at the discharge end of the hose at the beginning of each day's pumping operations to determine change in slump.
5. Determine the air content of concrete per ASTM C173. For concrete required to be air-entrained, test the first truck and every 20 m³ (25 cubic yards) thereafter each day. For concrete not required to be air-entrained, test every 80 m³ (100 cubic yards) at random. For pumped concrete, initially test concrete at both the hopper and the discharge end of the hose to determine change in air content.
6. If slump or air content fall outside specified limits, make another test immediately from another portion of same batch.
7. Perform unit weight tests in compliance with ASTM C138 for normal weight concrete and ASTM C567 for lightweight concrete. Test the first truck and each time cylinders are made.
8. Notify laboratory technician at batch plant of mix irregularities and request materials and proportioning check.
9. Verify that specified mixing has been accomplished.
10. Environmental Conditions: Determine the temperature per ASTM C1064 for each truckload of concrete during hot weather and cold weather concreting operations:
 - a. When ambient air temperature falls below 4.4 degrees C (40 degrees F), record maximum and minimum air temperatures in each 24 hour period; record air temperature inside protective enclosure; record minimum temperature of surface of hardened concrete.
 - b. When ambient air temperature rises above 29.4 degrees C (85 degrees F), record maximum and minimum air temperature in each 24 hour period; record minimum relative humidity; record maximum wind velocity; record maximum temperature of surface of hardened concrete.
11. Inspect the reinforcing steel placement, including bar size, bar spacing, top and bottom concrete cover, proper tie into the chairs, and grade of steel prior to concrete placement. Submit detailed report of observations.
12. Observe conveying, placement, and consolidation of concrete for conformance to specifications.
13. Observe condition of formed surfaces upon removal of formwork prior to repair of surface defects and observe repair of surface defects.
14. Observe curing procedures for conformance with specifications, record dates of concrete placement, start of preliminary curing, start of final curing, end of curing period.

15. Observe preparations for placement of concrete:
 - a. Inspect handling, conveying, and placing equipment, inspect vibrating and compaction equipment.
 - b. Inspect preparation of construction, expansion, and isolation joints.
16. Observe preparations for protection from hot weather, cold weather, sun, and rain, and preparations for curing.
17. Observe concrete mixing:
 - a. Monitor and record amount of water added at project site.
 - b. Observe minimum and maximum mixing times.
18. Measure concrete flatwork for levelness and flatness as follows:
 - a. Perform Floor Tolerance Measurements FF and FL in accordance with ASTM E1155. Calculate the actual overall F- numbers using the inferior/superior area method.
 - b. Perform all floor tolerance measurements within 48 hours after slab installation and prior to removal of shoring and formwork.
 - c. Provide the Contractor and the COR with the results of all profile tests, including a running tabulation of the overall FF and FL values for all slabs installed to date, within 72 hours after each slab installation.
19. Other inspections:
 - a. Grouting under base plates.
 - b. Grouting anchor bolts and reinforcing steel in hardened concrete.

C. Laboratory Tests of Field Samples:

1. Test compression test cylinders for strength in accordance with ASTM C39. For each test series, test one cylinder at 7 days and one cylinder at 28 days. Use remaining cylinder as a spare tested as directed by COR. Compile laboratory test reports as follows: Compressive strength test shall be result of one cylinder, except when one cylinder shows evidence of improper sampling, molding or testing, in which case it shall be discarded and strength of spare cylinder shall be used.
2. Make weight tests of hardened lightweight structural concrete in accordance with ASTM C567.
3. Furnish certified compression test reports (duplicate) to COR. In test report, indicate the following information:
 - a. Cylinder identification number and date cast.
 - b. Specific location at which test samples were taken.
 - c. Type of concrete, slump, and percent air.
 - d. Compressive strength of concrete in MPa (psi).
 - e. Weight of lightweight structural concrete in kg/m³ (pounds per cubic feet).

- f. Weather conditions during placing.
- g. Temperature of concrete in each test cylinder when test cylinder was molded.
- h. Maximum and minimum ambient temperature during placing.
- i. Ambient temperature when concrete sample in test cylinder was taken.
- j. Date delivered to laboratory and date tested.

3.6 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 MASONRY

- A. Mortar Tests:
 - 1. Laboratory compressive strength test:
 - a. Comply with ASTM C780.
 - b. Obtain samples during or immediately after discharge from batch mixer.
 - c. Furnish molds with 50 mm (2 inch), 3 compartment gang cube.
 - d. Test one sample at 7 days and 2 samples at 28 days.
 - 2. Two tests during first week of operation; one test per week after initial test until masonry completion.
- B. Grout Tests:
 - 1. Laboratory compressive strength test:
 - a. Comply with ASTM C1019.
 - b. Test one sample at 7 days and 2 samples at 28 days.
 - c. Perform test for each 230 m2 (2500 square feet) of masonry.

C. Masonry Unit Tests:

1. Laboratory Compressive Strength Test:

- a. Comply with ASTM C140.
- b. Test 3 samples for each 460 m2 (5000 square feet) of wall area.

D. Prism Tests: For each type of wall construction indicated, test masonry prisms per ASTM C1314 for each 460 m2 (5000 square feet) of wall area. Prepare one set of prisms for testing at 7 days and one set for testing at 28 days.

3.8 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.
 - 4) 20 percent of length of built-up column member partial penetration and fillet welds at random for root and final passes.
 - 5) 100 percent of length of built-up girder member partial penetration and fillet welds for root and final passes.
- g. Welding Ultrasonic Testing: Test in accordance with ASTM E164 and AWS D1.1 for 100 percent of all full penetration welds, braced and moment frame column splices, and a minimum of 20 percent of all other partial penetration column splices, at random.
 - h. Welding Radiographic Testing: Test in accordance with ASTM E94, and AWS D1.1 for 5 percent of all full penetration welds at random.
 - i. Verify that correction of rejected welds are made in accordance with AWS D1.1.
 - j. Testing and inspection do not relieve the Contractor of the responsibility for providing materials and fabrication procedures in compliance with the specified requirements.
2. Bolt Inspection:
- a. Inspect high-strength bolted connections in accordance AISC Specifications for Structural Joints Using ASTM A325 or A490 Bolts.
 - b. Slip-Critical Connections: Inspect 10 percent of bolts, but not less than 2 bolts, selected at random in each connection in accordance with AISC Specifications for Structural Joints Using ASTM A325 or A490 Bolts. Inspect all bolts in connection when one or more are rejected.
 - c. Fully Pre-tensioned Connections: Inspect 10 percent of bolts, but not less than 2 bolts, selected at random in 25 percent of connections in accordance with AISC Specification for Structural Joints Using ASTM A325 or A490 Bolts. Inspect all bolts in connection when one or more are rejected.
 - d. Bolts installed by turn-of-nut tightening may be inspected with calibrated wrench when visual inspection was not performed during tightening.
 - e. Snug Tight Connections: Inspect 10 percent of connections verifying that plies of connected elements have been brought into snug contact.
 - f. Inspect field erected assemblies; verify locations of structural steel for plumbness, level, and alignment.
- D. Submit inspection reports, record of welders and their certification, and identification, and instances of noncompliance to COR.

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 COR.

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 COR.

3.11 SPRAYED-ON FIREPROOFING

- A. Provide field inspection and testing services to certify sprayed-on fireproofing has been applied in accordance with contract documents.
- B. Obtain a copy of approved submittals from COR.
- C. Use approved installation in test areas as criteria for inspection of work.
- D. Test sprayed-on fireproofing for thickness and density in accordance with ASTM E605.
 - 1. Thickness gauge specified in ASTM E605 may be modified for pole extension so that overhead sprayed material can be reached from floor.
- E. Location of test areas for field tests as follows:
 - 1. Thickness: Select one bay per floor, or one bay for each 930 m² (10,000 square feet) of floor area, whichever provides for greater number of tests. Take thickness determinations from each of following locations: Metal deck, beam, and column.
 - 2. Density: Take density determinations from each floor, or one test from each 930 m² (10,000 square feet) of floor area, whichever provides for greater number of tests, from each of the following areas: Underside of metal deck, beam flanges, and beam web.
- F. Submit inspection reports, certification, and instances of noncompliance to COR.

END OF SECTION 01 45 29

SECTION 01 57 19 - TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 - GENERAL

1.1 DESCRIPTION

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

7. Sanitary Wastes:

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

1.2 QUALITY CONTROL

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

1.3 REFERENCES

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

33 CFR 328 Definitions

1.4 SUBMITTALS

- A. In accordance with Section, 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:
 - 1. Environmental Protection Plan: After the contract is awarded and prior to the commencement of the work, the Contractor shall meet with the COR to discuss the proposed Environmental Protection Plan and to develop mutual understanding relative to details of environmental protection. Not more than 20 days after the meeting, the Contractor shall prepare and submit to the COR 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.

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- 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.
 - l. MDEQ Storm Water Construction Permit:
 - 1) Contractor will complete the SWCP application process for VAMC review and Associate Director certification (per regulations VAMC must certify permit).
 - 2) Contractor to provide copies of the construction storm water permit as well as documented evidence of ongoing compliance with the Michigan Natural Resources and Environmental Protection Act of 1994, including Part 323 Michigan's Permit-By-Rule For Construction Activities.
 - 3) Contractor will obtain, implement and maintain this permit and associated plan.
 - m. Wayne County Soil Erosion and Sedimentation Control Permit:
 - 1) Contractor will provide copies of the application and issued Wayne County Soil Erosion and Sedimentation Permit.
 - 2) Contractor will provide documented evidence of ongoing compliance to permit requirements.
 - 3) Contractor will provide soil stockpile location and disposal facility prior to start of project.
 - 4) Contractor will obtain, implement and maintain this permit and associated 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.
- C. Contractor to provide a list of all bulk (container with capacity greater than 119 gallons) chemicals to be stored on site at any time during this project prior to start of project.

1.5 PROTECTION OF ENVIRONMENTAL RESOURCES

- A. Protect environmental resources within the project boundaries and those affected outside the limits of permanent work during the entire period of this contract. Confine activities to areas defined by the specifications and drawings.
- B. Protection of Land Resources: Prior to construction, identify all land resources to be preserved within the work area. Do not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, top soil, and land forms without permission from the COR. Do not fasten or attach ropes, cables, or guys to trees for anchorage unless specifically authorized, or where special emergency use is permitted.
 - 1. Work Area Limits: Prior to any construction, mark the areas that require work to be performed under this contract. Mark or fence isolated areas within the general work area that are to be saved and protected. Protect monuments, works of art, and markers before construction operations begin. Convey to all personnel the purpose of marking and protecting all necessary objects.
 - 2. Protection of Landscape: Protect trees, shrubs, vines, grasses, land forms, and other landscape features shown on the drawings to be preserved by marking, fencing, or using any other approved techniques.
 - a. Box and protect from damage existing trees and shrubs to remain on the construction site.
 - b. Immediately repair all damage to existing trees and shrubs by trimming, cleaning, and painting with antiseptic tree paint.
 - c. Do not store building materials or perform construction activities closer to existing trees or shrubs than the farthest extension of their limbs.
 - 3. Reduction of Exposure of Unprotected Erodible Soils: Plan and conduct earthwork to minimize the duration of exposure of unprotected soils. Clear areas in reasonably sized increments only as needed to use. Form earthwork to final grade as shown. Immediately protect side slopes and back slopes upon completion of rough grading.

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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. Sediment Basins: Trap sediment from construction areas in temporary or permanent sediment basins that accommodate the runoff of a local 10 year (design year) storm. After each storm, pump the basins dry and remove the accumulated sediment. Control overflow/drainage with paved weirs or by vertical overflow pipes, draining from the surface.
 - b. Reuse or conserve the collected topsoil sediment as directed by the COR. Topsoil use and requirements are specified in Section 31 20 00, EARTH MOVING.
 - c. 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 shown. Maintain temporary erosion and sediment control measures such as berms, dikes, drains, sedimentation basins, grassing, and mulching, until permanent drainage and erosion control facilities are completed and operative.
 6. Manage borrow areas on and off Government property to minimize erosion and to prevent sediment from entering nearby water courses or lakes.
 7. Manage and control spoil areas on and off Government property to limit spoil to areas on the Environmental Protection Plan and prevent erosion of soil or sediment from entering nearby water courses or lakes.
 8. Protect adjacent areas from despoilment by temporary excavations and embankments.
 9. Handle and dispose of solid wastes in such a manner that will prevent contamination of the environment. Place solid wastes (excluding clearing debris) in containers that are emptied on a regular schedule. Transport all solid waste off Government property and dispose of waste in compliance with Federal, State, and local requirements.
 10. Store chemical waste away from the work areas in corrosion resistant containers and dispose of waste in accordance with Federal, State, and local regulations.
 11. Handle discarded materials other than those included in the solid waste category as directed by the COR.
- C. Protection of Water Resources: Keep construction activities under surveillance, management, and control to avoid pollution of surface and ground waters and sewer systems. Implement management techniques to control water pollution by the listed construction activities that are included in this contract.
1. Washing and Curing Water: Do not allow wastewater directly derived from construction activities to enter water areas. Collect and place wastewater in retention ponds allowing the suspended material to settle, the pollutants to separate, or the water to evaporate.

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 Michigan and Federal emission and performance laws and standards. Maintain ambient air quality standards set by the Environmental Protection Agency, for those construction operations and activities specified.
1. Particulates: Control dust particles, aerosols, and gaseous by-products from all construction activities, processing, and preparation of materials (such as from asphaltic batch plants) at all times, including weekends, holidays, and hours when work is not in progress.
 2. Particulates Control: Maintain all excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and all other work areas within or outside the project boundaries free from particulates which would cause a hazard or a nuisance. Sprinklering, chemical treatment of an approved type, light bituminous treatment, baghouse, scrubbers, electrostatic precipitators, or other methods are permitted to control particulates in the work area.
 3. Hydrocarbons and Carbon Monoxide: Control monoxide emissions from equipment to Federal and State allowable limits.
 4. Odors: Control odors of construction activities and prevent obnoxious odors from occurring.
- F. Reduction of Noise: Minimize noise using every action possible. Perform noise-producing work in less sensitive hours of the day or week as directed by the COR. Maintain noise-produced work at or below the decibel levels and within the time periods specified.
1. Perform construction activities involving repetitive, high-level impact noise only between 8:00 a.m. and 6:00 p.m. unless otherwise permitted by local ordinance or the COR. Repetitive impact noise on the property shall not exceed the following dB limitations:

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

Less than three minutes of any hour	80
Less than 12 minutes of any hour	75

2. Provide sound-deadening devices on equipment and take noise abatement measures that are necessary to comply with the requirements of this contract, consisting of, but not limited to, the following:

- a. Maintain maximum permissible construction equipment noise levels at 15 m (50 feet) (dBA):

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

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

END OF SECTION 01 57 19

SECTION 01 74 19 - CONSTRUCTION WASTE MANAGEMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the requirements for the management of non-hazardous building construction and demolition waste.
- B. Waste disposal in landfills shall be minimized to the greatest extent possible. Of the inevitable waste that is generated, as much of the waste material as economically feasible shall be salvaged, recycled or reused.
- C. Contractor shall use all reasonable means to divert construction and demolition waste from landfills and incinerators, and facilitate their salvage and recycle not limited to the following:
 - 1. Waste Management Plan development and implementation.
 - 2. Techniques to minimize waste generation.
 - 3. Sorting and separating of waste materials.
 - 4. Salvage of existing materials and items for reuse or resale.
 - 5. Recycling of materials that cannot be reused or sold.
- D. At a minimum the following waste categories shall be diverted from landfills:
 - 1. Soil.
 - 2. Inerts (eg, concrete, masonry and asphalt).
 - 3. Clean dimensional wood and palette wood.
 - 4. Green waste (biodegradable landscaping materials).
 - 5. Engineered wood products (plywood, particle board and I-joists).
 - 6. Metal products (eg, steel, wire, beverage containers, copper).
 - 7. Cardboard, paper and packaging.
 - 8. Bitumen roofing materials.
 - 9. Plastics (eg, ABS, PVC).
 - 10. Carpet and/or pad.
 - 11. Gypsum board.
 - 12. Insulation.
 - 13. Paint.
 - 14. Fluorescent lamps.

1.2 RELATED WORK

- A. Section 01 00 00, GENERAL REQUIREMENTS.

- B. Section 02 41 00, DEMOLITION.

1.3 QUALITY ASSURANCE

- A. Contractor shall practice efficient waste management when sizing, cutting and installing building products. Processes shall be employed to ensure the generation of as little waste as possible. Construction /Demolition waste includes products of the following:
1. Excess or unusable construction materials.
 2. Packaging used for construction products.
 3. Poor planning and/or layout.
 4. Construction error.
 5. Over ordering.
 6. Weather damage.
 7. Contamination.
 8. Mishandling.
 9. Breakage.
- B. Establish and maintain the management of non-hazardous building construction and demolition waste set forth herein. Conduct a site assessment to estimate the types of materials that will be generated by demolition and construction.
- C. Contractor shall develop and implement procedures to reuse and recycle new materials to a minimum of 50 percent.
- D. Contractor shall be responsible for implementation of any special programs involving rebates or similar incentives related to recycling. Any revenues or savings obtained from salvage or recycling shall accrue to the contractor.
- E. Contractor shall provide all demolition, removal and legal disposal of materials. Contractor shall ensure that facilities used for recycling, reuse and disposal shall be permitted for the intended use to the extent required by local, state, federal regulations. The Whole Building Design Guide website <http://www.wbdg.org> provides a Construction Waste Management Database that contains information on companies that haul, collect, and process recyclable debris from construction projects.
- F. Contractor shall assign a specific area to facilitate separation of materials for reuse, salvage, recycling, and return. Such areas are to be kept neat and clean and clearly marked in order to avoid contamination or mixing of materials.
- G. Contractor shall provide on-site instructions and supervision of separation, handling, salvaging, recycling, reuse and return methods to be used by all parties during waste generating stages.
- H. Record on daily reports any problems in complying with laws, regulations and ordinances with corrective action taken.

1.4 TERMINOLOGY

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

- M. Recycling Facility: An operation that can legally accept materials for the purpose of processing the materials into an altered form for the manufacture of new products. Depending on the types of materials accepted and operating procedures, a recycling facility may or may not be required to have a solid waste facilities permit or be regulated by the local enforcement agency.
- N. Reuse: Materials that are recovered for use in the same form, on-site or off-site.
- O. Return: To give back reusable items or unused products to vendors for credit.
- P. Salvage: To remove waste materials from the site for resale or re-use by a third party.
- Q. Source-Separated Materials: Materials that are sorted by type at the site for the purpose of reuse and recycling.
- R. Solid Waste: Materials that have been designated as non-recyclable and are discarded for the purposes of disposal.
- S. Transfer Station: A facility that can legally accept solid waste for the purpose of temporarily storing the materials for re-loading onto other trucks and transporting them to a landfill for disposal, or recovering some materials for re-use or recycling.

1.5 SUBMITTALS

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES, furnish the following:
- B. Prepare and submit to the COR a written demolition debris management plan. The plan shall include, but not be limited to, the following information:
 - 1. Procedures to be used for debris management.
 - 2. Techniques to be used to minimize waste generation.
 - 3. Analysis of the estimated job site waste to be generated:
 - a. List of each material and quantity to be salvaged, reused, recycled.
 - b. List of each material and quantity proposed to be taken to a landfill.
 - c. List of each material and quantity of clean scrap metal.
 - d. List of each material and quantity of non-hazardous solid waste (industrial waste).
 - e. List of each material and quantity of universal waste.
 - f. List of each material and quantity of hazardous waste.
 - g. List of each material and quantity of radioactive waste.
 - h. List of each material and quantity of liquid waste.

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.
- D. Contractor will comply with Michigan Part 115 yard waste composting requirements. Contractor will provide all waste management documentation, including copies compost facility destination, to GEMS for compliance record retention.

3.2 DISPOSAL

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

3.3 REPORT

- A. With each application for progress payment, submit a summary of construction and demolition debris diversion and disposal including beginning and ending dates of period covered.
- B. Quantify all materials diverted from landfill disposal through salvage or recycling during the period with the receiving parties, dates removed, transportation costs, weight tickets, manifests, invoices. Include the net total costs or savings for each salvaged or recycled material.
- C. Quantify all materials disposed of during the period with the receiving parties, dates removed, transportation costs, weight tickets, tipping fees, manifests, invoices. Include the net total costs for each disposal.

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SECTION 01 91 00 - GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS shall form the basis of the construction phase commissioning process and procedures. The Commissioning Agent shall add, modify, and refine the commissioning procedures, as approved by the Department of Veterans Affairs (VA), to suit field conditions and actual manufacturer's equipment, incorporate test data and procedure results, and provide detailed scheduling for all commissioning tasks.
- B. Various sections of the project specifications require equipment startup, testing, and adjusting services. Requirements for startup, testing, and adjusting services specified in the Division 21, Division 22, Division 23, Division 26, Division 27, and Division 28 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 Division 21, Division 22, Division 23, Division 26, Division 27, and Division 28 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 contract documents and according to the manufacturer's recommendations.
 - 2. Verify and document proper integrated performance of equipment and systems.

3. Verify that Operations & Maintenance documentation is complete.
 4. Verify that all components requiring servicing can be accessed, serviced and removed without disturbing nearby components including ducts, piping, cabling or wiring.
 5. Verify that the VA's operating personnel are adequately trained to enable them to operate, monitor, adjust, maintain, and repair building systems in an effective and energy-efficient manner.
 6. Document the successful achievement of the commissioning objectives listed above.
- F. The commissioning process does not take away from or reduce the responsibility of the Contractor to provide a finished and fully functioning product.
- G. The Commissioning Agent, both the firm and individual designated as the Commissioning Agent, shall be certified by at least one of the following entities: the National Environmental Balancing Bureau (NEBB), the Associated Air Balance Council Commissioning Group (AABC), and the Building Commissioning Association (BCA). Certification(s) shall be valid and active. Proof of certification(s) shall be submitted to the Contracting Officer and the COR three (3) calendar days after the Notice to Proceed.

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 COR 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 COR.
- B. In this structure, only two contract parties are recognized and communications on contractual issues are strictly limited to VA COR 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 COR 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 COR.
- 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 COR. 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 COR 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 COR to require either an official interpretation of the construction documents or require a modification of the contract documents, the Contracting Officer or COR will issue an official directive to this effect.
 4. All parties to the Commissioning Process shall be individually responsible for alerting the COR 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 COR, 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 21 08 00 COMMISSIONING OF FIRE PROTECTION SYSTEMS.
- C. Section 22 08 00 COMMISSIONING OF PLUMBING SYSTEMS.
- D. Section 23 08 00 COMMISSIONING OF HVAC SYSTEMS.
- E. Section 26 08 00 COMMISSIONING OF ELECTRICAL SYSTEMS.
- F. Section 27 08 00 COMMISSIONING OF COMMUNICATIONS SYSTEMS.
- G. Section 28 08 00 COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS.

1.4 SUMMARY

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

1.5 DEFINITIONS

- A. Architect: Includes Architect identified in the Contract for Construction between the Department of Veterans Affairs and Contractor, plus consultant/design professionals responsible for design of fire suppression, plumbing, HVAC, controls for HVAC systems, electrical, communications, electronic safety and security, as well as other related systems.
- B. CxA: Commissioning Agent.
- C. Commissioning Plan: a document that is an overall plan that outlines the commissioning process, commissioning team responsibilities, schedule for commissioning activities, and commissioning documents.
- D. Commissioning Issue: a condition in the installation or function of a component, piece of equipment or system that affects the system operations, maintenance, and/or repair.
- E. Commissioning Observation: a condition in the installation or function of a component, piece of equipment or system that may not be in compliance with the Contract Documents, or may not be in compliance with the manufacturer's installation instruction, or may not be in compliance with generally accepted industry standards.

- F. **Systems Functional Performance Test:** a test, or tests, of the dynamic function and operation of equipment and systems using manual (direct observation) or monitoring methods. Systems Functional Performance Testing is the dynamic testing of systems (rather than just components) under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint). Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc. The systems are run through all the control system's sequences of operation and components are verified to be responding as the sequences state. Traditional air or water test and balancing (TAB) is not Systems Functional Performance Testing, in the commissioning sense of the word. TAB's primary work is setting up the system flows and pressures as specified, while System Functional Performance Testing is verifying that the system has already been set up properly and is functioning in accordance with the Construction Documents. The Commissioning Agent develops the Systems Functional Performance Test Procedures in a sequential written form, coordinates, witnesses, and documents the actual testing. Systems Functional Performance Testing is performed by the Contractor. Systems Functional Performance Tests are performed after startups, control systems are complete and operational, TAB functions and Pre-Functional Checklists are complete.
- G. **System:** A system is defined as the entire set of components, equipment, and subsystems which must be coordinated to work together during normal operation to produce results for which the system is designed. For example, air conditioning supply air is only one component of an entire system which provides comfort conditions for a building. Other related components are return air, exhaust air, steam supply, chilled water supply, refrigerant supply, hot water supply, controls and electrical service, etc. Another example of a system which involves several components of different disciplines is a boiler installation. Efficient and acceptable boiler operation depends upon the coordination and proper operation of the fuel supply, combustion air, controls, steam, feedwater supply, condensate return and other related components.
- H. **Pre-Functional Checklist:** a list of items provided by the Commissioning Agent to the Contractor that require inspection and elementary component tests conducted to verify proper installation of equipment. Pre-Functional Checklists are primarily static inspections and procedures to prepare the equipment or system for initial operation (e.g., belt tension, oil levels OK, labels affixed, gages in place, sensors calibrated, etc.). However, some Pre-Functional Checklist items entail simple testing of the function of a component, a piece of equipment or system (such as measuring the voltage imbalance on a three-phase pump motor of a chiller system). The term "Pre-Functional" refers to before Systems Functional Performance Testing. Pre-Functional Checklists augment and are combined with the manufacturer's startup checklist and the Contractor's Quality Control checklists.
- I. **Seasonal Functional Performance Testing:** a test or tests that are deferred until the system will experience conditions closer to their design conditions.

- J. VA: Includes the Contracting Officer, COR, 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. 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).
 - 2. Plumbing (Division 22)
 - a. Domestic Hot Water systems (Domestic water heaters, steam-to-hot water converters, hot water circulating pumps and motors, controls, combustion burners/fans/motors).
 - b. Medical Gas systems (Medical compressed air and air compressor, laboratory vacuum and vacuum pumps, nitrous oxide and oxygen, Medical Gas Alarm System).
 - c. Domestic Water Booster Pumps (Controls, piping, compression tanks, pumps, motors, and Variable Speed Drives).
 - d. Sewage Ejection Pumps (Sump level controls, pump alternator, alarms and alarm panel, pumps and motors).
 - e. Storm Sump Pumps (Sump level controls, pump alternator, alarms and alarm panel, pumps and motors).
 - f. Domestic Water Filtration and Softener Systems (Tanks and casings, gages and instruments, controls, pumps and motors – if applicable, packaged piping, alarms).
 - g. Chemical Waste System & Equipment (Waste storage tanks or sumps, controls and alarms, pumps and motors – if applicable).
 - h. Process Water Systems (Controls, piping, tanks and casings, gages and instruments, pumps, motors, and Variable Speed Drives – if applicable for reverse osmosis (RO) and deionized water (DI) systems).
 - i. Emergency Plumbing Fixtures (Showers, eye wash stations, water tempering valves, instruments and gages).

3. HVAC (Division 23)

- a. 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. Dehumidification Systems (Energy recovery devices – such as enthalpy wheels, fans, motors, Variable Speed Drives, cooling coils and control valves, heating coils and control valves, filters, dampers, safeties, controls, gages, and vibration isolation).
- c. Heating Hot Water Systems (Boilers, controls, instrumentation and gages, flues, heating water pumps and motors, Variable Speed Drives, mixing valves).
- d. Condensate Return Systems (Condensate receivers and transfer pumps, motors, controls, pump alternator, alarms and instrumentation, deaerators, boiler feed pumps and motors, safeties).
- e. 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).
- f. Exhaust Fans (Fan, motor, Variable Speed Drives, controls and safeties).
- g. Steam System (Boilers, controls, gages and instrumentation, safety relief valves, combustion burners/fans/motors, fuel delivery pumps and motors, flues).
- h. 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).
- i. Air Handling Systems (Fans, motors, Variable Speed Drives, Energy recovery devices – such as heat pipes, cooling coils and control valves, heating coils and control valves, filters, HEPA filter performance, dampers, safeties such as smoke detectors or freezestats and damper end switches, controls, gages, and vibration isolation).
- j. Room Pressurization Equipment (Pressure sensors, terminal units/dampers, and controls and alarms).
- k. HVAC Water Treatment Systems (Closed circuits – including shot feeders and final water analysis, open circuits – including water analysis, chemical/biocide tanks, injection piping, chemical/biocide pumps and motors, controls, water meter, and automatic blowdown).

4. Electrical (Division 26)

- a. Automatic Transfer Switches (Test with associated generator).
- b. Normal Power Distribution Systems (Grounding tests, coordination study review, major circuit breaker settings, meters and gages, and controls).

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- c. Life Safety Power Distribution Systems (Automatic transfer on loss of normal power, grounding tests, coordination study review, major circuit breaker settings, meters and gages, and controls).
 - d. Critical Power Distribution Systems (Automatic transfer on loss of normal power, grounding tests, coordination study review, major circuit breaker settings, meters and gages, and controls).
 - e. Essential Equipment Power Distribution Systems (Automatic transfer on loss of normal power, grounding tests, coordination study review, major circuit breaker settings, meters and gages, and controls).
 - f. Lighting Controls (Control system hardware and software, scene settings, zone settings, occupancy sensor interface, and unoccupied cycle control).
 - g. 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).
5. 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).
6. Electronic Safety and Security (Division 28)
- a. Fire Detection and Alarm (Master panel and software, addressable units – i.e. pull stations, flow detectors, heat detectors, etc., controls and alarm functions, horns/bells/door releases and other output devices, and fire command center functions – stairwell communications, stairwell pressurization fan start, mechanical systems shutdowns).

1.7 COMMISSIONING TEAM

A. Members Appointed by Contractor:

1. Contractor: The designated person, company, or entity that plans, schedules and coordinates the commissioning activities for the construction team.

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

B. Members Appointed by VA:

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

1.8 VA'S COMMISSIONING RESPONSIBILITIES

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

1.9 CONTRACTOR'S COMMISSIONING RESPONSIBILITIES

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

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- 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.

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- 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 Section 01 00 00 GENERAL REQUIREMENTS.
 - N. Review operation and maintenance training program developed by the Contractor. Verify training plans provide qualified instructors to conduct operation and maintenance training.
 - O. Prepare commissioning Field Observation Reports.
 - P. Prepare the Final Commissioning Report.
 - Q. Return to the site at 10 months into the 12 month warranty period and review with facility staff the current building operation and the condition of outstanding issues related to the original and seasonal Systems Functional Performance Testing. Also interview facility staff and identify problems or concerns they have operating the building as originally intended. Make suggestions for improvements and for recording these changes in the O&M manuals. Identify areas that may come under warranty or under the original construction contract. Assist facility staff in developing reports, documents and requests for services to remedy outstanding problems.

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

1.11 COMMISSIONING DOCUMENTATION

- A. Commissioning Agent's Certification(s): Commissioning Agent shall submit evidence of valid and current certification(s), as required in Section 1.1(G), to the Contracting Officer.
- B. Commissioning Plan: A document, prepared by Commissioning Agent, that outlines the schedule, allocation of resources, and documentation requirements of the commissioning process, and shall include, but is not limited, to the following:
 - 1. Plan for delivery and review of submittals, systems manuals, and other documents and reports. Identification of the relationship of these documents to other functions and a detailed description of submittals that are required to support the commissioning processes. Submittal dates shall include the latest date approved submittals must be received without adversely affecting commissioning plan.
 - 2. Description of the organization, layout, and content of commissioning documentation (including systems manual) and a detailed description of documents to be provided along with identification of responsible parties.
 - 3. Identification of systems and equipment to be commissioned.
 - 4. Schedule of Commissioning Coordination meetings.
 - 5. Identification of items that must be completed before the next operation can proceed.
 - 6. Description of responsibilities of commissioning team members.
 - 7. Description of observations to be made.
 - 8. Description of requirements for operation and maintenance training.
 - 9. Schedule for commissioning activities with dates coordinated with overall construction schedule.
 - 10. Process and schedule for documenting changes on a continuous basis to appear in Project Record Documents.
 - 11. Process and schedule for completing prestart and startup checklists for systems, subsystems, and equipment to be verified and tested.
 - 12. Preliminary Systems Functional Performance Test procedures.

- C. **Systems Functional Performance Test Procedures:** The Commissioning Agent will develop Systems Functional Performance Test Procedures for each system to be commissioned, including subsystems, or equipment and interfaces or interlocks with other systems. Systems Functional Performance Test Procedures will include a separate entry, with space for comments, for each item to be tested. Preliminary Systems Functional Performance Test Procedures will be provided to the VA, Architect/Engineer, and Contractor for review and comment. The Systems Performance Test Procedure will include test procedures for each mode of operation and provide space to indicate whether the mode under test responded as required. Each System Functional Performance Test procedure, regardless of system, subsystem, or equipment being tested, shall include, but not be limited to, the following:
1. Name and identification code of tested system.
 2. Test number.
 3. Time and date of test.
 4. Indication of whether the record is for a first test or retest following correction of a problem or issue.
 5. Dated signatures of the person performing test and of the witness, if applicable.
 6. Individuals present for test.
 7. Observations and Issues.
 8. Issue number, if any, generated as the result of test.
- D. **Pre-Functional Checklists:** The Commissioning Agent will prepare Pre-Functional Checklists. Pre-Functional Checklists shall be completed and signed by the Contractor, verifying that systems, subsystems, equipment, and associated controls are ready for testing. The Commissioning Agent will spot check Pre-Functional Checklists to verify accuracy and readiness for testing. Inaccurate or incomplete Pre-Functional Checklists shall be returned to the Contractor for correction and resubmission.
- E. **Test and Inspection Reports:** The Commissioning Agent will record test data, observations, and measurements on Systems Functional Performance Test Procedure. The report will also include recommendation for system acceptance or non-acceptance. Photographs, forms, and other means appropriate for the application shall be included with data. Commissioning Agent Will compile test and inspection reports and test and inspection certificates and include them in systems manual and commissioning report.
- F. **Corrective Action Documents:** The Commissioning Agent will document corrective action taken for systems and equipment that fail tests. The documentation will include any required modifications to systems and equipment and/or revisions to test procedures, if any. The Commissioning Agent will witness and document any retesting of systems and/or equipment requiring corrective action and document retest results.

G. Commissioning Issues Log: The Commissioning Agent will prepare and maintain Commissioning Issues Log that describes Commissioning Issues and Commissioning Observations that are identified during the Commissioning process. These observations and issues include, but are not limited to, those that are at variance with the Contract Documents. The Commissioning Issues Log will identify and track issues as they are encountered, the party responsible for resolution, progress toward resolution, and document how the issue was resolved. The Master Commissioning Issues Log will also track the status of unresolved issues.

1. Creating an Commissioning Issues Log Entry:

- a. Identify the issue with unique numeric or alphanumeric identifier by which the issue may be tracked.
- b. Assign a descriptive title for the issue.
- c. Identify date and time of the issue.
- d. Identify test number of test being performed at the time of the observation, if applicable, for cross reference.
- e. Identify system, subsystem, and equipment to which the issue applies.
- f. Identify location of system, subsystem, and equipment.
- g. Include information that may be helpful in diagnosing or evaluating the issue.
- h. Note recommended corrective action.
- i. Identify commissioning team member responsible for corrective action.
- j. Identify expected date of correction.
- k. Identify person that identified the issue.

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.

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- H. Final Commissioning Report: The Commissioning Agent will document results of the commissioning process, including unresolved issues, and performance of systems, subsystems, and equipment. The Commissioning Report will indicate whether systems, subsystems, and equipment have been properly installed and are performing according to the Contract Documents. This report will be used by the Department of Veterans Affairs when determining that systems will be accepted. This report will be used to evaluate systems, subsystems, and equipment and will serve as a future reference document during VA occupancy and operation. It shall describe components and performance that exceed requirements of the Contract Documents and those that do not meet requirements of the Contract Documents. The commissioning report will include, but is not limited to, the following:
1. Lists and explanations of substitutions; compromises; variances with the Contract Documents; record of conditions; and, if appropriate, recommendations for resolution. Design Narrative documentation maintained by the Commissioning Agent.
 2. Commissioning plan.
 3. Pre-Functional Checklists completed by the Contractor, with annotation of the Commissioning Agent review and spot check.
 4. Systems Functional Performance Test Procedures, with annotation of test results and test completion.
 5. Commissioning Issues Log.
 6. Listing of deferred and off season test(s) not performed, including the schedule for their completion.
- I. Addendum to Final Commissioning Report: The Commissioning Agent will prepare an Addendum to the Final Commissioning Report near the end of the Warranty Period. The Addendum will indicate whether systems, subsystems, and equipment are complete and continue to perform according to the Contract Documents. The Addendum to the Final Commissioning Report shall include, but is not limited to, the following:
1. Documentation of deferred and off season test(s) results.
 2. Completed Systems Functional Performance Test Procedures for off season test(s).
 3. Documentation that unresolved system performance issues have been resolved.
 4. Updated Commissioning Issues Log, including status of unresolved issues.
 5. Identification of potential Warranty Claims to be corrected by the Contractor.
- J. Systems Manual: The Commissioning Agent will gather required information and compile the Systems Manual. The Systems Manual will include, but is not limited to, the following:
1. Design Narrative, including system narratives, schematics, single-line diagrams, flow diagrams, equipment schedules, and changes made throughout the Project.
 2. Reference to Final Commissioning Plan.
 3. Reference to Final Commissioning Report.

4. Approved Operation and Maintenance Data as submitted by the Contractor.

1.12 SUBMITTALS

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

- C. Systems Functional Performance Test Procedure: The Commissioning Agent will submit preliminary Systems Functional Performance Test Procedures to the Contractor, and the VA for review and comment. The Contractor shall return review comments to the VA and the Commissioning Agent. The VA will also return review comments to the Commissioning Agent. The Commissioning Agent will incorporate review comments into the Final Systems Functional Test Procedures to be used in Systems Functional Performance Testing.
- D. Pre-Functional Checklists: The Commissioning Agent will submit Pre-Functional Checklists to be completed by the Contractor.
- E. Test and Inspection Reports: The Commissioning Agent will submit test and inspection reports to the VA with copies to the Contractor and the Architect/Engineer.
- F. Corrective Action Documents: The Commissioning Agent will submit corrective action documents to the VA COR 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 fifteen (15) calendar 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 thirty (30) calendar 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° C (1.0° F) and a resolution of + or - 0.1° C (0.2° F). Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available.

PART 3 - EXECUTION

3.1 STARTUP, INITIAL CHECKOUT, AND PRE-FUNCTIONAL CHECKLISTS

- A. The following procedures shall apply to all equipment and systems to be commissioned, according to Part 1, Systems to Be Commissioned.
1. Pre-Functional Checklists are important to ensure that the equipment and systems are hooked up and operational. These ensure that Systems Functional Performance Testing may proceed without unnecessary delays. Each system to be commissioned shall have a full Pre-Functional Checklist completed by the Contractor prior to Systems Functional Performance Testing. No sampling strategies are used.
 - a. The Pre-Functional Checklist will identify the trades responsible for completing the checklist. The Contractor shall ensure the appropriate trades complete the checklists.
 - b. The Commissioning Agent will review completed Pre-Functional Checklists and field-verify the accuracy of the completed checklist using sampling techniques.
 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, CO2 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.

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- 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 COR and Commissioning Agent for review and analysis before, during dynamic operation, and after Systems Functional Performance Testing. The Contractor shall provide, but not limited to, the following trend requirements and trend submissions:
1. Pre-testing, Testing, and Post-testing – Trend reports of trend logs and graphical trend plots are required as defined by the Commissioning Agent. The trend log points, sampling rate, graphical plot configuration, and duration will be dictated by the Commissioning Agent. At any time during the Commissioning Process the Commissioning Agent may recommend changes to aspects of trending as deemed necessary for proper system analysis. The Contractor shall implement any changes as directed by the COR. Any pre-test trend analysis comments generated by the Commissioning Team should be addressed and resolved by the Contractor, as directed by the COR, 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. 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		
RA Temperature	AI	15 Min	24 hours	3 days	N/A		
RA Humidity	AI	15 Min	24 hours	3 days	P	>60% RH	10 min
Mixed Air Temp	AI	None	None	None	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		
Return 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
CHW Valve Position	AI	15 Min	24 hours	3 days	N/A		
STM Valve Position	AI	15 Min	24 hours	3 days	N/A		
OA Flow	AI	15 Min	24 hours	3 days	P	±10% from SP	5 min
RA Flow	AI	15 Min	24 hours	3 days	P	±10% from SP	5 min
Duct Pressure	AI	15 Min	24 hours	3 days	C	±25% from SP	6 min
CO2 Level	AI	15 Min	24 hours	3 days	P	±10% from SP	10 min
Supply Fan 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
Return 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
Emergency AHU Shutdown	DI	COV	24 hours	3 days	P	True	1 min
Exhaust Fan #1 Status	DI	COV	24 hours	3 days	C	Status <> Command	10 min
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
OA Alarm	DI	COV	24 hours	3 days	C	True	10 min
High Static Alarm	DI	COV	24 hours	3 days	C	True	10 min
CO2 Alarm	DI	COV	24 hours	3 days	P	True	10 min
Power Failure	DI	COV	24 hours	3 days	P	True	1 min
Supply Fan Speed	AO	15 Min	24 hours	3 days	N/A		
Return Fan Speed	AO	15 Min	24 hours	3 days	N/A		
CHW Valve Position	AO	15 Min	24 hours	3 days	N/A		
STM Valve Position	AO	15 Min	24 hours	3 days	N/A		
Supply Fan S/S	DO	COV	24 hours	3 days	N/A		
Return Fan S/S	DO	COV	24 hours	3 days	N/A		
Exhaust Fan S/S	DO	COV	24 hours	3 days	N/A		

Air Handling Unit Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
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		

Terminal Unit (VAV, CAV, AFCV, 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
SA Temperature	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		

Unit Heater 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
Heating Valve Position	AO	15 Minutes	12 hours	3 days	N/A		
Unit Heater ON/OFF	DO	COV	12 hours	3 days	M	Status <> Command	30 min

Steam and Condensate Pumps Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Steam Flow (LB/HR)	AI	15 Minutes	12 hours	3 days	N/A		
Condensate Pump Run Hours	AI	15 Minutes	12 hours	3 days	N/A		
High Water Level Alarm	DI	COV	12 hours	3 days	C	True	5 Min
Condensate Pump Start/Stop	DO	COV	12 hours	3 days	P	Status <> Command	10 min

Domestic Hot Water Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Domestic HW Setpoint DWH-1	AI	15 Minute	12 Hours	3 days	N/A		
Domestic HW Setpoint DWH-2	AI	15 Minute	12 Hours	3 days	N/A		
Domestic HW Temperature	AI	15 Minute	12 Hours	3 days	C	> 135 °F	10 Min
Domestic HW Temperature	AI	15 Minute	12 Hours	3 days	P	±5°F from SP	10 Min
Dom. Circ. Pump #1 Status	DI	COV	12 Hours	3 days	M	Status <> Command	30 min
Dom. Circ. Pump #1 Start/Stop	DO	COV	12 Hours	3 days	N/A		
Domestic HW Start/Stop	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

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
HX-1 Entering Temperature	AI	15 min	12 hours	3 days	P	±5°F from SP	10 Min
HX-2 Entering Temperature	AI	15 min	12 hours	3 days	P	±5°F from SP	10 Min
HX-2 Leaving Temperature	AI	15 min	12 hours	3 days	P	±5°F from SP	10 Min
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		
Steam Station #2 1/3 Control Valve Position	AO	15 Min	12 Hours	3 days	N/A		
Steam Station #2 2/3 Control Valve Position	AO	15 Min	12 Hours	3 days	N/A		
Steam Station Bypass 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		

Hydronic Hot Water Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
HWR #1 Valve	DO	COV	12 Hours	3 days	N/A		
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 1 Entering Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 1 Leaving Temperature	AI	15 Minutes	12 Hours	3 days	P	±5°F from SP	10 Min
Chiller 1 Flow	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 1 Percent Load	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 1 KW Consumption	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 1 Tonnage	AI	15 Minutes	12 Hours	3 days	N/A		
Primary Loop Pump 1 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
Primary Loop Pump 2 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
Chiller 1 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
Chiller 1 Evaporator Iso-Valve	DI	COV	12 Hours	3 days	N/A		
Chiller 1 Evaporator Flow Switch	DI	COV	12 Hours	3 days	N/A		
Chiller 1 Unit Alarm	DI	COV	12 Hours	3 days	C	True	10 Min
Emergency Shutdown	DI	COV	12 Hours	3 days	P	True	1 Min

Chilled Water System Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Primary Loop Pump 1 VFD Speed	AO	15 Minutes	12 Hours	3 days	N/A		
Primary Loop Pump 2 VFD Speed	AO	15 Minutes	12 Hours	3 days	N/A		
Primary Pump 1 Start / Stop	DO	COV	12 Hours	3 days	N/A		
Primary Pump 2 Start / Stop	DO	COV	12 Hours	3 days	N/A		
Chiller 1 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 COR 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.

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- 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 COR, 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, and Division 28 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. Instructional 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 01 91 00

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

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.
- 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. Wherever a cutting torch or other equipment that might cause a fire is used, provide and maintain fire extinguishers nearby ready for immediate use. Instruct all possible users in use of fire extinguishers.
 - 3. Keep hydrants clear and accessible at all times. Prohibit debris from accumulating within a radius of 4500 mm (15 feet) of fire hydrants.
- G. Before beginning any demolition work, the Contractor shall survey the site and examine the drawings and specifications to determine the extent of the work. The contractor shall take necessary precautions to avoid damages to existing items to remain in place, to be reused, or to remain the property of the Medical Center; any damaged items shall be repaired or replaced as approved by the COR. The Contractor shall coordinate the work of this section with all other work and shall construct and maintain shoring, bracing, and supports as required. The Contractor shall ensure that structural elements are not overloaded and shall be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under this contract. Do not overload structural elements. Provide new supports and reinforcement for existing construction weakened by demolition or removal works. Repairs, reinforcement, or structural replacement must have COR's approval.
- H. The work shall comply with the requirements of Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.
- I. The work shall comply with the requirements of Section 01 00 00, GENERAL REQUIREMENTS, Article 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 by him daily, off the Medical Center to avoid accumulation at the demolition site. Materials that cannot be removed daily shall be stored in areas specified by the COR. Break up concrete slabs below grade that do not require removal from present location into pieces not exceeding 600 mm (24 inches) square to permit drainage. Contractor shall dispose debris in compliance with applicable federal, state or local permits, rules and/or regulations.
- C. 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 COR. When Utility lines are encountered that are not indicated on the drawings, the COR shall be notified prior to further work in that area.

3.2 CLEAN-UP

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

END OF SECTION 02 41 00

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 23, CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS.

1.3 TESTING AGENCY FOR CONCRETE MIX DESIGN

- A. Testing agency retained and reimbursed by the Contractor and approved by COR.
- B. Testing agency maintaining active participation in Program of Cement and Concrete Reference Laboratory (CCRL) of National Institute of Standards and Technology.
- C. Testing agency shall furnish equipment and qualified technicians to establish proportions of ingredients for concrete mixes.

1.4 TOLERANCES

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

- D. Slab Finishes: ACI 117, Section 4.5.6, F-number method in accordance with ASTM E1155, except as follows:
 - 1. Test entire slab surface, including those areas within 600 mm (2 feet) of construction joints and vertical elements that project through slab surface.
 - 2. Maximum elevation change which may occur within 600 mm (2 feet) of any column or wall element is 6 mm (0.25 inches).
 - 3. Allow sample measurement lines that are perpendicular to construction joints to extend past joint into previous placement no further than 1500 mm (5 feet).

1.5 REGULATORY REQUIREMENTS

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

1.6 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Shop Drawings: Reinforcing steel: Complete shop drawings
- C. Mill Test Reports:
 - 1. Reinforcing Steel.
 - 2. Cement.
- D. Manufacturer's Certificates:
 - 1. Abrasive aggregate.
 - 2. 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.
- F. Test Report for Concrete Mix Designs: Trial mixes including water-cement ratio curves, concrete mix ingredients, and admixtures.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Conform to ACI 304. Store aggregate separately for each kind or grade, to prevent segregation of sizes and avoid inclusion of dirt and other materials.
- B. Deliver cement in original sealed containers bearing name of brand and manufacturer, and marked with net weight of contents. Store in suitable watertight building in which floor is raised at least 300 mm (1 foot) above ground. Store bulk cement 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; COR; 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 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Concrete Institute (ACI):
- 117-10.....Tolerances for Concrete Construction and Materials
 - 211.1-91(R2009).....Selecting Proportions for Normal, Heavyweight, and Mass Concrete
 - 211.2-98(R2004).....Selecting Proportions for Structural Lightweight Concrete
 - 214R-02Evaluation of Strength Test Results of Concrete
 - 301-10.....Structural Concrete
 - 304R-00(R2009)Guide for Measuring, Mixing, Transporting, and Placing Concrete
 - 305R-10Hot Weather Concreting
 - 306R-10Cold Weather Concreting
 - 308R-01(R2008)Standard Practice for Curing Concrete
 - 309R-05Guide for Consolidation of Concrete
 - 318-08.....Building Code Requirements for Reinforced Concrete and Commentary
 - 347-04.....Guide to Formwork for Concrete
 - SP-66-04.....ACI Detailing Manual
- C. American National Standards Institute and American Hardboard Association (ANSI/AHA):
- A135.4-2004Basic Hardboard
- D. American Society for Testing and Materials (ASTM):
- A82/A82M-07Steel Wire, Plain, for Concrete Reinforcement
 - A185/185M-07Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
 - A615/A615M-09.....Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
 - A653/A653M-09.....Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - A706/A706M-09.....Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
 - A767/A767M-09.....Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement
 - A775/A775M-07Epoxy-Coated Reinforcing Steel Bars
 - A820-06Steel Fibers for Fiber-Reinforced Concrete
 - A996/A996M-09.....Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement
 - C31/C31M-09.....Making and Curing Concrete Test Specimens in the field
 - C33-08Concrete Aggregates

C39/C39M-09.....	Compressive Strength of Cylindrical Concrete Specimens
C94/C94M-09.....	Ready-Mixed Concrete
C143/C143M-10.....	Slump of Hydraulic Cement Concrete
C150-09	Portland Cement
C171-07	Sheet Materials for Curing Concrete
C172-08	Sampling Freshly Mixed Concrete
C173-10... ..	Air Content of Freshly Mixed Concrete by the Volumetric Method
C192/C192M-07.....	Making and Curing Concrete Test Specimens in the Laboratory
C231-09	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
C330-09	Lightweight Aggregates for Structural Concrete
C494/C494M-10.....	Chemical Admixtures for Concrete
C618-08	Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
C666/C666M-03.....	Resistance of Concrete to Rapid Freezing and Thawing
C881/C881M-02.....	Epoxy-Resin-Base Bonding Systems for Concrete
C1107/1107M-08	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(R2008)	Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)
D4397-09	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/D1.4M-11..... Structural Welding Code - Reinforcing Steel

F. Concrete Reinforcing Steel Institute (CRSI):

Handbook 2008

G. National Cooperative Highway Research Program (NCHRP):

Report On Concrete Sealers for the Protection of Bridge Structures

- H. U. S. Department of Commerce Product Standard (PS):
 - PS 1 Construction and Industrial Plywood
 - PS 20 American Softwood Lumber
- I. U. S. Army Corps of Engineers Handbook for Concrete and Cement:
 - CRD C513..... Rubber Waterstops
 - CRD C572..... Polyvinyl Chloride Waterstops

PART 2 - PRODUCTS

2.1 FORMS

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

2.2 MATERIALS

- A. Portland Cement: ASTM C150 Type I or II.
- B. Fly Ash: ASTM C618, Class C or F including supplementary optional requirements relating to reactive aggregates and alkalis, 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.

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- 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. Epoxy Coated Reinforcing Bars: ASTM A775.
 - M. Cold Drawn Steel Wire: ASTM A82.
 - N. 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.
 - O. Reinforcement for Metal Pan Stair Fill: 50 mm (2 inch) wire mesh, either hexagonal mesh at .8Kg/m² (1.5 pounds per square yard), or square mesh at .6Kg/m² (1.17 pounds per square yard).
 - 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. Moisture Vapor Emissions & Alkalinity Control Sealer: 100% active colorless aqueous silicate 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 .
 - 1. 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.

2. MVE 15-Year Warranty:

- a. 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.

V. 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.

W. 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/m³ (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/m³ (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 m³ (cubic yard) measured dry rodded and damp loose, specific gravity, fineness modulus, percentage of moisture, air content, water-cement -fly ash ratio, and consistency of each cylinder in terms of slump.
 3. Prepare a curve showing relationship between water-cement -fly ash ratio at 7-day and 28-day compressive strengths. Plot each curve using at least three specimens.
 4. If the field experience method is used, submit complete standard deviation analysis.
- B. Fly Ash Testing: Submit certificate verifying conformance with specifications initially with mix design and for each truck load of fly ash delivered from source. Notify COR immediately when change in source is anticipated. Prior to beginning trial mixes submit to the COR the following representative samples of material to be used, properly identified source and project description and number, type of testing (complete chemical and physical), suitably packaged for shipment, and addressed as specified. Allow 60 calendar days for test results after submittal of sample.
1. Fly ash - 2.25 kg (five pounds).
 2. Portland cement - 3.5 kg (8 pounds):
 - a. Address -Waterways Experiment Station (WES)
 - b. 3909 Halls Ferry Road
 - c. Vicksburg, MS 39180-6199
 - d. ATTN: Engineering Materials Group
- C. After approval of mixes no substitution in material or change in proportions of approval mixes may be made without additional tests and approval of COR 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. COR 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.
- D. Cement Factor: Maintain minimum cement factors in Table I regardless of compressive strength developed above minimums. Use Fly Ash as an admixture with 20% replacement by weight in all structural work. Increase this replacement to 40% for mass concrete, and reduce it to 10% for drilled piers and caissons.

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

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. Determined by Laboratory in accordance with ACI 211.1 for normal concrete or ACI 211.2 for lightweight structural concrete.

- E. Maximum Slump: Maximum slump, as determined by ASTM C143 with tolerances as established by ASTM C94, for concrete to be vibrated shall be as shown in Table II.

TABLE II - MAXIMUM SLUMP, MM (INCHES)*

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

- F. Slump 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.
- G. Air-Entrainment: Air-entrainment of normal weight concrete shall conform with Table III. Air-entrainment of lightweight structural concrete shall conform with Table IV. Determine air content by either ASTM C173 or ASTM C231.

**TABLE III - TOTAL AIR CONTENT
FOR VARIOUS SIZES OF COARSE AGGREGATES (NORMAL CONCRETE)**

Nominal Maximum Size of Total Air Content	Coarse Aggregate, mm (Inches) Percentage by Volume
10 mm (3/8 in).6 to 10	13 mm (1/2 in).5 to 9
20 mm (3/4 in).4 to 8	25 mm (1 in).3-1/2 to 6-1/2
40 mm (1 1/2 in).3 to 6	

- H. High early strength concrete, made with Type III cement or Type I cement plus non-corrosive accelerator, shall have a 7-day compressive strength equal to specified minimum 28-day compressive strength for concrete type specified made with standard Portland cement.
- I. Concrete slabs placed at air temperatures below 10 degrees C (50 degrees Fahrenheit) use non-corrosive, non-chloride accelerator. Concrete required 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, COR 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, COR 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, COR 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 COR.

2.4 BATCHING AND MIXING

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

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

1. Services of aggregate manufacturer's representative shall be furnished during the design of trial mixes and as requested by the COR for consultation during batching, mixing, and placing operations of lightweight structural concrete. Services 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 COR.

PART 3 - EXECUTION

3.1 FORMWORK

- A. General: Design in accordance with ACI 347 is the responsibility of the Contractor. The Contractor shall retain a registered Professional Engineer to design the formwork, shores, and reshores.
1. Form boards and plywood forms may be reused for contact surfaces of exposed concrete only if thoroughly cleaned, patched, and repaired and COR approves their reuse.
 2. Provide forms for concrete footings unless COR determines forms are not necessary.

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3. Corrugated fiberboard forms: Place forms on a smooth firm bed, set tight, with no buckled cartons to prevent horizontal displacement, and in a dry condition when concrete is placed.
- B. Treating and Wetting: Treat or wet contact forms as follows:
1. Coat plywood and board forms with non-staining form sealer. In hot weather, cool forms by wetting with cool water just before concrete is placed.
 2. Clean and coat removable metal forms with light form oil before reinforcement is placed. In hot weather, cool metal forms by thoroughly wetting with water just before placing concrete.
 3. Use sealer on reused plywood forms as specified for new material.
- C. Size and Spacing of Studs: Size and space studs, wales and other framing members for wall forms so as not to exceed safe working stress of kind of lumber used nor to develop deflection greater than $1/270$ of free span of member.
- D. Unlined Forms: Use plywood forms to obtain a smooth finish for concrete surfaces. Tightly butt edges of sheets to prevent leakage. Back up all vertical joints solidly and nail edges of adjacent sheets to same stud with 6d box nails spaced not over 150 mm (6 inches) apart.
- E. Lined Forms: May be used in lieu of unlined plywood forms. Back up form lining solidly with square edge board lumber securely nailed to studs with all edges in close contact to prevent bulging of lining. No joints in lining and backing 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.
- F. Architectural Liner: Attach liner as recommended by the manufacturer with tight joints to prevent leakage.
- G. Wall Form Ties: Locate wall form ties in symmetrically level horizontal rows at each line of wales and in plumb vertical tiers. Space ties to maintain true, plumb surfaces. Provide one row of ties within 150 mm (6 inches) above each construction joint. Space through-ties adjacent to horizontal and vertical construction joints not over 450 mm (18 inches) on center.
1. Tighten row of ties at bottom of form just before placing concrete and, if necessary, during placing of concrete to prevent seepage of concrete and to obtain a clean line. Ties to be entirely removed shall be loosened 24 hours after concrete is placed and shall be pulled from least important face when removed.
 2. Coat surfaces of all metal that is to be removed with paraffin, cup grease or a suitable compound to facilitate removal.

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- H. Inserts, Sleeves, and Similar Items: Flashing reglets, steel strips, masonry ties, anchors, wood blocks, nailing strips, grounds, inserts, wire hangers, sleeves, drains, guard angles, forms for floor hinge boxes, inserts or bond blocks for elevator guide rails and supports, and other items specified as furnished under this and other sections of specifications and required to be in their final position at time concrete is placed shall be properly located, accurately positioned, and built into construction, and maintained securely in place.
1. Locate inserts or hanger wires for furred and suspended ceilings only in bottom of concrete joists, or similar concrete member of overhead concrete joist construction.
 2. Install sleeves, inserts and similar items for mechanical services in accordance with drawings prepared specially for mechanical services. Contractor is responsible for accuracy and completeness of drawings and shall coordinate requirements for mechanical services and equipment.
 3. Do not install sleeves in beams, joists or columns except where shown or permitted by COR. Install sleeves in beams, joists, or columns that are not shown, but are permitted by the COR, and require no structural changes, at no additional cost to the Government.
 4. Minimum clear distance of embedded items such as conduit and pipe is at least three times diameter of conduit or pipe, except at stub-ups and other similar locations.
 5. Provide recesses and blockouts in floor slabs for door closers and other hardware as necessary in accordance with manufacturer's instructions.
- I. Construction Tolerances:
1. Set and maintain concrete formwork to assure erection of completed work within tolerances specified and to accommodate installation of other rough and finish materials. Accomplish remedial work necessary for correcting excessive tolerances. Erected work that exceeds specified tolerance limits shall be remedied or removed and replaced, at no additional cost to the Government.
 2. Permissible surface irregularities for various classes of materials are defined as "finishes" in specification sections covering individual materials. They 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 unless otherwise shown.

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- 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 318. Where concrete slabs are placed on ground, use concrete blocks or other non-corrodible material of proper height, for support of reinforcement. Use of brick or stone supports 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 COR.

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3. Mechanical Splices: Develop in tension and compression at least 125 percent of the yield strength (fy) of the bars. Stresses of transition splices between two reinforcing bar sizes based on area of smaller bar. Provide mechanical splices at locations indicated. Use approved exothermic, tapered threaded coupling, or swaged and threaded sleeve. Exposed threads and swaging in the field not permitted.
- a. Initial qualification: In the presence of COR, make three test mechanical splices of each bar size proposed to be spliced. 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 COR.
- F. Cleaning: Metal reinforcement, at time concrete is placed, shall be free from loose flaky rust, mud, oil, or similar coatings that will reduce bond.
- G. Future Bonding: Protect exposed reinforcement bars intended for bonding with future work by wrapping with felt and coating felt with a bituminous compound unless otherwise shown.

3.3 VAPOR BARRIER

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

3.4 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 m² (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 COR.
- B. Locate construction joints in suspended floors near the quarter-point of spans for slabs, beams or girders, unless a beam intersects a girder at center, in which case joint in girder shall be offset a distance equal to twice width of beam. Provide keys and inclined dowels as shown. Provide longitudinal keys as shown.
- C. Place concrete for columns slowly and in one operation between joints. Install joints in concrete columns at underside of deepest beam or girder framing into column.
- D. Allow 2 hours to elapse after column is cast before concrete of supported beam, girder or slab is placed. Place girders, beams, grade beams, column capitals, brackets, and haunches at the same time as slab unless otherwise shown.
- 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 COR before depositing concrete.
4. Provide runways for wheeling equipment to convey concrete to point of deposit. Keep equipment on runways which are not supported by or bear on reinforcement. Provide similar runways for protection of vapor barrier on coarse fill.

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

1. Preparing surface for applied topping:

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

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

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.

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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 COR.

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, thiocyanates or admixtures containing more than 0.05 percent chloride ions. Methods proposed for heating materials and arrangements for protecting concrete shall be made in advance of concrete placement and approved by COR.

3.10 PROTECTION AND CURING

- A. Conform to ACI 308: Initial curing shall immediately follow the finishing operation. Protect exposed surfaces of concrete from premature drying, wash by rain and running water, wind, mechanical injury, and excessively hot or cold temperatures. Keep concrete not covered with membrane or other curing material continuously wet for at least 7 days after placing, except wet curing period for high-early-strength concrete shall be not less than 3 days. Keep wood forms continuously wet to prevent moisture loss until forms are removed. Cure exposed concrete surfaces as described below. Other curing methods may be used if approved by COR.
 - 1. Liquid curing and sealing compounds: Apply by power-driven spray or roller in accordance with the manufacturer's instructions. Apply immediately after finishing. Maximum coverage 10m²/L (400 square feet per gallon) on steel troweled surfaces and 7.5m²/L (300 square feet per gallon) on floated or broomed surfaces for the curing/sealing compound.
 - 2. Plastic sheets: Apply as soon as concrete has hardened sufficiently to prevent surface damage. Utilize widest practical width sheet and overlap adjacent sheets 50 mm (2 inches). Tightly seal joints with tape.
 - 3. Paper: Utilize widest practical width paper and overlap adjacent sheets 50 mm (2 inches). Tightly seal joints with sand, wood planks, pressure-sensitive tape, mastic or glue.

3.11 REMOVAL OF FORMS

- A. Remove in a manner to assure complete safety of structure after the following conditions have been met.
 - 1. Where structure as a whole is supported on shores, forms for beams and girder sides, columns, and similar vertical structural members 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. 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 COR, and by rubbing lightly with a fine abrasive stone or hone. Use ample water during rubbing without working up a lather of mortar or changing texture of concrete.
3. Interior and exterior exposed areas finished: Give a grout finish of uniform color and smooth finish treated as follows:
 - a. After concrete has hardened and laitance, fins and burrs removed, scrub concrete with wire brushes. Clean stained concrete surfaces by use of a hone stone.
 - b. Apply grout composed of one part of Portland cement, one part fine sand, smaller than a 600 μ m (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 m² (2 square feet) in each 93 m² (1000 square feet) of textured surface.

B. Slab Finishes:

1. Monitoring and Adjustment: Provide continuous cycle of placement, measurement, evaluation and adjustment of procedures to produce slabs within specified tolerances. Monitor elevations of structural steel in key locations before and after concrete placement to establish typical deflection patterns for the structural steel. Determine elevations of cast-in-place slab soffits prior to removal of shores. Provide information to COR and floor consultant for evaluation and recommendations for subsequent placements.

2. Set perimeter forms to serve as screed using either optical or laser instruments. For slabs on grade, wet screeds may be used to establish initial grade during strike-off, unless COR determines that the method is proving insufficient to meet required finish tolerances and directs use of rigid screed guides. Where wet screeds are allowed, they shall be placed using grade stakes set by optical or laser instruments. Use rigid screed guides, as opposed to wet screeds, to control strike-off elevation for all types of elevated (non slab-on-grade) slabs. Divide bays into halves or thirds by hard screeds. Adjust as necessary where monitoring of previous placements indicates unshored structural steel deflections to other than a level profile.
3. Place slabs monolithically. Once slab placement commences, complete finishing operations within same day. Slope finished slab to floor drains where they occur, whether shown or not.
4. Use straightedges specifically made for screeding, such as hollow magnesium straightedges or power strike-offs. Do not use pieces of dimensioned lumber. Strike off and screed slab to a true surface at required elevations. Use optical or laser instruments to check concrete finished surface grade after strike-off. Repeat strike-off as necessary. Complete screeding before any excess moisture or bleeding water is present on surface. Do not sprinkle dry cement on the surface.
5. Immediately following screeding, and before any bleed water appears, use a 3000 mm (10 foot) wide highway straightedge in a cutting and filling operation to achieve surface flatness. Do not use bull floats or darbys, except that darbying 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.

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10. Broom Finish: Finish exterior slabs, ramps, and stair treads with a bristle brush moistened with clear water after surfaces have been floated. Brush in a direction transverse to main traffic. Match texture approved by COR from sample panel.
 11. Finished slab flatness (FF) and levelness (FL) values comply with the following minimum requirements:
 - a. Areas covered with carpeting, or not specified otherwise in b. below:
 - 1) Slab on Grade:

a) Specified overall value	FF 25/FL 20
b) Minimum local value	FF 17/FL 15
 - 2) Level suspended slabs (shored until after testing) and topping slabs:

a) Specified overall value	FF 25/FL 20
b) Minimum local value	FF 17/FL 15
 - 3) Unshored suspended slabs:

a) Specified overall value	FF 25
b) Minimum local value	FF 17
 - 4) Level tolerance such that 80 percent of all points fall within a 20 mm (3/4 inch) envelope +10 mm, -10 mm (+3/8 inch, -3/8 inch) from the design elevation.
 - b. Areas that will be exposed, receive thin-set tile or resilient flooring, or roof areas designed as future floors:
 - 1) Slab on grade:

a) Specified overall value	FF 36/FL 20
b) Minimum local value	FF 24/FL 15
 - 2) Level suspended slabs (shored until after testing) and topping slabs

a) Specified overall value	FF 30/FL 20
b) Minimum local value	FF 24/FL 15
 - 3) Unshored suspended slabs:

a) Specified overall value	FF 30
b) Minimum local value	FF 24
 - 4) 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 COR, to verify compliance with FF, FL, 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 FF and FL criteria is encouraged to retain the services of a floor consultant to assist with recommendations concerning adjustments to slab thicknesses, finishing techniques, and procedures on measurements of the finish as it progresses in order to achieve the specific flatness and levelness numbers.

13. Acceptance/ Rejection:

- a. If individual slab section measures less than either of specified minimum local FF/FL 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 FF/FL numbers, then whole slab shall be rejected and remedial measures shall be required.

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

3.14 SURFACE TREATMENTS

- A. 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 m² (7.5 percent per square foot) of area. Trowel concrete surface to smooth dense finish. After curing, rub treated surface with abrasive brick and water to slightly expose abrasive aggregate.

3.15 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 03 30 00

SECTION 04 05 13 - MASONRY MORTARING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Section specifies mortar materials and mixes.

1.2 RELATED WORK

- A. Mortar used in Section:
 - 1. Section 04 05 16, MASONRY GROUTING.
 - 2. Section 04 20 00, UNIT MASONRY.

1.3 TESTING LABORATORY-CONTRACTOR RETAINED

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

1.4 TESTS

- A. Test mortar and materials specified.
- B. Certified test reports.
- C. Identify materials by type, brand name and manufacturer or by origin.
- D. Do not use materials until laboratory test reports are approved by COR.
- E. After tests have been made and materials approved, do not change without additional test and approval of COR.
- F. Testing:
 - 1. Test materials proposed for use for compliance with specifications in accordance with test methods contained in referenced specifications and as follows.
 - 2. Mortar:
 - a. Test for compressive strength and water retention; ASTM C270.

- b. Mortar compressive strengths 28 days as follows:
 - c. Type M: Minimum 17230 kPa (2500 psi) at 28 days.
 - d. Type S: Minimum 12400 kPa (1800 psi) at 28 days.
 - e. Type N: Minimum 5170 kPa (750 psi) at 28 days.
 - 3. Cement:
 - a. Test for water soluble alkali (nonstaining) when nonstaining cement is specified.
 - b. Non-staining cement shall contain not more than 0.03 percent water soluble alkali.
 - 4. Sand: Test for deleterious substances, organic impurities, soundness and grading.
 - 5. High Bond Mortar: Test for compressive strength, tensile strength, flexural strength, and brick bond strength.
- G. During progress of work, testing laboratory specified in Section 01 45 29, TESTING LABORATORY SERVICES, takes and tests samples as specified in that section. Testing procedures and test methods in ASTM C780.

1.5 SUBMITTALS

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

- 3. Admixtures.
- 4. Liquid acrylic resin.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

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

1.7 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - C40-04 Organic Impurities in Fine Aggregates for Concrete
 - C91-05 Masonry Cement
 - C109-08 Compressive Strength of Hydraulic Cement Mortars (Using
2-in. or 50-MM Cube Specimens)
 - C144-04 Aggregate for Masonry Mortar
 - C150-09 Portland Cement
 - C207-06 Hydrated Lime for Masonry Purposes
 - C270-10 Mortar for Unit Masonry
 - C307-03(R2008) Tensile Strength of Chemical - Resistant Mortar, Grouts,
and Monolithic Surfacing
 - C321-00(R2005) Bond Strength of Chemical-Resistant Mortars
 - C348-08 Flexural Strength of Hydraulic Cement Mortars
 - C595-10 Blended Hydraulic Cement
 - C780-10 Preconstruction and Construction Evaluation of Mortars for
Plain and Reinforced Unit Masonry
 - C979-10 Pigments for Integrally Colored Concrete
 - C1329-05 Mortar Cement

PART 2 - PRODUCTS

2.1 HYDRATED LIME

- A. ASTM C207, Type S.

2.2 AGGREGATE FOR MASONRY MORTAR

- A. ASTM C144 and as follows:
 - 1. Light colored sand for mortar for laying face brick.
 - 2. White plastering sand meeting sieve analysis for mortar joints for pointing.
- B. Test sand for color value in accordance with ASTM C40. Sand producing color darker than specified standard is unacceptable.

2.3 BLENDED HYDRAULIC CEMENT

- A. ASTM C595, Type IS, IP.

2.4 MASONRY CEMENT

- A. ASTM C91. Type N, S, or M.
- B. Use white masonry cement whenever white mortar is specified.

2.5 MORTAR CEMENT

- A. ASTM C1329, Type N, S or M.

2.6 PORTLAND CEMENT

- A. ASTM C150, Type I.
- B. Use white Portland cement wherever white mortar is specified.

2.7 LIQUID ACRYLIC RESIN

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

2.8 WATER

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

2.9 POINTING MORTAR

- A. For Cast Stone or Precast Concrete: Proportion by volume; One part white Portland cement, two parts white sand, and 1/5 part hydrated lime.

2.10 MASONRY MORTAR

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

2.11 COLOR ADMIXTURE

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

PART 3 - EXECUTION

3.1 MIXING

- A. Mix in a mechanically operated mortar mixer.
 - 1. Mix mortar for at least three minutes but not more than five minutes.
- B. Measure ingredients by volume. Measure by the use of a container of known capacity.
- C. Mix water with dry ingredients in sufficient amount to provide a workable mixture which will adhere to vertical surfaces of masonry units.

- D. Mortar that has stiffened because of loss of water through evaporations:
 - 1. Re-tempered by adding water to restore to proper consistency and workability.
 - 2. Discard mortar that has reached its initial set or has not been used within two hours.
- E. Pointing Mortar:
 - 1. Mix dry ingredients with enough water to produce a damp mixture of workable consistency which will retain its shape when formed into a ball.
 - 2. Allow mortar to stand in dampened condition for one to 1-1/2 hours.
 - 3. Add water to bring mortar to a workable consistency prior to application.

3.2 MORTAR USE LOCATION

- A. Use Type M mortar for precast concrete panels and waterproof parging below grade.
- B. Use Type S mortar for masonry containing vertical reinforcing bars (non-engineered), masonry below grade, setting cast stone, and engineered reinforced unit masonry work.
- C. For brick veneer over frame back up walls, use Type N portland cement-lime mortar or Type S masonry cement or mortar cement mortar.
- D. Use Type N mortar for other masonry work, except as otherwise specified.
- E. Use Type N mortar for tuck pointing work.
- F. Use pointing mortar for items specified.

END OF SECTION 04 05 13

SECTION 04 05 16 - MASONRY GROUTING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Section specifies grout materials and mixes.

1.2 RELATED WORK

- A. Grout used in unit masonry assemblies: Section 04 20 00, UNIT MASONRY.

1.3 TESTS

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

1.4 SUBMITTALS

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

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

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

1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - C40-04Organic Impurities in Fine Aggregates for Concrete
 - C91-05Masonry Cement

C150-09	Portland Cement
C207-06	Hydrated Lime for Masonry Purposes
C404-07	Aggregate for Masonry Grout
C476-10	Grout for Masonry
C595-10	Blended Hydraulic Cement
C979-10	Pigments for Integrally Colored Concrete
C1019-11	Sampling and Testing Grout

PART 2 - PRODUCTS

2.1 HYDRATED LIME

- A. ASTM C207, Type S.

2.2 AGGREGATE FOR MASONRY GROUT

- A. ASTM C404, Size 8.

2.3 BLENDED HYDRAULIC CEMENT

- A. ASTM C595, Type IS, IP.

2.4 MASONRY CEMENT

- A. ASTM C91. Type N, S, or M.
- B. Use white masonry cement whenever white mortar is specified.

2.5 PORTLAND CEMENT

- A. ASTM C150, Type I.
- B. Use white Portland cement wherever white mortar is specified.

2.6 LIQUID ACRYLIC RESIN

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

2.7 WATER

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

2.8 GROUT

- A. Conform to ASTM C476 except as specified.
- B. Grout type proportioned by volume as follows:
 - 1. Fine Grout:
 - a. Portland cement or blended hydraulic cement: one part.
 - b. Hydrated lime: 0 to 1/10 part.
 - c. Fine aggregate: 2-1/4 to three times sum of volumes of cement and lime used.
 - 2. Coarse Grout:
 - a. Portland cement or blended hydraulic cement: one part.
 - b. Hydrated lime: 0 to 1/10 part.
 - c. Fine aggregate: 2-1/4 to three times sum of volumes of cement and lime used.
 - d. Coarse aggregate: one to two times sum of volumes of cement and lime used.
 - 3. Sum of volumes of fine and coarse aggregates: Do not exceed four times sum of volumes of cement and lime used.

PART 3 - EXECUTION

3.1 MIXING

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

3.2 GROUT USE LOCATIONS

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

END OF SECTION 04 05 16

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SECTION 04 20 00 - UNIT MASONRY

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies requirements for construction of masonry unit walls.
 - 1. Brick veneer.
 - 2. CMU partitions.

1.2 RELATED WORK

- A. Mortars and grouts: Section 04 05 13, MASONRY MORTARING, Section 04 05 16, MASONRY GROUTING.
- B. Steel lintels and shelf angles: Section 05 50 00, METAL FABRICATIONS.
- C. Parge coat: Section 07 11 13, BITUMINOUS DAMPPROOFING.
- D. Cavity insulation: Section 07 21 13, THERMAL INSULATION.
- E. Flashing: Section 07 60 00, FLASHING AND SHEET METAL.
- F. Sealants and sealant installation: Section 07 92 00, JOINT SEALANTS.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples:
 - 1. Face brick units sample panel, 200 mm by 400 mm (8 inches by 16 inches,) showing full color range and texture of bricks, bond, and proposed mortar joints.
- C. Manufacturer's Literature and Data:
 - 1. Brick.
 - 2. Anchors, ties, and reinforcement.
 - 3. Shear keys.
 - 4. Weeps.
 - 5. Flashing.

D. Certificates:

1. Indicating that the following items meet specification requirements:
 - a. Face brick units.
 - b. Solid and load-bearing concrete masonry units, including fire-resistant rated units.

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 Society for Testing and Materials (ASTM):

A951-06	Steel Wire for Masonry Joint Reinforcement.
A615/A615M-09	Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
A675/A675M-03(R2009)	Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties C34-03
	Structural Clay Load-Bearing Wall Tile
C55-09	Concrete Building Brick
C56-10	Structural Clay Non-Load-Bearing Tile
C62-0	Building Brick (Solid Masonry Units Made From Clay or Shale)
C67-09	Sampling and Testing Brick and Structural Clay Tile
C90-11	Load-Bearing Concrete Masonry Units
C126-10	Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units
C216-10	Facing Brick (Solid Masonry Units Made From Clay or Shale)
C476-10	Standard Specification for Grout for Masonry
C612-10	Mineral Fiber Block and Board Thermal Insulation
C744-10	Prefaced Concrete and Calcium Silicate Masonry Units.
D1056-07	Flexible Cellular Materials - Sponge or Expanded Rubber
D2000-08	Rubber Products in Automotive Applications
D2240-05(R2010)	Rubber Property - Durometer Hardness
D3574-08	Flexible Cellular Materials-Slab, Bonded, and Molded Urethane Foams
F1667-11	Fasteners: Nails, Spikes and Staples

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- C. Masonry Industry Council:
Hot and Cold Weather Masonry Construction Manual-98 (R2000)
- D. American Welding Society (AWS):
D1.4-11 Structural Welding Code – Reinforcing Steel
- E. Federal Specifications (FS):
FF-S-107C-00 Screws, Tapping and Drive
- F. Brick Industry Association - Technical Notes on Brick Construction (BIA):
11-2001 Guide Specifications for Brick Masonry, Part I
11A-1988 Guide Specifications for Brick Masonry, Part II
11B-1988 Guide Specifications for Brick Masonry, Part III Execution
11C-1998 Guide Specification for Brick Masonry Engineered Brick
Masonry, Part IV
11D-1988 Guide Specifications for Brick Masonry Engineered Brick
Masonry, Part IV continued
- G. Masonry Standards Joint Committee; Specifications for Masonry Structures TMS 602-08/ACI 530.1-08/ASCE 6-08 (2008 MSJC Book Version TMS-0402-08).

PART 2 - PRODUCTS

2.1 BRICK

- A. Face Brick:
1. ASTM C216, Grade SW, Type FBS, smooth texture.
 2. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
 3. Size:
 - a. Modular: 57 x 194 x 93 mm (2-1/4 x 7-5/8 x 3-5/8 inches).
 4. Colors: To match existing building.
 - a. Color #1: Orange tone.
 - b. Color #2: White tone.
 - c. Color #3: Beige tone.

2.2 CONCRETE MASONRY UNITS

- A. Hollow and Solid Load-Bearing Concrete Masonry Units: ASTM C90.
 - 1. Unit Weight: Normal weight.
 - 2. Fire rated units for fire rated partitions.
 - 3. Sizes: Modular: 397 x 194 x 194 mm (15-5/8 x 7-5/8 x 7-5/8 inches).
 - 4. For molded faces used as a finished surface, use concrete masonry units with uniform fine to medium surface texture unless specified otherwise.
 - 5. Use bullnose concrete masonry units at corners exposed in finished work with 25 mm (one inch) minimum radius rounded vertical exterior corners (bullnose units).

2.3 SHEAR KEYS

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

2.4 REINFORCEMENT

- A. Steel Reinforcing Bars: ASTM A615, deformed bars, 420 MPa (Grade 60) for bars No. 10 to No. 57 (No. 3 to No. 18), except as otherwise indicated.
- B. Where 6 mm diameter (No. 2) bars are shown, provide plain, round, carbon steel bars, ASTM A675, 550 MPa (Grade 80).
- C. Shop-fabricate reinforcement bars which are shown to be bent or hooked.
- D. Joint Reinforcement:
 - 1. Form from wire complying with ASTM A951.
 - 2. Galvanized after fabrication.
 - 3. Width of joint reinforcement 40 mm (1 5/8-inches) less than nominal width of masonry wall or partition.
 - 4. Cross wires welded to longitudinal wires.
 - 5. Joint reinforcing at least 3000 mm (10 feet) in length.
 - 6. Joint reinforcing in rolls is not acceptable.
 - 7. Joint reinforcing that is crimped to form drip is not acceptable.
 - 8. Maximum spacing of cross wires 400 mm (16 inches) to longitudinal wires.

-
9. Ladder Design:
 - a. Longitudinal wires deformed 4 mm (0.16 inch) diameter wire.
 - b. Cross wires 2.6 mm (0.10 inch) diameter.
 10. Trussed Design:
 - a. Longitudinal and cross wires not less than 4 mm (0.16 inch nominal) diameter.
 - b. Longitudinal wires deformed.
 11. Multiple wythes and cavity wall ties:
 - a. Longitudinal wires 2.6 mm (0.10 inch), two in each wythe with ladder truss wires 2.6 mm (0.10 inch) overlay, welded to each longitudinal wire.
 - b. Longitudinal wires 4 mm (0.16 inch) with U shape 2.6 mm (0.10 inch) rectangular ties extending into other wythe not less than 75 mm (3 inches) spaced 400 mm o.c. (16 inches). Adjustable type with U shape tie designed to receive 4 mm (0.16 inch) pintle projecting into other wythe 75 mm (3 inches) minimum.

2.5 ANCHORS, TIES, AND REINFORCEMENT

- A. Steel Reinforcing Bars: ASTM A615M, deformed bars, grade as shown.
- B. Joint Reinforcement:
 1. Form from wire complying with ASTM A951.
 2. Galvanized after fabrication.
 3. Width of joint reinforcement 40 mm (0.16 inches) less than nominal width of masonry wall or partition.
 4. Cross wires welded to longitudinal wires.
 5. Joint reinforcement at least 3000 mm (10 feet) in length.
 6. Joint reinforcement in rolls is not acceptable.
 7. Joint reinforcement that is crimped to form drip is not acceptable.
 8. Maximum spacing of cross wires 400 mm (16 inch) to longitudinal wires.
 9. Ladder Design:
 - a. Longitudinal wires deformed 4 mm (0.16 inch) diameter wire.
 - b. Cross wires 2.6 mm (0.10 inch) diameter.
 10. Trussed Design:
 - a. Longitudinal and cross wires not less than 4 mm (0.16 inch nominal) diameter.
 - b. Longitudinal wires deformed.

11. Multiple wythes wall ties:

- a. Longitudinal wires 4 mm (0.16 inch), two in each wythe with ladder truss wires 4 mm (0.16 inch) overlay, welded to each longitudinal wire.

12. Cavity wall ties:

- a. Longitudinal wires 4 mm (0.16 inch) with U shape 4 mm (0.16 inch) rectangular ties extending into other wythe not less than 75 mm (3 inches) spaced 400 mm o.c. (16 inches). Adjustable type with U shape tie designed to receive 4 mm (0.16 inch) pintle projecting into other wythe 75 mm (3 inches min.).

C. Adjustable Veneer Anchor for Frame Walls:

- 1. Two piece, adjustable anchor and tie.
- 2. Anchor and tie may be either type; use only one type throughout.
- 3. Loop Type:
 - a. Anchor: Screw-on galvanized steel anchor strap 2.75 mm (0.11 inch) by 19 mm (3/4 inch) wide by 225 mm (9 inches) long, with 9 mm (0.35 inch) offset and 100 mm (4 inch) adjustment. Provide 5 mm (0.20 inch) hole at each end for fasteners.
 - b. Ties: Triangular tie, fabricated of 5 mm (0.20 inch) diameter galvanized cold drawn steel wire. Ties long enough to engage the anchor and be embedded not less than 50 mm (2 inches) into the bed joint of the masonry veneer.
- 4. Angle Type:
 - a. Anchor: Minimum 2 mm (16 gage) thick galvanized steel angle shaped anchor strap. Provide hole in vertical leg for fastener. Provide hole near end of outstanding leg to suit upstanding portion of tie.
 - b. Tie: Fabricate from 5 mm (0.20 inch) diameter galvanized cold drawn steel wire. Form "L" shape to be embedded not less than 50 mm (2 inches) into the bed joint of the masonry veneer and provide upstanding leg to fit through hole in anchor and be long enough to allow 50 mm (2 inches) of vertical adjustment.

D. Individual Ties:

1. Adjustable Cavity Wall Ties:

- a. Adjustable wall ties may be used at Contractor's option.
- b. Two piece type permitting up to 40 mm (1-1/2 inch) adjustment.
- c. Form ties from 5 mm (3/16 inch) diameter galvanized steel wire.
- d. Form one piece to a rectangular shape 105 mm (4-1/8 inches) wide by length required to extend into the bed joint 50 mm (2 inches).

- e. Form the other piece to a 75 mm (3 inch) long by 75 mm (3 inch) wide shape, having a 75 mm (3 inch) long bent section for engaging the 105 mm (4-1/8 inch) wide piece to form adjustable connection.

E. Wall Ties, (Mesh or Wire):

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

F. Adjustable Steel Column Anchor:

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

G. Corrugated Wall Tie:

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

H. Adjustable Steel Beam Anchor:

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

I. Ridge Wall Anchors:

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

2.6 PREFORMED COMPRESSIBLE JOINT FILLER

- A. Thickness and depth to fill the joint as specified.
- B. Closed Cell Neoprene: ASTM D1056, Type 2, Class A, Grade 1, B2F1.

- C. Non-Combustible Type: ASTM C612, Class 5, 1800 degrees F.

2.7 CAVITY-WALL INSULATION

- A. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, closed-cell product extruded with an integral skin.

2.8 ACCESSORIES

- A. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
- B. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 3 mm (1/8 inch) less than depth of outer wythe, in color selected from manufacturer's standard.
- C. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
 - 1. Strips, full-depth of cavity and 250 mm (10 inches) high, with dovetail shaped notches 175 mm (7 inches) deep.
- D. Masonry Cleaner:
 - 1. Detergent type cleaner selected for each type masonry used.
 - 2. Acid cleaners are not acceptable.
 - 3. Use soapless type specially prepared for cleaning brick or concrete masonry as appropriate.
- E. Fasteners:
 - 1. Concrete Nails: ASTM F1667, Type I, Style 11, 19 mm (3/4 inch) minimum length.
 - 2. Masonry Nails: ASTM F1667, Type I, Style 17, 19 mm (3/4 inch) minimum length.
 - 3. Screws: FS-FF-S-107, Type A, AB, SF thread forming or cutting.

PART 3 - EXECUTION

3.1 JOB CONDITIONS

- A. Protection:
 - 1. Cover tops of walls with non-staining waterproof covering, when work is not in progress. Secure to prevent wind blow off.

2. On new work protect base of wall from mud, dirt, mortar droppings, and other materials that will stain face, until final landscaping or other site work is completed.

B. Cold Weather Protection:

1. Masonry may be laid in freezing weather when methods of protection are utilized.
2. Comply with MSJC and "Hot and Cold Weather Masonry Construction Manual".

3.2 CONSTRUCTION TOLERANCES

A. Lay masonry units plumb, level and true to line within the tolerances as per MSJC requirements and as follows:

B. Maximum variation from plumb:

1. In 3000 mm (10 feet) - 6 mm (1/4 inch).
2. In 6000 mm (20 feet) - 10 mm (3/8 inch).
3. In 12 000 mm (40 feet) or more - 13 mm (1/2 inch).

C. Maximum variation from level:

1. In any bay or up to 6000 mm (20 feet) - 6 mm (1/4 inch).
2. In 12 000 mm (40 feet) or more - 13 mm (1/2 inch).

D. Maximum variation from linear building lines:

1. In any bay or up to 6000 mm (20 feet) - 13 mm (1/2 inch).
2. In 12 000 mm (40 feet) or more - 19 mm (3/4 inch).

E. Maximum variation in cross-sectional dimensions of columns and thickness of walls from dimensions shown:

1. Minus 6 mm (1/4 inch).
2. Plus 13 mm (1/2 inch).

F. Maximum variation in prepared opening dimensions:

1. Accurate to minus 0 mm (0 inch).
2. Plus 6 mm (1/4 inch).

3.3 INSTALLATION GENERAL

A. Keep finish work free from mortar smears or spatters, and leave neat and clean.

B. Anchor masonry as specified in Paragraph, ANCHORAGE.

C. Wall Openings:

1. Fill hollow metal frames built into masonry walls and partitions solid with mortar as laying of masonry progresses.
2. If items are not available when walls are built, prepare openings for subsequent installation.

D. Tooling Joints:

1. Do not tool until mortar has stiffened enough to retain thumb print when thumb is pressed against mortar.
2. Tool while mortar is soft enough to be compressed into joints and not raked out.
3. Finish joints in exterior face masonry work with a jointing tool, and provide smooth, water-tight concave joint unless specified otherwise.
4. Tool exposed interior joints in finish work concave unless specified otherwise.

E. Partition Height:

1. Extend partitions at least 100 mm (four inches) above suspended ceiling or to overhead construction where no ceiling occurs.
2. Extend following partitions to overhead construction.
 - a. Where noted smoke partitions, FHP (full height partition), and FP (fire partition) and smoke partitions (SP) on drawings.
 - b. Both walls at expansion joints.
 - c. Corridor walls.
 - d. Walls at stairway and stair halls, elevators, dumbwaiters, trash and laundry chute shafts, and other vertical shafts.
 - e. Walls at refrigerator space.
 - f. Reinforced masonry partitions
3. Extend finish masonry partitions at least four-inches above suspended ceiling and continue with concrete masonry units to overhead construction.

F. Lintels:

1. Lintels are not required for openings less than 1000 mm (3 feet 4 inches) wide that have hollow metal frames.
2. Use steel lintels, for openings over 1600 mm (5 feet 4 inches) wide, brick masonry, and elevator openings unless shown otherwise.
3. Doors having overhead concealed door closers require a steel lintel, and a pocket for closer box.
4. Length for minimum bearing of 100 mm (4 inches) at ends.

G. Wall, Furring, and Partition Units:

1. Lay out field units to provide for running bond of walls and partitions, with vertical joints in second course centering on first course units unless specified otherwise.

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2. Align head joints of alternate vertical courses.
 3. At sides of openings, balance head joints in each course on vertical center lines of openings.
 4. Use no piece shorter than 100 mm (4 inches) long.
 5. On interior partitions provide a 6 mm (1/4 inch) open joint for caulking between existing construction, exterior walls, concrete work, and abutting masonry partitions.
 6. Use not less than 100 mm (4 inches) nominal thick masonry for free standing furring unless shown otherwise.
- H. Use not less than 100 mm (4 inches) nominal thick masonry for fireproofing steel columns unless shown otherwise.
- I. Before connecting new masonry with previously laid, remove loosened masonry or mortar, and clean and wet work in place as specified under wetting.
- J. When new masonry partitions start on existing floors, machine cut existing floor finish material down to concrete surface.
- K. Structural Steel Encased in Masonry:
1. Where structural steel is encased in masonry and the voids between the steel and masonry are filled with mortar, provide a minimum 25 mm (1 inch) mortar free expansion space between the masonry and the steel by applying a box board material to the steel before the masonry is laid.
 2. Do not place spacing material where steel is bearing on masonry or masonry is bearing on steel.
- L. Chases:
1. Do not install chases in masonry walls and partitions exposed to view in finished work, including painted or coated finishes on masonry.
 2. Masonry 100 mm (4 inch) nominal thick may have electrical conduits 25 mm (1 inch) or less in diameter when covered with soaps, or other finishes.
 3. Full recess chases after installation of conduit, with mortar and finish flush.
 4. When pipes or conduits, or both occur in hollow masonry unit partitions retain at least one web of the hollow masonry units.
- M. Wetting and Wetting Test:
1. Test and wet brick or clay tile in accordance with BIA 11B.
 2. Do not wet concrete masonry units or glazed structural facing tile before laying.
- N. Temporary Formwork: Provide formwork and shores as required for temporary support of reinforced masonry elements.

- O. Construct formwork to conform to shape, line and dimensions shown. Make sufficiently tight to prevent leakage of mortar, grout, or concrete (if any). Brace, tie and support as required to maintain position and shape during construction and curing of reinforced masonry.
- P. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and all other reasonable temporary loads that may be placed on them during construction.
- Q. Allow not less than the following minimum time to elapse after completion of members before removing shores or forms, provided suitable curing conditions have been obtained during the curing period.
 - 1. 10 days for girders and beams.
 - 2. 7 days for slabs.
 - 3. 7 days for reinforced masonry soffits.

3.4 ANCHORAGE

- A. Veneer to Frame Walls:
 - 1. Use adjustable veneer anchors.
 - 2. Fasten anchor to stud through sheathing with self drilling and tapping screw, one at each end of loop type anchor.
 - 3. Space anchors not more than 400 mm (16 inches) on center vertically at each stud.
- B. Veneer to Concrete Walls:
 - 1. Anchor new masonry facing to existing concrete with corrugated wall ties spaced at 400 mm, (16 inch) maximum vertical intervals, and at 600 mm (2 feet) maximum horizontal intervals. Fasten ties to concrete with power actuated fasteners or concrete nails.
- C. Masonry Facing to Backup and Cavity Wall Ties:
 - 1. Use individual ties for new work.
 - 2. Stagger ties in alternate courses, and space at 400 mm (16 inches) maximum vertically, and 600 mm (2 feet) horizontally.
 - 3. At openings, provide additional ties spaced not more than 900 mm (3 feet) apart vertically around perimeter of opening, and within 300 mm (12 inches) from edge of opening.
 - 4. Anchor new masonry facing to existing masonry with corrugated wall ties spaced at 400 mm (16 inch) maximum vertical intervals and at every second masonry unit horizontally. Fasten ties to masonry with masonry nails.
 - 5. Option: Use joint reinforcing for multiple wythes and cavity wall ties spaced not more than 400 mm (16 inches) vertically.

6. Tie interior and exterior wythes of reinforced masonry walls together with individual ties. Provide ties at intervals not to exceed 600 mm (24 inches) on center horizontally, and 400 mm (16 inches) on center vertically. Lay ties in the same line vertically in order to facilitate vibrating of the grout pours.

D. Anchorage of Abutting Masonry:

1. Anchor interior 100 mm (4 inch) thick masonry partitions to exterior masonry walls with wall ties. Space ties at 600 mm (2 foot) maximum vertical intervals. Extend ties 100 mm (4 inches) minimum into masonry.
2. Anchor interior masonry bearing walls or interior masonry partitions over 100 mm (4 inches) thick to masonry walls with rigid wall anchors spaced at 400 mm (16 inch) maximum vertical intervals.
3. Anchor abutting interior masonry partitions to concrete and existing masonry construction, with corrugated wall ties. Extend ties at least 100 mm (4 inches) into joints of new masonry. Fastened to concrete and masonry construction, with powder actuated drive pins, nail or other means that provides rigid anchorage. Install anchors at 400 mm (16 inch) maximum vertical intervals.

E. Masonry Furring:

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

F. Anchorage to Steel Beams or Columns:

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

3.5 REINFORCEMENT

A. Joint Reinforcement:

1. Use as joint reinforcement in CMU wythe of combination brick and CMU, cavity walls, and single wythe concrete masonry unit walls or partitions.
2. Reinforcing may be used in lieu of individual ties for anchoring brick facing to CMU backup in exterior masonry walls.
3. Brick veneer over frame backing walls does not require joint reinforcement.
4. Locate joint reinforcement in mortar joints at 400 mm (16 inch) maximum vertical intervals.
5. Additional joint reinforcement is required in mortar joints at both 200 mm (8 inches) and 400 (16 inches) above and below windows, doors, louvers and similar openings in masonry, except where other type anchors are required for anchorage of masonry to concrete structure.

6. Joint reinforcement is required in every other course of stack bond CMU masonry.
7. Wherever brick masonry is backed up with stacked bond masonry, joint reinforcement is required in every other course of CMU backup, and in corresponding joint of facing brick.

B. Steel Reinforcing Bars:

1. Install in cells of hollow masonry units where required for vertical reinforcement and in bond beam units for lintels and bond beam horizontal reinforcement. Install in wall cavities of reinforced masonry walls where shown.
2. Use grade 60 bars if not specified otherwise.
3. Bond Beams:
 - a. Form Bond beams of load-bearing concrete masonry units filled with ASTM C476 grout and reinforced with 2-#15m (#5) reinforcing steel unless shown otherwise. Do not cut reinforcement.
 - b. Brake bond beams only at expansion joints and at control joints, if shown.
4. Grout openings:
 - a. Leave cleanout holes in double wythe walls during construction by omitting units at the base of one side of the wall.
 - b. Locate 75 mm x 75 mm (3 in. x 3 in.) min. clean-out holes at location of vertical reinforcement.
 - c. Keep grout space clean of mortar accumulation and sand debris. Clean the grout space every day using a high pressure jet stream of water, or compressed air, or industrial vacuum, or by laying wood strips on the metal ties as the wall is built. If wood strips are used, lift strips with wires as the wall progresses and before placing each succeeding course of wall ties.

3.6 BRICK EXPANSION AND CMU CONTROL JOINTS

- A. Provide brick expansion (BEJ) and CMU control (CJ) joints where shown on drawings.
- B. Keep joint free of mortar and other debris.
- C. Where joints occur in masonry walls.
 1. Install preformed compressible joint filler in brick wythe.
 2. Install cross shaped shear keys in concrete masonry unit wythe with preformed compressible joint filler on each side of shear key unless otherwise specified.
 3. Install filler, backer rod, and sealant on exposed faces.
- D. Use standard notched concrete masonry units (sash blocks) made in full and half-length units where shear keys are used to create a continuous vertical joint.

- E. Interrupt steel joint reinforcement at expansion and control joints unless otherwise shown.
- F. Fill opening in exposed face of expansion and control joints with sealant as specified in Section 07 92 00, JOINT SEALANTS.

3.7 BUILDING EXPANSION AND SEISMIC JOINTS

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

3.8 ISOLATION SEAL

- A. Where full height walls or partitions lie parallel or perpendicular to and under structural beams or shelf angles, provide a separation between walls or partitions and bottom of beams or shelf angles not less than the masonry joint thickness unless shown otherwise.
- B. Insert in the separation, a continuous full width strip of non-combustible type compressible joint filler.
- C. Where exposed in finish work, cut back filler material in the joint enough to allow for the joint to be filled with sealant material specified in Section 07 92 00, JOINT SEALANTS.

3.9 BRICKWORK

- A. Lay clay brick in accordance with BIA Technical Note 11 series.
- B. Laying:
 - 1. Lay brick in running bond with course of masonry bonded at corners unless shown otherwise. Match bond of existing building on alterations and additions.
 - 2. Maintain bond pattern throughout.
 - 3. Do not use brick smaller than half-brick at any angle, corner, break or jamb.
 - 4. Where length of cut brick is greater than one half but less than a whole brick, maintain the vertical joint location of such units.
 - 5. Lay exposed brickwork joints symmetrical about center lines of openings.
 - 6. Do not structural bond multi wythe brick walls unless shown.
 - 7. Before starting work, lay facing brick on foundation wall and adjust bond to openings, angles, and corners.

8. Lay brick for sills with wash and drip.
9. Build solid brickwork as required for anchorage of items.

C. Joints:

1. Exterior and interior joint widths: Lay for three equal joints in 200 mm (eight inches) vertically, unless shown otherwise.
2. Rake joints for pointing with colored mortar when colored mortar is not full depth.
3. Arches:
 - a. Flat arches (jack arches) lay with camber of 1 in 200 (1/16 inch per foot) of span.
 - b. Face radial arches with radial brick with center line of joints on radial lines.
 - c. Form Radial joints of equal width.
 - d. Bond arches into backing with metal ties in every other joint.

D. Weep Holes:

1. Install weep holes at 600 mm (24 inches) on center in bottom of vertical joints of exterior masonry veneer or cavity wall facing over foundations, bond beams, and other water stops in the wall.
2. Install weep holes in head joints in exterior wythes.
3. Install cavity drainage material in cavity.

E. Cavity Type Exterior Walls:

1. Keep air space clean of mortar accumulations and debris.
 - a. Clean cavity by use of hard rubber, wood or metal channel strips having soft material on sides contacting wythes.
 - b. Lift strips with wires before placing next courses of horizontal joint reinforcement or individual ties.
2. For each lift lay two courses of concrete masonry units, followed by six courses of brick facing.
3. Lay the interior wythe of the masonry wall full height where dampproofing is required on cavity face. Coordinate to install dampproofing prior to laying outer wythe.
4. Insulated Cavity Type Exterior Walls:
 - a. Install the insulation against the cavity face of inner masonry wythe.
 - b. Place insulation between rows of ties or joint reinforcing or bond to masonry surface with a bonding agent as recommended by the manufacturer of the insulation.
 - c. Lay the outer masonry wythe up with an air space between insulation and masonry units.

5. Veneer Framed Walls:

- a. Build with 100 mm (4 inches) of face brick over sheathed stud wall with air space.
- b. Keep air space clean of mortar accumulations and debris.

3.10 CONCRETE MASONRY UNITS

A. Kind and Users:

1. Provide special concrete masonry shapes as required. Use solid concrete masonry units, where full units cannot be used, or where needed for anchorage of accessories.
2. Provide solid load-bearing concrete masonry units or grout the cell of hollow units at jambs of openings in walls, where structural members impose loads directly on concrete masonry, and where shown.
3. Provide rounded corner (bullnose) shapes at opening jambs in exposed work and at exterior corners.
4. Do not use brick jambs in exposed finish work.
5. Use concrete building brick only as filler in backup material where not exposed.
6. Masonry assemblies shall meet the required fire resistance in fire rated partitions of type and construction that will provide fire rating as shown.

B. Laying:

1. Lay concrete masonry units with 10 mm (3/8 inch) joints, with a bond overlap of not less than 1/4 of the unit length, except where stack bond is required.
2. Do not wet concrete masonry units before laying.
3. Bond external corners of partitions by overlapping alternate courses.
4. Lay first course in a full mortar bed.
5. Set anchorage items as work progress.
6. Where ends of anchors, bolts, and other embedded items, project into voids of units, completely fill such voids with mortar or grout.
7. Provide a 6 mm (1/4 inch) open joint for caulking between existing construction, exterior walls, concrete work, and abutting masonry partitions.
8. Lay concrete masonry units with full face shell mortar beds and fill head joint beds for depth equivalent to face shell thickness.
9. Lay concrete masonry units so that cores of units, that are to be filled with grout, are vertically continuous with joints of cross webs of such cores completely filled with mortar. Unobstructed core openings not less than 50 mm (2 inches) by 75 mm (3 inches).
10. Do not wedge the masonry against the steel reinforcing. Minimum 13 mm (1/2 inch) clear distance between reinforcing and masonry units.
11. Install deformed reinforcing bars of sizes shown.
12. Steel reinforcement, at time of placement, free of loose flaky rust, mud, oil, or other coatings that will destroy or reduce bond.
13. Steel reinforcement in place before grouting.

14. Minimum clear distance between parallel bars: One bar diameter.
15. Hold vertical steel reinforcement in place by centering clips, caging devices, tie wire, or other approved methods, vertically at spacings noted.
16. Support vertical bars near each end and at intermediate intervals not exceeding 192 bar diameters.
17. Reinforcement shall be fully encased by grout or concrete.
18. Splice reinforcement or attach reinforcement to dowels by placing in contact and secured or by placing the reinforcement within 1/5 of the required bar splice length.
19. Stagger splices in adjacent horizontal reinforcing bars. Lap reinforcing bars at splices a minimum of 40 bar diameters.
20. Grout cells of concrete masonry units, containing the reinforcing bars, solid as specified under grouting.
21. Cavity and joint horizontal reinforcement may be placed as the masonry work progresses.
22. Rake joints 6 to 10 mm (1/4 to 3/8 inch) deep for pointing with colored mortar when colored mortar is not full depth.

C. Waterproofing Parging:

1. Parge earth side of concrete masonry unit basement walls with dampproofing.
2. Clean wall surfaces to receive parging of dirt, oil, or grease, and moisten before application.
3. Thicken parging and round to form a cove at the junction of outside wall face and footing.

3.11 POINTING

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

3.12 GROUTING

- A. Preparation:
 1. Clean grout space of mortar droppings before placing grout.
 2. Close cleanouts.

3. Install vertical solid masonry dams across grout space for full height of wall at intervals of not more than 9000 mm (30 feet). Do not bond dam units into wythes as masonry headers.
4. Verify reinforcing bars are in cells of units or between wythes as shown.

B. Placing:

1. Place grout by hand bucket, concrete hopper, or grout pump.
2. Consolidate each lift of grout after free water has disappeared but before plasticity is lost.
3. Do not slush with mortar or use mortar with grout.
4. Interruptions:
 - a. When grouting must be stopped for more than an hour, top off grout 40 mm (1-1/2 inch) below top of last masonry course.
 - b. Grout from dam to dam on high lift method.
 - c. A longitudinal run of masonry may be stopped off only by raking back one-half a masonry unit length in each course and stopping grout 100 mm (4 inches) back of rake on low lift method.

C. Puddling Method:

1. Double wythe masonry constructed grouted in lifts not to exceed 300 mm (12 inches) or less than 50 mm (2 inches) wide.
2. Consolidate by puddling with a grout stick during and immediately after placing.
3. Grout the cores of concrete masonry units containing the reinforcing bars solid as the masonry work progresses.

D. Low Lift Method:

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

3.13 PLACING REINFORCEMENT

- A. General: Clean reinforcement of loose rust, mill scale, earth, ice or other materials which will reduce bond to mortar or grout. Do not use reinforcement bars with kinks or bends not shown on the Contract Drawings or final shop drawings, or bars with reduced cross-section due to excessive rusting or other causes.
- B. Position reinforcement accurately at the spacing indicated. Support and secure vertical bars against displacement. Horizontal reinforcement may be placed as the masonry work progresses. Where vertical bars are shown in close proximity, provide a clear distance between bars of not less than the nominal bar diameter or 25 mm (1 inch), whichever is greater.

- C. For columns, piers and pilasters, provide a clear distance between vertical bars as indicated, but not less than 1 1/2 times the nominal bar diameter or 38 mm (1-1/2 inches), whichever is greater. Provide lateral ties as indicated.
- D. Splice reinforcement bars where shown; do not splice at other places unless accepted by the COR. Provide lapped splices, unless otherwise indicated. In splicing vertical bars or attaching to dowels, lap ends, place in contact and wire tie.
- E. Provide not less than minimum lap as indicated on shop drawings, or if not indicated, as required by governing code.
- F. Weld splices where indicated. Comply with the requirements of AWS D1.4 for welding materials and procedures.
- G. Embed metal ties in mortar joints as work progresses, with a minimum mortar cover of 15 mm (5/8 inch) on exterior face of walls and 13 mm (1/2 inch) at other locations.
- H. Embed prefabricated horizontal joint reinforcement as the work progresses, with a minimum cover of 15 mm (5/8 inch) on exterior face of walls and 13 mm (1/2 inch) at other locations. Lap joint reinforcement not less than 150 mm (6 inches) at ends. Use prefabricated "L" and "T" sections to provide continuity at corners and intersections. Cut and bend joint reinforcement as recommended by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.
- I. Anchoring: Anchor reinforced masonry work to supporting structure as indicated.
- J. Anchor reinforced masonry walls to non-reinforced masonry where they intersect.

3.14 INSTALLATION OF REINFORCED CONCRETE UNIT MASONRY

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

2. Maintain vertical continuity of core or cell cavities, which are to be reinforced and grouted, to provide minimum clear dimension indicated and to provide minimum clearance and grout coverage for vertical reinforcement bars. Keep cavities free of mortar. Solidly bed webs in mortar where adjacent to reinforced cores or cells.
3. Where horizontal reinforced beams (bond beams) are shown, use special units or modify regular units to allow for placement of continuous horizontal reinforcement bars. Place small mesh expanded metal lath or wire screening in mortar joints under bond beam courses over cores or cells of non-reinforced vertical cells, or provide units with solid bottoms.

E. Columns, Piers and Pilasters:

1. Use CMU units of the size, shape and number of vertical core spaces shown. If not shown, use units which provide minimum clearances and grout coverage for number and size of vertical reinforcement bars shown.
2. Provide pattern bond shown, or if not shown, alternate head joints in vertical alignment.
3. Where bonded pilaster construction is shown, lay wall and pilaster units together to maximum pour height specified.

F. Grouting:

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

G. Low-Lift Grouting:

1. Provide minimum clear dimension of 50 mm (2 inches) and clear area of 5160 mm² (8 square inches) in vertical cores to be grouted.
2. Place vertical reinforcement prior to grouting of CMU. Extend above elevation of maximum pour height as required for splicing. Support in position at vertical intervals not exceeding 192 bar diameters nor 3 m (10 feet).
3. Lay CMU to maximum pour height. Do not exceed 1.5 m (5 foot) height, or if bond beam occurs below 1.5 m (5 foot) height, stop pour 38 mm (1-1/2 in) below top of bond beam.
4. Pour grout using chute container with spout or pump hose. Rod or vibrate grout during placing. Place grout continuously; do not interrupt pouring of grout for more than one hour. Terminate grout pours 38 mm (1-1/2 inches) below top course of pour.
5. Bond Beams: Stop grout in vertical cells 38 mm (1-1/2 inches) below bond beam course. Place horizontal reinforcement in bond beams; lap at corners and intersections as shown. Place grout in bond beam course before filling vertical cores above bond beam.

3.15 CLEANING AND REPAIR

A. General:

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

B. Ceramic Glazed Brick Units:

1. Clean as recommended by tile or brick manufacturer. Protect light colored mortar joints from discoloration during cleaning.

C. Face Brick (Alternate):

1. First wet surfaces with clean water, then wash down with a solution of soapless detergent. Do not use muriatic acid.
2. Brush with stiff fiber brushes while washing, and immediately thereafter hose down with clean water.
3. Free clean surfaces of traces of detergent, foreign streaks, or stains of any nature.

D. Concrete Masonry Units:

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

END OF SECTION 04 20 00

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. Steel Joist: Section 05 21 00, STEEL JOIST FRAMING.
- C. Steel Decking: Section 05 31 00, STEEL DECKING.
- D. Fireproofing: Section 07 81 00, APPLIED FIREPROOFING.
- E. Painting: Section 09 91 00, PAINTING.

1.3 QUALITY ASSURANCE

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

1.4 TOLERANCES

- 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 ASD Manual, Ninth Edition, Page 1-145), 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 COR of any location where the connection design criteria is not clearly indicated. The design of all connections is subject to the review and acceptance of the COR. Submit structural calculations prepared and sealed by a qualified engineer registered in the state where the project is located. Submit calculations for review before preparation of detail drawings.

1.6 REGULATORY REQUIREMENTS

- A. AISC: Specification for Structural Steel Buildings - Allowable Stress Design.
- 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:
 - 1. Connection calculations, if required.
- F. Record Surveys.

1.8 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Institute of Steel Construction (AISC)
 - 1. Specification for Structural Steel Buildings - Allowable Stress Design and Plastic Design (Second Edition, 2005)
 - 2. Load and Resistance Factor Design Specification for Structural Steel Buildings (Second Edition, 1995)
 - 3. Code of Standard Practice for Steel Buildings and Bridges (2010).
- C. American National Standards Institute (ANSI)
 - B18.22.1-65(R2008) Plain Washers
 - B18.22M-81(R2000) Metric Plain Washers
- D. American Society for Testing and Materials (ASTM)
 - A6/A6M-09 Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
 - A36/A36M-08 Standard Specification for Carbon Structural Steel
 - A53/A53M-10 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
 - A123/A123M-09 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - A242/A242M-04(R2009) Standard Specification for High-Strength Low-Alloy Structural Steel
 - A283/A283M-03(R2007) Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
 - A307-10 Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
 - A325-10 Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
 - A490-10 Standard Specification for Heat-Treated Steel Structural Bolts 150 ksi Minimum Tensile Strength
 - A500/A500M-10 Standard Specification for Cold Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

- A501-07 Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
- A572/A572M-07 Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
- A992/A992M-06 Standard Specification for Structural Steel Shapes
- E. American Welding Society (AWS)
 - D1.1/D1.1M-10 Structural Welding Code-Steel
- F. Research Council on Structural Connections (RCSC) of The Engineering Foundation
Specification for Structural Joints Using ASTM A325 or A490 Bolts
- G. Military Specifications (Mil. Spec.)
 - MIL-P-21035 Paint, High Zinc Dust Content, Galvanizing, Repair
- H. Occupational Safety and Health Administration (OSHA)
 - 29 CFR Part 1926-2001 Safety Standards for Steel Erection

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Structural Steel: ASTM 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 or A490 Bolts. 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 - Allowable Stress Design and Plastic 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.
- C. Do not apply paint to following:
 - 1. Surfaces within 50 mm (2 inches) of joints to be welded in field.
 - 2. Surfaces which will be encased in concrete.
 - 3. Surfaces which will receive sprayed on fireproofing.
 - 4. Top flange of members which will have shear connector studs applied.
- D. 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.
- E. 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 COR for approval. Reports shall be prepared by Registered Land Surveyor or Registered Civil Engineer as specified in Section 01 00 00, GENERAL REQUIREMENTS. Report shall specify that location of structural steel is acceptable for plumbness, level and alignment within specified tolerances specified in the AISC Manual.

END OF SECTION 05 12 00

SECTION 05 21 00 - STEEL JOIST FRAMING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies open web steel joists.

1.2 RELATED WORK

- A. Structural Steel: Section 05 12 00, STRUCTURAL STEEL FRAMING.
- B. Fireproofing: Section 07 81 00, APPLIED FIREPROOFING.
- C. Finish Painting: Section 09 91 00, PAINTING.

1.3 DESIGN REQUIREMENTS

- A. Design all elements with the latest published version of applicable Codes.

1.4 TOLERANCES

- A. Deviation from a straight line between ends of any installed joist shall not exceed 10 mm in 3 m (3/8 inch in 10 feet).

1.5 REGULATORY REQUIREMENTS

- A. Steel Joist Institute: Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders, (Latest Edition).

1.6 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop and Erection Drawings: Complete.
 - 1. Fabrication drawings including details and schedules for the fabrication and assembly of each joist.
 - 2. Erection drawings showing the size and location of each joist, bridging, cross bracing, bearing details, connections, welds, bolts and bearing plates.

- C. Certificates: Steel Joist Institute compliance.
- D. Design Calculations: If requested by the COR, submit complete calculations covering the design of all members and connections. Calculations must be specifically applicable to the joists supplied.

1.7 QUALITY ASSURANCE

- A. Provide documentation that the joist manufacturer is a member of the Steel Joist Institute and has satisfactorily completed work of a similar scope and nature.

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. Specification for Structural Steel Buildings – Allowable Stress Design and Plastic Design (Latest Edition).
 - 2. Load and Resistance Factor Design Specification for Structural Steel Buildings (Latest Edition).
- C. American Society for Testing and Materials (ASTM):
 - A307-07 Carbon Steel Bolts and Studs, 400 MPa (60,000 psi)
Tensile Strength
 - A325-09 Structural Bolts, Steel, Heat Treated, 800/700 MPa
(120/105 ksi) Minimum Tensile Strength
 - A490-08 Heat-Treated Steel Structural Bolts, 1000 MPA (150 ksi)
Minimum Tensile Strengths
- D. American Welding Society (AWS):
 - D1.1-08 Structural Welding Code – Steel
- E. SSPC: The Society for Protective Coatings:
 - Steel Structures Painting Manual, Volumes 1 and 2
- F. Steel Joist Institute (SJI):
 - Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders (Latest Edition).

- G. U.S. Army Corps of Engineers:

CRD-C-621 Specification for Non-Shrink Grout

PART 2 - PRODUCTS

2.1 OPEN WEB STEEL JOISTS

- A. K-Series conforming to Steel Joist Institute standard specifications.

2.2 ACCESSORIES – FITTINGS

- A. Accessories and fittings, including end supports and bridging, in accordance with standard Steel Joist Institute specification under which joists were designed.
- B. Unfinished Threaded Fasteners: ASTM A307, Grade A, regular hexagon type, low carbon steel.
- C. High-strength bolts, including nuts and washers: ASTM A325 or A490 heavy hexagon structural bolts.

PART 3 - EXECUTION

3.1 FABRICATION

- A. Fabrication and assembly in accordance with applicable standard Steel Joist Institute specification:
1. Make chord splices with full penetration welds capable of developing the ultimate strength in tension of the parent material. Make no allowance for the strength of back-up bars or other material incidental to welding.
 2. Provide shop-welded connection plates at panel points to receive supplemental framing.
 3. Holes in Chord Members: Provide holes in chord members where shown for securing other work to steel joists; however, deduct area of holes from the area of chord when calculating strength of member.
 4. Extended Ends: Provide extended ends on joists where shown, complying with manufacturer's standards and requirements of applicable STEEL JOIST INSTITUTE specifications.
 5. Bridging: Provide horizontal or diagonal type bridging for joists and joist girders, complying with STEEL JOIST INSTITUTE specifications. Provide bridging anchors for ends of bridging lines terminating at walls or beams. Provide bridging adequate to resist the loads indicated on the Contract Documents.

6. End Anchorage: Provide end anchorages, including bearing plates, to secure joists to adjacent construction, complying with STEEL JOIST INSTITUTE specifications, unless otherwise indicated. Design all end anchorages to resist a minimum net uplift of 1.6 kPa (35 pounds per square foot) of supported area.
7. Provide supplemental steel support framing for metal deck where normal deck bearing is precluded by other framing members and minor openings.

3.2 SHOP PAINTING

- A. Shop painting in accordance with applicable Steel Joist InstitutE standard specification.
- B. Shop paint joists and accessories with a rust-inhibiting primer paint. For joists which will be finish painted, limit paint to a primer which is compatible with specified finish paint. In high humidity areas, shop paint joists with a zinc-rich primer to receive top coats per the paint system manufacturer's recommendations.

3.3 ERECTION

- A. Installation of joists in accordance with applicable Steel Joist InstitutE standard specification.
- B. Handle joists in a manner to avoid damaging of joists. Remove damaged joists from site, except when field repair is approved and such repairs are satisfactorily made in accordance with manufacturer's recommendations.
- C. Accurately set joists and end anchorage in accordance with the applicable Steel Joist InstitutE standard specification. Secure joists resting on masonry or concrete bearing surfaces by welding or bolting to the steel bearing plates as indicated on the Contract Documents. Secure bridging and anchoring in place prior to application of any construction loads. Distribute any temporary loads so that carrying capacity of any joist is not exceeded. Loads shall not be applied to bridging where joist lengths are 12 m (40 feet) and longer. Where joist lengths are 12 m (40 feet) and longer, install a center row of bolted diagonal bridging to provide lateral stability before slackening of hoisting lines.

3.4 FIELD PAINTING

- A. Clean abraded, corroded, and field welded areas and touch up with same type of paint used in shop painting.
- B. Finish painting of steel surfaces is specified in Section 09 91 00, PAINTING.

END OF SECTION 05 21 00

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. Fireproofing: Section 07 81 00, APPLIED FIREPROOFING.
- C. 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.
 - 1. 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".
 - 2. 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. Specification for Structural Steel Buildings – Allowable Stress Design and Plastic Design (ninth Edition, 1989)
 - 2. Load and Resistance Factor Design Specification for Structural Steel Buildings (Latest 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.
- 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.
8. Acoustic Sound Barrier Closures: Manufacturer's standard mineral fiber closures.

2.2 REQUIREMENTS

- A. Provide steel decking of the type, depth, gauge, and section properties as shown.
- B. 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.
- C. 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.
- D. Steel decking units used for interstitial levels shall include an integral system.
 1. System to provide a simple point of attachment for light duty hanger devices.
 2. System to allow for flexibility for attaching hangers for support of suspended ceilings, electrical, plumbing, heating, or air conditioning items, weight not to exceed 50 kg/m² (10 psf).

3. System shall provide for a minimum spacing pattern of 300 mm (12 inches) on centers longitudinally and 600 mm (24 inches) on centers transversely.
4. Maximum load suspended from any hanger is 23 kg (50 pounds).
5. System consisting of fold-down type hanger tabs or lip hanger is acceptable.

PART 3 - EXECUTION

3.1 ERECTION

- A. Do not start installation of metal decking until corresponding steel framework has been plumbed, aligned and completed and until temporary shoring, where required, has been installed. Remove any oil, dirt, paint, ice, water and rust from steel surfaces to which metal decking will be welded.
- B. Coordinate and cooperate with structural steel erector in locating decking bundles to prevent overloading of structural members.
- C. Do not use floor deck units for storage or working platforms until permanently secured. Do not overload deck units once placed. Replace any deck units that become damaged after erection and prior to casting concrete at no cost to the Government.
- D. Provide steel decking in sufficient lengths to extend over 3 or more spans, except for interstitial levels.
- E. Place steel decking units at right angles to supporting members. End laps of sheets of roof deck shall be a minimum of 50 mm (2 inches) and shall occur over supports.
- F. Fastening Deck Units:
 1. Fasten floor deck units to steel supporting members by not less than 16 mm (5/8 inch) diameter puddle welds or elongated welds of equal strength, spaced not more than 305 mm (12 inches) o.c. with a minimum of two welds per unit at each support. Where two units abut, fasten each unit individually to the supporting steel framework.
 2. Tack weld or use self-tapping No. 8 or larger machine screws at 915 mm (3 feet) o.c. for fastening end closures. Only use welds to attach longitudinal end closures.
 3. Weld side laps of adjacent floor deck units that span more than 1524 mm (5 feet). Fasten at midspan or 305 mm (12 inches) 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. 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.
6. Weld end laps of corrugated form deck units in valley of side lap and at middle of sheet (maximum spacing of welds is 380 mm (15 inches)).
7. Weld corrugated deck to intermediate supports in an X pattern. Weld in valley of side laps on every other support and in the valley of the center corrugation on the remaining supports (maximum spacing of welds is 760 mm (30 inches)).

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 COR. Provide any additional reinforcing or framing required for the opening at no cost to the Government. Failure to comply with these requirements is cause for rejection of the work and removal and replacement of the affected metal deck.
6. Reinforcement at Openings: Provide additional metal reinforcement and closure pieces as required for strength, continuity of decking, and support of other work shown.

3.2 WELDING

- 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

1. Areas scarred during erection.
2. 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 05 31 00

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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 non-load-bearing steel stud curtain wall.
 - 2. Interior non-load-bearing steel stud wall.

1.2 RELATED WORK

- A. Structural steel framing: Section 05 12 00, STRUCTURAL STEEL FRAMING.
- B. Open web steel joists: Section 05 21 00, STEEL JOIST FRAMING.
- C. Exterior sheathing: Section 06 16 00, SHEATHING.
- D. Non-load-bearing metal stud framing assemblies: Section 09 22 16, NON-STRUCTURAL METAL FRAMING.
- E. 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 to withstand design loads within limits and under conditions required.
 - 1. Design Loads: Wind load as indicated on plans.
 - 2. Design framing systems to withstand design loads without deflections greater than the following:
 - a. Exterior Non-load-Bearing Curtain wall: Lateral deflection of 1/600 of the wall height.
 - b. Interior Non-load-Bearing wall: Lateral deflection of 1/240 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 67 degrees C (120 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 qualified professional engineer to prepare design calculations, shop drawings, and other structural data.

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.
- 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 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)

Specification and Commentary for the Design of Cold-Formed Steel Structural Members (1996)
- C. American Society of Testing and Materials (ASTM)

A36/A36M-08..... Standard Specifications for Carbon Structural Steel
A123/A123M-09..... Standard Specifications for Zinc (Hot-Dip Galvanized)
Coatings on Iron and Steel Products
A153/A153M-09..... Standard Specifications for Zinc Coating (Hot-Dip) on Iron
and Steel Hardware

A307-10	Standard Specifications for Carbon Steel Bolts and Studs
A653/A653M-10	Standard Specifications for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
C1107/C1107M-08	Standard Specifications for Packaged Dry, Hydraulic- Cement Grout (Non-shrink)
E488-96(R2003)	Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements
E1190-95(R2007)	Standard Test Methods for Strength of Power-Actuated Fasteners Installed in Structural Members

D. American Welding Society (AWS)

D1.3/D1.3M-08 Structural Welding Code-Sheet Steel

E. Military Specifications (Mil. Spec.)

MIL-P-21035B..... 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 a minimum web depth of 4" with lipped flanges, and complying with the following:
 - 1. Design Uncoated-Steel Thickness:
 - a. 20 gauge - 0.91 mm (0.0358-inch)
 - b. 18 gauge - 1.20 mm (0.0474-inch)

- c. 16 gauge - 1.52 mm (0.0598-inch)
 - d. 14 gauge - 1.90 mm (0.0747-inch)
 - e. 12 gauge - 2.66 mm (0.1046-inch)
 - 2. Flange Width:
 - a. 35 mm (1-3/8 inches)
 - b. 41 mm (1-5/8 inches)
 - c. 51 mm (2 inches)
 - d. 64 mm (2-1/2 inches)
 - 3. Web: Punched.
- 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.

2.3 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. Reinforcement plates.

2.4 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.

2.5 REQUIREMENTS

- A. Welding in accordance with AWS D1.3
- B. Furnish members and accessories by one manufacturer only.

PART 3 - EXECUTION

3.1 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.

3.2 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.

3.3 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.

3.4 FIELD REPAIR

- A. Touch-up damaged galvanizing with galvanizing repair paint.

END OF SECTION 05 40 00

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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. Gratings and frames.
 - 2. Loose lintels.
 - 3. Shelf angles.
 - 4. Ladders.

1.2 RELATED WORK

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

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Grating.
- C. Shop Drawings:
 - 1. Each item specified, showing complete detail, location in the project, material and size of components, method of joining various components and assemblies, finish, and location, size and type of anchors.
 - 2. Mark items requiring field assembly for erection identification and furnish erection drawings and instructions.
 - 3. Provide templates and rough-in measurements as required.
 - 4. 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 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
A307-07 Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
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
C1107-07 Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
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
D1.3-98 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

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. Gratings: 500 kg/m² (100 pounds per square foot). Use 2,000 pounds for concentrated loads.

2.2 MATERIALS

- A. Structural Steel: ASTM A36.
- B. Cast-Iron: ASTM A48, Class 30, commercial pattern.
- C. Steel Bars for Bar Gratings: ASTM A 36/A 36M or steel strip, ASTM A 1011/A 1011M or ASTM A 1018/A 1018M.
- D. Wire Rod for Bar Grating Crossbars: ASTM A 510 (ASTM A 510M).
- E. Malleable Iron Castings: A47.
- F. Grout: ASTM C1107, pourable type.

2.3 HARDWARE

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

B. Fasteners:

1. 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. 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.

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 METAL BAR GRATINGS AND FRAMES

A. Steel Welded Bar Grating:

1. Bearing Bar Spacing: 30 mm (1-3/16 inches) o.c.
2. Bearing Bar Depth: As required to comply with structural performance requirements.
3. Bearing Bar Thickness: As required to comply with structural performance requirements.
4. Crossbar Spacing: 102 mm (4 inches) o.c.
5. Traffic Surface: Plain.

B. Fabricate cutouts in grating sections for penetrations of sizes and at locations indicated. Cut openings neatly and accurately to size. Edge-band openings with metal sheet or bars having a thickness not less than grating material.

C. Frames and Supports for Metal Gratings: Fabricate from metal shapes, plates, and bars of welded construction to sizes, shapes, and profiles indicated and as necessary to receive gratings. Miter and weld connections for perimeter angle frames. Cut, drill, and tap units to receive hardware and similar items.

1. Unless otherwise indicated, fabricate from same basic metal as gratings.
2. Equip units indicated to be cast into concrete or built into masonry with integrally welded anchors. Unless otherwise indicated, space anchors 600 mm (24 inches) o.c. and provide minimum anchor units in the form of steel straps 32 mm (1-1/4 inches) wide by 6 mm (1/4 inch) thick by 200 mm (8 inches) long.

D. Steel Finish: Hot-dip galvanized with a coating weight of not less than 550 g/sq. m (1.8 oz./sq. ft.) of coated surface.

2.6 GRATINGS AND FRAMES, FABRICATION

- A. Fabricate gratings to support live loads specified and a concentrated load as specified.
- B. Provide clearance at all sides to permit easy removal of grating.

- C. Make cutouts in gratings with 6 mm (1/4 inch) minimum to 25 mm (one inch) maximum clearance for penetrations or passage of pipes and ducts. Edge band cutouts.
- D. Fabricate in sections not to exceed 2.3 m² (25 square feet) in area and 90 kg (200 pounds) in weight.
- E. Fabricate sections of grating with end-banding bars.
- F. Fabricate angle frames and supports, including anchorage as shown.
 - 1. Fabricate intermediate supporting members from "T's" or angles.
 - 2. Locate intermediate supports to support grating section edges.
 - 3. Fabricate frame to finish flush with top of grating.
 - 4. Locate anchors at ends and not over 600 mm (24 inches) o.c.
 - 5. Butt or miter, and weld angle frame at corners.
- G. Steel Bar Gratings:
 - 1. Fabricate grating using steel bars, frames, supports and other members shown in accordance with Metal Bar Grating Manual.
 - 2. Galvanize steel members after fabrication in accordance with ASTM A123, G-90 for exterior gratings, gratings in concrete floors, and interior grating where specified.

2.7 LOOSE LINTELS, FABRICATION

- 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. Finish:
 - 1. Exterior Items: Galvanized.
 - 2. Interior Items: Prime painted.

2.8 SHELF ANGLES, FABRICATION

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

2.9 LADDERS, FABRICATION

- A. Steel Ladders: Comply with ANSI A14.3.
 - 1. Fixed-rail type with steel rungs shouldered and headed into and welded to rails.
 - 2. Space siderails 457 mm (18 inches) apart unless otherwise indicated.
 - 3. Siderails: Continuous, 9.5-by-64 mm (3/8-by-2-1/2 inch) steel flat bars, with eased edges.
 - 4. Rungs: 1 -mm (3/4 inch) diameter steel bars.
 - 5. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
 - 6. Provide nonslip surfaces on top of each rung.
 - 7. 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.
 - 8. Provide holes for anchoring with expansion bolts through turned ends and brackets.
 - 9. Where shown, fabricate side rails curved, twisted and formed into a gooseneck.
 - 10. Prime ladders, including brackets and fasteners, with zinc-rich primer.
 - 11. Galvanize exterior ladders after fabrication, ASTM A123, G-90.

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 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.
- F. Attach removable units to supporting members with type and size of clips and fasteners indicated or, if not indicated, as recommended by grating manufacturer for type of installation conditions shown.

3.3 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.

3.4 SHELF ANGLES

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

3.5 LADDERS

- A. Anchor ladders to walls with expansion bolts through turned lugs or angle clips or brackets.

3.6 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 05 50 00

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SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Section specifies wood blocking, sheathing, furring, and nailers.

1.2 RELATED WORK

- A. Blocking in exterior wall framing: Section 05 40 00, COLD-FORMED METAL FRAMING.
- B. Gypsum sheathing: Section 06 16 00, SHEATHING.
- C. Blocking in interior wall framing: Section 09 22 16, NON-STRUCTURAL METAL FRAMING.
- D. Blocking for wall mounted items:
 - 1. Casework: Section 06 40 23, INTERIOR ARCHITECTURAL WOODWORK.
 - 2. Wall protection: Section 10 26 00, WALL AND DOOR PROTECTION.
 - 3. Grab bars: Section 10 28 00, TOILET, BATH, AND JANITORIAL ACCESSORIES.
 - 4. Lockers: Section 10 51 33, SOLID PHENOLIC LOCKERS.

1.3 SUBMITTALS

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

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING:

- A. Protect lumber and other products from dampness both during and after delivery at site.
- B. Pile lumber in stacks in such manner as to provide air circulation around surfaces of each piece.
- C. Stack plywood and other board products so as to prevent warping.

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

1.5 APPLICABLE PUBLICATIONS

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

- B. American Society of Mechanical Engineers (ASME):

B18.2.1-96(R2005) Square and Hex Bolts and Screws
B18.2.2-87 Square and Hex Nuts
B18.6.1-97 Wood Screws
B18.6.4-98(R2005) Thread Forming and Thread Cutting Tapping Screws and
Metallic Drive Screws

- C. American Society for Testing And Materials (ASTM):

A47-99(R2009) Ferritic Malleable Iron Castings
A48-03(R2008) Gray Iron Castings
A653/A653M-10 Steel Sheet Zinc-Coated (Galvanized) or Zinc-Iron Alloy
Coated (Galvannealed) by the Hot Dip Process
C954-10 Steel Drill Screws for the Application of Gypsum Board or
Metal Plaster Bases to Steel Studs from 0.033 inch (2.24
mm) to 0.112-inch (2.84 mm) in thickness
C1002-07 Steel Self-Piercing Tapping Screws for the Application of
Gypsum Panel Products or Metal Plaster Bases to Wood
Studs or Metal Studs
D143-09 Small Clear Specimens of Timber, Method of Testing
D1760-01 Pressure Treatment of Timber Products
D2559-10 Adhesives for Structural Laminated Wood Products for
Use Under Exterior (Wet Use) Exposure Conditions
D3498-11 Adhesives for Field-Gluing Plywood to Lumber Framing for
Floor Systems
F844-07 Washers, Steel, Plain (Flat) Unhardened for General Use
F1667-08 Nails, Spikes, and Staples

- D. Federal Specifications (Fed. Spec.):

MM-L-736C Lumber; Hardwood

- E. Commercial Item Description (CID):

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

F. Military Specification (Mil. Spec.):

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

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

PS 1-95 Construction and Industrial Plywood

PS 20-05 American Softwood Lumber Standard

PART 2 - PRODUCTS

2.1 LUMBER

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

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

B. Lumber Other Than Structural:

1. Unless otherwise specified, species graded under the grading rules of an inspection agency approved by Board of Review, American Lumber Standards Committee.
2. Framing lumber: Minimum extreme fiber stress in bending of 1100.
3. Furring, blocking, nailers and similar items 100 mm (4 inches) and narrower Standard Grade; and, members 150 mm (6 inches) and wider, Number 2 Grade.
4. Board Sub-flooring: Shiplap edge, 25 mm (1 inch) thick, not less than 200 mm (8 inches) wide.

C. Sizes:

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

D. Moisture Content:

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

E. Fire Retardant Treatment:

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

F. Preservative Treatment:

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

2.2 PLYWOOD

- A. Comply with Prod. Std., PS 1.
- B. Bear the mark of a recognized association or independent inspection agency that maintains continuing control over quality of plywood which identifies compliance by veneer grade, group number, span rating where applicable, and glue type.

2.3 STRUCTURAL-USE PANELS

- A. Comply with APA.
- B. Bearing the mark of a recognized association or independent agency that maintains continuing control over quality of panel which identifies compliance by end use, Span Rating, and exposure durability classification.
- C. Wall and Roof Sheathing:
 1. APA Rated sheathing panels, durability classification of Exposure 1 or Exterior Span Rating of 16/0 or greater for supports 400 mm (16 inches) on center and 24/0 or greater for supports 600 mm (24 inches) on center.

2.4 ROUGH HARDWARE AND ADHESIVES

- A. Anchor Bolts:
 - 1. ASME B18.2.1 and ANSI B18.2.2 galvanized, 13 mm (1/2 inch) unless shown otherwise.
 - 2. Extend at least 200 mm (8 inches) into masonry or concrete with ends bent 50 mm (2 inches).
- B. Miscellaneous Bolts: Expansion Bolts: C1D, A-A-55615; lag bolt, long enough to extend at least 65 mm (2-1/2 inches) into masonry or concrete. Use 13 mm (1/2 inch) bolt unless shown otherwise.
- C. Washers
 - 1. ASTM F844.
 - 2. Use zinc or cadmium coated steel or cast iron for washers exposed to weather.
- D. Screws:
 - 1. Wood to Wood: ANSI B18.6.1 or ASTM C1002.
 - 2. Wood to Steel: ASTM C954, or ASTM C1002.
- E. Nails:
 - 1. Size and type best suited for purpose unless noted otherwise. Use aluminum-alloy nails, plated nails, or zinc-coated nails, for nailing wood work exposed to weather and on roof blocking.
 - 2. ASTM F1667:
 - a. Common: Type I, Style 10.
 - b. Concrete: Type I, Style 11.
 - c. Barbed: Type I, Style 26.
 - d. Underlayment: Type I, Style 25.
 - e. Masonry: Type I, Style 27.
 - f. Use special nails designed for use with ties, strap anchors, framing connectors, joists hangers, and similar items. Nails not less than 32 mm (1-1/4 inches) long, 8d and deformed or annular ring shank.

PART 3 - EXECUTION

3.1 INSTALLATION OF FRAMING AND MISCELLANEOUS WOOD MEMBERS:

- A. Conform to applicable requirements of the following:
 - 1. APA for installation of plywood panels.

B. Fasteners:

1. Nails.

- a. Nail in accordance with the Recommended Nailing Schedule as specified in AFPA Manual for House Framing where detailed nailing requirements are not specified in nailing schedule. Select nail size and nail spacing sufficient to develop adequate strength for the connection without splitting the members.
- b. Use special nails with framing connectors.
- c. For sheathing, select length of nails sufficient to extend 25 mm (1 inch) into supports.
- d. Use eight penny or larger nails for nailing through 25 mm (1 inch) thick lumber and for toe nailing 50 mm (2 inch) thick lumber.
- e. Use 16 penny or larger nails for nailing through 50 mm (2 inch) thick lumber.
- f. Select the size and number of nails in accordance with the Nailing Schedule except for special nails with framing anchors.
- g. Nailing Schedule; Using Common Nails:

1) Sheathing:

- a) Plywood panel to each stud or joist face nail 8d, at supported edges 150 mm (6 inches) on center and at intermediate supports 250 mm (10 inches) on center. When gluing plywood to joint framing increase nail spacing to 300 mm (12 inches) at supported edges and 500 mm (20 inches) o.c. at intermediate supports.

2. Bolts:

- a. Fit bolt heads and nuts bearing on wood with washers.
- b. Countersink bolt heads flush with the surface of nailers.
- c. Embed in concrete and solid masonry or use expansion bolts. Special bolts or screws designed for anchor to solid masonry or concrete in drilled holes may be used.
- d. Use toggle bolts to hollow masonry or sheet metal.
- e. Use bolts to steel over 2.84 mm (0.112 inch, 11 gage) in thickness. Secure wood nailers to vertical structural steel members with bolts, placed one at ends of nailer and 600 mm (24 inch) intervals between end bolts. Use clips to beam flanges.

3. Drill screws to steel less than 2.84 mm (0.112 inch) thick.

- a. ASTM C1002 for steel less than 0.84 mm (0.033 inch) thick.
- b. ASTM C 954 for steel over 0.84 mm (0.033 inch) thick.

-
4. Power actuated drive pins may be used where practical to anchor to solid masonry, concrete, or steel.
 5. Do not anchor to wood plugs or nailing blocks in masonry or concrete. Use metal plugs, inserts or similar fastening.
 6. Screws to Join Wood:
 - a. Where shown or option to nails.
 - b. ASTM C1002, sized to provide not less than 25 mm (1 inch) penetration into anchorage member.
 - c. Spaced same as nails.
- C. Set sills or plates level in full bed of mortar on masonry or concrete walls.
1. Space anchor bolts 1200 mm (4 feet) on centers between ends and within 150 mm (6 inches) of end. Stagger bolts from side to side on plates over 175 mm (7 inches) in width.
 2. Use shims of slate, tile or similar approved material to level wood members resting on concrete or masonry. Do not use wood shims or wedges.
 3. Closely fit, and set to required lines.
- D. Cut notch, or bore in accordance with NFPA Manual for House-Framing for passage of ducts wires, bolts, pipes, conduits and to accommodate other work. Repair or replace miscut, misfit or damaged work.
- E. Blocking Nailers, and Furring:
1. Install furring, blocking, nailers, and grounds where shown.
 2. Use longest lengths practicable.
 3. Use fire retardant treated wood blocking where shown at openings and where shown or specified.
 4. Layers of Blocking or Plates:
 - a. Stagger end joints between upper and lower pieces.
 - b. Nail at ends and not over 600 mm (24 inches) between ends.
 - c. Stagger nails from side to side of wood member over 125 mm (5 inches) in width.
 5. Unless otherwise shown, use wall furring 25 mm by 75 mm (1 inch by 3 inch) continuous wood strips installed plumb on walls, using wood shims where necessary so face of furring forms a true, even plane. Space furring not over 400 mm (16 inches on centers, butt joints over bearings and rigidly secure in place. Anchor furring on 400 mm (16 inches) centers.
- F. Rough Bucks:
1. Install rough wood bucks at opening in masonry or concrete where wood frames or trim occur.
 2. Brace and maintain bucks plumb and true until masonry has been built around them or concrete cast in place.

3. Cut rough bucks from 50 mm (2 inch) thick stock, of same width as partitions in which they occur and of width shown in exterior walls.
4. Extend bucks full height of openings and across head of openings; fasten securely with anchors specified.

G. Wood Sheathing:

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

END OF SECTION 06 10 00

SECTION 06 16 00 - SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

- A. This section specifies installation and finishing of exterior glass-mat gypsum wall sheathing.

1.2 RELATED WORK

- A. Installation of steel framing members: Section 05 40 00, COLD-FORMED METAL FRAMING.
- B. Wood sheathing: Section 06 10 00, ROUGH CARPENTRY
- C. Substrate to Exterior Finish Systems: Section 07 24 00, EXTERIOR INSULATION AND FINISH SYSTEMS.
- D. Joint sealants: Section 07 92 00, JOINT SEALANTS.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

2.2 WALL SHEATHING

- A. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.
 - 1. Type and Thickness: Type X, 5/8 inch (15.9 mm) thick.

2.3 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

2.4 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

- A. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C 834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.
 - 1. Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 inches (50 mm) wide, 10 by 10 or 10 by 20 threads/inch (390 by 390 or 390 by 780 threads/m), of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Coordinate wall sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- D. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

3.2 GYPSUM SHEATHING INSTALLATION

- A. Comply with GA-253 and with manufacturer's written instructions.
 - 1. Fasten gypsum sheathing to cold-formed metal framing with screws.
 - 2. Install boards with a 3/8-inch (9.5-mm) gap where non-load-bearing construction abuts structural elements.
 - 3. Install boards with a 1/4-inch (6.4-mm) gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.
- B. Seal sheathing joints according to sheathing manufacturer's written instructions.
 - 1. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel silicone emulsion sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

END OF SECTION 06 16 00

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SECTION 06 40 23 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
1. Custom casework.
 2. Laminate-clad column wraps.
 3. Laminate-clad cabinets.
 4. Acoustical/tackable panels.
 5. Stainless steel countertops.
 6. Solid-surfacing-material construction:
 - a. Countertops and splashes.
 - b. Window sills.
 - c. Shower wall panels.
 - d. Shower receptors.

1.2 RELATED WORK

- A. Wood furring, blocking, shims, and hanging strips required for installing woodwork and concealed within other construction before woodwork installation: Section 06 10 00, ROUGH CARPENTRY.

1.3 DEFINITIONS

- A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Product Data: For panel products, high-pressure decorative laminate, solid-surfacing material, fire-retardant-treated materials, fabrics, cabinet hardware and accessories, and finishing materials and processes.

- C. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
 - 1. Show details.
 - 2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
 - 3. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, and other items installed in architectural woodwork.
- D. Samples:
 - 1. Plastic laminates, 8 by 10 inches, for each type, color, pattern, and surface finish.
 - 2. Metal laminates, 8 by 10 inches, for each type, color, pattern, and surface finish.
 - 3. Thermoset decorative-panels, 8 by 10 inches, for each type, color, pattern, and surface finish, with edge banding on 1 edge.
 - 4. Solid-surfacing materials, 6 inches square.
 - 5. Fabrics, 6 inches square.
 - 6. Exposed cabinet hardware and accessories, one unit for each type and finish.

1.5 QUALITY ASSURANCE

- A. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.
- B. Fire-Test-Response Characteristics: Where fire-retardant materials or products are indicated, provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view 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 basic designation only.
- B. Composite Panel Association (CPA):
 - A208.1-99 Particleboard
- C. U.S. Department of Commerce Product Standards (Prod. Std):
 - PS1-95 Construction and Industrial Plywood

D. Architectural Woodwork Institute (AWI):

Architectural Woodwork Quality Standards, Guide Specifications Quality Certification Program - 1999

E. National Electrical Manufacturers Association (NEMA):

LD3-05 High Pressure Decorative Laminates

LD3.1-95 Performance, Application Fabrication and Installations of High-Pressure Decorative Laminates

F. Hardwood Plywood and Veneer Association

HP-1 Hardwood and Decorative Plywood

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.

1.9 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Provide materials that comply with requirements of AWI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.
- B. Wood Products:
 - 1. Medium-Density Fiberboard: ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.
 - 2. Particleboard: ANSI A208.1, Grade M-2 or straw-based particleboard complying with requirements in ANSI A208.1, Grade M-2, except for density.
 - 3. Softwood Plywood: DOC PS1, five ply construction from 1/2 inch to 1-1/8 inch thickness, and seven ply for 1 1/4 inch thickness.
- C. Cellulose Fiber Structural Panels: Class A fired-rated. Molded, recycled post-consumer paper, cellulose fiber structural panel. Physical properties as follows:
 - 1. Thickness: 1/2 inch (13 mm).
 - 2. Density: 34-40 pcf (544-640 kg/cu. m) tested in accordance with ASTM C 209.
 - 3. Class I or A. Flame spread 25, fuel contributed 0, smoke developed 20 as per ASTM E 84.
- D. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.
- E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.
 - 1. Product: Provide products listed in the Interior Materials Schedule on the drawings, no substitutions.
 - 2. Colors and Patterns: Refer to the Interior Materials Schedule on the drawings.
 - 3. Backing sheet on bottom of plastic laminate covered wood tops. Backer Type BKL.
- F. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.
- G. Solid-Surfacing Material: Homogeneous solid sheets of Filled Methyl Methacrylic Polymer complying with ISSFA-2.
 - 1. Product: Provide products listed in the Interior Materials Schedule on the drawings, no substitutions.
 - 2. Colors and Patterns: Refer to the Interior Materials Schedule on the drawings.
 - a. Color throughout with subtle veining through thickness.

3. Joint adhesive and sealer: Manufacturers silicone adhesive and sealant for joining methyl methacrylic polymer sheet.
- H. PVC Edge Banding: Extruded thermoplastic PVC (Polyvinyl Chloride Plastic) strip.
- I. Fabrics: 100 percent polyester, inherently and permanently flame resistant, stain resistant, and antimicrobial.
 1. Product: Provide the products listed in the Finish Materials Schedule on the drawings.

2.2 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this Article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified.
 1. Do not use treated materials that do not comply with requirements of referenced woodworking standard or that are warped, discolored, or otherwise defective.
 2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
 3. Identify fire-retardant-treated materials with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Comply with performance requirements of AWPA C20 (lumber) and AWPA C27 (plywood). Use the following treatment type:
 1. Interior Type A: Low-hygroscopic formulation.
 2. Mill lumber after treatment within limits set for wood removal that do not affect listed fire-test-response characteristics, using a woodworking plant certified by testing and inspecting agency.
 3. Kiln-dry materials before and after treatment to levels required for untreated materials.
- C. Fire-Retardant Particleboard: Panels complying with the following requirements, made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 25 or less per ASTM E 84.
- D. Fire-Retardant Fiberboard: Medium-density fiberboard panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 200 or less per ASTM E 84.

2.3 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets.
- B. Hinges:
 - 1. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 135 degrees of opening, self-closing.
- C. Door and Drawer Pulls:
 - 1. Back-Mounted Wire Pulls: BHMA A156.9, B02011; back mounted, solid metal, 4 inches long, 5/16 inch in diameter.
- D. Keyed Door and Drawer Locks: BHMA A156.11
 - 1. Cylinder type pin tumbler.
 - 2. Equip all doors and drawers with locks as shown on the drawings.
 - 3. All locks to be keyed the same.
- E. Drawer Slides: BHMA A156.9, B05091.
 - 1. Heavy Duty (Grade 1HD-100): Side mounted; full-extension type; zinc-plated steel ball-bearing slides; 100-pound load rating/pair.
 - a. Box Drawer Slides.
- F. Shelf Rests: BHMA A156.9, B04013; stainless steel, 304, satin finish.
- G. Grommets for Cable Passage through Countertops: 2-inch (51-mm) OD, black, molded-plastic grommets and matching plastic caps with slot for wire passage.
- H. Countertop Brackets: Bracket fabricated from aluminum T sections.
 - 1. Material: Fabricate components from extruded aluminum sections complying with ASTM B221, 6063-T5 alloy and temper.
 - 2. Fabrication: Support brackets fabricated by welding miter cut extruded aluminum sections, grinding and deburring sharp edges and welds, drilling holes for field attachment, and factory finishing.
 - 3. Load capacity per bracket: 204 kg (450 pounds).
 - 4. Factory applied finishes: Exposed aluminum surfaces shall be free of scratches and other serious blemishes and be factory finished with primer suitable for field painting.

- I. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
 - 1. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.
- J. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.4 MISCELLANEOUS MATERIALS

- A. Stainless Steel Base: Refer to the Materials Schedule on the drawings.
- B. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln dried to less than 15 percent moisture content.
- C. Edging Materials:
 - 1. 1mm PVC banding, machine applied.
 - 2. 3mm PVC banding, machine applied and machine profiled to 1/8 inch radius.
- D. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors. All exposed anchors and fasteners to be tamper-resistant.
- E. Adhesives, General: Do not use adhesives that contain urea formaldehyde.

2.5 FABRICATION, GENERAL

- A. Interior Woodwork Grade: Unless otherwise indicated, provide Custom-grade interior woodwork complying with referenced quality standard.
- B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.
- C. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- D. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
 - 1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members 3/4 Inch Thick or Less: 1/16 inch.

2. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members and Rails: 1/16 inch.
- E. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
1. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.
- F. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
1. Seal edges of openings in countertops with a coat of varnish.

2.6 PLASTIC-LAMINATE CABINETS

- A. Grade: Custom.
- B. AWI Type of Cabinet Construction: Flush overlay.
- C. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:
1. Horizontal Surfaces Other Than Tops: Grade HGS.
 2. Vertical Surfaces: Grade VGS.
 3. Edges: PVC edge banding, 3-mm thick, matching laminate in color, pattern, and finish.
- D. Materials for Semi-exposed Surfaces:
1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, Grade VGS.
 - a. Edges of Plastic-Laminate Shelves: PVC edge banding, 3-mm thick, matching laminate in color, pattern, and finish.
 - b. For semi-exposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, Grade VGS.
 2. Drawer Sides and Backs: Thermoset decorative panels.
 3. Drawer Bottoms: Thermoset decorative panels.

- E. Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High-pressure decorative laminate, Grade BKL.

2.7 STAINLESS-STEEL COUNTERTOPS AND SINKS

- A. Countertops: Fabricate from 0.062-inch- (1.59-mm-) thick, stainless-steel sheet. Provide smooth, clean exposed tops and edges in uniform plane, free of defects. Provide front and end overhang of 1 inch (25 mm) over the base cabinets.
 - 1. Joints: Fabricate countertops without field-made joints.
 - 2. Weld shop-made joints.
 - 3. Sound deaden the undersurface with heavy-build mastic coating.
 - 4. Extend the top down to provide a 1-inch- (25-mm-) thick edge with a 1/2-inch (12.7-mm) return flange.
 - 5. Form the backsplash coved to and integral with top surface, with a 1/2-inch- (12.7-mm) thick top edge and 1/2-inch (12.7-mm) return flange.
 - 6. Provide raised (marine) edge around perimeter of tops containing sinks; pitch tops containing sinks two ways to provide drainage without channeling or grooving.
 - 7. Where stainless-steel sinks occur in stainless-steel tops, factory weld into one integral unit.
- B. Grind and polish surfaces to produce uniform, directional satin finish matching No. 4 finish, with no evidence of welds and free of cross scratches. Run grain with long dimension of each piece. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces clean.

2.8 SOLID-SURFACING-MATERIAL CONSTRUCTION

- A. General:
 - 1. Fabricate in one piece, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.
 - 2. Fabricate components to greatest extent practical to sizes and shapes indicated, in accordance with approved shop drawings and manufacturer's printed instructions and technical bulletins.
 - 3. Form joints between components using manufacturer's standard joint adhesive without conspicuous joints.
 - 4. Colors, Patterns, and Finishes: Refer to the Interior Materials Schedule on the drawings.
- B. Countertops:
 - 1. Grade: Custom.
 - 2. Solid-Surfacing-Material Thickness: 1/2 inch.

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3. Edge Detail:
 - a. Open edge conditions: Eased, 1/4-inch radius top and bottom edge.
 - b. Countertops at cabinets: Eased, 1/4-inch radius top edge.
 4. Fabricate tops with shop-applied edges of materials and configuration indicated.
 5. Fabricate tops with loose backsplashes for field application.
- C. Window Sills:
1. Solid-Surfacing-Material Thickness: 1/2 inch.
 2. Edge Detail: 1/4-inch radius exposed edges.
- D. Shower Walls:
1. Solid-Surfacing-Material Thickness: 1/4 inch.
 2. Edge Detail: 1/8-inch radius top and bottom edge.
 3. Provide factory cutouts for plumbing fittings and bath accessories as indicated on the drawings.
 4. Rout and finish component edges with clean, sharp returns.
 - a. Rout cutouts, radii and contours to template.
 - b. Smooth edges.
 - c. Repair or reject defective and inaccurate work.
- E. Pre-Formed Shower Receptor:
1. Custom ADA Shower Receptors:
 - a. Material: Shower receptor shall be manufactured from polyester/acrylic blended resins with natural filler material. Slip resistant non-textured surface.
 - b. Minimum wall thickness 1/2 inch throughout, and 3/4 inch in a 12 inch diameter area at drain.
 - c. Shower pan shall be completely self-supported with cast integral webbing structure and not filled with foam, fillers, or composite materials for structural support.
 - d. Center drain location: Slope to drain shall be 1/4" per foot.
 - e. Receptor threshold shall be 1/2" high maximum with beveled edges.

2.9 ACOUSTICAL/TACKABLE PANELS

- A. Adhere fabric to fiberboard panel and wrap all edges, adhering on back side.

2.10 LAMINATE-CLAD COLUMN COVERS

- A. Frame and form MDF substrate to column shape in two parts. Adhere laminate to substrate. Provide minimum width matching metal T-molding at vertical joints.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.
- B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

- A. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.
- B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.
- C. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.
- D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.
- F. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

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- G. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 2. Maintain veneer sequence matching of cabinets with transparent finish.
 3. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches o.c. with one of the following:
 - a. No. 10 wafer-head screws sized for 1-inch penetration into wood framing, blocking, or hanging strips.
 - b. No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.
- H. Solid Surface Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
 2. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 3. Secure backsplashes to walls with adhesive.
 4. Calk space between backsplash and wall with sealant specified in Division 07 Section "Joint Sealants."
- I. Stainless Steel Countertops:
1. Install metal countertops level, plumb, and true; shim as required, using concealed shims.
 2. Secure tops to cabinets with Z- or L-type fasteners or equivalent; use two or more fasteners at each front, end, and back.
 3. Abut top and edge surfaces in one true plane, with internal supports placed to prevent deflection.
 4. Seal junctures of tops, splashes, and walls with mildew-resistant silicone sealant.
- J. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

- B. Clean, lubricate, and adjust hardware.
- C. Clean woodwork on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 06 40 23

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SECTION 07 11 13 - BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies materials and workmanship for bituminous dampproofing on concrete and masonry surfaces.
 - 1. Dampproofing on concrete foundation walls.
 - 2. Dampproofing on concrete masonry unit backer.

1.2 RELATED SECTIONS

- A. Dampproofing on concrete masonry unit backer: Section 04 20 00, UNIT MASONRY.

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. Product description.
 - 2. Application instructions.

1.4 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - D226-06 Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
 - D449-03(R2008) Asphalt Used in Dampproofing and Waterproofing
 - D1227-95(R2007) Emulsified Asphalt Used as a Protective Coating for Roofing

PART 2 - PRODUCTS

2.1 ASPHALT EMULSION (COLD APPLIED)

- A. ASTM D1227, Type III (spray grade).

2.2 AUXILIARY MATERIALS

- A. General: Furnish auxiliary materials recommended in writing by dampproofing manufacturer for intended use and compatible with bituminous dampproofing.
- B. Emulsified-Asphalt Primer: ASTM D 1227, Type III, Class 1, except diluted with water as recommended in writing by manufacturer.
- C. Asphalt-Coated Glass Fabric: ASTM D 1668, Type I.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

- A. Surfaces to receive dampproofing shall be clean and smooth.
- B. Remove foreign matter, loose particles of mortar or other cementitious droppings.
- C. Clean and wash soil or dirt particles from surface.
- D. Remove free water; surfaces may remain damp.

3.2 APPLICATION, GENERAL

- A. Comply with manufacturer's written instructions for substrate preparation, dampproofing application, cure time between coats, and drying time before backfilling unless more stringent requirements are indicated.
 - 1. Apply dampproofing to provide continuous plane of protection.
 - 2. Apply additional coats if recommended in writing by manufacturer or to achieve a smooth surface and uninterrupted coverage.

- B. Where dampproofing footings and foundation walls, apply from finished-grade line to top of footing; extend over top of footing and down a minimum of 150 mm (6 inches) over outside face of footing.
 - 1. Extend dampproofing 300 mm (12 inches) onto intersecting walls and footings, but do not extend onto surfaces exposed to view when Project is completed.
 - 2. Install flashings and corner protection stripping at internal and external corners, changes in plane, construction joints, cracks, and where shown as "reinforced," by embedding an 200-mm- (8-inch-) wide strip of asphalt-coated glass fabric in a heavy coat of dampproofing. Dampproofing coat for embedding fabric is in addition to other coats required.
- C. Where dampproofing exterior face of inner wythe of exterior masonry cavity walls, lap dampproofing at least 6 mm (1/4 inch) onto flashing, masonry reinforcement, veneer ties, and other items that penetrate inner wythe.
 - 1. Extend dampproofing over outer face of structural members and concrete slabs that interrupt inner wythe.
 - 2. Lap dampproofing at least 6 mm (1/4 inch) onto shelf angles supporting veneer.

3.3 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

- A. Concrete Foundations: Apply two brush or spray coats at not less than 0.6 L/sq. m (1.5 gal./100 sq. ft.) for first coat and 0.4 L/sq. m (1 gal./100 sq. ft.) for second coat, one fibered brush or spray coat at not less than 1.2 L/sq. m (3 gal./100 sq. ft.), or one trowel coat at not less than 1.6 L/sq. m (4 gal./100 sq. ft.).
- B. Exterior Face of Inner Wythe of Cavity Walls: Apply primer and one brush or spray coat at not less than 0.4 L/sq. m (1 gal./100 sq. ft.).

END OF SECTION 07 11 13

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SECTION 07 21 13 - THERMAL INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies thermal and acoustical insulation for buildings.
 - 1. Extruded polystyrene board (XPS).
 - 2. Mineral-wool blanket insulation.
 - 3. Glass-fiber blanket insulation.
 - 4. Acoustical insulation.

1.2 RELATED WORK

- A. Cavity wall insulation: Section 04 20 00, UNIT MASONRY.
- B. Insulation in connection with roofing and waterproofing: Section 07 22 00, ROOF AND DECK INSULATION.
- C. 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. 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):

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
C665-06	Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
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
Rigid foam	9 percent recovered material
Glass fiber	6 percent recovered material
Rock wool material	75 percent recovered material

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

2.2 RIGID INSULATION

- A. Extruded Polystyrene Board (XPS): ASTM C578, Type IV, 1.55 pcf density, square edge. Thickness as shown on the drawings.

2.3 BATT INSULATION

- A. Glass Fiber Batt or Blankets: ASTM C665. Maximum flame spread of 10 and smoke development of 10 when tested in accordance with ASTM E84.
- B. Unfaced, Mineral-Wool Board Insulation: ASTM C 612; with maximum flame-spread and smoke-developed indexes of 15 and zero, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
- C. Thickness as shown; of widths and lengths to fit tight against framing.

2.4 ACOUSTICAL INSULATION

- A. Glass Fiber Batt or Blankets: ASTM C665. Maximum flame spread of 10 and smoke development of 10 when tested in accordance with ASTM E84.
- 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 FASTENERS

- A. Staples or Nails: ASTM F1667, zinc-coated, size and type best suited for purpose.

- B. Screws: ASTM C954 or C1002, size and length best suited for purpose with washer not less than 50 mm (two inches) in diameter.
- C. Impaling Pins: Steel pins with head not less than 50 mm (two inches) in diameter with adhesive for anchorage to substrate. Provide impaling pins of length to extend beyond insulation and retain cap washer when washer is placed on the pin.

2.6 ADHESIVE

- A. As recommended by the manufacturer of the insulation.
- B. Asphalt: ASTM D312, Type III or IV.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Install rigid insulating units with joints close and flush, in regular courses and with cross joints broken.
- D. Install batt or blanket insulation with tight joints and filling framing void completely. Seal cuts, tears, and unlapped joints with tape.
- E. Fit insulation tight against adjoining construction and penetrations, unless specified otherwise.

3.2 MASONRY CAVITY WALLS

- A. Mount insulation on exterior faces of inner wythes of masonry cavity walls and brick faced concrete walls. Fill joints with same material used for bonding.
- B. Bond expanded polystyrene board to surfaces with adhesive and applied in accordance with recommendations of insulation manufacturer.
- C. Install pads of adhesive spaced approximately 610 mm (24 inches) o.c. both ways on inside face, and as recommended by manufacturer. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates.

3.3 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.
- 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.

3.4 RIGID INSULATION ON SURFACE OF EXTERIOR WALLS

- A. 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.

3.5 BATT 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. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
- D. Maintain 76-mm (3-inch) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
- E. For metal-framed wall cavities where cavity heights exceed 2438 mm (96 inches), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.

3.6 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.

END OF SECTION 07 21 13

SECTION 07 22 00 - ROOF AND DECK INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Roof and deck insulation, on new construction ready to receive roofing or waterproofing membrane.

1.2 RELATED WORK

- A. Wood cants, blocking, and edge strips: Section 06 10 00, ROUGH CARPENTRY.
- B. Coordination with roofing system: Section 07 53 23, ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING.

1.3 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only. Editions of applicable publications current on date of issue of bidding documents apply unless otherwise indicated.
- B. American Society of Heating, Refrigeration and Air Conditioning (ASHRAE):
 - 90.1-07 Energy Standard for Buildings Except Low-Rise Residential Buildings
- C. ASTM International (ASTM):
 - C1289-10 Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
 - D41-05 Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
 - D312-06 Asphalt Used in Roofing
 - D2178-04 Asphalt Glass Felt Used in Roofing and Waterproofing
 - D2822-05 Asphalt Roof Cement
 - D4586-07 Standard Specification for Asphalt Roof Cement, Asbestos-Free
 - E84-09 Standard Test Method for Surface Burning Characteristics of Building Material
 - F1667-05 Driven Fasteners: Nails, Spikes, and Staples

D. FM Approvals: RoofNav Approved Roofing Assemblies and Products.

4450-89.....	Approved Standard for Class 1 Insulated Steel Deck Roofs
4470-10.....	Approved Standard for Class 1 Roof Coverings
1-28-09	Loss Prevention Data Sheet: Design Wind Loads.
1-29-09	Loss Prevention Data Sheet: Above-Deck Roof Components
1-49-09	Loss Prevention Data Sheet: Perimeter Flashing

E. National Roofing Contractors Association: Roofing and Waterproofing Manual

F. Underwriters Laboratories, Inc. (UL): Fire Resistance Directory (2009)

1.4 PERFORMANCE REQUIREMENTS

- A. Thermal Performance: Provide roof insulation meeting minimum overall average R-value of 33, with minimum R-value at any location of 10.
- B. FM Approvals: Provide roof insulation complying with requirements in FM Approvals 4450 and 4470 as part of specified roofing system, listed in FM Approvals "RoofNav" as part of roofing system meeting Fire/Windstorm Classification in Division 07 roofing section.

1.5 QUALITY CONTROL

- A. Requirements of Division 07 roofing section for qualifications of roofing system insulation Installer; Work of this Section shall be performed by same Installer.
- B. Requirements of Division 07 roofing section for inspection of Work of this Section and qualifications of Inspector.
- C. Unless specified otherwise, comply with the recommendations of the NRCA "Roofing and Waterproofing Manual" applicable to insulation for storage, handling, and application.
- D. Requirements of roofing system uplift pressure design for specified roofing system.
- E. Requirements of applicable FM Approval for specified roofing system insulation attachment.

1.6 SUBMITTALS

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

B. Product Data:

1. Roof insulation, each type.
2. Asphalt or adhesive materials, each type.
3. Roofing cement, each type.
4. Fastening requirements.
5. Certificates:
 - a. Indicating type, thermal conductance, and minimum and average thickness of insulation.
 - b. Indicating materials and method of application of insulation system meet the requirements of FM Approvals for specified roofing system.

C. Shop Drawings: Include plans, sections, details, and attachments.

1. Nailers, cants, and terminations.
2. Layout of insulation showing slopes, tapers, penetration, and edge conditions.
3. Layout of tapered roof system showing units required.

D. Samples:

1. Roof insulation, each type.

1.7 DELIVERY, STORAGE AND MARKING

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

1.8 QUALITY ASSURANCE

- A. Roof insulation on combustible or steel decks shall have a flame spread rating not greater than 75 and a smoke developed rating not greater than 150, exclusive of covering, when tested in accordance with ASTM E84, or shall have successfully passed FM Approvals 4450.
1. Insulation bearing the UL label and listed in the UL Building Materials Directory as meeting the flame spread and smoke developed ratings will be accepted in-lieu-of copies of test reports.
 2. Compliance with flame spread and smoke developed ratings will not be required when insulation has been tested as part of a roof construction assembly of the particular type used for this project and the construction is listed as fire-classified in the UL Building Materials Directory or listed as Class I roof deck construction in the FM Approvals "RoofNav."
 3. Insulation tested as part of a roof construction assembly shall bear UL or FM labels attesting to the ratings specified herein.

PART 2 - PRODUCTS

2.1 ADHESIVE MATERIALS

- A. Adhesive Materials, General: Adhesive and sealant materials recommended by roofing system manufacturer for intended use, identical to materials utilized in approved listed roofing system, and compatible with roofing membrane.
- B. Primer: ASTM D41.
- C. Asphalt: ASTM D312, Type III or IV for vapor retarders and insulation.
- D. Roof Cement: Asbestos free, ASTM D2822, Type I or Type II; or, D4586, Type I or Type II.

2.2 ROOF AND DECK INSULATION

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

2.3 INSULATION ACCESSORIES

- A. Glass (Felt): ASTM D2178, Type VI, heavy duty ply sheet.
- B. Cants and Tapered Edge Strips:
 - 1. Wood Cant Strips: Refer to Division 06 Section "Rough Carpentry."
 - 2. Insulation Cant Strips: ASTM C208, Type II, Grade 1, cellulosic-fiber insulation board.
 - 3. Tapered Edge Strips: 1:12 (one inch per foot), from 0 mm (0 inches), 300 mm to 450 mm (12 inches to 18 inches) wide.
 - a. Cellulosic Fiberboard: ASTM C208.
 - b. Mineral Fiberboard: ASTM C726.

- c. Perlite Board: ASTM C728.

2.4 FASTENERS

- A. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with FM Approvals 4470, designed for fastening substrate board to roof deck.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions with Installer to verify compliance with project requirements and suitability to accept subsequent insulation work. Correct unsatisfactory conditions before proceeding with insulation work.
- B. Do not apply insulation if deck 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 is attached to, in place ready to receive insulation.

3.3 RIGID INSULATION INSTALLATION

- A. Insulation Installation, General:
 - 1. Install roof insulation in accordance with roofing system manufacturer's written instructions.
 - 2. Install roof insulation in accordance with requirements of FM Approval's Listing for specified roofing system.
 - 3. Cant Strips: Install preformed insulation cant strips or wood cant strips specified in Division 06 Section ROUGH CARPENTRY at junctures of roofing system with vertical construction.
- B. Insulation Thickness:
 - 1. Thickness of roof insulation shown on drawings is nominal. Actual thickness shall provide the average thermal resistance "R" value of not less than that specified in Performance Requirements Article.

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2. Insulation on Metal Decks: Provide minimum thickness of insulation for metal decks recommended by the insulation manufacturer to span rib opening (flute size) of metal deck used. Support edges of insulation on metal deck ribs.
 3. When thickness of insulation to be used is more or less than that shown on the drawings, make adjustments in the alignment and location of roof drains, flashing, gravel stops, fascias and similar items at no additional cost to the Government.
 4. Where tapered insulation is used, the thickness of the insulation at high points and roof edges shall be as shown on the drawings; the thickness at the low point (drains) shall be not less than 38 mm (1-1/2 inches).
 5. Use not less than two layers of insulation when insulation is 68 mm (2.7 inch) or more in thickness unless specified otherwise. Stagger joints minimum 150 mm (6 inches).
- C. Lay insulating units with close joints, in regular courses and with cross joints broken. When laid in more than one layer, break joints of succeeding layers of roof insulation with those in preceding layer.
- D. Lay units with long dimension perpendicular to the rolled (longitudinal) direction of the roofing felt.
- E. Seal all cut edges at penetrations and at edges against blocking with bitumen or roof cement.
- F. Cut to fit tight against blocking or penetrations.
- G. Cover all insulation installed on the same day; comply with temporary protection requirements of Section 07 53 23, ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING.
- H. Installation Method:
1. Mechanically Fastened and Adhered Insulation: Install first layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
 - a. Fasten first layer of insulation to resist uplift pressure at corners, perimeter, and field of roof.
 - b. Set each subsequent layer of insulation in a solid mopping of hot roofing asphalt.
 - c. Set each subsequent layer of insulation in insulation adhesive, firmly pressing and maintaining insulation in place.

END OF SECTION 07 22 00

SECTION 07 24 00 - EXTERIOR INSULATION AND FINISH SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section includes the following Exterior Finish Systems:
 - 1. Direct Exterior Finish Systems (DEFS): Synthetic stucco base coat and simulated stucco finish coat applied directly to exterior glass-mat gypsum wall sheathing.
 - 2. Exterior Insulation and Finish System (EIFS): Synthetic coatings on rigid insulation on exterior glass-mat gypsum wall sheathing.

1.2 RELATED WORK

- A. Exterior glass-mat gypsum wall sheathing: Section 06 16 00, SHEATHING.
- B. Joint sealants: Section 07 90 00, JOINT SEALANTS.

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. Manufacturer's literature and instructions for installation of the system. Include manufacturer's recommended details for corner treatment, sills, soffits, dentils, quoins, lintels, openings and other special applications.
 - 2. Summary of test results by the Exterior Finish System manufacturer to substantiate compliance with the specified performance requirements. Furnish complete test reports as required.
- C. Shop Drawings: For EIFS; plans, elevations and details.
- D. Samples:
 - 1. Two 300 mm (one-foot) square samples of each DEFS and EIFS finish showing color and texture.

1.4 DELIVERY AND STORAGE

- A. Deliver materials in unopened packages with manufacturer's labels intact, legible and grade seals unbroken.
- B. Store and handle in strict compliance with manufacturer's instructions. Protect from damage.
- C. Remove from premises any damaged or deteriorated material.

1.5 ENVIRONMENTAL CONDITIONS

- A. Unless a higher temperature is required by the system manufacturer, the ambient air temperature shall be 7 degrees Celsius (45 degrees F) or greater and rising at the time of installation of the system and shall be predicted to remain at 7 degrees Celsius (45 degrees F) or greater for at least 24 hours after installation.

1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):

B117-07	Operating Salt Spray (Fog) Apparatus
C67-07	Sampling and Testing Brick and Structural Clay Tile
C177-04	Steady-State Heat Flux measurements and Thermal Transmission Properties by Means of the Guarded-Hot- Plate Apparatus
C297-04	Flatwise Tensile Strength of Sandwich Constructions
C578-07	Rigid, Cellular Polystyrene Thermal Insulation
C666-03	Resistance of Concrete to Rapid Freezing and Thawing
C920-05	Elastomeric Joint Sealants
D968-05(R2007)	Abrasion Resistance of Organic Coatings by Falling Abrasive
D2794-93(R2004)	Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
E84-07	Surface Burning Characteristics of Building Materials
E96-05	Water Vapor Transmission of Materials
E108-07	Fire Tests of Roof Coverings
E330-02	Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference
E331-00	Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference

G90-05..... Accelerated Outdoor Weathering of Nonmetallic Materials
Using Concentrated Natural Sunlight

C. Exterior Insulation Manufacturers Association (EIMA)

101.86-1992..... Resistance of Exterior Insulation and Finish Systems to the
Effects of Rapid Deformation (Impact)

PART 2 - PRODUCTS

2.1 DIRECT EXTERIOR FINISH SYSTEM (DEFS)

- A. Description: Synthetic stucco base coat and simulated stucco finish coat applied directly to exterior glass-mat gypsum wall sheathing.
- B. Exterior Glass-Mat Gypsum Sheathing:
 - 1. Installed and taped as defined in Section 06 16 00, SHEATHING and as recommended by Exterior Finish System manufacturer.
- C. Accessories:
 - 1. Trim, control joints and corner beads as recommended by Exterior Finish System manufacturer.
- D. Stucco finish:
 - 1. Base coat: Ready-to-mix, Portland cement mortar containing dry latex polymers.
 - 2. Finish coat: Pre-colored, ready-mixed, polymeric coating.
 - 3. Performance Requirements (Test, Test Method, Requirement):
 - a. Surface Burning Characteristics: ASTM E 84, Class A.
 - b. Abrasion Resistance: ASTM D 968, 500 liters of light smoothing. No loss of film integrity.
 - c. Bond Strength: ASTM C 297, 50 psi
 - d. Salt Spray Resistance: ASTM B 117, 300 hours exposure. No deleterious effects.
 - e. Freeze/Thaw Resistance: ASTM C 666 proc. B, 100 Cycles. No deterioration, no delamination.
 - f. Accelerated Weathering: ASTM G 90, 2000 hours. No deterioration
 - g. Rapid Deformation: ASTM D2794, No cracking or impact failure.
- E. Sealant: ASTM C 920, material having a minimum joint movement of 50% with 100% recovery. Type, grade and use shall be as recommended by the sealant manufacturer.

2.2 EXTERIOR INSULATION AND FINISH SYSTEM (EIFS)

- A. Description: PB system consisting of Type I molded rigid polystyrene insulation adhesively adhered to the sheathing and finished with a glass-fiber-mesh reinforced based-coat and a textured finish coat.
- B. Performance Requirements (Test, Test Method, Requirement):
 - 1. Flame Spread (Test samples shall include base coat, fabric, finish mounted on non- combustible substrate): ASTM E84; Flame spread of 25 or less. Smoke developed rating 450 or less.
 - 2. Full Scale Wall Fire Test: ASTM E108; No significant surface flaming or propagation of vertical or lateral flames.
 - 3. Impact Resistance (Sample shall be cured. Finish, base coat and fabric over 25mm (1 inch) insulation typical of project application): EIMA 101.86 (Hemispherical Head Test); Standard Impact Resistance 2.83 to 5.54J (25-49 inch-lbs).
 - 4. Structural Performance (Test panels 1200 mm x 1200 mm (4 feet by 4 feet) typical of project application): ASTM E330; No permanent deformation, delamination or deterioration for positive and negative pressures as required.
 - 5. Water Penetration: ASTM E331; No Water penetration.
 - 6. Abrasion Resistance: ASTM D968; 500 liters of sand-slight smoothing - no loss of film integrity.
 - 7. Accelerated Weathering: ASTM G90; 2000 hours, no deterioration.
 - 8. Salt Spray Resistance: ASTM B117; Withstand 300 hours, no deleterious effects.
 - 9. Water Vapor: ASTM E96; Not more than 18 grains an hour per square foot.
 - 10. Absorption-Freeze-Thaw (Pre-weighed 100 mm x 200 mm (4" by 8") specimens; 25 mm (1") insulation, faced with finish coat cured and stored in air; tested with edges and back open.): ASTM C67, 50 Cycles, 20 hrs. at - 9 deg C, 4-hr. thaw in water; After 50 cycles – Total weight gain of not more than 6.2 grams. No checking splitting, or cracking.
- C. Adhesive: Manufacturers standard product including primer as required compatible with sheathing.
- D. Insulation:
 - 1. Thermal Resistance: Thermal resistance (R-value), as indicated, measured by ASTM C177.
 - 2. Insulating Material: ASTM C578, as recommended by EIFS manufacturer and treated to be compatible with EIFS components. Age insulation a minimum of 6 weeks prior to installation.
 - 3. Provide Type I Molded Expanded Polystyrene (MEPS) insulation board for Type PB systems, in sizes as required except no larger than 600 mm X 1200 mm (24 X 48 inches) boards, and not more than 100 mm (4 inches) in thickness.

- E. Create a means of drainage between the insulation board and sheathing.
- F. All penetrations and terminations shall be flashed.
- G. Mechanical Anchors: As recommended by the EIFS manufacturer.
- H. Accessories: Conform to the recommendations of the EIFS manufacturer, including trim, edging, anchors, expansion joints, and other items required for proper installation of the EIFS. All metal items and fasteners to be corrosion resistant.
- I. Reinforcing Fabric: Balanced, open weave, glass fiber fabric made from twisted multi-end strands specifically treated for compatibility with the other materials of the system. Minimum weight 4.3 oz/sq. yd.
- J. Base Coat: For PB system, manufacturer's standard product. Minimum thickness of 1-1/2 times reinforcing fabric thickness but not less than 2.4 mm (3/32 inches) wet thickness.
- K. Finish Coat: For PB system, manufacturer's standard product. Minimum thickness 1.6 mm (1/16 inch), complying with Performance Requirements in paragraph B.
- L. Sealant: ASTM C 920; material having a minimum joint movement of 50% with 100% recovery. Type, grade and use shall be as recommended by the sealant manufacturer. When required, primer, bond breaker and backer rods shall be non-staining as recommended by the sealant manufacturer. Do not use absorptive materials as backer rods.

2.3 FINISH COLORS

- A. Finish Colors: To be selected from manufacturer's full range.
 - 1. Tint base coat as recommended by manufacturer for finish coat color.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine substrate, opening supports and conditions under which this work is to be performed. Notify COR in writing of conditions detrimental to the proper completion of this work. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 CONTROL JOINTS

- A. See drawings for location of building control joints and surface control joints. Install surface control joints as follows:
- B. Direct Exterior Finish System (DEFS): Install at 6 meters (20 feet) o.c. maximum in either direction, erecting the continuous vertical joints first at building expansion joints, intersection of dissimilar substrates or finishing materials where concentrated stresses or movement is anticipated. Leave a 13 mm (1/2") minimum continuous gap between board panels to receive control joint.
- C. Exterior Insulation and Finish System (EIFS): Install at 15 meters (50 feet) maximum in both directions and at building expansion joints, floor lines and where EIFS intersects other materials per manufacturer's recommendations.

3.3 SEALANTS

- A. Apply according to manufacturer's recommendations and the following:
- B. Direct Exterior Finish System (DEFS): Caulk all intersections of sheathing with windows, doors, control joints, other openings and locations as shown on drawings. Do not caulk locations intended for water drainage.
- C. Exterior Insulation and Finish System (EIFS): Apply sealant per EIFS manufacturer's recommendation. Do not seal locations intended for water drainage.

3.4 ACCESSORIES

- A. Install according to manufacturer's recommendation.

3.5 FINISH

- A. Direct Exterior Finish Systems (DEFS):
 - 1. Joint Reinforcement: Pre-fill cement board joints and trim with synthetic stucco Base Coat mixed according to manufacturer's directions. Immediately embed reinforcing tape into wet Base Coat and tightly trowel to board surface to avoid crowning joints. Cure for a minimum of four hours before application of base coat.
 - 2. Base Coat: Apply base coat a minimum of 1.6 mm (1/16") uniformly smooth and flat over the entire surface including joints and trim. Dampen board surface as necessary under rapid drying conditions. Embed reinforcing fabric in basecoat while wet and cover with basecoat material so pattern of fabric is not visible.

3. Finish: Trowel apply ready-mixed exterior finish to base coat texturing surface as specified to a uniform thickness of 1.6 mm to 4.8 mm (1/16" to 3/16"). Dampen base coat as necessary under rapid drying conditions. Joining between batches shall occur at surface breaks such as corners, control joints, windows.

B. Exterior Insulation And Finish System (EIFS):

1. Insulation Board: Place horizontally from level base line. Stagger vertical joints and interlock at corners. Butt joints tightly. Provide flush surfaces at joints. Offset insulation board joints from joints in sheathing by at least 200 mm (8 inches). Do not align joints with corners of doors, windows and other openings. Do not leave insulation board exposed longer than recommended by insulation manufacturer.
2. Adhesive: Apply directly to entire back surface of the insulation board as recommended by the system manufacturer and immediately apply to cement board substrate. Apply firm pressure over entire board to ensure uniform contact and level surface. Allow adhesive to cure for a minimum of 24 hours before sanding.
3. Mechanical Fasteners: Fasten with manufacturer's standard anchors, spaced as recommended by manufacturer, but not more than 600 mm (2 feet) horizontally and vertically.
4. Sanding: Sand entire surface of insulation before application of base coat to improve bonding of basecoat, level high joints and remove dirt and weathering damage. Do not pre-fill low areas with basecoat.
5. Base Coat and Reinforcing Fabric: Trowel apply to the insulation a uniform thickness of base coat as recommended by the system manufacturer but not less than 1-1/2 times the reinforcing fabric thickness with a minimum of 2.4 mm (3/32 inch). Install reinforcing fabric in accordance with manufacturer's instructions. Provide diagonal reinforcement at opening corners, backwrapping, and any other reinforcement recommended by EIFS manufacturer. The fabric shall not be visible beneath the surface of the basecoat after installation. Cure the basecoat for a minimum of 24 hours before application of the finish coat.
6. Finish: Inspect basecoat for damage or defects and repair prior to application of finish coat. Trowel apply finish coat according to manufacturer's recommendations but a minimum of 1.6 mm (1/16 inch). Texture finish as required. Provide finish surfaces that are plumb and plane with no greater deviation than 1:500 (1/4 inch in 10 feet).

3.6 CLEAN UP

- A. Upon completion, remove all scaffolding, equipment, materials and debris from site. Remove all temporary protection installed to facilitate installation of system.

END OF SECTION 07 24 00

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SECTION 07 27 13 - MODIFIED BITUMINOUS SHEET AIR BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes self-adhering, vapor-retarding, modified bituminous sheet air barriers.

1.2 RELATED WORK

- A. Exterior glass-mat gypsum wall sheathing: Section 06 16 00, SHEATHING.
- B. Rigid polystyrene insulation: Section 07 21 13, THERMAL INSULATION.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- B. Product Data: For each type of product.
 - 1. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
- C. Sample: For each type of product.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General: Air barrier shall be capable of performing as a continuous vapor-retarding air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

2.2 SELF-ADHERING SHEET AIR BARRIER

- A. Modified Bituminous Sheet: 1.0-mm- (40-mil-) thick, self-adhering sheet consisting of 0.9 mm (36 mils) of rubberized asphalt laminated to a 0.1-mm- (4-mil-) thick, cross-laminated polyethylene film with release liner on adhesive side.
- B. Physical and Performance Properties:
 - 1. Air Permeance: Maximum 0.02 L/s x sq. m of surface area at 75-Pa (0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft.) pressure difference; ASTM E 2178.
 - 2. Tensile Strength: Minimum 1.7 MPa (250 psi); ASTM D 412, Die C.
 - 3. Ultimate Elongation: Minimum 200 percent; ASTM D 412, Die C.
 - 4. Puncture Resistance: Minimum 180 N (40 lbf); ASTM E 154.
 - 5. Water Absorption: Maximum 0.15 percent weight gain after 48-hour immersion at 21 deg C (70 deg F); ASTM D 570.
 - 6. Vapor Permeance: Maximum 2.9 ng/Pa x s x sq. m (0.05 perm); ASTM E 96/E 96M, Water Method.

2.3 ACCESSORY MATERIALS

- A. General: Accessory materials recommended by air-barrier manufacturer to produce a complete air-barrier assembly and compatible with primary air-barrier membrane.
- B. Termination Mastic: Air-barrier manufacturer's standard cold fluid-applied elastomeric liquid; trowel grade.
- C. Sprayed Polyurethane Foam Sealant: One- or two-component, foamed-in-place, polyurethane foam sealant, 24- to 32-kg/cu. m (1.5- to 2.0-lb/cu. ft.) density; flame-spread index of 25 or less according to ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

- A. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
- B. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching membrane.
- C. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
- D. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.
- E. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

3.2 INSTALLATION

- A. General: Install modified bituminous sheets and accessory materials according to air-barrier manufacturer's written instructions and according to recommendations in ASTM D 6135.
 - 1. When ambient and substrate temperatures range between minus 4 and plus 5 deg C (25 and 40 deg F), install self-adhering, modified bituminous air-barrier sheet produced for low-temperature application. Do not install low-temperature sheet if ambient or substrate temperature is higher than 16 deg C (60 deg F).
- B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier sheet on same day. Reprime areas exposed for more than 24 hours.
 - 1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.
- C. Apply and firmly adhere modified bituminous sheets horizontally over area to receive air barrier. Accurately align sheets and maintain uniform 64-mm- (2-1/2-inch-) minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure airtight installation.
 - 1. Apply sheets in a shingled manner to shed water without interception by any exposed sheet edges.
 - 2. Roll sheets firmly to enhance adhesion to substrate.
- D. Seal top of through-wall flashings to air-barrier sheet.

- E. Seal exposed edges of sheet at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
- F. Install air-barrier sheet and accessory materials to form a seal with adjacent construction and to maintain a continuous air barrier.
- G. Connect and seal exterior wall air-barrier membrane continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.
- H. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transitions and flashing so that a minimum of 75 mm (3 inches) of coverage is achieved over each substrate. Maintain 75 mm (3 inches) of full contact over firm bearing to perimeter frames with not less than 25 mm (1 inch) of full contact.
- I. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, doors, and miscellaneous penetrations of air-barrier membrane with foam sealant.
- J. At end of each working day, seal top edge of air-barrier material to substrate with termination mastic.
- K. Repair punctures, voids, and deficient lapped seams in air barrier. Slit and flatten fishmouths and blisters. Patch with air-barrier sheet extending 150 mm (6 inches) beyond repaired areas in all directions.
- L. Do not cover air barrier until it has been tested and inspected by Department of Veterans Affairs's testing agency.
- M. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.3 FIELD QUALITY CONTROL

- A. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements.
- B. Air barriers will be considered defective if they do not pass inspections.
 - 1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
 - 2. Remove and replace deficient air-barrier components for reinspection as specified above.

- C. Repair damage to air barriers caused by inspection; follow manufacturer's written instructions.
- D. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
 - 1. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. If exposed to these conditions for more than 30 days, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed membrane according to air-barrier manufacturer's written instructions.
 - 2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.

END OF SECTION 07 27 13

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SECTION 07 53 23 - ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies adhered Ethylene Propylene Diene Monomer (EPDM) sheet roofing.

1.2 RELATED WORK

- A. Wood cants, blocking and wood edge strips: Section 06 10 00, ROUGH CARPENTRY.
- B. Roof insulation under membrane: 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. Copings, flashings, metal roof edges and expansion joints: Section 07 72 00, ROOF ACCESSORIES.

1.3 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):

A167-99(R2009)	Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip
B209-07	Aluminum and Aluminum-Alloy Sheet and Plate
D751-06	Coated Fabrics
D2103-10	Polyethylene Film and Sheeting
D2240-05(R2010)	Rubber Property - Durometer Hardness
D3884-09	Abrasive Resistance of Textile Fabrics (Rotary Platform, Double-Head Method)
D4637-10	EPDM Sheet Used in Single-Ply Roof Membrane
D4586-07	Asphalt Roof Cement, Asbestos Free
E96-10	Water Vapor Transmission of Materials
E108-10	Fire Tests of Roof Coverings
G21-09	Resistance of Synthetic Polymeric Materials to Fungi

- C. National Roofing Contractors Association (NRCA):
Fifth Edition - 05..... The NRCA Roofing and Waterproofing Manual.
- D. Federal Specifications (Fed. Spec.)
FF-S-107C(2)..... Screws, Tapping and Drive
FF-S-111D(1)..... Screw, Wood
UU-B-790A..... Building Paper, Vegetable Fiber (Kraft, Waterproofed,
Water Repellent and Fire Resistant)
- E. Factory Mutual Engineering and Research Corporation (FM):
Annual Issue Approval Guide Building Materials
- F. Underwriters Laboratories, Inc (UL):
Annual Issue Building Materials Directory
Annual Issue Fire Resistance Directory
- G. Warnock Hersey (WH):
Annual Issue Certification Listings

1.4 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 VA 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 label on each container or certification with each load of bulk bitumen, indicating Flash Point (FP), Finished Blowing Temperature (FBT), Softening Point (SP), Equiviscous Temperature (EVT).
3. 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.).

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.
 - a. Refer to structural drawing Sheet S-600 for wind loads.
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-90.
 - b. Hail Resistance: MH.

E. Pre-Roofing Meeting:

1. Upon completion of roof deck installation and prior to any roofing application, hold a pre-roofing meeting arranged by the Contractor and attended by the Roofing Inspector, Material Manufacturers Technical Representative, Roofing Applicator, Contractor, and COR.
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.

1.5 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 1. Asphalt and adhesive materials.
 2. EPDM sheet roofing and flashing membrane.
 3. Roofing cement.
 4. Roof walkway.
 5. Fastening materials and requirements.
 6. Application instructions.
 7. Certificates:
 - a. Indicating materials and method of application of roofing system meets requirements of FM Approvals "RoofNav" for specified fire/windstorm classification.
 - b. Indicating compliance with load/strain properties requirement.
 - c. Indicating compliance with energy performance requirement.
- C. Shop Drawings: Include plans, sections, details, and attachments.
 1. Base flashings and terminations.
- D. Samples:
 1. Sheet membrane: One 150 mm (6 inch) square piece.
 2. Sheet flashing: One 150 mm (6 inch) square piece.
 3. Fasteners: Two, each type.
 4. Welded seam: Two 300 mm (12 inch) square samples of welded seams to represent quality of field welded seams.
- E. Contract Close-out Submittals:
 1. Field reports of roofing inspector.
 2. Maintenance Manuals.
 3. Warranty signed by installer and manufacturer.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, and handle materials as specified by manufacturer.
- B. Store volatile materials separate from other materials with separation to prevent fire from damaging the work, or other materials.

PART 2 - PRODUCTS

2.1 EPDM SHEET ROOFING

- A. Conform to ASTM D4637, Type I, Grade 1, non-reinforced, black color.
- B. Additional Properties:

PROPERTY	TEST METHOD	REQUIREMENT
Shore A Hardness	ASTM D2240	55 to 75 Durometer
Water Vapor Permeance	ASTM E96	Minimum 0.14 perms Water Method
Fungi Resistance	ASTM G21	After 21 days, no sustained growth or discoloration.
Fire Resistance	ASTM E108 Class A	No Combustion Beyond Flame/Heat Source

- C. Thickness:
 - 1. Use 1.14 mm (0.045-inch) thick sheet for adhered system.
- D. Pipe Boots:
 - 1. Molded EDPM designed for flashing of round penetrations, 200 mm (8 inch) minimum height.
 - 2. Color same as roof membrane.

2.2 EPDM FLASHING SHEET

- A. Conform to ASTM D4637, Type I, Grade 1, Class U, unreinforced, color, same as roof membrane modified as specified for flashing.
- B. Self curing EPDM flashing, adaptable to irregular shapes and surfaces.
- C. Minimum thickness 1.5 mm (0.060-inch).

2.3 MISCELLANEOUS ROOFING MEMBRANE MATERIALS

- A. Sheet roofing manufacturers specified products.
- B. Splice Adhesive: For roofing and flashing sheet.
- C. Lap Sealant: Liquid EPDM rubber for roofing sheet exposed lap edge.
- D. Bonding Adhesives: Neoprene, compatible with roofing membrane, flashing membrane, insulation, metals, concrete, and masonry for bonding roofing and flashing sheet to substrate.
- E. Fastener Sealer: One part elastomeric adhesive sealant.
- F. Temporary Closure Sealers (Night Sealant): Polyurethane two part sealer.
- G. Primers, Splice Tapes, Cleaners, and Butyl Rubber Seals: As specified by roof membrane manufacturer.
- H. Asphalt Roof Cement: ASTM D4586.

2.4 FASTENERS

- A. Fasteners and washers required for securing sheet roofing to deck:
 - 1. Steel stress plate washers as required by sheet roofing manufacturer:
 - a. Coated against corrosion.
 - b. Separate or attached to fastener.
 - c. Approximately 50 mm (2 inch) diameter or 40 mm x 65 mm (1-1/2 by 2-1/2 inches) rectangular plate with rounded corners, minimum thickness 0.6 mm (0.023-inch).
 - 2. Fastening strip or batten strip for securing roof membrane to deck:
 - a. Stainless steel strip: ASTM A167 type 302 or 304, minimum 0.5 mm (0.018-inch) thick.
 - b. Aluminum strip: ASTM B209, minimum 2.4 mm (0.094-inch) thick.
 - c. Rounded corners on strips.
 - d. Form strips 38 mm (1-1/2 inches) wide, 3000 mm (10 feet) maximum length with 6 mm x 10 mm (1/4 by 3/8 inch) punched slotted holes at 100 mm (4 inch) centers; centered on width of strip. Punch holes 2 mm (1/16 inch) larger than fastener shank when shank is larger than 5 mm (3/16 inch).

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3. Steel Decks: Screws; Fed Spec FF-S-107, hardened nylon screw or steel screw coated to resist corrosion, self drilling, anti-backout thread design. Minimum pullout resistance of 135 Kg (300 pounds), minimum thread penetration of 13 mm (1/2 inch).
 4. Concrete and Masonry Wall Surfaces:
 - a. Nail penetration 13 mm (1/2 inch).
 5. Wood:
 - a. Screws; Fed. Spec. FF-S-111, Type I, Style 2.5, coated to resist corrosion, length to provide 19 mm (3/4 inch) minimum penetration.
 - b. Nails: Barbed shank, galvanized.
 6. Washers: Neoprene backed metal washer 28 mm (1-1/8 inch) minimum diameter.
 7. To Sheet Metal: Self tapping screw; Fed. Spec. FF-S-107, 2 mm (No. 14), sheet metal screw, minimum thread penetration of 6 mm (1/4 inch); stainless steel.
- B. Pipe Compression Clamp or Drawband:
1. Stainless steel or cadmium plated steel drawband.
 2. Worm drive clamp device.
- C. Surface mounted base flashing clamp strip:
1. Stainless steel strip, ASTM A167, type 302 or 304, dead soft temper, minimum 0.5 mm (0.018-inch) thick.
 2. Aluminum strip: ASTM B209 24 mm (.094-inch) thick.
 3. For exposed location, form strips with 6 mm (1/4 inch) wide top edge bent out 45 degrees (for sealant) from 40 mm (1-1/2 inch) wide material; 2400 mm (8 feet) maximum length with slotted 6 mm x 10 mm (1/4 by 3/8-inch) holes punched at 200 mm (8 inch) centers, centered between bend and bottom edges.
 4. For locations covered by cap flashings, form strips 30 mm (1-1/4 inch) wide, 2400 mm (8 feet) maximum length with slotted holes 6 mm x 10 mm (1/4 by 3/8 inch) punched at 200 mm (8 inch) centers, centered on strip width.

2.5 FLEXIBLE TUBING

- A. Closed cell neoprene, butyl polyethylene, vinyl, or polyethylene tube or rod.
- B. Diameter approximately 1-1/2 times joint width.

2.6 WALKWAY PADS

- A. Rubber walkway pad approximately 450 mm x 450 mm (30 by 30 inches) square or manufacturers standard size with rounded corners.
- B. Approximately 13 mm (1/2 inch) thick.
- C. Ultraviolet light stabilized.

PART 3 - EXECUTION

3.1 GENERAL

- A. Do not apply if deck will be used for subsequent work platform, storage of materials, or staging or scaffolding will be erected thereon unless protection provided to distribute loads less than one-half compression resistance of roofing system materials.
 - 1. Curbs, blocking, edge strips, and other components to which roofing and base flashing is attached in place ready to receive insulation and, roofing.
 - 2. Coordinate roof operation with sheet metal work and roof insulation work so that insulation and flashing are installed concurrently to permit continuous roofing operations.
 - 3. Complete installation of flashing, insulation, and roofing in the same day except for the area where temporary protection is required when work is stopped.
- B. Phased construction is not permitted. The complete installation of roofing system is required in the same day except for area where temporary protection is required when work is stopped. Complete installation includes pavers and ballast for ballasted systems.
- C. 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.
- D. 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, snow, fog, ice, or frost) is present in any amount in or on the materials.
 - 1. Do not apply materials to substrate having temperature of 4°C (40 degrees F) or less, or when materials applied with the roof require higher application temperature.
 - 2. Do not apply materials when the temperature is below 4°C (40 degrees F).

F. Temporary Protection:

1. Install temporary protection consisting of a temporary seal and water cut-offs 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. Temporarily seal exposed surfaces of insulation within the roofing membrane.
3. Do not leave insulation surfaces or edges exposed.
4. Use polyethylene film or building paper to separate roof sheet from bituminous materials.
5. Apply the temporary seal and water cut off by extending the roof membrane beyond the insulation and securely embedding the edge of the roof membrane in 6 mm (1/4 inch) thick by 50 mm (2 inches) wide strip of temporary closure sealant (night sealant) and weight edge with sandbags, to prevent displacement; space sandbags not over 2400 mm (8 foot) centers. Check daily to insure temporary seal remains watertight. Reseal open areas and weight down.
6. Before the work resumes, cut off and discard portions of the roof membrane in contact with roof cement or bituminous materials.
 - a. Cut not less than 150 mm (6 inches) back from bituminous coated edges or surfaces.
 - b. Remove temporary polyethylene film or building paper.
7. Remove and discard sandbags contaminated with bituminous products.
8. For roof areas that are to remain intact and that are subject to foot traffic and damage, provide temporary wood walkways with notches in sleepers to permit free drainage.
9. Provide 2 mm (6 mil) polyethylene sheeting or building paper cover over roofing membrane under temporary wood walkways and adjacent areas. Round all edges and corners of wood bearing on roof surface.

3.2 PREPARATION

- A. Test pull out resistance of fasteners in deck in the presence of the COR before starting roofing work. Tests are not required for wood.
1. Test applicable fastener type in applicable deck.
 2. Install fasteners through a sample of the insulation, if any is to be used, into the structural deck.
 3. Test the pull out resistance with a pull out tester.
 4. Test one fastener in each deck level and one for every 230 m² (2500 square feet) of deck type and level.
 5. Test at locations designated by COR.
 6. Do not proceed with the roofing work if the pull out resistance of the fasteners is less than specified.

7. Test results:

- a. Repeat tests using other type fasteners or use additional fasteners to stay within the pullout load resistance criteria.
 - b. Patch cementitious deck to repair areas of fastener tests holes.
- B. Remove dirt, debris, and surface moisture. Cover or fill voids greater than 6 mm (1/4 inch) wide to provide solid support for roof membrane.

3.3 INSTALLATION OF ROOFING AND FLASHING

- A. Do not allow the membrane to come in contact with surfaces contaminated with asphalt, coal tar, oil, grease, or other substances which are not compatible with EPDM roofing membrane.
- B. If possible, install the membrane so the sheets run perpendicular to the long dimension of the insulation boards.
- C. If possible, start at the low point of the roof and work towards the high point. Lap the sheets so the flow of water is not against the edges of the sheet. Coordinate with roof insulation installation.
- D. Position the membrane so it is free of buckles and wrinkles.
- E. Roll sheet out on deck; inspect for defects as sheet is being rolled out and remove defective areas:
 - 1. Allow 30 minutes for relaxing before proceeding.
 - 2. Lap edges and ends of sheets 75 mm (3 inches) or more as recommended by the manufacturer. Clean lap surfaces as specified by manufacturer.
 - 3. Adhesively splice laps. Apply pressure as required. Seam strength of laps as required by ASTM D4637.
 - 4. Check seams to ensure continuous adhesion and correct defects.
 - 5. Finish edges of laps with a continuous beveled bead of lap sealant to sheet edges to provide smooth transition as specified by manufacturer.
 - 6. Finish seams as the membrane is being installed (same day).
 - 7. Anchor perimeter to deck or wall as specified.
- F. Membrane Perimeter Anchorage:
 - 1. Install batten strip or steel stress plate with fasteners at the perimeter of each roof level, curb flashing, expansion joints and similar penetrations as indicated in accordance with membrane manufacturer's instructions on top of roof membrane to wall or deck.

2. Mechanically fastened as follows:

- a. Top of mechanical fastener set flush with top surface of the nailing strip or stress plate.
- b. Space mechanical fasteners a maximum 300 mm (12 inches) on center.
- c. Start 25 mm (1 inch) from the end of the nailing strip when used.
- d. When strip is cut round edge and corners before installing.
- e. Set fasteners in lap sealant and cover fastener head with fastener sealer including batten strip or stress plate.
- f. Stop fastening strip where the use of the nailing strip interferes with the flow of the surface water, separate by a 150 mm (6 inch) space, then start again.
- g. After mechanically fastening cover and seal with a 225 mm (9 inch) wide strip of flashing sheet. Use splice adhesive on all laps and finish edge with sealant as specified.
- h. At gravel stops and fascia-cants turn the membrane down over the front edge of the blocking, cant, or the nailer to below blocking. Secure the membrane to the vertical portion of the nailer; with fasteners spaced not over 150 mm (6 inches) on centers.
- i. At parapet walls intersecting building walls and curbs, secure the membrane to the structural deck with fasteners 150 mm (6 inches) on center or as shown in NRCA manual (Fifth Edition)

G. Adhered System:

1. Apply bonding adhesive in quantities required by roof membrane manufacturer.
2. Fold sheet back on itself, clean and coat the bottom side of the membrane and the top of the deck with adhesive. Do not coat the lap joint area.
3. After adhesive has set according to adhesive manufacturer's application instruction, roll the membrane into the adhesive in manner that minimizes voids and wrinkles.
4. Repeat for other half of sheet. Cut voids and wrinkles to lay flat and clean for repair patch over cut area.

H. Install flashings as the membrane is being installed (same day). If the flashing cannot be completely installed in one day, complete the installation until the flashing is in a watertight condition and provide temporary covers or seals.

I. Flashing Roof Drains:

1. Install roof drain flashing as recommended by the membrane manufacturer, generally as follows:
 - a. Coordinate to set the metal drain flashing in asphalt roof cement, holding cement back from the edge of the metal flange.
 - b. Do not allow the roof cement to come in contact with the EPDM roof membrane.

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- c. Adhere the EPDM roof membrane to the metal flashing with the membrane manufacturer's recommended bonding adhesive.
 - 2. Turn down the metal drain flashing and EPDM roof membrane into the drain body and install clamping ring and stainer.
- J. Installing EPDM Base Flashing and Pipe Flashing:
- 1. Install EPDM flashing membranes to pipes, walls or curbs to a height not less than 200 mm (8 inches) above roof surfaces and 100 mm (4 inches) on roof membranes. Install in accordance with NRCA manual:
 - a. Adhere flashing to pipe, wall or curb with bonding adhesive.
 - b. Form inside and outside corners of EPDM flashing membrane in accordance with NRCA manual (Fifth Edition). Form pipe flashing in accordance with NRCA manual (Fifth Edition).
 - c. Lap ends not less than 100 mm (4 inches).
 - d. Adhesively splice flashing membranes together and flashing membranes to roof membranes. Finish exposed edges with sealant as specified.
 - 2. Anchor top of flashing to walls or curbs with fasteners spaced not over 150 mm (6 inches) on center. Use surface mounted fastening strip with sealant on ducts. Use pipe clamps on pipes or other round penetrations.
 - 3. Apply sealant to top edge of flashing.
- K. Installing Building Expansion Joints:
- 1. Install base flashing on curbs as specified.
 - 2. Coordinate installation with metal expansion joint cover or roof expansion joint system.
 - 3. Install flexible tubing 1-1/2 times width of joint over joint. Cover tubing with EPDM cover strip adhered to base flashing and lapping base flashing 100 mm (4 inches). Finish edges of laps with sealants as specified.
- L. Repairs to membrane and flashings:
- 1. Remove sections of EPDM sheet roofing or flashing that is creased wrinkled or fishmouthed.
 - 2. Cover removed areas, cuts and damaged areas with a patch extending 100 mm (4 inches) beyond damaged, cut, or removed area. Adhesively splice to roof membrane or flashing. Finish edge of lap with sealant as specified.

3.4 WALKWAY PADS

- A. Clean membrane where pads are applied.

- B. Adhere pads to membrane with splicing cement.
- C. Allow not less than 1 inch break between pads and 2 inch maximum break.

3.5 FIELD QUALITY CONTROL

- A. Examine and probe seams in the membrane and flashing in the presence of the COR and Membrane Manufacturer's Inspector.
- B. Probe the edges of welded seams with a blunt tipped instrument. Use sufficient hand pressure to detect marginal bonds, voids, skips, and fishmouths.
- C. Cut 100 mm (4 inch) wide by 300 mm (12 inch) long samples through the seams where directed by the COR.
 - 1. Cut one sample for every 450 m (1500 linear feet) of seams.
 - 2. Cut the samples perpendicular to the longitudinal direction of the seams.
 - 3. Failure of the samples to maintain the standard of quality within a reasonable tolerance of the approved samples will be cause for rejection of the work.
- D. Repair areas of welded seams where samples have been taken or marginal bond voids or skips occur.
- E. Repair fishmouths and wrinkles by cutting to lay flat and installing patch over cut area extending 100 mm (4 inches) beyond cut.

3.6 TEMPORARY ROOF

- A. Install temporary roof when sequences of work or weather does not permit installation of a completed permanent roof system or roof would be subject to phasing of roof work, construction traffic, scaffolds, and work over roof area.
- B. Use of 1.15 mm (0.045-inch) thick non-reinforced EPDM membrane or other temporary membrane as approved.
- C. Install not less than 6 mm (1/4 inch) thick plywood underlayment over steel decks before installing temporary roof.
- D. Secure membrane to deck with mechanical fasteners or temporary ballast not exceeding deck dead load capacity.
- E. Repair cuts, tears, and punctures with patches to keep system watertight.
- F. Install permanent roof system within one year.

3.7 FIELD QUALITY CONTROL

- A. Roofing Inspector: Contractor shall engage a qualified roofing inspector for a minimum of 10 full-time days on site to perform roof tests and inspections and to prepare start up, interim, and final reports.
- B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
 - 1. Notify Architect and VA 48 hours in advance of date and time of inspection.
- C. Repair or remove and replace components of roofing work where test results or inspections indicate that they do not comply with specified requirements.
 - 1. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.8 PROTECTING AND CLEANING

- A. Protect membrane roofing system from damage and wear during remainder of construction period.
- B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements; repair substrates; and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of acceptance by VA.
- C. Clean overspray and spillage from adjacent construction. Clean membrane and restore surface to like-new condition meeting solar reflectance requirements.

END OF SECTION 07 53 23

SECTION 07 60 00 - FLASHING AND SHEET METAL

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section includes formed sheet metal work for miscellaneous wall and roof flashings not covered in other sections.

1.2 RELATED WORK

- A. Masonry assembly flashings: Section 04 20 00, UNIT MASONRY.
- B. Flashing components of factory finished wall systems: Section 07 40 00, METAL WALL PANELS.
- C. Membrane roofing base flashings and stripping: Section 07 53 23 EPDM ROOFING.
- D. Manufactured flashing, copings, roof edge metal, and expansion joints: Section 07 71 00 ROOF SPECIALTIES.
- E. Joint Sealants: Section 07 92 00, JOINT SEALANTS.

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. ASTM International (ASTM):
 - A167-99(R2009) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
 - B32-08 Solder Metal
 - B370-09 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
D4586-07 Asphalt Roof Cement, Asbestos Free

D. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
Architectural Sheet Metal Manual.

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

AMP 500-06 Metal Finishes Manual

F. Federal Specification (Fed. Spec):

A-A-1925A Shield, Expansion; (Nail Anchors)

UU-B-790A Building Paper, Vegetable Fiber

G. International Code Commission (ICC): International Building Code, Current Edition

1.4 SUBMITTALS

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

B. Shop Drawings: For all specified items.

C. Manufacturer's Literature and Data: For all specified items.

PART 2 - PRODUCTS

2.1 FLASHING AND SHEET METAL MATERIALS

A. Stainless Steel: ASTM A167, Type 302B, dead soft temper.

B. 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.

- C. Non-reinforced, Elastomeric Sheetting: Elastomeric substances reduced to thermoplastic state and extruded into continuous homogenous sheet (0.056 inch) thick. Sheetting 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. Sheetting 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).

2.2 FLASHING ACCESSORIES

- A. Solder: ASTM B32; flux type and alloy composition as required for use with metals to be soldered.
- B. 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).
- C. Bituminous Paint: ASTM D1187, Type I.
- D. 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.
- E. Sealant: As specified in Section 07 92 00, JOINT SEALANTS for exterior locations.
- F. Roof Cement: ASTM D4586.

2.3 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.

C. Exposed Locations:

1. Copper: 0.4 Kg (16 oz).
2. Stainless steel: 0.4 mm (0.015 inch).

2.4 FABRICATION, GENERAL

A. Jointing:

1. In general, copper and 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, non-reinforced 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 of minimum 0.6 Kg (24 ounce) copper or 0.6 mm (0.024 inch) thick stainless steel.
3. Use material compatible with sheet metal to be secured by the edge strip.
4. Fabricate in 3000 mm (10 feet) maximum lengths with not less than 19 mm (3/4 inch) loose lock into metal secured by edge strip.
5. Fabricate Strips for fascia anchorage to extend below the supporting wood construction to form a drip and to allow the flashing to be hooked over the lower edge at least 19 mm (3/4-inch).
6. Fabricate anchor edge maximum width of 75 mm (3 inches) or of sufficient width to provide adequate bearing area to insure a rigid installation using 1 Kg (32 oz) copper or 0.8 mm (0.031 inch) thick stainless steel or 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, current edition.

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.

2.5 FINISHES

- 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 AMP 500, 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.

2.6 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 or stainless steel.

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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. For Flashing at Architectural Precast Concrete Panels or Stone Panels.
1. Use plan flat sheet of stainless steel.
 2. Form exposed portions with drip as specified or receiver.
- E. Window Sill Flashing and Lintel Flashing:
1. Use either copper, stainless steel, nonreinforced elastomeric sheeting, or bituminous 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.
- F. 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.

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).

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- 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.

END OF SECTION 07 60 00

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SECTION 07 71 00 - ROOF SPECIALTIES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies roof hatches.

1.2 RELATED WORK

- A. Sealant material and installation: Section 07 92 00, JOINT SEALANTS.
- B. Rigid insulations for roofing: Section 07 22 00, ROOF AND DECK INSULATION

1.3 QUALITY CONTROL

- A. All roof accessories shall be the products of manufacturers regularly engaged in producing the kinds of products specified.
- B. Each accessory type shall be the same and be made by the same manufacturer.
- C. Each accessory shall be completely assembled to the greatest extent possible before delivery to the site.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: Each item specified showing design, details of construction, installation and fastenings.
- C. Manufacturer's Literature and Data: Each item specified.

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. 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-10 Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-
Coated (Galvannealed) By the Hot-Dip Process

B209/209M-07 Aluminum and Aluminum Alloy-Sheet and Plate

B221/221M-08 Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and
Tubes

C612-10 Mineral Fiber Block and Board Thermal Insulation

D1187-97(R2002) Asphalt-Base Emulsions for Use as Protective Coatings for
Metal

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

AMP 500 Series Metal Finishes Manual

E. American Architectural Manufacturers Association (AAMA):

2605-11 High Performance Organic Coatings on Architectural
Extrusions and Panels

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum, Extruded: ASTM B221/B221M.

B. Aluminum Sheet: ASTM B209/B209M.

C. Galvanized-Steel Tube: ASTM A 500/A 500M, round tube, hot-dip galvanized
according to ASTM A 123/A 123M.

2.2 ROOF HATCH (SCUTTLE)

A. Fabricate from aluminum with mill finish.

B. Curb and Cover:

1. Exterior facing: Minimum 2.3 mm (0.09 inch) thick sheet aluminum.
2. Interior facing: Minimum 1 mm (0.04 inch) thick sheet aluminum.

3. Minimum of 25 mm (one inch) thick mineral fiber insulation between facings of cover and over exterior face of curb.
4. Form exterior curb facing with an integral three inch wide roof flange and cap flashing minimum 2.3 mm (0.09 inch) thick sheet aluminum.
5. Make curb 300 mm (12 inches).
6. Form cover to lap curb and cap flashing.
7. Size: 36 by 30 inches.

C. Hardware:

1. Provide spring snap latch with inside and outside operating handles and padlock hasp on inside. Provide two snap latches when hinge side is over 2100 mm (7 feet) long.
2. Provide pintle hinges.
3. Provide automatic hold open and operating arm with enclosed torsion or compression spring lifting mechanism.
4. Covers shall automatically lock in the open position at not less than 70 degrees.
5. Provide weatherstripping at cover closure.
6. Galvanize all hardware items.

D. Ladder-Assist Post: Roof-hatch manufacturer's standard device for attachment to roof-access ladder.

1. Operation: Post locks in place on full extension; release mechanism returns post to closed position.
2. Height: 1060 mm (42 inches) above finished roof deck.
3. Material: Galvanized steel.
4. Post: 41-mm- (1-5/8-inch-) diameter pipe.
5. Finish: Manufacturer's standard baked enamel or powder coat.

a. Color: Safety yellow.

E. Safety Railing System: Roof-hatch manufacturer's standard system including rails, clamps, fasteners, safety barrier at railing opening, and accessories required for a complete installation; attached to roof hatch and complying with 29 CFR 1910.23 requirements and authorities having jurisdiction.

1. Height: 1060 mm (42 inches) above finished roof deck.
2. Posts and Rails: Galvanized-steel pipe, 31 mm (1-1/4 inches) in diameter or galvanized-steel tube, 41 mm (1-5/8 inches) in diameter.
3. Flat Bar: Galvanized steel, 50 mm (2 inches) high by 9 mm (3/8 inch) thick.
4. Maximum Opening Size: System constructed to prevent passage of a sphere 533 mm (21 inches) in diameter.
5. Chain Passway Barrier: Galvanized proof coil chain with quick link on fixed end.
6. Post and Rail Tops and Ends: Weather resistant, closed or plugged with prefabricated end fittings.
7. Provide weep holes or another means to drain entrapped water in hollow sections of handrail and railing members.

8. Fabricate joints exposed to weather to be watertight.
9. Fasteners: Manufacturer's standard, finished to match railing system.
10. Finish: Manufacturer's standard.
 - a. Color: Safety yellow.

F. Assembly:

1. Completely shop assemble roof scuttle.
2. Fully weld all joints exposed to the weather and built into the roofing.
3. Finish weld smooth where exposed.
4. Operation with minimum force to open and close.

2.3 FINISH

- A. In accordance with NAAMM Amp 500 Series.
- B. Aluminum, Mill Finish: AA-MIX, as fabricated.
- C. Galvanized Steel:
 1. Baked-Enamel or Powder-Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of 2 mils (0.05 mm).

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).

3.2 PROTECTION OF ALUMINUM

- A. Provide protection for aluminum against galvanic action wherever dissimilar materials are in contact, by painting the contact surfaces of the dissimilar material with two coats of asphalt coating (complete coverage), or by separating the contact surfaces with a preformed neoprene tape having pressure sensitive adhesive coating on side.
- B. Paint aluminum in contact with wood, concrete and masonry, or other absorptive materials, that may become repeatedly wet, with two coats of asphalt coating.

3.3 ADJUSTING

- A. Adjust roof hatch hardware to operate freely and so that cover will operate without binding, close tightly at perimeter, and latch securely.

3.4 PROTECTION

- A. Protect roof accessories from damage during installation and after completion of the work from subsequent construction.

END OF SECTION 07 71 00

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SECTION 07 72 00 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies copings, roof expansion joints, reglets, and counterflashing.

1.2 RELATED WORK

- A. Wood cants, blocking and wood edge strips: Section 06 10 00, ROUGH CARPENTRY.
- B. Membrane roofing: Section 07 53 23 EPDM ROOFING.
- C. Sealant material and installation: Section 07 92 00, JOINT SEALANTS.
- D. Fire-rated expansion joints: Section 07 95 13, EXPANSION JOINT COVER ASSEMBLIES.

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. Manufacturer's Literature and Data: Each item specified.
 - 1. Certificates: Stating that aluminum has been given specified thickness of anodizing.
- C. Shop Drawings: Each item specified showing design, details of construction, installation and fastenings.

- ## 1.5 APPLICABLE PUBLICATIONS

- 2605-11.....High Performance Organic Coatings on Architectural Extrusions and Panels.

2.1 MATERIALS

- 07 72 00 - 2
ROOF ACCESSORIES
VA Master Specifications 10-11

2.2 COPINGS

- A. Fabricate of aluminum not less than 1.6-mm (0.063) inch thick.
- B. Turn outer edges down each face of wall as shown.
- C. Maximum lengths of 3000 mm (10 feet).
- D. Shop fabricate external and internal corners as one piece assemblies with not less than 300 mm (12 inch) leg lengths.
- E. Copings shall be Category 5 FM rated.
- F. Provide 100 mm (four inch) wide 0.8 mm (0.032 inch) thick watertight joint covers.
- G. Provide anchor gutter bar of 0.8 mm (0.032 inch) thick with anchor holes formed for underside of joint.
- H. 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.
- I. Finish: Fluorocarbon as specified.

2.3 BELLOWS-TYPE ROOF EXPANSION JOINTS

- A. Flanged Bellows Roof Expansion Joint: Manufactured, continuous, waterproof, joint-cover assembly, consisting of exposed membrane bellows, laminated to flexible, closed-cell support foam, and secured along each edge to a metal flange for nailing to substrate. Provide factory-fabricated units for corner and joint intersections and horizontal and vertical transitions including those to other building expansion joints.
 - 1. Bellows: EPDM flexible membrane.
 - 2. Flanges: Galvanized steel.
 - 3. Cover Membrane: Flexible membrane, factory laminated to bellows and covering entire joint assembly and curbs.
 - 4. Secondary Seal: Continuous, waterproof membrane within joint and attached to substrate on sides of joint below the primary bellows assembly.
 - a. Thermal Insulation: Fill space above secondary seal with manufacturer's standard, factory-installed insulation; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84.

5. Fire Barrier: Manufacturer's standard fire-resistive joint system with ratings determined per ASTM E 1966 or UL 2079 to resist spread of fire and to accommodate building thermal movements without impairing its ability to resist the passage of fire and hot gases.
 - a. Fire-Resistance Rating: Not less than fire-resistance rating of the roof assembly.

2.4 REGLETS AND COUNTERFLASHINGS

- A. Reglets: Manufactured units formed to provide secure interlocking of separate reglet and counterflashing pieces, from the following exposed metal:
 1. Formed Aluminum: 0.050 inch (1.27 mm) thick.
 2. Corners: Factory mitered and mechanically clinched and sealed watertight.
 3. Surface-Mounted Type: Provide reglets with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
 4. Masonry Type, Embedded: Provide reglets with offset top flange for embedment in masonry mortar joint.
- B. Counterflashings: Manufactured units of heights to overlap top edges of base flashings by 4 inches (100 mm) and in lengths not exceeding 12 feet (3.6 m) designed to snap into reglets or through-wall-flashing receiver and compress against base flashings with joints lapped, from the following exposed metal:
 1. Formed Aluminum: 0.032 inch (0.81 mm) thick.
- C. Accessories:
 1. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where reglet is provided separate from metal counterflashing.
 2. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.
- D. Aluminum Finish: Two-coat fluoropolymer.
 1. Color: As selected by Architect from manufacturer's full range.

2.5 FINISH

- A. In accordance with NAAMM Amp 500-505.

- B. Copings, reglets and counterflashing:
 - 1. Fluorocarbon Finish: AAMA 2605.2 high performance organic coating.
- C. Roof expansion joints: Mill.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Install roof accessories where shown.
- B. Secure with fasteners in accordance with manufacture's printed installation instructions and approved shop drawings unless shown otherwise.
- C. Comply with section 07 92 00, JOINT SEALANTS to install sealants where manufactures installation instructions require sealant.
- D. Coordinate with roofing work for installation of items in sequence to prevent water infiltration.
- E. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
- F. Aluminum Coping:
 - 1. Install sections of coping with approximately 6 mm (1/4-inch) space between ends of sections.
 - 2. Center joint gutter bar and covers at joints and securely lock in place.
 - 3. When snap-on system is used insure front and back edges are locked in place.
- G. Expansion Joint Covers:
 - 1. Install to terminate base flashing 200 mm (8 inches) above roof.
 - 2. Install moisture seals to drain water to outlets that do not permit water to enter buildings construction.
 - 3. Use stainless steel screws when exposed.

3.1 COUNTERFLASHINGS

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 manufacturer's 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.
 - F. Insert counterflashings into reglets or other indicated receivers; ensure that counterflashings overlap 100 mm (4 inches) over top edge of base flashings. Lap counterflashing joints a minimum of 100 mm (4 inches) and bed with sealant. Fit counterflashings tightly to base flashings.

3.2 REGLETS

- A. Install reglets in a manner to provide a watertight installation.
 1. Embedded Reglets: See Section 042000 "Unit Masonry" for installation of reglets.
 2. Surface-Mounted Reglets: Install reglets to receive flashings where flashing without embedded reglets is indicated on Drawings. Install at height so that inserted counterflashings overlap 100 mm (4 inches) over top edge of base flashings.
- 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 on 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.

3.3 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.

3.4 ADJUSTING

- A. Adjust expansion joints to close tightly and be watertight; insuring maximum allowance for building movement.

3.5 PROTECTION

- A. Protect roof accessories from damage during installation and after completion of the work from subsequent construction.

END OF SECTION 07 72 00

SECTION 07 81 00 - APPLIED FIREPROOFING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies mineral fiber and cementitious coverings to provide fire resistance to interior structural steel members shown.
 - 1. Refer to Sheet G-100 for requirements fireproofing rating.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Manufacturer's complete and detailed application instructions and specifications.
 - 2. Manufacturer's repair and patching instructions.
 - 3. Certificates:
 - a. Certificate from testing laboratory attesting fireproofing material and application method meet the specified fire ratings.
 - b. List thickness and density of material required to meet fire ratings.
 - c. Accompanied by complete test report and test record.
 - d. Manufacturer's certificate indicating sprayed-on fireproofing material supplied under the Contract is same within manufacturing tolerance as fireproofing material tested.

1.3 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver to job-site in sealed containers marked and labeled to show manufacturer's name and brand and certification of compliance with the specified requirements.
- B. Remove damaged containers from the site.
- C. Store the materials off the ground, under cover, away from damp surfaces.
- D. Keep dry until ready for use.
- E. Remove materials that have been exposed to water before installation from the site.

1.4 QUALITY CONTROL

- A. Test for fire endurance in accordance with ASTM E119, for fire rating specified, in a nationally recognized laboratory.
- B. Manufacturer's inspection and approval of surfaces to receive fireproofing as specified under paragraph Examination.
- C. Manufacturer's approval of fireproofing applications.
- D. Manufacturer's approval of completed installation.
- E. Manufacturer's representative shall observe and advise at the commencement of application, and shall visit the site as required thereafter for the purpose of ascertaining proper application.
- F. Pre-Application Test Area.
 - 1. Apply a test area consisting of a typical overhead fireproofing installation, including not less than 4.5 m (15 feet) of beam and deck.
 - a. Apply to one column.
 - b. Apply for the hourly ratings used.
 - 2. Install in location selected by the COR, for approval by the representative of the fireproofing material manufacturer and by the Government.
 - 3. Perform Bond test on painted steel in accordance with ASTM E736.
 - 4. Do not proceed in other areas until installation of test area has been completed and approved.
 - 5. Keep approved installation area open for observation as criteria for sprayed-on fireproofing.

1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - C841-03 Installation of Interior Lathing and Furring
 - C847-06 Metal Lath
 - E84-08 Surface Burning Characteristics of Building Materials
 - E119-08 Fire Tests of Building Construction and Materials
 - E605-93 (R2006) Thickness and Density of Sprayed Fire-Resistive Materials
Applied to Structural Members
 - E736-00 Cohesion/Adhesion of Sprayed Fire-Resistive Materials
Applied to Structural Members

E759-92 (R2005)	The Effect of Deflection on Sprayed Fire-Resistive Material Applied to Structural Members
E760-92 (R2005)	Impact on Bonding of Sprayed Fire-Resistive Material Applied to Structural Members
E761-92 (R2005)	Compressive Strength of Fire-Resistive Material Applied to Structural Members
E859-93 (R2006)	Air Erosion of Sprayed Fire-Resistive Materials Applied to Structural Members
E937-93 (R2005)	Corrosion of Steel by Sprayed Fire-Resistive Material Applied to Structural Members
E1042-02	Acoustically, Absorptive Materials Applied by Trowel or Spray.
G21-96 (R2002)	Determining Resistance of Synthetic Polymeric Materials to Fungi

C. Underwriters Laboratories, Inc. (UL):

Fire Resistance Directory...Latest Edition including Supplements

D. Warnock Hersey (WH):

Certification Listings..... Latest Edition

E. Factory Mutual System (FM):

Approval Guide Latest Edition including Supplements

PART 2 - PRODUCTS

2.1 SPRAYED-ON FIREPROOFING

A. ASTM E1042, Class (a), Category A.

1. Type I, factory mixed cementitious materials with approved aggregate.
2. Type II, factory mixed mineral fiber with integral inorganic binders minimum 240 kg/m³ (15 lb/ft³) density per ASTM E605 test unless specified otherwise. Use in areas that are completely encased.

B. Materials containing asbestos are not permitted.

- C. Fireproofing characteristics when applied in the thickness and density required to achieve the fire-rating specified.

	Characteristic	Test	Results
1.	Deflection	ASTM E759	No cracking, spalling, or delamination when backing to which it is applied has a deflection up to 1/120 in 3m (10 ft.)
2.	Corrosion-Resistance	ASTM E937	No promotion of corrosion of steel.
3.	Bond Impact	ASTM E760	No cracking, spalling, or delamination.
4.	Cohesion/Adhesion (Bond Strength)	ASTM E736	Minimum cohesive/adhesive strength of 9.57 kPa (200 lbf/ft ²) for protected areas. 19.15 kPa (400 lbf/ft ²) for exposed areas.
5.	Air Erosion	ASTM E859	Maximum gain weight of the collecting filter 0.27gm/m ² (0.025 gm/ft ²).
6.	Compressive Strength	ASTM E761	Minimum compressive strength 36 kPa (5 lbf/in ²).
7.	Surface Burning Characteristics with adhesive and sealer to be used	ASTM E84	Flame spread 25 or less smoke developed 50 or less
8.	Fungi Resistance	ASTM G21	Resistance to mold growth when inoculated with aspergillus niger (28 days for general application)

2.2 ADHESIVE

- A. Bonding adhesive for Type II (fibrous) materials as recommended and supplied by the fireproofing material manufacturer.
- B. Adhesive may be an integral part of the material or applied separately to surface receiving fireproofing material.

2.3 SEALER

- A. Sealer for Type II (fibrous) material as recommended and supplied by the fireproofing material manufacturer.
- B. Surface burning characteristics as specified for fireproofing material.
- C. Fungus resistant.

- D. Sealer may be an integral part of the material or applied separately to the exposed surface. When applied separately use contrasting color pigmented sealer, white preferred.

2.4 WATER

- A. Clean, fresh, and free from organic and mineral impurities.
- B. pH of 6.9 to 7.1.

2.5 MECHANICAL BOND MATERIAL

- A. Expanded Metal Lath: ASTM C847, minimum weight of 0.92 kg/m² (1.7 pounds per square yard).
- B. Fasteners: ASTM C841.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify surfaces to receive fireproofing are clean and free of dust, soot, oil, grease, water soluble materials or any foreign substance which would prevent adhesion of the fireproofing material.
- B. Verify hangers, inserts and clips are installed before the application of fireproofing material.
- C. Verify ductwork, piping, and other obstructing material and equipment is not installed that will interfere with fireproofing installation.
- D. Verify concrete work on steel decking and concrete encased steel is completed.
- E. Verify temperature and enclosure conditions are required by fire-proofing material manufacturer.

3.2 APPLICATION

- A. Do not start application until written approval has been obtained from manufacturer of fireproofing materials that surfaces have been inspected by the manufacturer or his representative, and are suitable to receive sprayed-on fireproofing.
- B. Coordinate application of fireproofing material with other trades.

C. Application of Metal Lath:

1. Apply to beam and columns having painted surfaces which fail ASTM E736 Bond Test requirements in pre-application test area.
2. Apply to beam flanges 300 mm (12-inches) or more in width.
3. Apply to column flanges 400 mm (16-inches) or more in width.
4. Apply to beam or column web 400 mm (16-inches) or more in depth.
5. Tack weld or mechanically fasten on maximum of 300 mm (12-inch) center.
6. See design criteria section of the approved assemblies used.
7. Lap and tie lath member in accordance with ASTM C841.

D. Mix and apply in accordance with manufacturer's instructions.

1. Mechanically control material and water ratios.
2. Apply adhesive and sealer, when not an integral part of the materials, in accordance with the manufacturer's instructions.
3. Apply to density and thickness indicated in UL Fire Resistance Directory, FM Approval Guide, or WH Certification Listings unless specified otherwise. Test in accordance with ASTM E119.
4. Minimum applied dry density per cubic meter (cubic foot) for the underside of the walk on deck (interstitial) hung purl in or beam and steel deck, columns in interstitial spaces and mechanical equipment rooms shall be as follows:
 - a. Type I - 240 kg/m³ (15 lb/ft³).
 - b. Type II - 350 kg/m³ (22 lb/ft³).

E. Application shall be completed in one area, inspected and approved by COR before removal of application equipment and proceeding with further work.

3.3 FIELD TESTS

- A. Tests of applied material will be performed by Contractor retained Testing Laboratory. See Section 01 45 29, TESTING LABORATORY SERVICES.
- B. COR will select area to be tested in specific bays on each floor using a geometric grid pattern.
- C. Test for thickness and density in accordance with ASTM E605. Areas showing thickness less than that required as a result of fire endurance test will be rejected.
- D. Areas showing less than required fireproofing characteristics will be rejected on the following field tests.
 1. Test for cohesion/adhesion: ASTM E736.
 2. Test for bond impact strength: ASTM E760.

3.4 PATCHING AND REPAIRING

- A. Inspect after mechanical, electrical and other trades have completed work in contact with fireproofing material, but before sprayed material is covered by subsequent construction.
- B. Perform corrective measures in accordance with fireproofing material Manufacturer's recommendations.
 - 1. Respray areas requiring additional fireproofing material to provide the required thickness, and replace dislodged or removed material.
 - 2. Spray material for patching by machine directly on point to be patched, or into a container and then hand apply.
 - 3. Hand mixing of material is not permitted.
- C. Repair:
 - 1. Respray all test and rejected areas.
 - 2. Patch fireproofing material which is removed or disturbed after approval.
- D. Perform final inspection of sprayed areas after patching and repair.

3.5 SCHEDULE

- A. Apply fireproofing material in interior structural steel members and on underside of interior steel floor and roof decks as shown on the drawings, except on following surfaces:
 - 1. Structural steel and underside of steel decks in elevator or dumbwaiter machine rooms.
 - 2. Steel members in elevator hoist ways.
 - 3. Areas used as air handling plenums.
 - 4. Steel to be encased in concrete or designated to receive other type of fireproofing.
- B. Provide Type I fireproofing in areas of exposed structural systems.
- C. Provide Type II fireproofing in areas of concealed structural systems.

END OF SECTION 07 81 00

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SECTION 07 84 00 - FIRESTOPPING

PART 1 - GENERAL

1.1 DESCRIPTION

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

1.2 RELATED WORK

- A. Expansion and seismic joint firestopping: Section 07 95 13, EXPANSION JOINT COVER ASSEMBLIES.
- B. Spray applied fireproofing: Section 07 81 00, APPLIED FIREPROOFING
- C. Sealants and application: Section 07 92 00, JOINT SEALANTS.
- D. Fire and smoke damper assemblies in ductwork: Section 23 31 00, HVAC DUCTS AND CASINGS; 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. Manufacturer's Literature and Data:
 - 1. List of FM, UL, or WH classification number of systems installed.
 - 2. Installation instructions for types of firestopping and smoke stopping used.
 - 3. 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 QUALITY ASSURANCE

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

1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - E84-10 Surface Burning Characteristics of Building Materials
 - E814-11 Fire Tests of Through-Penetration Fire Stops
- C. Factory Mutual Engineering and Research Corporation (FM):
 - Annual Issue Approval Guide Building Materials
- D. Underwriters Laboratories, Inc. (UL):
 - Annual Issue Building Materials Directory
 - Annual Issue Fire Resistance Directory
 - 1479-10..... Fire Tests of Through-Penetration Firestops
- E. Warnock Hersey (WH):
 - Annual Issue Certification Listings

PART 2 - PRODUCTS

2.1 FIRESTOP SYSTEMS

- A. Use either factory built (Firestop Devices) or field erected (through-Penetration Firestop Systems) to form a specific building system maintaining required integrity of the fire barrier and stop the passage of gases or smoke.
- B. Through-penetration firestop systems and firestop devices tested in accordance with ASTM E814 or UL 1479 using the "F" or "T" rating to maintain the same rating and integrity as the fire barrier being sealed. "T" ratings are not required for penetrations smaller than or equal to 100 mm (4 in) nominal pipe or 0.01 m² (16 sq. in.) in overall cross sectional area.
- C. Products requiring heat activation to seal an opening by its intumescence shall exhibit a demonstrated ability to function as designed to maintain the fire barrier.

-
- D. Firestop sealants used for firestopping or smoke sealing shall have following properties:
1. Contain no flammable or toxic solvents.
 2. Have no dangerous or flammable out gassing during the drying or curing of products.
 3. Water-resistant after drying or curing and unaffected by high humidity, condensation or transient water exposure.
 4. When used in exposed areas, shall be capable of being sanded and finished with similar surface treatments as used on the surrounding wall or floor surface.
- E. Firestopping system or devices used for penetrations by glass pipe, plastic pipe or conduits, unenclosed cables, or other non-metallic materials shall have following properties:
1. Classified for use with the particular type of penetrating material used.
 2. Penetrations containing loose electrical cables, computer data cables, and communications cables protected using firestopping systems that allow unrestricted cable changes without damage to the seal.
 3. Intumescent products which would expand to seal the opening and act as fire, smoke, toxic fumes, and, water sealant.
- F. Maximum flame spread of 25 and smoke development of 50 when tested in accordance with ASTM E84.
- G. FM, UL, or WH rated or tested by an approved laboratory in accordance with ASTM E814.
- H. Materials to be asbestos free.

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 IDENTIFICATION

- A. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 150 mm (6 inches) of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
 - 1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
 - 2. Contractor's name, address, and phone number.
 - 3. Designation of applicable testing and inspecting agency.
 - 4. Date of installation.
 - 5. Manufacturer's name.
 - 6. Installer's name.

3.5 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 COR.
- C. Clean up spills of liquid type materials.

END OF SECTION 07 84 00

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SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Section covers all sealant and caulking materials and their application, wherever required for complete installation of building materials or systems.

1.2 RELATED WORK

- A. Firestopping penetrations: Section 07 84 00, FIRESTOPPING.

1.3 QUALITY CONTROL

- A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.
- C. Product Testing: Obtain test results from a qualified testing agency based on testing current sealant formulations within a 12-month period.
 - 1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021.
 - 2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C920, and where applicable, to other standard test methods.
 - 3. Test elastomeric joint sealants according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C920 for adhesion and cohesion under cyclic movement, adhesion-in peel, and indentation hardness.
 - 4. Test other joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.
- D. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to joint substrates in accordance with sealant manufacturer's recommendations:
 - 1. Locate test joints where indicated or, if not indicated, as directed by Contracting Officer.

2. Conduct field tests for each application indicated below:
 - a. Each type of elastomeric sealant and joint substrate indicated.
 - b. Each type of non-elastomeric sealant and joint substrate indicated.
 3. Notify COR seven days in advance of dates and times when test joints will be erected.
 4. Arrange for tests to take place with joint sealant manufacturer's technical representative present.
- E. VOC: Acrylic latex and Silicon sealants shall have less than 50g/l VOC content.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's installation instructions for each product used.
- C. Cured samples of exposed sealants for each color where required to match adjacent material.
- D. Manufacturer's Literature and Data:
 1. Caulking compound
 2. Primers
 3. Sealing compound, each type, including compatibility when different sealants are in contact with each other.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations:
 1. Do not proceed with installation of joint sealants under following conditions:
 - a. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4 °C (40 °F).
 - b. When joint substrates are wet.
- B. Joint-Width Conditions:
 1. Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

C. Joint-Substrate Conditions:

1. Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.6 DELIVERY, HANDLING, AND STORAGE

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

1.7 DEFINITIONS

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

1.8 APPLICABLE PUBLICATIONS

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

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

C509-06	Elastomeric Cellular Preformed Gasket and Sealing Material
C612-10	Mineral Fiber Block and Board Thermal Insulation
C717-10	Standard Terminology of Building Seals and Sealants
C834-10	Latex Sealants
C919-08	Use of Sealants in Acoustical Applications
C920-10	Elastomeric Joint Sealants
C1021-08	Laboratories Engaged in Testing of Building Sealants.
C1193-09	Standard Guide for Use of Joint Sealants
C1330-02 (R2007)	Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants
D1056-07	Specification for Flexible Cellular Materials—Sponge or Expanded Rubber

E84-09 Surface Burning Characteristics of Building Materials

C. Sealant, Waterproofing and Restoration Institute (SWRI).

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: Not Used

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, acetoxo 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-11:

1. ASTM C920 polyurethane.
2. Type M/S.
3. Class 25.
4. Grade P/NS.
5. Shore A hardness of 35 to 50.

K. 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:
- C. Type C: Closed-cell material with a surface skin.
- D. 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.
- E. 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 POURIOUS 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.

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2. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air. Porous joint surfaces include the following:
 - a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
 3. Remove laitance and form-release agents from concrete.
 4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
 - a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.
- C. Do not cut or damage joint edges.
- D. Apply masking tape to face of surfaces adjacent to joints before applying primers, caulking, or sealing compounds.
1. Do not leave gaps between ends of sealant backings.
 2. Do not stretch, twist, puncture, or tear sealant backings.
 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- E. Apply primer to sides of joints wherever required by compound manufacturer's printed instructions.
1. Apply primer prior to installation of back-up rod or bond breaker tape.
 2. Use brush or other approved means that will reach all parts of joints.
- F. Take all necessary steps to prevent three sided adhesion of sealants.

3.3 BACKING INSTALLATION

- A. Install back-up material, to form joints enclosed on three sides as required for specified depth of sealant.
- B. Where deep joints occur, install filler to fill space behind the back-up rod and position the rod at proper depth.
- C. Cut fillers installed by others to proper depth for installation of back-up rod and sealants.

- D. Install back-up rod, without puncturing the material, to a uniform depth, within plus or minus 3 mm (1/8 inch) for sealant depths specified.
- E. Where space for back-up rod does not exist, install bond breaker tape strip at bottom (or back) of joint so sealant bonds only to two opposing surfaces.
- F. Take all necessary steps to prevent three sided adhesion of sealants.

3.4 SEALANT DEPTHS AND GEOMETRY

- A. At widths up to 6 mm (1/4 inch), sealant depth equal to width.
- B. At widths over 6 mm (1/4 inch), sealant depth 1/2 of width up to 13 mm (1/2 inch) maximum depth at center of joint with sealant thickness at center of joint approximately 1/2 of depth at adhesion surface.

3.5 INSTALLATION

- A. General:
 - 1. Apply sealants and caulking only when ambient temperature is between 5° C and 38° C (40° and 100° F).
 - 2. Do not use polysulfide base sealants where sealant may be exposed to fumes from bituminous materials, or where water vapor in continuous contact with cementitious materials may be present.
 - 3. Do not use sealant type listed by manufacture as not suitable for use in locations specified.
 - 4. Apply caulking and sealing compound in accordance with manufacturer's printed instructions.
 - 5. Avoid dropping or smearing compound on adjacent surfaces.
 - 6. Fill joints solidly with compound and finish compound smooth.
 - 7. Tool joints to concave surface unless shown or specified otherwise.
 - 8. Finish paving or floor joints flush unless joint is otherwise detailed.
 - 9. Apply compounds with nozzle size to fit joint width.
 - 10. Test sealants for compatibility with each other and substrate. Use only compatible sealant.
- B. For application of sealants, follow requirements of ASTM C1193 unless specified otherwise.
- C. Where gypsum board partitions are of sound rated, fire rated, or smoke barrier construction, follow requirements of ASTM C919 only to seal all cut-outs and intersections with the adjoining construction unless specified otherwise.
 - 1. Apply a 6 mm (1/4 inch) minimum bead of sealant each side of runners (tracks), including those used at partition intersections with dissimilar wall construction.

2. Coordinate with application of gypsum board to install sealant immediately prior to application of gypsum board.
3. Partition Intersections: Seal edges of face layer of gypsum board abutting intersecting partitions, before taping and finishing or application of veneer plaster-joint reinforcing.
4. Openings: Apply a 6 mm (1/4 inch) bead of sealant around all cut-outs to seal openings of electrical boxes, ducts, pipes and similar penetrations. To seal electrical boxes, seal sides and backs.
5. Control Joints: Before control joints are installed, apply sealant in back of control joint to reduce flanking path for sound through control joint.

3.6 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field-test joint-sealant adhesion to joint substrates as recommended by sealant manufacturer:
 1. Extent of Testing: Test completed elastomeric sealant joints as follows:
 - a. Perform 10 tests for first 300 m (1000 feet) of joint length for each type of elastomeric sealant and joint substrate.
 - b. Perform one test for each 300 m (1000 feet) of joint length thereafter or one test per each floor per elevation.
- B. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field adhesion test log.
- C. Inspect tested joints and report on following:
 1. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate.
 2. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
 3. Whether sealants filled joint cavities and are free from voids.
 4. Whether sealant dimensions and configurations comply with specified requirements.
- D. Record test results in a field adhesion test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
- E. Repair sealants pulled from test area by applying new sealants following same procedures used to originally seal joints. Ensure that original sealant surfaces are clean and new sealant contacts original sealant.

- F. Evaluation of Field-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements, will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.7 CLEANING

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

3.8 LOCATIONS

- A. Exterior Building Joints, Horizontal and Vertical:
 - 1. Metal to Metal: Type S-1, S-2
 - 2. Metal to Masonry: Type S-1
 - 3. Masonry to Masonry: Type S-1
 - 4. Threshold Setting Bed: Type S-1, S-3, S-4
 - 5. Masonry Expansion and Control Joints: Type S-6
- 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: 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. Exposed Isolation Joints at Top of Full Height Walls: Types C-1, C-2 and C-3.
5. Exposed Acoustical Joint at Sound Rated Partitions Type C-2.
6. Concealed Acoustic Sealant Type S-4, C-1, C-2 and C-3.

END OF SECTION 07 92 00

SECTION 07 95 13 - EXPANSION JOINT COVER ASSEMBLIES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section includes interior and exterior expansion control systems:
 - 1. Floor.
 - 2. Wall.
 - 3. Ceiling.

1.2 RELATED WORK

- A. Sheet Metal Expansion Joint Seals: Section 07 60 00, FLASHING AND SHEET METAL.
- B. Roof Expansion Joint Cover Assemblies: Section 07 72 00, ROOF ACCESORIES.

1.3 QUALITY ASSURANCE

- A. Project Conditions:
 - 1. Check actual locations of walls and other construction, to which work must fit, by accurate field measurements before fabrication.
 - 2. Show recorded measurements on final shop drawings.
- B. Fire tests performed by Factory Mutual, Underwriters Laboratories, Inc., Warnock Hersey or other approved independent testing laboratory.

1.4 DELIVERY STORAGE AND HANDLING

- A. Take care in handling of materials so as not to injure finished surface and components.
- B. Store materials under cover in a dry and clean location off the ground.
- C. Remove materials which are damaged or otherwise not suitable for installation from job site and replace with acceptable materials.

1.5 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Submit copies of manufacturer's current literature and data for each item specified.
 - 2. Clearly indicate movement capability of cover assemblies.
 - 3. Certificates: Material test reports from approved independent testing laboratory indicating and interpreting test results relative to compliance of fire-rated expansion joint assemblies with requirements specified.
- C. Shop Drawings:
 - 1. Showing full extent of expansion joint cover assemblies; include large-scale details indicating profiles of each type of expansion joint cover assembly, splice joints between sections, joiners with other type assemblies, special end conditions, anchorages, fasteners, and relationship to adjoining work and finishes.
 - 2. Include description of materials and finishes and installation instructions.
- D. Samples:
 - 1. Samples of each type and color of metal finish on metal of same thickness and alloy used in work.
 - 2. Samples of each type and color of flexible seal used in work.

1.6 APPLICABLE PUBLICATIONS

- A. Publications listed form part of this specification to extent referenced. Publications are referred to in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - A36/A36M-08..... Structural Steel
 - A167-99 (R2009) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
 - A283/A283M-07 Low and Intermediate Tensile Strength Carbon Steel Plates
 - A786/A786M-05(R2009) Rolled Steel Floor Plates
 - B36/B36M-08..... Brass, Plate, Sheet, Strip, and Rolled Bar
 - B121-01(R2006) Lead Brass Plate, Sheet, Strip and Rolled Bar
 - B209M-07 Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
 - B221M-08 Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes (Metric)

B455-10	Copper-Zinc Lead Alloy (Leaded Brass) Extruded Shapes
C864-05	Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers
C920-11	Elastomeric Joint Sealants
D1187-97 (R2002)	Asphalt Base Emulsions for Use as Protective Coatings for Metal
D2287-96 (R2010)	Non-rigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds
E119-10	Fire Tests of Building Construction and Materials
E814-11	Fire Tests of Through-Penetration Fire Stops

C. Federal Specifications (Fed. Spec):

TT-P-645B Primer, Paint, Zinc-Molybdate, Alkyd Type

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

AMP 500 Series Metal Finishes Manual

E. National Fire Protection Association (NFPA):

251-06..... Tests of Fire Endurance of Building Construction and
Materials

F. Underwriters Laboratories Inc. (UL):

263-11 Fire Tests of Building Construction and Materials

PART 2 - PRODUCTS

2.1 MATERIALS

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

B. Aluminum:

1. Extruded: ASTM B221, alloy 6063-T5.
2. Plate and Sheet: ASTM B209, alloy 6061-T6.

C. Elastomeric Sealant:

1. ASTM C920, polyurethane.
2. Type.
3. Class 25.
4. Grade P or NS.
5. Shore A hardness 25, unless specified otherwise.

- D. Thermoplastic Rubber:
 - 1. ASTM C864.
 - 2. Dense Neoprene or other material standard with expansion joint manufacturers having the same physical properties.
- E. Vinyl Invertor Sealant Waterstops: Manufacturers' standard shapes and grade.
- F. Fire Barrier:
 - 1. Designed for indicated or required dynamic structural movement without material degradation or fatigue.
 - 2. Tested in maximum joint width condition as a component of an expansion joint cover assembly in accordance with UL 263 NFPA 251, or ASTM E119 and E814, including hose steam test at full-rated period.
- G. Zinc-Molybdate Primer: Fed. Spec. TT-P-645.
- H. Accessories:
 - 1. Manufacturer's standard anchors, fasteners, set screws, spaces, flexible secondary water stops or seals and filler materials, drain tubes, adhesive and other accessories as indicated or required for complete installations.
 - 2. Compatible with materials in contact.
 - 3. Water stops.

2.2 FABRICATION

- A. General:
 - 1. Use ceiling and wall expansion joint cover assemblies of same design as floor to wall and floor to floor expansion joint cover assemblies. Unless shown otherwise.
 - 2. Provide expansion joint cover assemblies of design, basic profile, materials and operation indicated required to accommodate joint size variations in adjacent surfaces, and as required for anticipated structural movement.
 - 3. Deliver to job site ready for use and fabricated in as large sections and assemblies as practical. Assemblies identical to submitted and reviewed shop drawings, samples and certificates.
 - 4. Furnish units in longest practicable lengths to minimize number of end joints. Provide mitered corners where joint changes directions or abuts other materials.
 - 5. Include closure materials and transition pieces, tee-joints, corners, curbs, cross-connections and other assemblies.

6. Fire Performance Characteristics:

- a. Provide expansion joint cover assemblies identical to those of assemblies whose fire resistance has been determined per ASTM E119 and E814, NFPA 251, or UL 263 including hose stream test at full-rated period.
- b. Fire rating: Not less than rating of adjacent floor or wall construction.

7. Fire Barrier Systems:

- a. Material to carry label of approved independent testing laboratory, and be subject to follow-up system for quality assurance.
 - b. Include thermal insulation where necessary, in accordance with above tests, with factory cut miters and transitions.
 - c. For joint widths up to and including 150 mm (six inches), supply barrier in lengths up to 15000 mm (50 feet) to eliminate field splicing.
 - d. For joint widths of seven inches and wider, supply barrier 3000 mm (10-foot) modules with overlapping ends for field splicing.
 - e. For joints within enclosed spaces such as chase walls, include 1 mm (0.032-inch) thick galvanized steel cover where conventional expansion joint cover is not used.
8. Seal Strip factory - formed and bonded to metal frames and anchor members.
9. Compression Seals: Prefabricate from thermoplastic rubber or dense neoprene to sizes and approximate profiles shown.

B. Floor-to-Floor Metal Plate Joints: No Bump Center-Plate System.

- 1. Frames on each side of joint designed to support cover plate of design shown.
 - a. Continuous frame designed to finish flush with adjacent floor of profile indicated with seating surface and raised floor rim to accommodate flooring.
 - b. Provide concealed bolt and steel anchors for embedment in concrete.
 - c. Designed for filler materials between raised rim of frame and edge of cover plate where shown.
 - d. Frame and cover plates of some metal where exposed.
 - 1) Design cover plates to support 180 Kg (400 lbs) per 0.3 square meters (1-square foot).
 - 2) Cover plates free of rattle due to traffic.
 - 3) No gaps or budes occur on filler material during design movement of joint.
 - 4) Provide manufacturer's continuous standard flexible vinyl water stop under floor joint cover assemblies.

2.3 INTERIOR EXPANSION CONTROL SYSTEMS

- A. Floor-to-Wall Metal Plate Joints:
 - 1. Provide one frame on floor side of joint only. Provide wall side frame where required by manufacturer's design.
 - 2. Angle Cover Plates: Provide angle cover plates for joints to wall with countersunk flat-head exposed fasteners for securing to wall unless shown otherwise.
 - 3. Space fasteners as recommended by manufacturer.
 - 4. Match cover of adjacent floor to floor cover.
- B. Interior Wall Joint Cover Assemblies: Surface Mounted Metal Cover Plates.
 - 1. Concealed frame for fastening to wall on one sides of joint.
 - 2. Extend cover to lap each side of joint and to permit free movement on one side.
 - 3. Provide concealed attachment of cover t frame cover in close contact with adjacent finish wall surfaces.
 - 4. Use angle cover plates at intersection of walls.
 - 5. Use smooth surface cover plates matching floor plates.
 - 6. Use expansion fire inserts in fire rated walls, rated same as hour rating of wall.
- C. Ceiling and Soffit Assemblies:
 - 1. Variable movement vinyl insert in metal frame on both sides of joint.
 - 2. Designed for flush mounting with no exposed fasteners.
 - 3. Vinyl insert locked into metal frame.
 - 4. Vinyl insert semi rigid either flush face or accordion shape as showed to span joint width without sagging.

2.4 EXTERIOR WALL EXPANSION CONTROL SYSTEMS

- A. Wall-to-Wall: Preformed cellular foam.
 - 1. Primary preformed silicone rubber seal.
 - a. Color: As selected by Architect from manufacturer's full range.
 - 2. Secondary Foam Seal: Cellular polyurethane / polyester backer block factory bonded to the silicone face seal.

2.5 METAL FINISHES

- A. General:
 - 1. Apply finishes in factory after products are fabricated.
 - 2. Protect finishes on exposed surfaces with protective covering before shipment.

B. Aluminum Finishes:

1. Finish letters and numbers for anodized aluminum are in accordance with the NAAMM AMP 501, Aluminum Association's Designation System).
 - a. Clear anodized finish: AA-C22A41 Chemically etched medium matte, clear anodic coating, Class I Architectural, 0.7 - mil thick.
2. Factory-Primed Concealed Surface: NAAMM AMP 505 Protect concealed aluminum surfaces that will be in contact with plaster, concrete or masonry surfaces when installed by applying a shop coat of zinc-molybdate primer to contact surfaces. Provide minimum dry film thickness of 2.0 mils.

C. Stainless Steel: NAAMM AMP 503, finish No. 2B.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Manufacturer's representative shall make a thorough examination of surfaces receiving work of this section.
- B. Before starting installation, notify prime contractor of defects which would affect satisfactory completion of work.

3.2 PREPARATION

- A. Verify measurements and dimensions at job site and cooperate in coordination and scheduling of work with work of related trades.
- B. Give particular attention to installation of items embedded in concrete and masonry so as not to delay job progress.
- C. Provide templates to related trade for location of support and anchorage items.

3.3 INSTALLATION

- A. Install in accordance with manufacturers installation instructions unless specified otherwise.

-
- B. Provide anchorage devices and fasteners for securing expansion joint assemblies to in-place construction including threaded fasteners with drilled-in fasteners for masonry and concrete where anchoring members are not embedded in concrete. Provide metal fasteners of type and size to suit type of construction indicated and provide for secure attachment of expansion joint cover assemblies.
 - C. Perform cutting, drilling and fitting required for installation of expansion joint cover assemblies.
 - D. Install joint cover assemblies in true alignment and proper relationship to expansion joint opening and adjoining finished surfaces measured from established lines and levels.
 - E. Allow for thermal expansion and contraction of metal to avoid buckling.
 - F. Set floor covers at elevations flush with adjacent finished floor materials unless shown otherwise.
 - G. Material and method of grouting floor frames set in prepared recesses in accordance with manufacturer's instructions.
 - H. Locate wall, ceiling and soffit covers in continuous contact with adjacent surfaces. Securely attach in place with required accessories.
 - I. Locate anchors at interval recommended by manufacturer, but not less than 75 mm (3-inches) from each ends, and, not more than 600 mm (24-inches) on centers.
 - J. Maintain continuity of expansion joint cover assemblies with end joints held to a minimum and metal members aligned mechanically using splice joints.
 - K. Cut and fit ends to produce joints that will accommodate thermal expansion and contraction of metal to avoid buckling of frames or plates.
 - L. Flush Metal Cover Plates:
 - 1. Secure flexible filler between frames so that it will compress and expand.
 - 2. Adhere flexible filler materials to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.
 - M. Waterstops:
 - 1. Install in conjunction with floor joints and where shown, run continuously to prevent water damage to finish spaces.
 - 2. Provide seal with frame to prevent water leakage.
 - 3. Provide outlet tubes from waterstops to drain to prevent damage to finish spaces.

N. Fire Barriers:

1. Install in compliance with tested assembly.
2. Install in floors and in fire rated walls.
3. Use fire barrier sealant or caulk supplied with system.

O. Sealants:

1. Install to prevent water and air infiltration.

END OF SECTION 07 95 13

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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. Interior wood doors: Section 08 14 00, INTERIOR WOOD DOORS.
- B. Ballistic resistant rated doors and frames: Section 08 34 53, SECURITY DOORS AND FRAMES.
- C. Aluminum frames entrance work: Section 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS.
- D. Ballistic resistant rated windows and frames: Section 08 56 53, BALLISTIC RESISTANT WINDOWS.
- E. Door Hardware: Section 08 71 00, DOOR HARDWARE.
- F. Glazing and ballistic rated glazing: Section 08 80 00, GLAZING.
- G. Card readers and biometric devices: Section 28 13 00, PHYSICAL ACCESS CONTROL SYSTEMS.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturers Literature and Data:
 - 1. Fire rated doors and frames, showing conformance with NFPA 80 and Underwriters Laboratory, Inc., or Intertek Testing Services or Factory Mutual fire rating requirements and temperature rise rating for stairwell doors. Submit proof of temperature rating.

1.4 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.

1.5 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.

1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. Door and Hardware Institute (DHI):
 - A115 Series Steel Door and Frame Preparation for Hardware, Series A115.1 through A115.17 (Dates Vary)
- C. Steel Door Institute (SDI):
 - 113-01 Thermal Transmittance of Steel Door and Frame Assemblies
 - A250.8-03 Standard Steel Doors and Frames
- D. American Society for Testing and Materials (ASTM):
 - 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
- E. The National Association Architectural Metal Manufacturers (NAAMM):
 - Metal Finishes Manual (1988 Edition)
- F. National Fire Protection Association (NFPA):
 - 80-09 Fire Doors and Fire Windows

- G. Underwriters Laboratories, Inc. (UL):
Fire Resistance Directory
- H. Intertek Testing Services (ITS):
Certifications Listings Latest Edition
- I. Factory Mutual System (FM):
Approval Guide

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Sheet Steel: ASTM A1008, cold-rolled for panels (face sheets) of doors.
- B. Anchors, Fastenings and Accessories: Fastenings anchors, clips connecting members and sleeves from zinc coated steel.
- C. Prime Paint: Paint that meets or exceeds the requirements of A250.8.

2.2 METAL FRAMES

- A. General:
 - 1. Interior frames: SDI A250.8, 16 gauge 1.3 mm (0.053 inch) thick sheet steel, primed.
 - 2. Exterior door frames: SDI A250.8, 14 gauge 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. Construction:
 - a. Full-profile welded.
 - b. 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.

C. Terminated Stops: SDI A250.8; provide at all interior frames with stops.

D. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with butted hairline joints.

1. Provide fixed stops and moldings welded on secure side of hollow-metal work.
2. Design rabbet width and depth to receive glazing material or panel shown or specified.
3. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
4. Provide loose stops and moldings on inside of hollow-metal work.
5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
6. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

E. Frame Anchors:

1. Floor anchors:

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

2. Jamb anchors:

- a. Locate anchors on jambs near top and bottom of each frame, and at intermediate points not over 600 mm (24 inches) apart.
- b. Form jamb anchors of not less than 1 mm (0.042 inch) thick steel unless otherwise specified.

- c. Anchors set in masonry: Use adjustable anchors designed for friction fit against the frame and for extension into the masonry not less than 250 mm (10 inches). Use one of following type:
 - 1) Wire loop type of 5 mm (3/16 inch) diameter wire.
 - 2) T-shape or strap and stirrup type of corrugated or perforated sheet steel.
- d. Anchors for stud partitions: Either weld to frame or use lock-in snap-in type. Provide tabs for securing anchor to the sides of the studs.
- e. Anchors for frames set in prepared openings:
 - 1) Steel pipe spacers with 6 mm (1/4 inch) inside diameter welded to plate reinforcing at jamb stops or hat shaped formed strap spacers, 50 mm (2 inches) wide, welded to jamb near stop.
 - 2) Drill jamb stop and strap spacers for 6 mm (1/4 inch) flat head bolts to pass thru frame and spacers.
 - 3) Two piece frames: Subframe or rough buck drilled for 6 mm (1/4 inch) bolts.
- f. Anchors for observation windows and other continuous frames set in stud partitions.
 - 1) In addition to jamb anchors, weld clip anchors to sills and heads of continuous frames over 1200 mm (4 feet) long.
 - 2) Anchors spaced 600 mm (24 inches) on centers maximum.
- g. Modify frame anchors to fit special frame and wall construction and provide special anchors where shown or required.

2.3 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. Standard Duty Doors: SDI A250.8, Level 1, Model 2 of size and design shown.

- 1. Use for interior locations only.
- 2. Do not use for stairwell doors, security doors and detention doors.

- C. Extra Heavy Duty Doors: SDI A250.8, Level 3, Model 2 of size and design shown.
 - 1. Provide polystyrene cores.
 - 2. Use for exterior and stairwell doors.
- D. Smoke Doors:
 - 1. Close top and vertical edges flush.
 - 2. Provide seamless vertical edges.
 - 3. Apply Steel astragal to the meeting stile 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.
- E. 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.

2.4 SHOP PAINTING

- A. SDI A250.8.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Plumb, align and brace frames securely until permanent anchors are set.
 - 1. Use triangular bracing near each corner on both sides of frames with temporary wood spreaders at midpoint.
 - 2. Use wood spreaders at bottom of frame if the shipping spreader is removed.
 - 3. Protect frame from accidental abuse.

4. Where construction will permit concealment, leave the shipping spreaders in place after installation, otherwise remove the spreaders after the frames are set and anchored.
5. Remove wood spreaders and braces only after the walls are built and jamb anchors are secured.

B. Floor Anchors:

1. Anchor the bottom of door frames to floor with two 6 mm (1/4 inch) diameter expansion bolts. Use 9 mm (3/8 inch) bolts on lead lined frames.
2. Power actuated drive pins may be used to secure frame anchors to concrete floors.

C. Jamb Anchors:

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

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

E. Frames for Sound Rated Doors: Coordinate to line frames for sound rated doors with insulation.

3.2 INSTALLATION OF DOORS AND APPLICATION OF HARDWARE

A. Install doors and hardware as specified in the following Sections:

1. Section 08 11 13, HOLLOW METAL DOORS AND FRAMES.
2. Section 08 14 00, WOOD DOORS.
3. Section 08 71 00, DOOR HARDWARE.

END OF SECTION 08 11 13

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SECTION 08 14 00 - INTERIOR WOOD DOORS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies laminate veneer solid-core wood doors with prefinished, prefit option.

1.2 RELATED WORK

- A. Metal door frames: Section 08 11 13, HOLLOW METAL DOORS AND FRAMES.
- B. Windows and frames of a forced entry/ballistic resistant rated: Section 08 56 53, SECURITY WINDOWS
- C. Door hardware: Section 08 71 00, DOOR HARDWARE.
- D. Installation of doors and hardware:
 - 1. Section 08 11 13, HOLLOW METAL DOORS AND FRAMES.
 - 2. Section 08 14 00, WOOD DOORS.
 - 3. Section 08 71 00, DOOR HARDWARE.
- E. Glazing and ballistic rated glazing: Section 08 80 00, GLAZING.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples:
 - 1. Minimum 102 by 102 mm (4 by 4 inch) construction sample, showing the following:
 - a. Door construction – stile and core.
 - b. Factory finished veneer – face and edge.
- C. Shop Drawings and Door Schedule:
 - 1. Show every door in project and schedule location in building.
 - 2. Indicate type, grade, finish and size; include detail of glazing, and pertinent details.

3. Provide information concerning specific requirements not included in the manufacturer's literature and data submittal.

D. Manufacturer's Literature and Data:

1. Labeled fire rated doors showing conformance with NFPA 80.
2. Laboratory Test Reports:
 - a. Screw holding capacity test report in accordance with WDMA T.M.10.
 - b. Split resistance test report in accordance with WDMA T.M.5.
 - c. Cycle/slam test report in accordance with WDMA T.M.7.
 - d. Hinge-loading test report in accordance with WDMA T.M.8.

1.4 DELIVERY AND STORAGE

- A. Factory seal doors and accessories in minimum of 6 mill polyethylene bags or cardboard packages which shall remain unbroken during delivery and storage.
- B. Store in accordance with WDMA I.S.1-A, J-1 Job Site Information.
- C. Label package for door opening where used.

1.5 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. Window and Door Manufacturers Association (WDMA):

I.S.1-A-04.....	Architectural Wood Flush Doors
I.S.4-07A.....	Water-Repellent Preservative Non-Pressure Treatment for Millwork
I.S.6A-01	Architectural Wood Stile and Rail Doors
T.M.5-90	Split Resistance Test Method
T.M.6-08	Adhesive (Glue Bond) Durability Test Method
T.M.7-08	Cycle-Slam Test Method
T.M.8-08	Hinge Loading Test Method
T.M.10-08	Screwholding Test Method
- C. National Fire Protection Association (NFPA):

80-07.....	Protection of Buildings from Exterior Fire
252-08.....	Fire Tests of Door Assemblies

D. ASTM International (ASTM):

E90-04Laboratory Measurements of Airborne Sound
Transmission Loss

PART 2 - PRODUCTS

2.1 FLUSH DOORS

A. General:

1. Meet requirements of WDMA I.S.1-A, Extra Heavy Duty.
2. Adhesive: Type II
3. Thickness: 45 mm (1-3/4 inches) unless otherwise shown or specified.
4. Give exposed wood parts of exterior doors a water-repellent preservative treatment in accordance with WDMA I.S.4.

B. Laminate Veneer:

1. Grade: Custom.
2. Plastic Laminate Face: High-pressure decorative laminates complying with NEMA LD 3, Grade HGS.
 - a. Color: To be selected from manufacturer's full range.
3. Exposed Vertical and Top Edges: Plastic laminate that matches faces, applied before faces.
4. Construction: Three plies. Stiles and rails are bonded to core, then entire unit abrasive planed before faces are applied.

C. Wood for stops, louvers, muntins and moldings of flush doors required to have transparent finish:

1. Solid wood to match veneer.
2. Glazing:
 - a. On non-labeled doors use applied wood stops nailed tight on room side and attached on opposite side with flathead, countersunk wood screws, spaced approximately 125 mm (5 inches) on centers.
3. Provide tamper proof screws (spanner head locks) in Psychiatric Areas.

D. Fire rated wood doors:

1. Fire Performance Rating:
 - a. 20 minute.
 - b. 45 minute, "C" label.
 - c. 90 minute, "B" label.
2. Labels:
 - a. Doors shall conform to the requirements of ASTM E2074, or NFPA 252, and, carry an identifying label from a qualified testing and inspection agency for class of door or opening shown designating fire performance rating.
 - b. Metal labels with raised or incised markings.
3. Performance Criteria for Stiles of doors utilizing standard mortise leaf hinges:
 - a. Hinge Loading: WDMA T.M.8. Average of 10 test samples for Extra Heavy Duty doors.
 - b. Direct screw withdrawal: WDMA T.M.10 for Extra Heavy Duty doors. Average of 10 test samples using a steel, fully threaded #12 wood screw.
 - c. Cycle Slam: 1,000,000 cycles with no loose hinge screws or other visible signs of failure when tested in accordance with WDMA T.M.7.
4. Additional Hardware Reinforcement:
 - a. Provide fire rated doors with hardware reinforcement blocking.
 - b. Size of lock blocks as required to secure hardware specified.
 - c. Top, bottom and intermediate rail blocks shall measure not less than 125 mm (five inches) minimum by full core width.
 - d. Reinforcement blocking in compliance with manufacturer's labeling requirements.
 - e. Mineral material similar to core is not acceptable.
5. Other Core Components: Manufacturer's standard as allowed by the labeling requirements.
6. Provide steel frame approved for use in labeled doors for vision panels.
7. Provide steel astragal on pair of doors.
8. Provide tamper proof screws (spanner head locks) in Psychiatric Areas.

E. Smoke Barrier Doors:

1. For glazed openings use steel frames approved for use in labeled doors.
2. Provide a steel astragal on one leaf of pairs of doors, including double egress doors.

2.2 PREFINISH, PREFIT

- A. Flush doors shall be factory machined to receive hardware, bevels, undercuts, cutouts, accessories and fitting for frame.
- B. Factory fitting to conform to specification for shop and field fitting, including factory application of sealer to edge and routings.

2.3 IDENTIFICATION MARK:

- A. On top edge of door.
- B. Either a stamp, brand or other indelible mark, giving manufacturer's name, door's trade name, construction of door, code date of manufacture and quality.
- C. Accompanied by either of the following additional requirements:
 - 1. An identification mark or a separate certification including name of inspection organization.
 - 2. Identification of standards for door, including glue type.
 - 3. Identification of veneer and quality certification.
 - 4. Identification of preservative treatment for stile and rail doors.

PART 3 - EXECUTION

3.1 DOOR PREPARATION

- A. Field, shop or factory preparation: Do not violate the qualified testing and inspection agency label requirements for fire rated doors.
- B. Clearances between Doors and Frames and Floors:
 - 1. Maximum 3 mm (1/8 inch) clearance at the jambs, heads, and meeting stiles, and a 19 mm (3/4 inch) clearance at bottom, except as otherwise specified.
 - 2. Maximum clearance at bottom of sound rated doors, light-proofed doors, doors to operating rooms, and doors designated to be fitted with mechanical seal: 10 mm (3/8 inch).
- C. Provide cutouts for special details required and specified.
- D. Rout doors for hardware using templates and location heights specified in Section, 08 71 00 DOOR HARDWARE.
- E. Fit doors to frame, bevel lock edge of doors 3 mm (1/8 inch) for each 50 mm (two inches) of door thickness.

- F. Immediately after fitting and cutting of doors for hardware, seal cut edges of doors with two coats of water resistant sealer.
- G. Apply a steel astragal on the opposite side of active door on pairs of fire rated doors.
- H. Apply a steel astragal to meeting style of active leaf of pair of doors or double egress smoke doors.

3.2 INSTALLATION OF DOORS APPLICATION OF HARDWARE

- A. Install doors and hardware as specified in this Section.

3.3 DOOR PROTECTION

- A. As door installation is completed, place polyethylene bag or cardboard shipping container over door and tape in place.
- B. Provide protective covering over knobs and handles in addition to covering door.
- C. Maintain covering in good condition until removal is approved by COR.

END OF SECTION 08 14 00

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. Gypsum board infill: Section 09 29 00, GYPSUM BOARD.
- B. Locations of access doors for duct work cleanouts:
 - 1. Section 23 31 00, HVAC DUCTS AND CASINGS
 - 2. 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-2009) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip
 - A1008-10 Steel Sheet, Cold-Rolled, Carbon, Structural, High Strength Low-Alloy
- C. American Welding Society (AWS)
 - D1.3-08 Structural Welding Code Sheet Steel

- D. National Fire Protection Association (NFPA)
80-10..... 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 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.

2.3 ACCESS DOOR, RECESSED PANEL

- A. Door Panel:
 - 1. Form of 1.2 mm (0.0478 inch) thick steel sheet to form a 25 mm (one inch) deep recessed pan to accommodate the installation of acoustical units or other materials where shown in walls and ceiling.
 - 2. Reinforce as required to prevent sagging.
- B. Frame:
 - 1. Form of 1.5 mm (0.0598 inch) thick steel sheet of depth and configuration to suit installation in suspension system of ceiling or wall framing.
 - 2. Extend sides of frame to protect edge of acoustical units when panel is in open position.
 - 3. Provide shims, bushings, clips and other devices necessary for installation.
- C. Hinge: Continuous steel hinge with stainless steel pin or concealed hinge.
- D. Lock:
 - 1. Flush screwdriver operated cam lock.
 - 2. Provide sleeve of plastic or stainless steel grommet to protect hole made in acoustical unit for screwdriver access to lock.
 - 3. Provide tamper proof screws (spanner head locks) for access panels in Psychiatric Areas.

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.

2.5 SIZE:

- A. Minimum 600 mm (24 inches) square door unless otherwise shown.

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.
- B. Use fire rated doors in fire rated partitions and 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.
- D. Set recessed panel access doors recessed so that face of surrounding materials will finish on the same plane, when finish in door is installed.

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 08 31 13

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SECTION 08 33 00 - COILING DOORS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies coiling doors of sizes shown, complete as specified.

1.2 RELATED WORK

- A. Electric devices and wiring: DIVISION 26, ELECTRICAL.

1.3 MANUFACTURER'S AND INSTALLER'S QUALIFICATIONS

- A. Coiling doors shall be products of manufacturers regularly engaged in manufacturing items of type specified.
- B. Install items under direct supervision of manufacturer's representative or trained personnel.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings:
 - 1. Each type of door showing details of construction, accessories and hardware, electrical and mechanical items supporting brackets for motors, location, and ratings of motors, and safety devices.
 - 2. Wiring diagrams for motors and controls, including wiring diagram for door, showing electrical interlock of motor with manually operated dead lock, and electrical rough-in.
- C. Manufacturer's Literature and Data:
 - 1. Brochures or catalog cuts, each type door.
 - 2. Manufacturer's installation procedures and instructions.
 - 3. Maintenance instructions, parts list.

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 for Testing and Materials (ASTM)
 - A36/A36M-08..... Structural Steel
 - A653/A653M-10..... Steel Sheet, Zinc-Coated (Galvanized) Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
- C. National Electrical Manufacturers Association (NEMA)
 - ICS 1-00(R2008)..... Industrial Control and Systems General Requirements
 - ICS 2-00(R2005)..... Industrial Control, and Systems, Controllers, Contactors, and Overload Relays
 - ICS 6-93 (R2006)..... Industrial Control and Systems Enclosures
 - MG 1-10..... Motors and Generators
 - ST 20-92 (RI997) Dry-Type Transformers for General Applications
- D. Master Painters Institute (MPI)
 - MPI #35 Exterior Bituminous Coating
 - MPI #76 Quick Drying Alkyd Metal Primer
- E. National Association of Architectural Metal Manufacturers (NAAMM)
 - AMP 500 Series..... Metal Finishes Manual

PART 2 - PRODUCTS

2.1 MATERIAL

- A. Steel: A653 for forming operation. ASTM A36 for structural sections.

2.2 DESIGN REQUIREMENTS

- A. Coiling doors shall be spring counter balanced, overhead coiling type, inside face mounted with guides at jambs set back a sufficient distance to provide a clear opening when door is in open position.
- B. All motor operators shall have manual emergency mechanical operators.

2.3 FABRICATION

A. Curtains:

1. Slats: Interlocking uninsulated roll-formed galvanized steel, flat crown profile type CAW, 22 gauge for widths up to 3.75 m (12 feet 4 inches), 24 gauge for widths up to 4.88 m (16 feet). End of each slat shall be locked from lateral movement by a staking lock system.

B. Bottom Bar:

1. Two angles of equal weight, one on each side, standard extruded aluminum members not less than 3 mm (0.125 inch) thick.
2. Bottom bar designed to receive weather-stripping and safety device, and be securely fastened to bottom of curtain or grille.

C. Barrel and Spring Counterbalance:

1. Curtain shall coil on a barrel supported at end of opening on brackets and be balanced by helical springs.
2. Barrel fabricated of steel pipe or commercial welded steel tubing of proper diameter and thickness for the size of curtain, to limit deflection with curtain rolled up, not to exceed 1 in 400 (0.03 inch per foot) of span.
3. Close ends of barrel with cast iron plugs, machined to fit the opening.
4. Within the barrel, install an oil-tempered, helical, counter balancing steel spring, capable of producing sufficient torque to assure easy operation of the door curtain from any position.
5. At least 80 percent of the door weight shall be counter balanced at any position.
6. Spring-tension shall be adjustable from outside of bracket without removing the hood or motor operator.

D. Brackets:

1. Steel plate designed to form end closure and support for hood and the end of the barrel assembly.
2. End of barrel or shaft shall screw into bracket hubs fabricated of cast iron or steel.
3. Equip bracket hubs or barrel plugs with prelubricated ball bearings, shielded or sealed.

E. Guides:

1. Manufacturer's standard formed sections or angles of steel not less than 5 mm (3/16 inch) thick.
2. Form a channel pocket of sufficient depth to retain the curtain in place under the horizontal pressure specified, and prevent ends of curtain from slipping out of guide slots.

3. Top sections flared for smooth entry of curtain to vertical sections that will facilitate entry of curtain.
4. Provide stops to limit curtain travel above top of guides.
5. Mounting brackets shall provide closure between guides and jambs.

F. Hoods:

1. Steel galvanized, 0.6 mm (0.0239 inch) thick.
2. Form hood to fit contour of end brackets.
3. Reinforce at top and bottom edges with rolled beads, rods or angles. Hoods more than 3600 mm (12 feet) in length shall have intermediate supporting brackets.
4. Fasten to brackets with screws or bolts and provide for attachment to wall with bolts.

G. Fasteners: Exposed and semi-exposed fasteners shall be tamper-resistant.

2.4 ELECTRIC MOTOR OPERATORS

A. Provide operators complete with electric motor, machine cut reduction gears, steel chain and sprockets, magnetic brake, overload protection, brackets, push button controls, limit switches, magnetic reversing contactor, and other accessories necessary for proper operation including emergency manual operator.

B. Design:

1. Design the operator so that the motor may be removed without disturbing the limit-switch timing and without affecting the emergency manual operators.
2. Make provision for emergency manual operation of door by chain-gear mechanism.
3. Arrange the emergency manual operating mechanism so that it may be immediately put into and out of operation from the floor with an electrical or mechanical device, which will disconnect the motor from the operating mechanism when the emergency manual operating mechanism is engaged, and its use shall not affect the timing of the limit switches, in case of electrical failure.
4. Provide interlock with motor to prevent motor from operating when manual locks are activated.

C. Motors:

1. Motors shall conform to NEMA MG1, suitable for operation on current of the characteristics indicated, and shall operate at not more than 3600 rpm. Single-phase motors shall not have commutation or more than one starting contact. Motor enclosures shall be the drip proof type of NEMA TENV type.

2. Motors shall be high starting torque, reversible type, of sufficient horsepower and torque output to move the door in either direction from any position, and produce a door travel speed of not less than 0.66 foot or more than one foot per second, without exceeding the rated capacity.

D. Controls:

1. Provide button-type controls outside room and remote controls at the nurse station.
2. The control equipment shall conform to NEMA ICS 1 and 2.
3. Control enclosures shall be NEMA ICS 6, Type 12 or Type 4, except that contractor enclosures may be Type 1.
4. Remote control switches shall be at least 1500 mm (5 feet) above the floor line, and located so that the operator will have complete visibility of the door at all times.
5. Each door motor shall have an enclosed, across-the-line type, magnetic reversing contactor, thermal overload protection, solenoid operated brake, limit switches, and remote control switches at locations shown.
6. Use three-button type, push button switch, unless noted to be key activated, with the buttons marked, OPEN, CLOSE, and STOP.
 - a. The OPEN and STOP buttons shall be of the type requiring only momentary pressure to operate. The CLOSE button shall be of the type requiring constant pressure to maintain the closing motion of the door. When the door is in motion, and the STOP button is pressed, the door shall stop instantly and remain in the stop position; from the stop position, the door may then be operated in either direction by the OPEN or Close buttons.
 - b. Push buttons shall be full-guarded to prevent accidental operation.
7. Provide limit switches to automatically stop the doors at their fully open and closed positions. Positions of the limit switches shall be readily adjustable.
8. Safety device:
 - a. The bottom bar of power-operated doors shall have a fail safe safety device that will immediately stop and reverse the door in its closing travel upon contact with an obstruction in the door opening, or upon failure of the device, or any component of the device, or any component of the control system, and cause the door to return to its full open position. The door closing circuit shall be electrically locked out, and the door shall be operable manually until the failure or damage has been corrected.
 - b. Safety device shall not be used as a limit switch.
 - c. Safety device connecting cable to motor shall be flexible "Type SO" cable and spring loaded automatic take up reel or equivalent device, as required for proper operation of the doors.

9. Transformer:
 - a. Provide a control transformer in power circuits as necessary to reduce the voltage on the control circuits to 120 volts or less.
 - b. The transformer shall conform to NEMA ST20.
10. Electrical components shall conform to NFPA 70.

2.5 FINISHES

- A. Steel:
 1. Clean surfaces of steel free from scale, rust, oil and grease, and then apply a shop prime paint after fabrication.
 2. Curtain slats, bottom bar and guides shall be galvanized in accordance with ASTM A 653 and receive rust-inhibitive, roll coating process, including 0.2 mils thick baked-on prime paint.
 3. Field paint finish coat.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install doors in accordance with approved shop drawings and manufacturer's instructions.
- B. Locate anchors and inserts for guides, brackets, motors, switches, hardware, and other accessories accurately.
- C. Securely attach guides to adjoining construction with not less than 9 mm (3/8 inch) diameter bolts, near each end and spaced not over 600 mm (24 inches) apart.
 1. Fasteners: Exposed and semi-exposed fasteners shall be tamper-resistant.
- D. Locate control switches where shown.
- E. Install all electric devices and wiring as specified in DIVISION 26 ELECTRICAL and DIVISION 28 - ELECTRONIC SAFETY AND SECURITY.

3.2 REPAIR

- A. Repair prime painted zinc-coated surfaces and bare zinc-coated surfaces that are damaged by the application of galvanizing repair compound. Spot prime all damaged shop prime painted surfaces including repaired prime painted zinc-coated surfaces.

- B. Coiling doors shall be lubricated, properly adjusted, and demonstrated to operate freely.

3.3 INSPECTION

- A. Upon completion, doors shall be free from warp, twist, or distortion.

END OF SECTION 08 33 00

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SECTION 08 34 53 - SECURITY DOORS AND FRAMES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section includes ballistic resistant (BR) door assemblies (door and frame).

1.2 RELATED WORK

- A. Ballistic resistant rated windows and frames: Section 08 56 53, BALLISTIC RESISTANT (BR) WINDOWS.
- B. Door hardware: Section 08 71 00, DOOR HARDWARE.
- C. Glazing and ballistic rated glazing: Section 08 80 00, GLAZING.
- D. Card readers: Section 28 13 00, PHYSICAL ACCESS CONTROL SYSTEMS.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Fabricate and install BR door assemblies to achieve indicated levels of resistance. Extend resistance to include anchorages, interfaces with adjoining substrates, and hardware. Security attacks shall be unable to penetrate through closed/locked security door assemblies in manner described; it is recognized that such attacks may damage units beyond repair and reuse, requiring replacement of work by Government:
 - 1. Ballistic Resistant (BR) assemblies: Where door assembly is shown or scheduled as BR, provide door manufacturer's materials and fabrication for panel, inserts, and framing of unit. Provide rated units where shown or scheduled.
 - a. UL 752 Level 3 Super Power (SPSA).

1.4 SUBMITTALS

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

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- B. Manufacturers Literature and Data: Include data substantiating that products comply with requirements of these specifications.
1. Certificates: Letter from manufacturer indicating the products have been certified to meet the specified ratings.
- C. Shop Drawings and Door Schedule: Showing each door opening with dimensioned details of each door assembly, including performance rating, swing, hardware set, installation and adjacent construction.
1. Door Schedule:
 - a. Model Number.
 - b. Ballistic resistant rating.
 - c. Marks (window no.).
 - d. Door/frame finish.
 - e. Door type.
 2. Elevation Drawings:
 - a. Rough opening.
 - b. Door opening.
 - c. Frame opening.
 - d. Vision opening.
 - e. Door and frame gauge thickness.
 3. Plan Drawings:
 - a. Relate to elevation on drawing.
 - b. Identify "Attack" and "Protected" sides.
 - c. Identify door swings.
 - d. Provide key on drawings.
 - e. Indicate room space numbers taken from Contract Drawings.
 4. Details: Show section at not less than $\frac{3}{4}$ inch = 1 ft (1:20) scale of members indicating construction, size, and thickness of components, frame profile, location of conduit entry, threshold configuration, vision panel together with connections, fastenings, and means of separating dissimilar metals.

1.5 QUALITY ASSURANCE

- A. Testing Laboratory Qualifications: For compliance with non-security performance requirements (such as fire ratings, resistance to deterioration from moisture, accessibility to persons with disabilities, or sound attenuation) on security door assemblies of this Section, use only those testing laboratories which have successfully demonstrated that they have experience and capabilities needed to satisfactorily conduct required tests.

- B. Provide products that meet the requirements of Unified Facilities Criteria for DOD minimum Antiterrorism Standards for Buildings UFC4-010-01.

1.6 IDENTIFICATION SYSTEMS

- A. Identify each assembly to provide VA with ready reference to original manufacturer to facilitate reorders, replacement parts, service, resolution of complaints, and inventory. The label shall be typically embossed/printed metal plate or metallic foil with adhesive backing for permanent identification. Locate label so that it is readily visible and convenient for identification by Project Manager after installation of assembly. The label shall be approximately 1-1/2 inch x 3 inch (40 x 75 mm) and shall cite:
 - 1. Manufacturer's name/city/state.
 - 2. Contract number.
 - 3. Month/Year of manufacture.
 - 4. Mark number and Ballistic resistant rating.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver each assembly project site with fabrication, finishing, and assembly of primary panels, inserts, and frames completed and prepared for installation and connection with security systems. Disassemble hardware for shipping only to extent hardware interferes with shipping.
- B. Provide removable spreader bar between jambs during fabrication, delivery, and installation and to include mullions of each frame assembly, except where integral threshold is required and serves same purpose. Do not mar finishes of assembly with installation or removal of spreader bars.
- C. Provide protection of pre-finished units, such as pre-finished with baked enamel or stainless steel, using self-adhesive paper.

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. American National Standards Institute (ANSI):
 - A250.8-2003 Recommended Specifications for Standard Steel Doors and Frames (formerly SDI-100)
 - A250.11-2001 Recommended Erection Instructions for Steel Frames (formerly SDI-105)

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

A153/A153M-09.....	Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
A167-99(2009).....	Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
A653/A653M-09.....	Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
A1008/A1008M-09.....	Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
A1011/A1011M-09a.....	Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
D1044-08.....	Standard Test Method for Resistance of Transparent Plastics to Surface Abrasion
E2074-00	Standard Test Method for Fire Tests of Door Assemblies, Including Positive Pressure Testing of Side-Hinged and Pivoted Swinging Door Assemblies

D. National Fire Protection Association (NFPA):

NFPA 80 – 2010	Standard for Fire Doors and Other Opening Protectives
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E. Society for Protective Coatings (SSPC):

SSPC-SP 2 – 2004	Hand Tool Cleaning
SSPC-SP 3 – 2004	Power Tool Cleaning

F. Underwriters Laboratories, Inc. (UL):

UL752-2006	Bullet Resisting Equipment
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G. Unified Facilities Criteria (UFC):

4-010-01-2007	DOD Minimum Antiterrorism Standards for Buildings
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H. United States General Services Administration (GSA):

UFAS-1998	Uniform Federal Accessibility Standards
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PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Certified Units: Provide units, including frames and sub-frames which are produced by manufacturer who has previously produced, within last 10 years, units of similar security attack resistance of equivalent size and resistance ratings.

2.2 MATERIALS, GENERAL

- A. Cold-Rolled Steel Sheets: ASTM A1008, commercial quality, except as otherwise indicated.
- B. Supports and Anchors: Fabricate to endure required performances, but of not less than 1.5 mm (1/16-inch) sheet steel. For exterior wall assemblies, hot-dip zinc coat support/anchor units after fabrication in compliance with ASTM A 153, Class B.
- C. Inserts, Bolts, Fasteners: Standard units of strengths required to endure performances; hot-dip zinc coated where used in exterior wall assemblies in compliance with ASTM A 153, Class C/D.
- D. Vision Lights: Fabricate vision lights of sizes shown and scheduled with same performance capabilities as specified/shown for door assembly where installed. Where applicable, achieve performances and combined performances through lamination of transparent sheets, films, and screens of standard manufactured/tested products. Comply with applicable provisions of Division 8, Section 08 80 00, GLAZING.
 - 1. Ballistic Resistance (BR): Where assembly is indicated for ballistic-resistance rating (BR), provide light of size shown or scheduled in accordance with certification.
 - 2. Vision light faces general: Except as otherwise shown, where ballistic resistance is required, provide face of light exposed on exterior (to the "attack") as glass surface, and where unit is of laminated construction, provide face exposed on interior ("safe") as polycarbonate surface. Provide exposed polycarbonate surfaces to include an abrasion-resistant coating for 3 percent maximum haze increase for 100 revolutions on 500g Taber abraser, ASTM D 1044.

2.3 HARDWARE

- A. General: Provide special units of door hardware to achieve performances, and as shown and scheduled. Standard units for each security door assembly are specified to be furnished as work of Section 08 71 00, DOOR HARDWARE; see Project "Finish Hardware Schedule" and provisions of this Section, as well as notes on door-and-frame schedule.

2.4 BALLISTIC RESISTANT (BR) DOOR

- A. Ballistic resistant doors are to be seamless design. Door face sheets are to be joined at their vertical edge with a center seam that is welded the full height of door. Welds are to be ground, filled, and dressed smooth. Seams are to be invisible and surface smooth. Face sheets are to be totally supported by a 1.5 LB/CF density styrene core chemically bonded to interior surface. The top of the door is to be closed flush with a cap screwed into a welded-in inverted channel. The bottom of the door is to be closed with an inverted channel welded to both face sheets.
- B. Armor plate is internal, welded in place, and conforms to ASTM 569.

2.5 BALLISTIC RESISTANT (BR) DOOR FRAME

- A. Frames to be fully welded.

2.6 FABRICATION AND ASSEMBLY

- A. General: Fabricate, test, and preassemble security door assemblies with hardware at factory; disassemble hardware only to extent necessary for handling, packaging, shipment, and installation at Project. Fabricate metal work to comply with performance requirements. Fabrications shall be rigid, neat, and free from warp/buckle/similar defects, with eased edges and continuously-welded joints, ground where exposed, to produce smooth, flush, invisible joints. Weld in accordance with AWS D1.1, Structural Welding Code for Steel:
 - 1. Prepare panels and frames of each assembly to receive hardware, devices, and accessory units as shown and scheduled. Reinforce work for hardware and devices, and cut work for mortised or concealed units; comply with ANSI A115 series specifications, working from templates supplied by unit manufacturers and suppliers:
 - a. Locate hardware, devices, and accessories as required by Section 08 71 00, DOOR HARDWARE.
 - b. Locate hardware, devices, and accessories as shown and scheduled (including on approved shop drawings) or, if not otherwise indicated:
 - 1) In accordance with security device manufacturer's recommendation for optimum responses, but in any case, as required to achieve required assembly performances.
 - c. Except where assembly is equipped with door-seal stripping at jambs and head, provide neoprene door silencers on stops; three at strike jamb for single door, and four at head for double door.

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- d. Except as otherwise indicated, pre-fabricate and preassemble security door assemblies to include full extent of required conduit-protected electrical/electronic power-and-control wiring placed and supported to avoid conflicts with other elements and subsequent drilling/cutting-in of work during installation of units. Provide access ports as required to support 25 mm (1- inch) conduit.
 - e. Clearances: Not more than 3 mm (1/8-inch) at jambs and heads. Not more than 6 mm (1/4-inch) at bottom. Undercut for carpets are not permitted where doors are used in corridors. Fabricate frames with horizontally slotted bolt holes.
 2. Provide removable glazing stops and similar moldings on interior or "safe" side of assemblies. Glazing shall be removable without removing door from frame.
 3. Shop Painting: Provide base-coat, factory-applied painting of ferrous metal elements of assemblies.
 - a. Clean steel and zinc-coated steel surfaces of mill scale, rust, oil, grease, dirt and other substances, immediately before finish application.
 - b. Apply pretreatment of cold phosphate solution (SSPC-SP2) or basic zinc chromate/vinyl-butyl solution (SSPC-SP3).
 - c. Apply paint coat specified for shop application, and bake on within time limits recommended by manufacturer of pretreatment. Apply in a uniform, smooth coat to result in dry film thickness of not less than 0.002 inch (0.05 mm).
 4. Vision panels:
 - a. The transparencies shall be enclosed and cushioned within core of door for continuous perimeter bite of not less than 20 mm (3/4 inch) on each side and 6 mm (1/4 inch) cushion clearance to fixed metal stop on glazing edges. Glazing shall be installed by manufacturer with no raw metal edges evident or in contact with glass in door vision openings. Vision opening edges shall be cushioned and trimmed neatly to provide acceptable appearance.
 - b. If external frames are used to either side or to both faces of door, frame(s) shall not exceed 40 mm (1-9/16 inch) in width and shall be configured internally to cushion all perimeter edges and faces of glazing and provide minimum bite of 20 mm (3/4 inch) and 6 mm (1/4 inch) cushion clearance to fixed metal stop on glazing edges. Frame shall not produce pinch point with hardware. All external bolts to attach frame shall be flush mounted. Alternatively, protruding bolt heads shall be covered with additional trim frame and flush mounted screws.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install security door assemblies in accordance with approved shop drawings, manufacturer's data and instructions, and requirements of these specifications. Install as required to achieve specified performances, and to comply with recommendations of related industry association or testing agency sponsoring standards for required non-security performances. Install door assemblies plumb and level:
1. Install assemblies in compliance with recommendations and instructions of ANSI A250.8 and ANSI A250.11.
 2. At fire-rated door openings, comply with NFPA Standard No. 80.
 3. Properly hang and align FE/BR doors so that pull open exertion does not exceed 5.4 kg (12 lbs).
 4. Installer shall not grind any portion of door, frame or locking device strikes.
 5. Locking device strikes shall engage strike plate without binding.
- B. Anchorage: The door manufacturer shall provide anchors appropriate for substrate to which door frame is to be fastened. Structural frames shall have pre-drilled bolt hole patterns not to exceed 300 mm (12 inches) on center. The manufacturer shall verify substrates involved, and supply any special fastening tools (e.g., special drill or bit) required by anchoring system. The anchor shall be acceptable for shock/short duration loading, and have potential for removal during life of building. The anchor shall also meet the following requirements:
1. Anchor diameter: 10 mm (3/8 inch) minimum.
 2. Embedment and edge distances shall be as indicated on Contract Drawings and as appropriate for anchor and substrate, but not less than the following:
 - a. Embedment in solid masonry: 150 mm (6 inches).
 - b. Edge distance: 75 mm (3 inches).
 3. The minimum anchor strengths shall be:
 - a. Yield Strength: 900 MPa (135,000 psi).
 - b. Tensile Strength: 1240 MPa (186,000 psi).

3.2 ADJUST AND CLEAN

- A. General: Remove protective coverings and clean exposed surfaces. Repair damaged elements, restore abraded surfaces, touch-up base-coat paint finish with air-drying primer, and remove imperfections from exposed natural metal finishes.

- B. Check and readjust hardware, devices, and accessories with door-to-frame-and-sill/threshold clearances set for proper operation of locks, door seals, and other operational units. Do not remove permanently applied performance labels.
- C. Comply with "Door Hardware" section requirements for protection and handling of keys and locking devices, and associated information.
- D. Exercise extreme care in the cleaning of exposed surfaces of polycarbonate; comply with manufacturer's directions.

END OF SECTION 08 34 53

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SECTION 08 41 13 - ALUMINUM-FRAMED STOREFRONT SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies exterior and interior aluminum storefront systems.

1.2 RELATED WORK

- A. Interior wood doors: Section 08 14 00, INTERIOR WOOD DOORS.
- B. Hardware: Section 08 71 00, DOOR HARDWARE.
- C. Glass and glazing: Section 08 80 00, GLAZING.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: Showing construction, anchorage, reinforcement, and installation details.
- C. Manufacturer's Literature and Data:
 - 1. Storefront construction.
 - 2. Stating that aluminum has been given specified thickness of anodizing.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Deliver aluminum storefront material to the site in packages or containers; labeled for identification with the manufacturer's name, brand and contents.
- B. Store aluminum storefront material in weather-tight and dry storage facility.
- C. Protect from damage from handling, weather and construction operations before, during and after installation.

1.5 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 for Testing and Materials (ASTM)
 - B209-07 Aluminum and Aluminum-Alloy Sheet and Plate
 - B221-08 Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
 - E283-04 Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
 - E331-00(R2009) Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference
 - F468-10 Nonferrous Bolts, Hex Cap Screws, and Studs for General Use
 - F593-02(R2008) Stainless Steel Bolts, Hex Cap Screws, and Studs
- C. National Association of Architectural Metal Manufacturers (NAAMM)
 - AMP 500 Series Metal Finishes Manual
- D. American Architectural Manufacturer's Association (AAMA)
 - 2604-10 High Performance Organic Coatings on Architectural Aluminum Extrusions and Panels
- E. American Welding Society (AWS)
 - D1.2-08 Structural Welding Code Aluminum

1.6 PERFORMANCE REQUIREMENTS, EXTERIOR STOREFRONT SYSTEMS

- A. Shapes and thickness of framing members shall be sufficient to withstand a design wind load of not less than 1.4 kilopascals (30 pounds per square foot) of supported area with a deflection of not more than 1/175 times the length of the member and a safety factor of not less than 1.65 (applied to overall load failure of the unit). Provide glazing beads, moldings, and trim of not less than 1.25 mm (0.050 inch) nominal thickness.
- B. Air Infiltration: When tested in accordance with ASTM E 283, air infiltration shall not exceed 2.63×10^{-5} cm per square meter (0.06 cubic feet per minute per square foot) of fixed area at a test pressure of 0.30 kPa (6.24 pounds per square foot) 80 kilometers (50 mile) per hour wind.

- C. Water Penetration: When tested in accordance with ASTM E 331, there shall be no water penetration at a pressure of 0.38 kPa (8 pounds per square foot) of fixed area.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum, ASTM B209 and B221:
 - 1. Alloy 6063 temper T5 for door frames, fixed glass sidelights and transoms.
- B. Thermal Break: Manufacturer standard low conductive material retarding heat flow in the framework, where insulating glass is scheduled.
- C. Fasteners:
 - 1. Aluminum: ASTM F468, Alloy 2024.
 - 2. Stainless Steel: ASTM F593, Alloy Groups 1, 2 and 3.

2.2 FABRICATION

- A. Fabricate doors, of extruded aluminum sections not less than 3 mm (0.125 inch) thick. Fabricate glazing beads of aluminum not less than 1.0 mm (0.050 inch) thick.
- B. Accurately form metal parts and accurately fit and rigidly assemble joints, except those joints designed to accommodate movement. Seal joints to prevent leakage of both air and water.
- C. Make welds in aluminum in accordance with the recommended practice AWA D1.2. Use electrodes and methods recommended by the manufacturers of the metals and alloys being welded. Make welds behind finished surfaces so as to cause no distortion or discoloration of the exposed side. Clean welded joints of welding flux and dress exposed and contact surfaces.
- D. Make provisions in frames to receive the specified hardware and accessories. Coordinate schedule and template for hardware specified under Section 08 71 00, DOOR HARDWARE.
- 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. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
 - 1. Glazing System: Retained mechanically with gaskets on four sides.
 - 2. Fabrication Method: Field-fabricated stick system.
 - 3. Exterior Storefront Systems:
 - a. Construction: Thermally broken.
 - b. Glazing Plane: Front.
 - c. Frame Size: 51 by 204 mm (2 by 8 inch).
 - 4. Interior Storefront Systems:
 - a. Construction: Non-thermal.
 - b. Glazing Plane: Center.
 - c. Frame Size: 51 by 114 mm (2 by 4-1/2 inch).
- B. Fabricate frames, mullions, transoms, frames for fixed glass and similar members from extruded aluminum not less than 3 mm (0.125 inch) thick.
- C. Provide integral stops and glass rebates and applied snap-on type trim.
- D. Use concealed screws, bolts and other fasteners. Secure cover boxes to frames in back of all lock strike cutouts.

2.5 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.

2.6 FINISH

- A. In accordance with NAAMM AMP 500 series.
- B. Exterior Storefront Systems:
 - 1. High-Performance Organic Finish: 3-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.
 - a. Color: Match existing curtain wall system.
- C. Interior Storefront Systems:
 - 1. Anodized Aluminum: Clear Finish: Chemically etched medium matte, with clear anodic coating, Class I Architectural, 7 mils thick.

2.7 GLAZING

- A. Glazing: Comply with Section 08 80 00, GLAZING.
- B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

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. Install hardware specified under Section 08 71 00, DOOR HARDWARE.
- D. Install doors specified under Section 08 14 00, INTERIOR WOOD DOORS.

- E. Install glazing specified under Section 08 80 00, GLAZING.

3.2 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 08 41 13

SECTION 08 42 29 - AUTOMATIC ENTRANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior and interior, sliding, power-operated automatic entrances.

1.2 RELATED WORK

- A. Glazing: Section 08 80 00, GLAZING.
- B. Sealants and Joint Fillers: Section 07 92 00, JOINT SEALANTS.
- C. Electric devices and wiring: DIVISION 26, ELECTRICAL.

1.3 PERFORMANCE REQUIREMENTS

A. Opening-Force Requirements:

1. Breakaway Device for Power-Operated Doors: Not more than 222 N (50 lbf) required for a breakaway door or panel to open.

B. Entrapment Force Requirements:

1. Power-Operated Sliding Doors: Not more than 133 N (30 lbf) required to prevent stopped door from closing.

1.4 SUBMITTALS

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data: For each type of product indicated.
- C. Shop Drawings: For automatic entrances. Include plans, elevations, sections, details, hardware mounting heights, and attachments to other work.
1. Wiring Diagrams: For power, signal, and control wiring.
 2. Activation and safety devices.

3. Include hardware schedule and indicate hardware types, functions, quantities, and locations.
- D. Sample: For each exposed product and for each color and texture specified.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Power-Operated Door Standard: BHMA A156.10.
- C. Emergency-Exit Door Requirements: Comply with requirements of authorities having jurisdiction for automatic entrances serving as a required means of egress.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 1. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221M (ASTM B 221).
 2. Sheet and Plate: ASTM B 209M (ASTM B 209).
- B. Steel Reinforcement: With manufacturer's standard corrosion-resistant primer complying with SSPC-PS Guide No. 12.00 applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.
 1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
 2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
 3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.
- C. Nonmetallic, Shrinkage-Resistant Grout: Premixed, nonmetallic, noncorrosive, non-staining grout; complying with ASTM C 1107; of consistency suitable for application.
- D. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements, except containing no asbestos; formulated for 0.76-mm (30-mil) thickness per coat.
- E. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories compatible with adjacent materials.

2.2 SLIDING AUTOMATIC ENTRANCES

- A. General: Provide manufacturer's standard automatic entrances including doors, sidelites, framing, headers, carrier assemblies, roller tracks, door operators, activation and safety devices, and accessories required for a complete installation.
1. Single-sliding doors, with transom and pocketed sidelites.
 - a. Traffic Pattern: Two-way.
 - b. Emergency Breakaway Capability: Sliding leaf (leaves) only.
 - c. Mounting: Between jambs.
 2. Biparting-sliding doors, with transom and pocketed sidelites.
 - a. Traffic Pattern: Two-way.
 - b. Emergency Breakaway Capability: Sliding leaf (leaves) only.
 - c. Mounting: Between jambs.
 3. Operator Features:
 - a. Power opening and closing.
 - b. Drive system: Chain or belt.
 - c. Adjustable opening and closing speeds.
 - d. Adjustable hold-open time between 0 and 30 seconds.
 - e. Obstruction recycle.
 - f. On-off/hold-open switch to control electric power to operator.
 4. Sliding Door Carrier Assemblies and Overhead Roller Tracks: Manufacturer's standard carrier assembly that allows vertical adjustment; consisting of nylon- or delrin-covered, ball-bearing-center steel wheels operating on a continuous roller track, or ball-bearing-center steel wheels operating on a nylon- or delrin-covered, continuous roller track. Support doors from carrier assembly by cantilever and pivot assembly.
 - a. Rollers: Minimum of two ball-bearing roller wheels and two antirise rollers for each active leaf.
 5. Sliding Door Threshold: Manufacturer's standard threshold members and bottom-guide track system, with stainless-steel, ball-bearing-center roller wheels.
 - a. Configuration: Saddle-type threshold across door opening and surface-mounted guide track system at sidelites.
 6. Activation and Safety Devices: Contractor to provide the following or a combination device.
 - a. Activation Device: Motion sensors mounted on door header to detect pedestrians in activating zone to activate door operator.

- b. Safety Devices: Two photoelectric beams mounted in sidelite jambs to detect pedestrians in presence zone and to prevent door from closing.
- 7. Finish: Finish framing, door(s), sidelite(s), and header with high-performance organic finish (three-coat fluoropolymer).
 - a. Color: Match adjacent curtain wall

2.3 ENTRANCE COMPONENTS

- A. Framing and Transom Members: Manufacturer's standard extruded aluminum, minimum 3.2 mm (0.125 inch) thick and reinforced as required to support imposed loads.
 - 1. Nominal Size: 45 by 102 mm (1-3/4 by 4 inches).
 - 2. Extruded Glazing Stops and Applied Trim: Minimum 1.6-mm (0.062-inch) wall thickness.
- B. Stile and Rail Doors: Manufacturer's standard 45-mm- (1-3/4-inch-) thick, glazed doors with minimum 3.2-mm- (0.125-inch-) thick, extruded-aluminum tubular stile and rail members. Mechanically fasten corners with reinforcing brackets that are welded, or incorporate concealed tie-rods that span full length of top and bottom rails.
 - 1. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and manufacturer's standard preformed gaskets.
 - 2. Stile Design: Medium stile, 90-mm (3-1/2-inch) nominal width.
 - 3. Rail Design:
 - a. Top Rail: 165-mm (6-1/2-inch) nominal height
 - b. Bottom Rail: 254-mm (10-inch) nominal height.
- C. Headers: Fabricated from minimum 3.2-mm- (0.125-inch-) thick, extruded aluminum and extending full width of automatic entrance units to conceal door operators and controls. Provide hinged or removable access panels for service and adjustment of door operators and controls. Secure panels to prevent unauthorized access.
 - 1. Mounting: Surface mounted.
 - 2. Capacity: Capable of supporting doors up to 79 kg (175 lb) per leaf over spans up to 4.3 m (14 feet) without intermediate supports.
 - a. Provide sag rods for spans exceeding 4.3 m (14 feet).
- D. Signage: Affixed to both sides of each door as required by BHMA A156.10 and BHMA A156.19 for type of door and its operation.
 - 1. Application Process: Decals.

2.4 DOOR OPERATORS AND ACTIVATION AND SAFETY DEVICES

- A. Door Operators: Provide door operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for long-term, maintenance-free operation under normal traffic load for type of occupancy indicated.
 - 1. Door Operator Performance: Provide door operators that will open and close doors and maintain them in fully closed position when subjected to Project's design wind loads.
 - 2. Electromechanical Operators: Concealed, self-contained, overhead unit powered by fractional-horsepower, permanent-magnet dc motor; with closing speed controlled mechanically by gear train and dynamically by braking action of electric motor; with solid-state microprocessor controller; UL 325; and with manual operation with power off.
- B. Motion Sensors: Self-contained, K-band-frequency, microwave-scanner units with metal or plastic housing; adjustable to provide detection field sizes and functions required by BHMA A156.10; with relay hold time of not less than 2 to 10 seconds.
 - 1. Provide capability for switching between bidirectional and unidirectional detection.
 - 2. For one-way-traffic entrances, sensor on egress side shall not be active when doors are fully closed.
- C. Presence Sensors: Self-contained, infrared-scanner units with metal or plastic housing; adjustable to provide detection field sizes and functions required by BHMA A156.10; with relay hold time of not less than 2 to 10 seconds. Sensors shall remain active at all times.
- D. Combination Motion/Presence Sensors: Self-contained units; consisting of both motion and presence sensors in a single metal or plastic housing; adjustable to provide detection field sizes and functions required by BHMA A156.10.
- E. Electrical Interlocks: Unless units are equipped with self-protecting devices or circuits, provide electrical interlocks to prevent activation of operator when door is locked, latched, or bolted.

2.5 HARDWARE

- A. General: Provide units in sizes and types recommended by automatic entrance and hardware manufacturers for entrances and uses indicated. Finish exposed parts to match door finish.
- B. Breakaway Device for Power-Operated Doors: Provide breakaway device that allows door to swing out in direction of egress to full 90 degrees from any operating position. Maximum force to open door shall be 222 N (50 lbf) according to BHMA A156.10. Interrupt powered operation of door operator while in breakaway mode.

- C. Deadlocks: Manufacturer's standard deadbolt operated by exterior cylinder and interior thumb turn, with minimum 25-mm- (1-inch-) long throw bolt; BHMA A156.5, Grade 1.
 - 1. Cylinders: Provided by Department of Veterans Affairs (VA).
 - 2. Deadbolts: Laminated-steel hook, mortise type, BHMA A156.5, Grade 1.
- D. Thresholds: BHMA A156.21, extruded-aluminum raised thresholds; with beveled edges with a slope of not more than 1:2 and a maximum height of 13 mm (1/2 inch). Provide cutouts as required for door operating hardware.
- E. Weather Stripping: Manufacturer's standard replaceable components.
 - 1. Sliding Type: AAMA 701, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

2.6 FABRICATION

- A. General: Factory fabricate automatic entrance components to designs, sizes, and thicknesses indicated and to comply with indicated standards.
- B. Framing: Provide automatic entrances as prefabricated assemblies. Complete fabrication, assembly, finishing, hardware application, and other work before shipment to Project site.
- C. Doors: Factory fabricated and assembled in profiles indicated. Reinforce as required to support imposed loads and for installing hardware.
- D. Door Operators: Factory fabricated and installed in headers, including adjusting and testing.
- E. Glazing: Fabricate framing with minimum glazing edge clearances for thickness and type of glazing indicated, according to GANA's "Glazing Manual."
- F. Hardware: Factory install hardware to greatest extent possible; remove only as required for final finishing operation and for delivery to and installation at Project site. Cut, drill, and tap for factory-installed hardware before applying finishes.
 - 1. Provide sliding-type weather stripping, mortised into door, at perimeter of doors.
- G. Activation and Safety Devices:
 - 1. General: Factory install devices in doors and headers as required by BHMA A156.10 for type of door and direction of travel.

2.7 ALUMINUM FINISHES

- A. High-Performance Organic Finish: 3-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.
 - 1. Color and Gloss: Match curtain-wall system.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure non-movement joints. Seal joints watertight.
 - 1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
 - 2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- B. Entrances: Install automatic entrances plumb and true in alignment with established lines and grades without warp or rack of framing members and doors. Anchor securely in place.
 - 1. Install surface-mounted hardware using concealed fasteners to greatest extent possible.
 - 2. Set headers, carrier assemblies, tracks, operating brackets, and guides level and true to location with anchorage for permanent support.
 - 3. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within system to exterior.
 - 4. Level recesses for recessed thresholds using non-shrink grout.
 - 5. Provide thresholds at exterior doors and where indicated.
- C. Activation and Safety Devices: Install and adjust devices to provide detection field and functions indicated.
- D. Glazing: Install glazing as specified in Section 08 80 00, GLAZING.
- E. Sealants: Comply with requirements specified in Section 07 92 00 JOINT SEALANTS to provide weather-tight installation.
 - 1. Set thresholds, bottom-guide track system, framing members and flashings in full sealant bed.
 - 2. Seal perimeter of framing members with sealant.

- F. Signage: Apply signage on both sides of each door as required by referenced door standards.
- G. Wiring within Automatic Entrance Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's written limitations on bending radii. Provide and use lacing bars and distribution spools.
- H. Inspection: Engage Installer's certified inspector to test and inspect automatic entrances and prepare test and inspection reports.
 - 1. Certified inspector shall test and inspect each automatic entrance to determine compliance of installed systems with applicable BHMA standards.
 - 2. Field Quality-Control Report: Certified inspector shall submit report in writing to Architect and Contractor within 24 hours after inspection.
 - 3. Work will be considered defective if it does not pass tests and inspections.
- I. Adjusting: Adjust door operators, controls, and hardware for smooth and safe operation and for weathertight closure; comply with requirements in BHMA A156.10.
 - 1. Readjust door operators and controls after repeated operation of completed installation equivalent to 3 days' use by normal traffic (100 to 300 cycles). Lubricate hardware, operating equipment, and other moving parts.
- J. Demonstration: Engage a certified inspector to train VA's maintenance personnel to adjust, operate, and maintain automatic entrances.

END OF SECTION 08 42 29

SECTION 08 42 43 - INTENSIVE CARE UNIT/CRITICAL CARE UNIT (ICU/CCU) ENTRANCES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes manually operated ICU/CCU entrances.

1.2 RELATED SECTIONS

- A. Sealants and joint fillers: Section 07 92 00, JOINT SEALANTS.
- B. Glazing: Section 08 80 00, GLAZING.

1.3 SUBMITTALS

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data: For each type of product indicated.
- C. Shop Drawings: For ICU/CCU entrances. Include plans, elevations, sections, details, hardware mounting heights, and attachments to other work.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation and maintenance of units required for this Project.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
- B. Sealants and Joint Fillers: As specified in Section 07 92 00, JOINT SEALANTS.
- C. Shrinkage-Resistant Grout: Premixed, nonmetallic, noncorrosive, non-staining grout complying with ASTM C 1107; of consistency suitable for application.

- D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.2 ICU/CCU ENTRANCE ASSEMBLIES

- A. General: Provide manufacturer's standard factory-glazed ICU/CCU entrances including door leaves, sidelites, framing, headers, carrier assemblies, roller tracks, and accessories required for a complete installation.
- B. Opening-Force Requirement, Sliding: Not more than 22.2 N (5 lbf) to fully open door.
- C. ICU/CCU Entrance:
1. Configuration: Bi-parting-sliding four-panel door, with one operable leaf and side lite on each side; with breakaway capability for sliding leaves only.
 2. Mounting: Between jambs.
 3. Floor Track Configuration: No track across sliding-door opening and at side lites (trackless).
 4. Finish: Finish framing, door(s), side lite(s), and header with Class I, clear anodic finish.

2.3 COMPONENTS

- A. Framing Members: Manufacturer's standard extruded aluminum, minimum 3.2 mm (0.125 inch) thick and reinforced as required to support imposed loads.
1. Nominal Size: 45 by 115 mm (1-3/4 by 4-1/2 inches).
 2. Extruded Glazing Stops and Applied Trim: Minimum 1.6-mm (0.062-inch) wall thickness.
- B. Stile and Rail Doors: Manufacturer's standard 45-mm (1-3/4-inch) thick glazed doors with minimum 3.2-mm (0.125-inch) thick, extruded-aluminum tubular stile and rail members. Mechanically fasten corners with reinforcing brackets that are welded, or incorporate concealed tie rods that span full length of top and bottom rails.
1. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets for glazing indicated.
 2. Stile Design: Medium stile; 90-mm (3-1/2-inch) nominal width.
 3. Rail Design: 125-mm (5-inch) nominal height.
 4. Muntin Bars: Horizontal tubular rail member for each sidelite; match stile design.
- C. Sidelites: Manufacturer's standard 45-mm (1-3/4-inch) deep sidelites with minimum 3.2-mm (0.125-inch) thick, extruded-aluminum tubular stile and rail members matching door design and finish.
1. Glazing Stops and Gaskets: Same materials and design as for stile and rail door.

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- 2. Muntin Bars: Horizontal tubular rail member for each sidelite; match stile design.
 - D. Glazing: As specified in Section 08 80 00, GLAZING.
 - E. Headers: Fabricated from minimum 3.2-mm (0.125-inch) thick extruded aluminum, and extending full width of ICU/CCU entrance units to conceal carrier assemblies and roller tracks. Provide hinged or removable access panels for service and adjustment. Secure panels to prevent unauthorized access.
 - 1. Capacity: Capable of supporting doors over spans up to 4.3 m (14 feet) without intermediate supports.
 - 2. Provide sag rods for spans exceeding 4.3 m (14 feet).
 - F. Carrier Assemblies and Overhead Roller Tracks: Manufacturer's standard carrier assembly that allows vertical adjustment; consisting of nylon- or delrin-covered, ball-bearing-center steel wheels operating on a continuous roller track or of ball-bearing-center steel wheels operating on a nylon- or delrin-covered, continuous roller track.
 - G. Fasteners and Accessories: Manufacturer's standard, corrosion-resistant, non-staining, non-bleeding fasteners and accessories compatible with adjacent materials.

2.4 HARDWARE

- A. General: Provide units in sizes and types recommended by ICU/CCU entrance and hardware manufacturers for entrances and uses indicated. Finish exposed parts to match door finish unless otherwise indicated.
- B. Breakaway Hardware: Provide release hardware that allows indicated panels to swing out in direction of egress to full 90 degrees from sliding mode.
 - 1. Maximum Force to Open Panel: 222 N (50 lbf).
 - 2. Release Position: At any point in sliding door travel.

2.5 FABRICATION

- A. General: Factory fabricate ICU/CCU entrance components to designs, sizes, and thicknesses indicated and to comply with indicated standards.
- B. Framing: Provide ICU/CCU entrances as prefabricated assemblies. Complete fabrication, assembly, finishing, hardware application, and other work before shipment to Project site.
- C. Doors: Factory fabricated and assembled in profiles indicated. Reinforce as required to support imposed loads and for installing hardware.

- D. Glazing: Fabricate framing with minimum glazing edge clearances for thickness and type of glazing indicated, according to GANA's "Glazing Manual."
- E. Hardware: Factory install hardware to the greatest extent possible; remove only as required for final finishing operation and for delivery to and installation at Project site. Cut, drill, and tap for factory-installed hardware before applying finishes.
 - 1. Provide sliding weather stripping, mortised into door, at perimeter of sliding doors.
- F. Electrical Grounding: Fabricate ICU/CCU entrances to be internally grounded, complying with requirements of authorities having jurisdiction.

2.6 ALUMINUM FINISHES

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

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure non-movement joints. Seal joints watertight.
 - 1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
 - 2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous coating.
- B. Install ICU/CCU entrances plumb and true in alignment with established lines and grades without warp or rack of framing members and doors. Anchor securely in place.
 - 1. Install surface-mounted hardware using concealed fasteners to greatest extent possible.
 - 2. Set headers, carrier assemblies, tracks, operating brackets, and guides level and true to location with anchorage for permanent support.
 - 3. Level recesses for recessed floor tracks using shrinkage-resistant grout.
- C. Glazing: Install glazing as specified in Section 08 80 00, GLAZING.

- D. Sealants: Comply with requirements in Section 07 92 00, JOINT SEALANTS for installing sealants, fillers, and gaskets.
 - 1. Set framing members, floor tracks, and flashings in full sealant bed.
 - 2. Seal perimeter of framing members with sealant.
- E. Grounding: Connect ICU/CCU-entrance, electrical grounding systems to building grounding system as specified in Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.
- F. Adjust force to open swing panels.
- G. Test grounding system for compliance with requirements of authorities having jurisdiction.

END OF SECTION 08 42 43

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SECTION 08 51 13 - ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section includes fixed aluminum windows of type and size shown, complete with hardware, related components and accessories.

1.2 DEFINITIONS

- A. Accessories: Mullions, staff beads, casings, closures, trim, moldings, panning systems, sub-sills, clips anchors, fasteners, weather-stripping, integral blinds 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. Glazing: Section 08 80 00, GLAZING.

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. Elevations and details of each window type.
 2. Identifying parts of window units by name and kind of metal or material, show construction, locking systems, mechanical operators, trim, installation and anchorages.
 3. Include glazing details and standards for factory glazed units.
- C. Manufacturer's Literature and Data.
- D. Samples: Provide samples showing finishes specified.

1.7 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)
90.1-07.....Energy Standard of Buildings
- C. American Architectural Manufacturers Association (AAMA):
101/I.S.2/A440-08.....Windows, Doors, and Unit Skylights
505-09.....Dry Shrinkage and Composite Performance Thermal
Cycling Test Procedures

2605-05.....	Superior Performing Organic Coatings on Architectural Aluminum Extrusions and Panels
TIR-A8-08	Structural Performance of Poured and Debridged Framing Systems

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

A653/A653M-09.....	Steel Sheet, Zinc Coated (Galvanized), Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-dip Process
E 90-09	Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions

E. National Fenestration Rating Council (NFRC):

NFRC 100-10.....	Determining Fenestration Product U-Factors
NFRC 200-10.....	Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence

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

AMP 500-06	Metal Finishes Manual
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PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum Extrusions; Sheet and Plate: AAMA 101/I.S.2.
- B. Sheet Steel, Galvanized: ASTM A653; G90 galvanized coating.
- C. Weather-strips: AAMA 101/I.S.2; except leaf type weather-stripping is not permitted.
- D. 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.
 - 4. Provide tamper-resistant fasteners in Psych rooms where exposed.

E. Hardware:

1. Locks: Two position locking bolts or cam type tamperproof custodial locks with a single point control located not higher than five feet from floor level. Locate locking devices in the vent side rail. Fastenings for locks and keepers shall be concealed or nonremovable.
2. Locking Device Strikes: Locate strikes in frame jamb. Strikes shall be adjustable for locking tension. Fabricate strikes from Type 304 stainless steel or white bronze.
3. Fabricate hinges of noncorrosive metal. Hinges may be either fully concealed when window is closed or semi-concealed with exposed knuckles. All exposed knuckle hinges shall have hospital tips, at both ends. Surface mounted hinges will not be accepted.
4. Hardware for Maintenance Opening of Windows: Opening beyond the six inch position shall be accomplished with a window washers key. The release device shall capture the key when window is in the open position.
5. Design operating device to prevent opening with standard tools, coins or bent wire devices.

2.2 THERMAL AND CONDENSATION PERFORMANCE

- A. Condensation Resistance Factor (CRF): Minimum CRF of C 45.
- B. 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.
- C. 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 glazed.
 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. In Psychiatric rooms, glaze from outside or cavity side of dual glazed windows.
 7. Provide removable fin type glazing beads.

C. Trim:

1. Trim includes sills, 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 ALUMINUM WINDOWS

- A. Frames and Sashes: Thermally broken aluminum extrusions complying with AAMA/WDMA/CSA 101/I.S.2/A440.
 - 1. AMMA 101/I.S.2; Type Heavy Commercial F-HC100 / F-AW100.
 - 2. Operation: Fixed.
- B. Glazing:
 - 1. Dual-glazed with integral blinds: (Provide unless otherwise noted)
 - a. Exterior Lite: 6 mm (1/4-inch) clear annealed glass, ASTM C 1036, Type 1, Class 1, q3; pyrolytic Low-E coating on second surface.
 - b. Integral Blinds: Aluminum slats, approximately 5/8 inch (16 mm) wide, with polyester fiber cords, equipped for tilting by standard operating hardware located on inside face of sash.
 - c. Interior Lite: 6 mm (1/4-inch) clear annealed glass, ASTM C 1036, Type 1, Class 1, q3.
 - 2. Spandrel glazing: (Denoted as "S" on the window elevations on the drawings)
 - a. Exterior Lite: 6 mm (1/4-inch) clear annealed glass, ASTM C 1036, Type 1, Class 1, q3; pyrolytic Low-E coating on second surface.
 - b. Interior Lite: 6 mm (1/4-inch) clear annealed glass, ASTM C1048, Kind HS, Condition B, Type I, Quality q3 with ceramic coating applied over and fused into #4 glass surface.

2.5 METAL FINISHES

- A. In accordance with NAAMM AMP500 series.
- B. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat.
 - 1. Color: Match existing curtain wall system.
- C. Shop and Touch-Up Primer for Steel Components: SSPC Paint 25 red oxide.
- D. Apply one coat of bituminous paint to concealed aluminum and steel surfaces in contact with cementitious or dissimilar materials.
- E. 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 (at Psych rooms).
 - 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 08 51 13

SECTION 08 56 53 - BALLISTIC RESISTANT (BR) WINDOWS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section includes ballistic resistant (BR) window assemblies (glazing and frame).
 - 1. Aluminum vision security windows with USST speak thru.

1.2 RELATED DOCUMENTS

- A. Ballistic resistant rated doors and frames: Section 08 34 53, SECURITY DOORS AND FRAMES.
- B. Glazing and ballistic rated glazing: Section 08 80 00, GLAZING.

1.3 SYSTEM PERFORMANCE

- A. General: Fabricate and install BR window assemblies to achieve indicated levels of resistance. Extend resistance to include anchorages, interfaces with adjoining substrates, glass retention, and hardware. Security attacks shall be unable to penetrate through closed/locked security window assemblies in manner described; it is recognized that such attacks may damage units beyond repair and reuse, requiring replacement.
 - 1. Ballistic Resistant (BR) assemblies: Where assembly is shown or scheduled as BR, provide manufacturer's materials and fabrication for panel, inserts, and framing of unit. Provide rated units where shown or scheduled.
 - a. UL 752 Level 3 Super Power (SPSA).

1.4 SUBMITTALS

- A. General: For each security window assembly, submit the following in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- B. Manufacturers Literature and Data: Include data substantiating that products comply with requirements of these specifications.
 - 1. Certificates: Letter from manufacturer indicating the products have been certified to meet the specified ratings.

-
- C. Shop Drawings and Door Schedule: Showing each door opening with dimensioned details of each door assembly, including performance rating, swing, hardware set, installation and adjacent construction.
1. Window Schedule:
 - a. Model Number.
 - b. Ballistic resistant rating.
 - c. Marks (opening number).
 - d. Frame finish.
 - e. Frame type.
 2. Elevation Drawings:
 - a. Rough opening.
 - b. Window opening.
 - c. Frame opening.
 - d. Frame gauge thickness.
 3. Plan Drawings:
 - a. Relate to elevation on drawing.
 - b. Identify "Attack" and "Protected" sides.
 - c. Provide key on drawings.
 - d. Indicate room space numbers taken from Contract Drawings.
 4. Details: Show section at not less than $\frac{3}{4}$ inch = 1 ft (1:20) scale of members indicating construction, size, and thickness of components, frame profile, vision panel together with connections, fastenings, and means of separating dissimilar metals.

1.5 QUALITY CONTROL

- A. Testing Laboratory Qualifications: For compliance with non-security performance requirements (such as fire ratings, resistance to deterioration from moisture, accessibility to persons with disabilities, or sound attenuation) on security door assemblies of this Section, use only those testing laboratories which have successfully demonstrated that they have experience and capabilities needed to satisfactorily conduct required tests.
- B. Provide products that meet the requirements of Unified Facilities Criteria for DOD Minimum Antiterrorism Standards for Buildings UFC4-010-01.

1.6 IDENTIFICATION SYSTEMS

- A. Identify each assembly to provide VA with ready reference to original manufacturer to facilitate reorders, replacement parts, service, resolution of complaints, and inventory. The label shall be typically embossed/printed metal plate or metallic foil with adhesive backing for permanent identification. Locate label so that it is readily visible and convenient for identification by Project Manager after installation of assembly. The label shall be approximately 40 x 75 mm (1½ inch x 3 inch) and shall cite:
1. Manufacturer's name/city/state.
 2. Contract number.
 3. Month/Year of manufacture.
 4. Mark number and Ballistic resistant rating.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Comply with Manufacturer's directions and as required to prevent edge damage or other damage to assembly resulting from effects of moisture, condensation, temperature changes, direct exposure to sun, and contact with chemical solvents.
- B. Deliver prefabricated units to Project as completely assembled units, ready for anchorage into supporting structure, and for interfacing with other work.

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. American Society for Testing and Materials (ASTM):
- ASTM A36/A36M-05 Standard Specification for Carbon Structural Steel
- ASTM A123/A123M-02 Standard Specification for Zinc (Hot-Dip Galvanized)
Coatings on Iron and Steel Products
- ASTM B221-06 Standard Specification for Aluminum and Aluminum-Alloy
Extruded Bars, Rods, Wire, Profiles, and Tubes
- C. National Association of Architectural Metal Manufacturers (NAAMM)
- AMP 500-505-88 Metal Finishes Manual
- D. Underwriters Laboratories, Inc. (UL):
- UL752-2005 Bullet Resisting Equipment

E. Unified Facilities Criteria (UFC):

4-010-01-2007DOD Minimum Antiterrorism Standards for Buildings

PART 2 - PRODUCTS

2.1 MANUFACTURER/FABRICATOR

- A. Certified Units: Provide units and sub-frames which are manufactured/fabricated by firms which have produced identical units required for this Project and which have been certified to comply with requirements for levels of resistance to attack specified.

2.2 MATERIALS

- A. Steel Shapes/Plates/Bars: ASTM A 36, except where another designation is indicated.
- B. Bolts and Fasteners: Provide AISI Type 300-series stainless steel screws, bolts, nuts, and washers; comply with ASTM A 320. Provide nonremovable type where accessible from attack side.
- C. Aluminum Extrusions/Bars: Provide members complying with ASTM B 221, alloy 6063-T5, -T6, or -T52, or alloy 6061-T6, for principal framing members, with 3/16 inch (4.76 mm) minimum thickness of walls; provide alloy 6063-T5, -T6, or -T52 for trim and stops which are not exposed to forced entry attack, of 1/16 inch (1.575 mm) minimum thickness.
- D. Glazing Materials: Refer to Section 08 80 00, GLAZING:

2.3 VISION SECURITY WINDOWS

- A. Provide fixed vision security windows with framing on four sides and no operable sash or ventilator.
- B. Framing: Fabricate perimeter framing, mullions, and glazing stops from aluminum as follows:
1. Profile: Manufacturer's standard, with 32 mm (1-1/4 inches) minimum face dimension.
 2. Depth: Manufacturer's standard.
 3. Glass Orientation: Vertical.
- C. Round 6" diameter cast stainless steel talk thru design offering natural voice transmission with evenly spaced concentric louvers. Interior model. Adjustable for 1/4" to 1 7/8" thick glass. Class 3 bullet resistance.

2.4 FABRICATION

- A. Unit Framing: Shop fabricate unit framing system of section profiles in metal as shown. Provide full-strength, mitered-and-welded corner joints. Provide framing units to achieve specified performances, but not less than metal thicknesses and dimensions shown. Comply with applicable AWS standards for welding, with exposed welds ground reasonably smooth. Provide welded-in-place reinforcements, including anchorage devices as shown. Fabricate metal glazing stops for removal, with mitered corners and countersunk screw attachment to frame.
 - 1. New Building: Each exterior frame system shall have inner frame, outer frame, and fasteners to connect them together. The outer frame shall be continuous steel frame embedded in exterior wall as concrete wall is constructed. The inner frame shall be preassembled with glazing and shall be bolted to outer frame. Both frames shall be supplied by one manufacturer.
- B. Unit Anchorages: Fabricate metal anchorage system/devices as shown, and as required to achieve performance requirements.
- C. Unit Glazing: Install glazing sheets in frames at fabrication plant prior to delivery to project. See section 08 80 00 for laminated glass assemblies that meet the requirements of UFC4-010-01.

2.5 FINISHES

- A. General Finishing: Provide the following factory-applied finishes on the fabricated units of metal window framing and sub-framing, including hardware and accessories. Comply with NAAMM Metal Finishes Manual AMP 500-505-88 as applicable:
 - 1. Fabricated aluminum: Provide Class I clear anodized coating of 0.018 mm thickness; comply with Aluminum Association designation AA-MI2C22A41.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine prepared substrate openings to receive framed fenestration units of this Section. Check anchorages for location and coordination of face plans between walls and fenestration units. Check dimensions and clearances for sealant applications.
- B. Coat substrate surfaces of concrete, masonry, or steel where they will be in contact or close proximity with aluminum or stainless steel framing of fenestration units. Apply 1/32 inch (0.76 mm) coating of bituminous paint, confined to surfaces which will be concealed.

3.2 INSTALLATION

- A. Coordinate installation of window units in sub-frames with installation of expansion joint materials, isolators, joint fillers, spacer strips, tapes, gaskets, sealants, removable sub-frame stops, and other elements as indicated. Tighten bolts for maximum shear and tensile strength, for resisting forces indicated. Comply with Fabricator's instructions and recommendations.
- B. Place installation accessory items as shown and as required for unit installations, including flashings, shims, fillers, bedding materials, and anchorage accessories. Prepare openings for unit interfaces with other work.
- C. Install window units uniformly to lines and elevations indicated, plumb and level, true to plane of optical reflection. Comply with Fabricator's instructions for final assembly and installation. Install anchor bolts and devices as indicated, exercising care to shim and tighten against substrates without distorting or deflecting frames from intended lines. Provide uniform spaces around units for subsequent installation of joint sealer materials, which are not work of this Section, see Division 7 section for sealants.
- D. Anchorage: The window manufacturer is responsible to provide anchors appropriate for substrate to which window assembly is to be fastened.
 - 1. New building window assembly installation: The window frame system shall consist of inner and outer frame. The outer frame shall be embedded in concrete wall as concrete is placed with sufficient anchorage (embedded studs) to meet performance requirements of this Section. The inner frame shall be anchored to outer frame with ½ inch (13 mm) bolts having the following minimum requirements:
 - a. Yield strength: 130,000 psi (900 MPa)
 - b. Tensile strength: 150,000 psi (1033 MPa)
 - 2. Existing building window assembly installation: Structural frames shall have pre-drilled bolt holes at 12 inches (300 mm) o.c. maximum. The manufacturer shall verify substrates involved and supply fastening tools (e.g., drill, bit) required by their anchoring system. The anchor shall be acceptable for shock/short duration loading, and have potential for removal during life of building. The anchor shall also meet the following requirements:
 - a. Anchor diameter: 3/8 inch (10 mm) minimum.
 - b. Embedment and edge distances shall be as certified for window, but not less than the following:
 - 1) Embedment in concrete: 3½ inch (90 mm).
 - 2) Embedment in solid masonry: 6 inches (150 mm).
 - 3) Edge distance: 3 inches (75 mm).

- c. The minimum anchor strengths shall be as certified for window, but not less than:
 - 1) Yield strength: 130,000 psi (900 MPa)
 - 2) Tensile strength: 180,000 psi (1240 MPa)
- 3. Avoid cutting of rebar during concrete anchor installation.
- E. Remove protective covering from finished metal surfaces, and from exposed glass and plastic glazing sheets.

3.3 CLEANING AND PROTECTION

- A. General: Upon completion of installation of metal windows, clean exposed surfaces of window units and sub-frames; comply with Fabricator's instructions. Remove excess and migrating joint sealing compounds, dirt, and foreign substances. Repair damaged areas of factory-applied finishes in accordance with Fabricator's instructions; comply with COR'S requests. Continue maintenance of exposed finishes through remainder of construction period.
- B. Protection: Provide breakage protection promptly upon completion of fenestration installation. Install crossed streamers of cloth/plastic, adhered to unit framing exterior faces. Maintain through construction completion.
- C. Repair and Replacement: Touch up minor finish damage on metal surfaces where handling and installation have produced marred or abraded areas which can be readily corrected. Replace or refinish units where damage is of greater substance, as directed by COR.
- D. Glazing: Clean glazing in accordance with Section 08 80 00, GLAZING.

END OF SECTION 08 56 53

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SECTION 08 71 00 - DOOR HARDWARE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Door hardware and related items necessary for complete installation and operation of doors.

1.2 SOLE SOURCE JUSTIFICATION

- A. Yale has been justified by the VA as the sole source manufacturer for the lock and latchsets. No substitutions will be accepted.

1.3 RELATED WORK

- A. Application of Hardware:
 - 1. Section 08 11 13, HOLLOW METAL DOORS AND FRAMES
 - 2. Section 08 14 00, INTERIOR WOOD DOORS
 - 3. Section 08 34 53, SECURITY DOORS AND FRAME
 - 4. Section 08 71 13, AUTOMATIC DOOR OPERATORS
- B. Electrical: Division 26, ELECTRICAL.
- C. Card Readers: Section 28 13 00, PHYSICAL ACCESS CONTROL SYSTEMS.
- D. Fire Detection: Section 28 31 00, FIRE DETECTION AND ALARM.

1.4 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.

1.5 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:

Hardware Item	Quantity	Size	Reference Publication Type No.	Finish	Mfr. Name and Catalog No.	Key Control Symbols	UL Mark (if fire rated and listed)	ANSI/BHMA Finish Designation

C. Samples and Manufacturers' Literature:

1. Samples: All hardware items (proposed for the project) that have not been previously approved by Builders Hardware Manufacturers Association shall be submitted for approval. Tag and mark all items with manufacturer's name, catalog number and project number.
2. Samples are not required for hardware listed in the specifications by manufacturer's catalog number, if the contractor proposes to use the manufacturer's product specified.

D. Certificate of Compliance and Test Reports: Submit certificates that hardware conforms to the requirements specified herein. Certificates shall be accompanied by copies of reports as referenced. The testing shall have been conducted either in the manufacturer's plant and certified by an independent testing laboratory or conducted in an independent laboratory, within four years of submittal of reports for approval.

1.7 DELIVERY AND MARKING

- A. Deliver items of hardware to job site in their original containers, complete with necessary appurtenances including screws, keys, and instructions. Tag one of each different item of hardware and deliver to COR for reference purposes. Tag shall identify items by Project Specification number and manufacturer's catalog number. These items shall remain on file in COR's office until all other similar items have been installed in project, at which time the COR will deliver items on file to Contractor for installation in predetermined locations on the project.

1.8 PREINSTALLATION MEETING

- A. Convene a pre-installation 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 by the VA Locksmith. Provide removable core cylinders that are removable only with a special key or tool without disassembly of knob or lockset. Cylinders shall be 7 pin type. Keying information shall be furnished at a later date by the COR.

1.10 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. In text, hardware items are referred to by series, types, listed in such specifications and standards, except as otherwise specified.

B. American Society for Testing and Materials (ASTM)

E2180-07 Standard Test Method for Determining the Activity of
Incorporated Antimicrobial Agent(s) In Polymeric or
Hydrophobic Materials

C. American National Standards Institute/Builders Hardware Manufacturers Association
(ANSI/BHMA)

A156.1-06 Butts and Hinges
A156.3-08 Exit Devices, Coordinators, and Auto Flush Bolts
A156.4-08 Door Controls (Closers)
A156.5-01 Auxiliary Locks and Associated Products
A156.6-05 Architectural Door Trim
A156.8-05 Door Controls-Overhead Stops and Holders
A156.12-05 Interconnected Locks and Latches
A156.13-05 Mortise Locks and Latches Series 1000
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)

Building Materials Directory (2008)

PART 2 - PRODUCTS

2.1 BUTT HINGES

- A. ANSI A156.1. Provide five-knuckle hinges. The following types of butt hinges shall be used for the types of doors listed, except where otherwise specified:
 - 1. 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, 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.

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 Hinges for Fire-Rated Assemblies: Stainless steel.
 - 3. Provide with non-removable pin (hospital tip option) at lockable outswing doors.
 - 4. Where required to clear adjacent casing, trim, and wall conditions and allow full door swing, provide wide throw hinges of minimum width required.

5. Provide with manufacturer's cut-outs for separate mortised power transfers and/or mortised automatic door bottoms where they occur.
6. Where thru-wire power transfers are integral to the hinge, provide hinge with easily removable portion to allow easy access to wiring connections.
7. 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 FLOOR PIVOT SETS

- A. Comply with ANSI A156.4. Provide stainless steel floor plates for floor pivots, except where metal thresholds occur. Pivots for non-labeled doors shall be cast, forged or extruded brass or bronze.

2.4 DOOR CLOSING DEVICES

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

2.5 OVERHEAD CLOSERS

- A. Conform to ANSI A156.4, Grade 1.
- B. Closers shall conform to the following:
 1. The closer shall have minimum 50 percent adjustable closing force over minimum value for that closer and have adjustable hydraulic back check effective between 60 degrees and 85 degrees of door opening.
 2. Where specified, closer shall have hold-open feature.
 3. Size Requirements: Provide multi-size closers, sizes 1 through 6, except where multi-size closer is not available for the required application.
 4. Material of closer body shall be forged or cast.
 5. Arm and brackets for closers shall be steel, malleable iron or high strength ductile cast iron.
 6. Where closers are exposed to the exterior or are mounted in rooms that experience high humidity, provide closer body and arm assembly of stainless steel material.
 7. Closers shall have full size metal cover; plastic covers will not be accepted.
 8. Closers shall have adjustable hydraulic back-check, separate valves for closing and latching speed, adjustable back-check positioning valve, and adjustable delayed action valve.

9. Provide closers with any accessories required for the mounting application, including (but not limited to) drop plates, special soffit plates, spacers for heavy-duty parallel arm fifth screws, bull-nose or other regular arm brackets, longer or shorter arm assemblies, and special factory templating. Provide special arms, drop plates, and templating as needed to allow mounting at doors with overhead stops and/or holders.
10. Closer arms or backcheck valve shall not be used to stop the door from overswing, except in applications where a separate wall, floor, or overhead stop cannot be used.
11. Provide parallel arm closers with heavy duty rigid arm.
12. Where closers are to be installed on the push side of the door, provide parallel arm type except where conditions require use of top jamb arm.
13. Provide all surface closers with the same body attachment screw pattern for ease of replacement and maintenance.
14. All closers shall have a 1 ½" (38mm) minimum piston diameter.

2.6 DOOR STOPS

- A. Conform to ANSI A156.16.
- B. Provide door stops wherever an opened door or any item of hardware thereon would strike a wall, column, equipment or other parts of building construction. For concrete, masonry or quarry tile construction, use lead expansion shields for mounting door stops.
- C. Where cylindrical locks with turn pieces or pushbuttons occur, equip wall bumpers Type L02251 (rubber pads having concave face) to receive turn piece or button.
- D. Provide 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.
- E. Omit stops where floor mounted door holders are required and where automatic operated doors occur.
- F. Provide appropriate roller bumper for each set of doors (except where closet doors occur) where two doors would interfere with each other in swinging.
- G. Provide appropriate door mounted stop on doors in individual toilets where floor or wall mounted stops cannot be used.
- H. Provide overhead surface applied stop Type C02541, ANSI A156.8 on patient toilet doors in bedrooms where toilet door could come in contact with the bedroom door.
- I. 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.

- J. 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 LOCKS AND LATCHES

- A. Conform to ANSI A156.2. Locks and latches for doors 45 mm (1-3/4 inch) thick or over shall have beveled fronts. Lock cylinders shall have not less than seven pins. Cylinders for all locksets shall be removable core type. Cylinders shall be furnished with construction removable cores and construction master keys. Cylinder shall be removable by special key or tool. Construct all cores so that they will be interchangeable into the core housings of all mortise locks, rim locks, cylindrical locks, and any other type lock included in the Great Grand Master Key System. Disassembly of lever or lockset shall not be required to remove core from lockset. All locksets or latches on double doors with fire label shall have latch bolt with 19 mm (3/4 inch) throw, unless shorter throw allowed by the door manufacturer's fire label. Provide temporary keying device or construction core of allow opening and closing during construction and prior to the installation of final cores.
- B. In addition to above requirements, locks and latches shall comply with following requirements:
 - 1. Mortise Lock and Latch Sets: Conform to ANSI/BHMA A156.13. Mortise locksets shall be series 1000, minimum Grade 2.
 - a. 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 matching existing. No substitute lever material shall be accepted.
 - b. 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.
 - c. Lock function F02 shall be furnished with emergency tools/keys for emergency entrance.
 - d. 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. Auxiliary locks shall be as specified under hardware sets and conform to ANSI A156.5.
3. Locks on designated doors in Psychiatric (Mental Health) areas shall be provided with anti-ligature lever and rose. Locks shall be fabricated of wrought stainless steel.
4. Privacy locks in non-mental-health patient rooms shall have an inside thumbturn for privacy and an outside thumbturn for emergency entrance. Single occupancy patient privacy doors shall typically swing out; where such doors cannot swing out, provide center-pivoted doors with rescue hardware (see HW-2B).

2.9 PUSH-BUTTON COMBINATION LOCKS

- A. ANSI/BHMA A156.13, Grade 1. Battery operated pushbutton entry.
- B. Construction: Heavy duty mortise lock housing conforming to ANSI/BHMA A156.13, Grade 1. Lever handles and operating components in compliance with the UFAS and the ADA Accessibility Guidelines. Match lever handles of locks and latchsets on adjacent doors.
- C. Special Features: Key override to permit a master keyed security system and a pushbutton security code activated passage feature to allow access without using the entry code.

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. Holding Strength: 35 pounds.
- B. Delayed-Egress Locks: BHMA A156.24.
 1. Means of Egress Doors: Lock releases within 15 seconds after applying a force not more than 15 lbf (67 N) for not more than 3 seconds, as required by NFPA 101.
 2. Security Grade: Activated from secure side of door by initiating device.
 3. Movement Grade: Activated by door movement as initiating device.
 4. The lock housing shall not project more than 4-inches (101mm) from the underside of the frame head stop.

2.11 ELECTRIC STRIKES

- A. ANSI/ BHMA A156.31 Grade 1.
- B. General: Use fail-secure electric strikes at fire-rated doors.

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

- B. Psychiatric keys shall be cut so that first two bittings closest to the key shoulder are shallow to provide greater strength at point of greatest torque.

2.13 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 where specified. Kick plates shall be 254 mm (10 inches) or 305 mm (12 inches) high. Provide kick 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 plates to within 6 mm (1/4 inch) of each edge of doors. Kick plates shall butt astragals. For jamb stop requirements, see specification sections pertaining to door frames.
 - 3. Kick 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. Provide stainless steel edge guards where so specified at wood doors. Provide mortised type instead of surface type except where door construction and/or ratings will not allow. Provide edge guards of bevel and thickness to match wood door. Provide edge guards with factory cut-outs for door hardware that must be installed through or extend through the edge guard. Provide full-height edge guards except where door rating does not allow; in such cases, provide edge guards to height of bottom of typical lockset armor front. Forward edge guards to wood door manufacturer for factory installation on doors.

2.14 EXIT DEVICES

- A. Conform to ANSI Standard A156.3. Exit devices shall be Grade 1; type and function are specified in hardware sets. Provide flush with finished floor strikes for vertical rod exit devices in interior of building. Trim shall have cast satin stainless steel lever handles of design similar to locksets, unless otherwise specified. Provide key cylinders for keyed operating trim and, where specified, cylinder dogging.
- B. Surface vertical rod panics shall only be provided less bottom rod; provide fire pins as required by exit device and door fire labels. Do not provide surface vertical rod panics at exterior doors.
- C. Concealed vertical rod panics shall be provided less bottom rod at interior doors, unless lockable or otherwise specified; provide fire pins as required by exit device and door fire labels. Where concealed vertical rod panics are specified at exterior doors, provide with both top and bottom rods.
- D. Where removable mullions are specified at pairs with rim panic devices, provide mullion with key-removable feature.
- E. At non-rated openings with panic hardware, provide panic hardware with key cylinder dogging feature.
- F. Exit devices for fire doors shall comply with Underwriters Laboratories, Inc., requirements for Fire Exit Hardware. Submit proof of compliance.

2.15 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.

2.16 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.

2.17 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.

2.18 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.

2.19 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.

2.20 THRESHOLDS

- A. Conform to ANSI A156.21, mill finish extruded aluminum, except as otherwise specified. In existing construction, thresholds shall be installed in a bed of sealant with ¼-20 stainless steel machine screws and expansion shields. In new construction, embed aluminum anchors coated with epoxy in concrete to secure thresholds. Furnish thresholds for the full width of the openings.
- B. For thresholds at elevators entrances see other sections of specifications.
- C. At exterior doors and any interior doors exposed to moisture, provide threshold with non-slip abrasive finish.
- D. Provide with miter returns where threshold extends more than 12 mm (0.5 inch) from frame face.

2.21 AUTOMATIC DOOR BOTTOM SEAL AND RUBBER GASKET

- 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).

2.22 DOOR GASKETING

- A. Provide continuous weatherseal on exterior doors and smoke, light, or sound seals on interior doors where indicated or scheduled. Provide intumescent seals as required to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies. Provide only those units where resilient or flexible seal strip is easily replaceable and readily available from stocks maintained by manufacturer.
- B. Conform to ANSI A156.22. Air leakage shall not to exceed 0.50 CFM per foot of crack length (0.000774m³/s/m).

2.23 MISCELLANEOUS HARDWARE

- A. Access Doors (including Sheet Metal, Screen and Woven Wire Mesh Types): Except for fire-rated doors and doors to Temperature Control Cabinets, equip each single or double metal access door with Lock Type E76213, conforming to ANSI A156.5. Key locks as directed. Ship lock prepaid to the door manufacturer. Hinges shall be provided by door manufacturer.

- B. Mutes: Conform to ANSI A156.16. Provide door mutes or door silencers Type L03011 or L03021, depending on frame material, of white or light gray color, on each steel or wood door frame, except at fire-rated frames, lead-lined frames and frames for sound-resistant, lightproof and electromagnetically shielded doors. Furnish 3 mutes for single doors and 2 mutes for each pair of doors, except double-acting doors. Provide 4 mutes or silencers for frames for each Dutch type door. Provide 2 mutes for each edge of sliding door which would contact door frame.

2.24 FINISHES

- A. Exposed surfaces of hardware shall have ANSI A156.18, finishes as specified below. Finishes on all hinges, pivots, closers, thresholds, 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. Hardware Finishes for Existing Buildings: U.S. Standard finishes shall match finishes of hardware in (similar) existing spaces.
- E. Anti-microbial Coating: All hand-operated hardware (levers, pulls, push bars, push plates, paddles, and panic bars) shall be provided with an anti-microbial/anti-fungal coating that has passed ASTM E2180 tests. Coating to consist of ionic silver (Ag+). Silver ions surround bacterial cells, inhibiting growth of bacteria, mold, and mildew by blockading food and respiration supplies.

2.25 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 existing buildings locate hardware on doors at heights to match existing hardware. The Contractor shall visit the site, verify location of existing hardware and submit locations to VA COR for approval.
- B. 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:
- C. 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 except security bedroom, bathroom and anteroom doors which shall have closer installed parallel arm on exterior side of doors. At exterior doors, closers shall be mounted on interior side. Where closers are mounted on doors they shall be mounted with sex nuts and bolts; foot shall be fastened to frame with machine screws.
- B. Hinge Size Requirements:

Door Thickness	Door Width	Hinge Height
45 mm (1-3/4 inch)	900 mm (3 feet) and less	113 mm (4-1/2 inches)
45 mm (1-3/4 inch)	Over 900 mm (3 feet) but not more than 1200 mm (4 feet)	125 mm (5 inches)
35 mm (1-3/8 inch) (hollow core wood doors)	Not over 1200 mm (4 feet)	113 mm (4-1/2 inches)

- C. Hinge leaves shall be sufficiently wide to allow doors to swing clear of door frame trim and surrounding conditions.
- D. Where new hinges are specified for new doors in existing frames or existing doors in new frames, sizes of new hinges shall match sizes of existing hinges; or, contractor may reuse existing hinges provided hinges are restored to satisfactory operating condition as approved by COR. Existing hinges shall not be reused on door openings having new doors and new frames. Coordinate preparation for hinge cut-outs and screw-hole locations on doors and frames.

- E. Hinges Required Per Door:

Doors 1500 mm (5 ft) or less in height	2 butts
Doors over 1500 mm (5 ft) high and not over 2280 mm (7 ft 6 in) high	3 butts
Doors over 2280 mm (7 feet 6 inches) high	4 butts
Dutch type doors	4 butts
Doors with spring hinges 1370 mm (4 feet 6 inches) high or less	2 butts
Doors with spring hinges over 1370 mm (4 feet 6 inches)	3 butts

- F. Fastenings: Suitable size and type and shall harmonize with hardware as to material and finish. Provide machine screws and lead expansion shields to secure hardware to concrete, ceramic or quarry floor tile, or solid masonry. Fiber or rawl plugs and adhesives are not permitted. All fastenings exposed to weather shall be of nonferrous metal. At designated doors in Psychiatric (Mental Health) areas provide tamper-resistant fasteners.
- G. After locks have been installed; show in presence of COR 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 COR 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 COR 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 COR and VA Locksmith.

3.5 HARDWARE SETS

- A. Following sets of hardware correspond to hardware symbols shown on drawings.

HDW SET # 1

- 1 CONTINUOUS HINGE
- 1 PASSAGE LATCH SET (F01)
- 1 WALL STOP
- 2 SS ARMOR PLATE

HDW SET # 2

- 3 BB HINGES 4.5"
- 1 PASSAGE LATCH SET (F01)
- 1 WALL STOP
- 2 SS KICK PLATE (NO KICK PLATES AT OPENING 1903A.1)

HDW SET #3

- 3 BB HINGES 4.5"
- 1 PRIVACY LOCKSET (F19) W/ INDICATOR
- 1 WALL STOP
- 2 SS KICK PLATE

HDW SET # 4

- 1 PR DOUBLE ACTING PIVOTS
- 1 EMERGENCY STRIKE/STOP
- 1 PRIVACY LOCKSET (F19) W/ INDICATOR
- 1 WALL STOP
- 2 SS KICK PLATE

HDW SET # 5

- 1 PR DOUBLE ACTING PIVOTS
- 1 PRIVACY LOCKSET (STANLEY SPSL OR EQUAL)
- 1 EMERGENCY STRIKE/STOP
- 1 WALL STOP
- 2 SS KICK PLATE
- 1 DOOR SENSOR ASSEMBLY, KEYSWITCH AND STROBE LIGHT (STANLEY SEDA OR EQUAL)

HDW SET # 6

- 3 BB HINGES 4.5"
- 1 LOCKSET (FO4)
- 1 CLOSER
- 1 WALL STOP
- 2 SS KICK PLATE

HDW SET # 6A

- 3 BB HINGES 4.5"
- 1 LOCKSET (FO4)
- 1 CLOSER
- 1 WALL STOP
- 2 SS KICK PLATE
- 1 SMOKE SEAL

HDW SET # 7

- 3 BB HINGES 4.5"
- 1 LOCKSET (F07)
- 1 CLOSER
- 1 WALL STOP
- 2 SS KICK PLATE

HDW SET # 7A

- 3 BB HINGES 4.5"
- 1 LOCKSET (F07)
- 1 CLOSER
- 1 WALL STOP
- 2 SS KICK PLATE
- 1 SMOKE SEAL

HDW SET # 8

- 1 CONTINUOUS HINGE
- 1 LOCKSET (F07)
- 1 CLOSER
- 1 WALL STOP
- 2 SS KICK PLATE
- 1 SMOKE SEAL

HDW SET # 9

- 3 BB HINGES 4.5"
- 1 KEYPAD CYL LOCKSET (DL2800 OR EQUAL)
- 1 CLOSER
- 1 SS ARMOR PLATE - PUSH SIDE
- 1 WALL STOP

HDW SET # 9A

- 3 BB HINGES 4.5"
- 1 KEYPAD CYLINDER LOCKSET (DL2800 OR EQUAL)
- 1 CLOSER
- 1 SS ARMOR PLATE - PUSH SIDE
- 1 WALL STOP
- 1 SMOKE SEALS

HDW SET # 10

- 6 BB HINGES 4.5"
- 1 KEYPAD CYLINDER LOCKSET (DL2800 OR EQUAL)
- 1 PR. MANUAL FLUSH BOLTS
- 2 SS ARMOR PLATE - PUSH SIDE

HDW SET # 11

- 2 CONTINUOUS HINGE
- 1 PASSAGE SET (FO1)
- 1 PR. MANUAL FLUSH BOLTS
- 1 WALL STOP
- 4 SS KICK PLATE

HDW SET # 12 – NOT USED

HDW SET # 13 – NOT USED

HDW SET # 14

- 1 CONTINUOUS HINGE
- 1 LOCKSET (F07)
- 1 CLOSER
- 1 SS ARMOR PLATE - PUSH SIDE
- 1 THRESHOLD
- 1 DOOR SWEEP
- 1 WEATHERSTRIP
- 1 OVERHEAD RAIN DRIP

HDW SET # 15

- 8 BB HINGES 5" HW
- 1 LOCKSET (F07)
- 1 PR MANUAL FLUSH BOLTS
- 2 CLOSER/HOLDOPENS
- 2 SS ARMOR PLATE - PUSH SIDE
- 1 COORDINATOR
- 1 ASTRAGAL
- 1 THRESHOLD
- 1 WEATHER STRIPPING
- 2 DOOR SWEEPS
- 1 OVERHEAD RAIN DRIP
- 1 LATCH GUARD

HDW SET # 16 – NOT USED

HDW SET # 17 – NOT USED

HDW SET # 18 – NOT USED

HDW SET # 19

- 3 BB HINGES 4.5"
- 1 KEYPAD CYL LOCKSET (DL2800 OR EQUAL)
- 1 CLOSER
- 1 WALL STOP
- 2 SS KICK PLATE

HDW SET # 20

- 3 BB HINGES 4.5"
- 1 RIM PANIC DEVICE
- 1 KEYED LEVER TRIM
- 1 DOOR/FRAME MONITOR SWITCH
- 1 CLOSER
- 2 SS KICK PLATE
- 1 THRESHOLD
- 1 DOOR SWEEP
- 1 WEATHER STRIP
- 1 OVERHEAD RAIN DRIP EDGE
- 1 LATCH GUARD

HDW SET # 21

- 2 BB HINGES 4.5"
- 1 ELECTRIFIED BB HINGE (CENTER) 4.5"
- 1 DELAYED EGRESS RIM PANIC DEVICE
- 1 KEYED LEVER TRIM
- 1 CLOSER
- 2 SS KICK PLATE
- 1 SMOKE SEAL

HDW SET # 22

- 2 CONTINUOUS HINGES
- 2 PUSH PLATES
- 2 PULL PLATES
- 4 SS ARMOR PLATES
- 2 EDGE GUARDS
- 2 HINGE GUARDS
- 1 DUAL AUTO OPERATOR (DE)
- 2 MOTION FOR EXIT SENSORS
- 1 CARD READER
- 1 REQUEST TO EXIT SWITCH
- 2 MAG LOCKS
- 1 SMOKE SEAL – PROVIDE AT OPENINGS CC196.1

HDW SET # 23

- 2 CONTINUOUS HINGES
- 2 PUSH PLATES
- 2 PULL PLATES
- 4 SS ARMOR PLATES
- 2 EDGE GUARDS
- 2 HINGE GUARDS
- 1 AUTO OPERATOR (PR)
- 2 MOTION FOR EXIT SENSORS
- 1 CARD READER
- 1 REQUEST TO EXIT SWITCH
- 2 MAG LOCKS

HDW SET # 24

- 6 BB HINGE 4.5"
- 2 PUSH PLATES
- 2 PULL PLATES
- 1 AUTO OPERATOR (PR)
- 2 MOTION FOR EXIT SENSORS
- 1 THRESHOLD
- 2 DOOR SWEEPS
- 1 WEATHERSTRIP

HDW SET # 25

- 6 BB HINGES 4.5"
- 2 SURFACE VERTICAL ROD EXIT DEVICES
- 2 KEYED LEVER TRIM
- 2 DUST STRIKES
- 2 HOLD OPEN/CLOSERS
- 1 SMOKE SEAL

OPERATIONAL NARRATIVE – HOLD OPEN CLOSET TO TIE TO FIRE ALARM SYSTEM, HOLD OPENS TO RELEASE IF ALARM IS ACTIVATED.

HDW SET # 26

- 3 BB HINGES 4.5"
- 1 KEYPAD CYL LOCKSET (DL2800 OR EQUAL)
- 1 CLOSER
- 1 SS KICK PLATES
- 1 WALL STOP

HDW SET # 27

- 1 CONTINUOUS HINGE – ELECTRIFIED POWER TRANSFER
- 1 PASSAGE LATCHSET (STANLEY SPSL OR EQUAL)
- 1 MAG LOCK
- 1 WALL STOP
- 2 SS ARMOR PLATES
- 1 DOOR SENSOR ASSEMBLY, KEYSWITCH AND STROBE LIGHT (STANLEY SEDA OR EQUAL)

OPERATIONAL NARRATIVE – PROVIDE SWITCH WITH INDICATOR LIGHT TO ACTIVATE MAGNETIC LOCK. TIE TO FIRE ALARM SYSTEM, FAILSAFE CONDITION IF ALARM IS ACTIVATED.

HDW SET # 28

- 6 BB HINGES 4.5"
- 1 RIM EXIT DEVICE
- 1 SURFACE FLUSH BOLT SET
- 2 CLOSERS
- 1 SMOKE SEAL

HDW SET # 29

- 3 BB HINGES 4.5"
- 1 RIM PANIC DEVICE
- 1 KEYED LEVER TRIM
- 1 CLOSER
- 1 SMOKE SEAL

HDW SET # 30

- 1 CONTINUOUS HINGE
- 1 LOCKSET (F07) LEVEL 3 BALLISTICS RATED
- 1 CARD READER
- 1 ELECTRIC STRIKE
- 1 CLOSER
- 1 SS KICK PLATE

HDW SET # 31

HARDWARE BY DOOR SUPPLIER

DOOR SENSOR SYSTEM

PROVIDE CONSOLE, CONTROLLER, AND POWER SUPPLY(S) FOR A COMPLETE SYSTEM

END OF SECTION 08 71 00

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 interior swing doors.

1.2 RELATED WORK

- A. Hollow metal doors and frames: Section 08 11 13, HOLLOW METAL DOORS AND FRAMES.
- B. Interior wood doors: Section 08 14 00, INTERIOR WOOD DOORS.
- C. Door hardware; Section 08 71 00, DOOR HARDWARE.
- D. Electric general wiring, connections and equipment requirements; Division 26, ELECTRICAL.
- E. Card readers: Section 28 13 00, PHYSICAL ACCESS CONTROL SYSTEMS.
- F. Interface with fire alarm system: 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 MAINTENANCE MANUALS

- A. In accordance with Section 01 00 00, GENERAL REQUIREMENTS Article titled "INSTRUCTIONS", furnish maintenance manuals and instructions on automatic door operators.

1.5 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.

1.6 DESIGN CRITERIA

- A. As a minimum automatic door equipment shall comply with the requirements of BHMA 156.10. Except as otherwise noted on drawings, provide operators which will move the doors from the fully closed to fully opened position in three seconds maximum time interval, when speed adjustment is at maximum setting.
- B. Equipment: Conforming to UL 325. Provide key operated power disconnect wall switch for each door installation.
- C. Electrical Wiring, Connections and Equipment: Provide all motor, starter, controls, associated devices, and interconnecting wiring required for the installation. Equipment and wiring shall be as specified in Division 26, ELECTRICAL.

1.7 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. 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

1.8 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 MICROPROCESSOR CONTROLS

- A. The system shall include a multi-function microprocessor control providing adjustable hold open time (1–30 seconds), LED indications for sensor input signals and operator status and power assist close options. Control shall be capable of receiving activation signals from any device with normally open dry contact output. All activation modes shall provide fully adjustable opening speed:
- B. The door shall be held open by low voltage applied to the continuous duty motor. The control shall include an adjustable safety circuit that monitors door operation and stops the opening direction of the door if an obstruction is sensed. The motor shall include a recycle feature that reopens the door if an obstruction is sensed at any point during the closing cycle. The control shall include a standard three position key switch with functions for ON, OFF, and HOLD OPEN, mounted on operator enclosure, door frame, or wall, as indicated in the architectural drawings.

2.3 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 (1/2-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. 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.
- C. Time delay switches shall be adjustable between 3 to 60 seconds and shall control closing cycle of doors.
- D. Decals with sign "In" or "Do Not Enter" shall be installed on both faces of each door 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 of traffic (pedestrians, carts, stretchers and wheelchairs) expected to pass through doors. Each door leaf of pairs of doors shall open and close in synchronization. On pairs of doors, operators shall allow either door to be opened manually without the other door opening.
- D. Install controls at positions shown and make them convenient for particular traffic expected to pass through openings. Maximum height of push plate wall switches from finished floors shall be 40 inches unless otherwise approved by the COR.

3.2 INSTRUCTIONS

- A. Following the installation and final adjustments of the door operators, the installer shall fully instruct VA personnel on the operating, servicing and safety requirements for the swing automatic door operators.
- B. Coordinate instruction to VA personnel with COR.

END OF SECTION 08 71 13

SECTION 08 80 00 - GLAZING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies glass, related glazing materials and accessories. Glazing products specified apply to factory and field glazed items.
- B. Glazing products include:
 - 1. Heat-strengthened glazing.
 - 2. Tempered glazing.
 - 3. Coated glazing.
 - a. Low-emissivity.
 - b. Ceramic coated spandrel.
 - 4. Fire resistant glazing.
 - 5. Ballistic resistant glazing.
- C. Glazing systems include:
 - 1. Insulated glazing.
 - 2. Integral blind glazing.
 - 3. Sliding glass systems.

1.2 RELATED WORK

- A. Hollow metal doors and borrowed lites: Section 08 11 13, HOLLOW METAL DOORS AND FRAMES
- B. Interior wood doors: Section 08 14 00, INTERIOR WOOD DOORS.
- C. Exterior and interior aluminum-framed storefront systems: Section 08 41 13, ALUMINUM-FRAMED STOREFRONT SYSTEMS.
- D. Factory glazed by manufacturer in following units:
 - 1. Ballistic Resistance (BR) rated door glazing and frames: 08 34 53 SECURITY DOORS AND FRAMES.
 - 2. Automatic Entrances: Section 08 42 29, AUTOMATIC ENTRANCES.
 - 3. ICU/CCU Entrances: Section 08 42 43, INTENSIVE CARE UNIT – CRITICAL CARE UNIT (ICU-CCU) ENTRANCES.

4. Aluminum Windows: Section 08 51 13, ALUMINUM WINDOWS.
5. Ballistic Resistance (BR) rated window glazing and frames: Section 08 56 53 BALLISTIC RESISTANT WINDOWS.

1.3 LABELS

A. Temporary labels:

1. Provide temporary label on each light of glass and plastic material 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 and plastic material is approved by COR.

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.
3. Ballistic resistance glass or plastic assemblies:
 - a. Ballistic resistance glass assemblies in accordance with UL 752 requirements for power rating specified.
 - b. Identify each security glazing permanently with glazing manufacturer's name, date of manufacture, product number, and DOS Code number inconspicuously located in lower corner on protective side and visible after glazing is framed.
 - c. The "attack (threat) side" shall be identified in bold lettering on each side of glazing with removable label.

1.4 PERFORMANCE REQUIREMENTS

A. Building Enclosure Vapor Retarder and Air Barrier:

1. Utilize the inner pane of multiple pane sealed units for the continuity of the air barrier and vapor retarder seal.
2. Maintain a continuous air barrier and vapor retarder throughout the glazed assembly from glass pane to heel bead of glazing sealant.

B. Glass Thickness:

1. Select thickness of exterior glass to withstand dead loads and wind loads acting normal to plane of glass at design pressures calculated in accordance with ASCE 7 code.
2. Test in accordance with ASTM E 1300.
3. Thicknesses listed are minimum. Coordinate thicknesses with framing system manufacturers.

C. Ballistic resistance glass assemblies:

1. For ballistic resistant windows follow Unified Facilities Criteria, DOD Minimum Antiterrorism Standards for Buildings UFC4-010-01.
2. Spall Resistance: Laminated glazing shall not produce spall to interior (protected side) when impacted with scheduled ballistics.
3. Tolerances:
 - a. Outside dimensions: Overall outside dimensions (height and width) of laminated security glazing shall maintain tolerance of ± 3 mm.
 - b. Warpage: Out-of-flat (warpage or bowing) condition of laminates shall not exceed 2.5 mm per lineal meter. The condition, if present, shall be localized to extent not greater than 0.75 mm for any 0.3 meter section.

1.5 SUBMITTALS

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

B. Manufacturer's Literature and Data:

1. Glass, each kind required.
2. Insulating glass units.
3. Elastic compound for metal sash glazing.
4. Glazing cushion.
5. Sealing compound.
6. Ballistics resistive material.
7. Manufacturer's certificates:
 - a. Certificates stating that wire glass, meets requirements for safety glazing material as specified in ANSI Z97.1.
 - b. Certificate on shading coefficient.
 - c. Certificate on "R" value when value is specified.
 - d. Certificate test reports confirming compliance's with specified bullet resistive rating.
 - e. Certificate that ballistics resistant glass meets the requirements of UFC4-010-01.

C. Samples:

1. Size: Minimum 150 mm by 150 mm (6 inches by 6 inches).
2. Fire resistant glazing.
3. Ballistics resistant glazing.
4. Insulating glass units (SEU): Each type.

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 thermoplastic elastomer (TPE) tape. Alternatively, continuous channel shaped extrusion of TPE 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 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
E1300-09 Determining Load Resistance of Glass in Buildings
E2190-08 Insulating Glass Unit

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- 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
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)
 - Glazing Manual (Latest Edition)
 - Sealant Manual (2008)
 - L. American Society of Civil Engineers (ASCE)
 - ASCE 7-10 Wind Load Provisions

PART 2 - PRODUCT

2.1 GLASS PRODUCTS

- A. General: Use thickness stated unless specified otherwise in assemblies.
- B. Clear Heat Strengthened Glass:
 - 1. ASTM C1048, Kind HS, Condition A, Type I, Class 1, Quality q3.
 - 2. Thickness: 6 mm (1/4 inch).

C. Clear Tempered Glass:

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

D. Low-E Heat Strengthened Glass:

1. ASTM C1048, Kind HS, Condition B, Type I, Class 1, Quality q3 with low emissivity pyrolytic coating.
 - a. Apply coating to second surface of insulating glass units.
2. Thickness: 6 mm (1/4 inch).

E. Low-E Tempered Glass:

1. ASTM C1048, Kind FT, Condition C, Type I, Class 1, Quality q3 with low emissivity pyrolytic coating.
 - a. Apply coating to second surface of insulating glass units.
2. Thickness: 6 mm (1/4 inch).

F. Ceramic Coated Spandrel Glass:

1. ASTM C1048, Kind HS, Condition B, Type I, Class 1, Quality q3 with ceramic coating applied over and fused into glass surface.
 - a. Apply coating to second surface.
 - b. Color to be selected from manufacturer's full range.
2. Thickness: 6 mm (1/4 inch).

2.2 FIRE RESISTANT GLASS

A. Fire resistant glass or glass assembly classified by UL in Building Materials Directory or other approved testing laboratory bearing permanent mark of classification.

B. Fire-Resistant Glass With Wire Mesh:

1. Fire-rated and impact safety-rated glazing composed of wired glass and surface-applied fire-rated film.
2. Wired Flat Glass: ASTM C1036, Type II, Class 1, Form 1, Pattern PI, Finish F1, Quality Q5, Mesh M1.
3. Thickness: 6 mm (1/4 inch) thick, unpolished.
4. Fire Rating: Ranging from 20 to 90 minutes, refer to drawings.
5. WireLiteNT; distributed by Technical Glass Products or equal.

C. Fire-Resistant Glass Without Wire Mesh:

1. Laminated fire-rated and impact safety-rated glass ceramic.
2. Thickness: 4.8 mm (3/16 inch) thick, unpolished.
3. Fire Rating: Ranging from 20 minutes to 3 hours, refer to drawings.
4. FireLitePlus; distributed by Technical Glass Product or equal.

2.3 LAMINATED GLAZING ASSEMBLIES

- A. Two or more lites of glass bonded with an interlayer material for use in building glazing
- B. Use 1.5 mm (0.060 inch) thick clear interlayer for:
1. Heat strengthened or fully tempered glass assemblies.
- C. Laminated Clear Tempered Glazing:
1. Both panes ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality q3.
 2. Thickness: Each pane 4.8 mm (3/16 inch) thick.

2.4 BULLET RESISTIVE ASSEMBLY

- A. Provide protection listed by UL ABPMED as bullet resisting, with a power rating of ballistic level in accordance with UL 752.
1. Use ASTM C1048, Kind HS, Condition A, Type I, Class 1, Quality q3, outer glass panes.
 2. Fabricate from Type I, Class 1, Quality q3 glass with polyvinyl butyral plastic interlayers between the layers of glass.
 3. Ballistics Level: UL 752 Level 3 Super Power (SPSA).

2.5 GLASS CLAD POLYCARBONATE SECURITY GLAZING ASSEMBLY

- A. Use 1.3 mm (0.050 inch) polyurethane sheeting for interlayer between glass and polycarbonate.
- B. Clear Heat Strengthened Glass Clad Polycarbonate.
1. Use ASTM C1048, Kind HS, Condition A, Type I, Class 1, Quality q3, outer glass panes.
 2. Use clear polycarbonate sheet, 3 mm (1/8 inch) thick core.
 3. Thickness, 11 mm (7/16 inch).

C. Clear Tempered Glass Clad Polycarbonate:

1. Use ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality q3, 3 mm (1/8 inch) thick outer glass panes.
2. Use clear polycarbonate sheet, 3 mm (1/8 inch) thick core.
3. Thickness, 11 mm (7/16 inch).

D. Maximum Allowable Area: Laminated glazing shall not exceed 1.32 meter square unless glazing has been certified.

2.6 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. Sealed Edge Units Makeup:

1. SEU-1 (Clear Heat Strengthened):

a. Outboard Lite:

- 1) Glass Type: Clear heat strengthened glass.
- 2) Coating: Low-E on #2 surface.
- 3) Nominal Thickness: 6 mm (1/4 inch).

b. Spacer:

- 1) Nominal Thickness: 13 mm (1/2 inch).
- 2) Gas Fill: Air.

c. Inboard Lite:

- 1) Glass Type: Clear heat strengthened glass.
- 2) Coating: N/A.
- 3) Nominal Thickness: 6 mm (1/4 inch).

2. SEU-2 (Clear Tempered):

a. Outboard Lite:

- 1) Glass Type: Clear tempered glass.
- 2) Coating: Low-E on #2 surface.
- 3) Nominal Thickness: 6 mm (1/4 inch).

b. Spacer:

- 1) Nominal Thickness: 13 mm (1/2 inch).

-
- 2) Gas Fill: Air.
 - c. Inboard Lite:
 - 1) Glass Type: Clear tempered glass.
 - 2) Coating: N/A.
 - 3) Nominal Thickness: 6 mm (1/4 inch).
 - 3. SEU-3 (Clear Low-E Spandrel):
 - a. Outboard Lite:
 - 1) Glass Type: Clear heat strengthened glass.
 - 2) Coating: Low-E on #2 surface.
 - 3) Nominal Thickness: 6 mm (1/4 inch).
 - b. Spacer:
 - 1) Nominal Thickness: 13 mm (1/2 inch).
 - 2) Gas Fill: Air.
 - c. Inboard Lite:
 - 1) Glass Type: Clear heat strengthened ceramic coated spandrel glass.
 - 2) Coating: Ceramic coating on #4 surface.
 - 3) Nominal Thickness: 6 mm (1/4 inch).
 - 4. SEU-4 (Clear Low-E Tempered Spandrel):
 - a. Outboard Lite
 - 1) Glass Type: Clear tempered Low-E coated.
 - 2) Coating: Pyrolytic Low-E on #2 Surface.
 - 3) Nominal Thickness: 6 mm (1/4 inch).
 - b. Spacer
 - 1) Nominal Thickness: 13 mm (1/2 inch).
 - 2) Gas Fill: Air.
 - c. Inboard Lite
 - 1) Glass Type: Clear tempered ceramic coated spandrel.
 - 2) Coating: Ceramic coating on #4 surface.
 - 3) Nominal Thickness: 6 mm (1/4 inch).

- C. Minimal Performance Characteristics (Center of Glass):
 - 1. Visible Transmittance: 74%
 - 2. Visible Reflectance: 17%
 - 3. Winter U-factor (U-value): 0.35
 - 4. Shading Coefficient (SC): 0.71
 - 5. Solar heat Gain Coefficient (SHGC): 0.62
- D. Glass shall be heat strengthened or tempered as required by codes, or as required to meet thermal stress and wind loads.
- E. 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.

2.7 INTEGRAL BLIND GLAZING (Denoted as "IBG" on the drawings)

- A. Description: Insulated or replaceable glass system with integral blind.
- B. Integral blind: The slats are aluminum alloy 6010-T8, size is 0.500" x .008" painted with a polyester UV resistant finish. The head rail and bottom rail profiles are 6063-T5 alloy painted in coordinated color with the slat. The internal mechanism has steel gears hardened on the surface and bearings to reduce friction.
 - 1. The blinds are supported within the insulated glass unit by sidetracks. These support the head rail and provide spacing between the blind and inside surface of the interior panes of glass.
 - 2. Operator: Manual, knob operator, tilt only. Single control, install unit with operator on corridor side.
 - 3. Color: To be selected from Manufacturer's full range.
- C. Glazing:
 - 1. Provide 1/4-inch clear tempered glass both sides of integral blind, unless otherwise noted.
 - 2. Provide 5/16-in thick (min. 1.5 mm interlayer) clear tempered laminated glass on the room-side lite at Psych Holding rooms.

2.8 SLIDING GLASS SYSTEM

- A. Aluminum track system for sliding glass doors:
 - 1. Surface mounted, lower track.
 - 2. Shoe with steel ball bearing rollers.
 - 3. Plastic or vinyl top guides.
 - 4. Upper double channel track.
 - 5. Track stops.

- 6. Edge finger pull.
- 7. Sliding glass door lock – tamper resistant ratchet bar, lock, cylinder and keys.
- B. Material: Extruded aluminum, clear satin anodized finish.
- C. Glazing: 1/4-inch clear tempered glass.

2.9 GLAZING ACCESSORIES

- A. As required to supplement the accessories provided with the items to be glazed and to provide a complete installation. Ferrous metal accessories exposed in the finished work shall have a finish that will not corrode or stain while in service.
- B. Setting Blocks: ASTM C864:
 - 1. Channel shape; having 6 mm (1/4 inch) internal depth.
 - 2. Shore a hardness of 80 to 90 Durometer.
 - 3. Block lengths: 50 mm (two inches) except 100 to 150 mm (four to six inches) for insulating glass.
 - 4. Block width: Approximately 1.6 mm (1/16 inch) less than the full width of the rabbet.
 - 5. Block thickness: Minimum 4.8 mm (3/16 inch). Thickness sized for rabbet depth as required.
- C. Spacers: ASTM C864:
 - 1. Channel shape having a 6 mm (1/4 inch) internal depth.
 - 2. Flanges not less 2.4 mm (3/32 inch) thick and web 3 mm (1/8 inch) thick.
 - 3. Lengths: One to 25 to 76 mm (one to three inches).
 - 4. Shore a hardness of 40 to 50 Durometer.
- D. Sealing Tapes:
 - 1. Semi-solid polymeric based material exhibiting pressure-sensitive adhesion and withstanding exposure to sunlight, moisture, heat, cold, and aging.
 - 2. Shape, size and degree of softness and strength suitable for use in glazing application to prevent water infiltration.
- E. Glazing Gaskets: ASTM C864:
 - 1. Firm dense wedge shape for locking in sash.
 - 2. Soft, closed cell with locking key for sash key.
 - 3. Flanges may terminate above the glazing-beads or terminate flush with top of beads.
- F. Lock-Strip Glazing Gaskets: ASTM C542, shape, size, and mounting as indicated.

- G. Glazing Sealants: ASTM C920, silicone neutral cure:
 - 1. Type S.
 - 2. Class 25
 - 3. Grade NS.
 - 4. Shore A hardness of 25 to 30 Durometer.
- H. 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.
- I. Color:
 - 1. Color of glazing compounds, gaskets, and sealants used for aluminum color frames shall match color of the finished aluminum and be nonstaining.
 - 2. Color of other glazing compounds, gaskets, and sealants which will be exposed in the finished work and unpainted shall be black, gray, or neutral color.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions:
 - 1. Examine openings for glass and glazing units; determine they are proper size; plumb; square; and level before installation is started.
 - 2. Verify that glazing openings conform with details, dimensions and tolerances indicated on manufacturer's approved shop drawings.
- B. Advise Contractor of conditions which may adversely affect glass and glazing unit installation, prior to commencement of installation: Do not proceed with installation until unsatisfactory conditions have been corrected.
- C. Verify that wash down of adjacent masonry is completed prior to erection of glass and glazing units to prevent damage to glass and glazing units by cleaning materials.

3.2 PREPARATION

- A. For sealant glazing, prepare glazing surfaces in accordance with GANA-02 Sealant Manual.
- B. Determine glazing unit size and edge clearances by measuring the actual unit to receive the glazing.

- C. Shop fabricate and cut glass with smooth, straight edges of full size required by openings to provide GANA recommended edge clearances.
- D. Verify that components used are compatible.
- E. Clean and dry glazing surfaces.
- F. Prime surfaces scheduled to receive sealants, as determined by preconstruction sealant-substrate testing.

3.3 INSTALLATION - GENERAL

- A. Install in accordance with GANA-01 Glazing Manual and GANA-02 Sealant Manual unless specified otherwise.
- B. Glaze in accordance with recommendations of glazing and framing manufacturers, and as required to meet the Performance Test Requirements specified in other applicable sections of specifications.
- C. Set glazing without bending, twisting, or forcing of units.
- D. Do not allow glass to rest on or contact any framing member.
- E. Glaze doors and operable sash, in a securely fixed or closed and locked position, until sealant, glazing compound, or putty has thoroughly set.
- F. Tempered glass: Install with roller distortions in horizontal position unless otherwise directed.
- G. Plastic:
 - 1. Use dry glazing method.
 - 2. Use only neoprene or EPDM gaskets.
- 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.

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.

K. Ballistics Resistant Glazing:

1. Glaze as recommended by manufacturer, using glazing material which will permit expansion and contraction of the bullet resistive material in the frame.

L. Sliding Glass System:

1. Set upper channel into interior aluminum storefront glazing channel.
2. Mount lower track to countertop with tamper-resistant fasteners.
3. Set stops for fixed units.

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

- A. Cut glazing spline to length; install on glazing pane. Seal corners by butting and sealing junctions with butyl sealant.
- B. Place setting blocks at 1/4 points with edge block no more than 150 mm (6 inches) from corners.
- C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.
- D. Install removable stops without displacing glazing spline. Exert pressure for full continuous contact.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Trim protruding tape edge.

3.5 REPLACEMENT AND CLEANING

- A. Clean new glass surfaces removing temporary labels, paint spots, and defacement after approval by COR.
- B. Replace cracked, broken, and imperfect glass, or glass which has been installed improperly.
- C. Leave glass, putty, and other setting material in clean, whole, and acceptable condition.

3.6 PROTECTION

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

3.7 GLAZING SCHEDULE

- A. General: Refer to drawings for glazing types and locations.
- B. Fire Resistant Glass:
 - 1. Install clear wire glass in interior fire rated or labeled doors and windows.
- C. Tempered Glass:
 - 1. Install in glazed doors unless indicated otherwise.
 - 2. Install in curtain wall, storefront, windows, and door sidelights adjacent to doors.
- D. Integral Blind Glazing:
 - 1. Install units at Observation, Exam, Isolation and Psych Holding room doors and observation windows as indicated on the drawings.
 - 2. Install units with operator on corridor side.
- E. Bullet Resisting Assembly: Install specified assembly in windows at the Security Office.
- F. Spandrel Glass: Install specified spandrel glazing where indicated.

END OF SECTION 08 80 00

SECTION 08 90 00 - LOUVERS AND VENTS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies fixed architectural exterior wall louvers.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings:
 - 1. Each type, showing material, finish, size of members, method of assembly, and installation and anchorage details.
- C. Manufacturer's Literature and Data:
 - 1. Each type of louver and vent.

1.3 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. The Master Painters Institute (MPI)
Approved Product List – September 2011
- C. American Society for Testing and Materials (ASTM)
B209/B209M-03(R2007) Aluminum and Aluminum Alloy, Sheet and Plate
B221-08 Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire,
Shapes, and Tubes
B221M-07 Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire
Shapes, and Tubes
- D. National Association of Architectural Metal Manufacturers (NAAMM)
AMP 500-06 Metal Finishes Manual

- E. National Fire Protection Association (NFPA)
90A-09 Installation of Air Conditioning and Ventilating Systems
- F. American Architectural Manufacturers Association (AAMA)
2605-11 High Performance Organic Coatings on Architectural
Extrusions and Panels
- G. Air Movement and Control Association, Inc. (AMCA)
500-L-07 Testing Louvers

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum, Extruded: ASTM B221/B221M.
- B. Aluminum, Plate and Sheet: ASTM B209/B209M.
- C. 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.

2.2 EXTERIOR WALL LOUVERS

- A. General:
 - 1. Provide fixed type louvers of size and design shown on the drawings.
 - 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. AMCA Performance: A 4' x 4' unit shall conform to the following and be licensed to bear the AMCA seal:
 - a. Free Area 8.34 sq. ft. (0.755 sq. m.)
 - b. Free area velocity at the point of beginning water penetration 1250 FPM (381 m/min)
 - c. Intake Pressure drop at the point of beginning water penetration 0.24 in. H₂O (6.09 mm)
 - d. Exhaust Pressure drop at the point of beginning water penetration 0.16 in. H₂O (4.06 mm)
2. Wind Load: Louver design shall limit span between visible mullions to 3 m (10 feet) and shall incorporate structural supports required to withstand a windload of .96 kPa (20 lbs. per sq. ft.), equivalent of a 145 KPH (90 mph) wind.
3. 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 6063-T5 aluminum.
2. Frame depth: 152 mm (6 inches).
 - a. 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.
3. Blades: Fixed drainable type, positioned at 37-1/2 degree, spaced approximately 150 mm 152 mm (6 inches) center to center.

2.3 CLOSURE ANGLES AND CLOSURE PLATES

- A. Fabricate from 2 mm (0.074-inch) thick 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 LOUVER SCREENS

- A. General: Provide screen at each exterior louver.
 - 1. Screen Location for Fixed Louvers: Interior face.
 - 2. Screening Type: Bird screening.
- B. Louver Screen Frames: Same type and form of metal as indicated for louver to which screens are attached.
- C. Louver Screening for Aluminum Louvers:
 - 1. Bird Screening: Flattened, expanded aluminum, 19 by 1.27 mm (3/4 by 0.050 inch) thick.

2.5 FINISH

- A. In accordance with NAAMM Metal Finishes Manual: AMP 500-505
 - 1. High-Performance Organic Finish: 3-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.
 - a. Color: To be selected from the manufacturer's standard colors.

2.6 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. Generally, set wall louvers in masonry walls during progress of the work. If wall louvers and vents are not delivered to job in time for installation in prepared openings, make provision for later installation. Set in cast-in-place concrete in prepared openings.

3.2 CLEANING AND ADJUSTING

- A. After installation, all exposed prefinished and plated items and all items fabricated from stainless steel and aluminum shall be cleaned as recommended by the manufacturer and protected from damage until completion of the project.

END OF SECTION 08 90 00

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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 or other building boards.

1.2 RELATED WORK

- A. Load bearing and exterior framing: Section 05 40 00, COLD-FORMED METAL FRAMING.
- B. Support for wall mounted items:
 - 1. Section 05 50 00, METAL FABRICATIONS.
 - 2. Section 06 10 00, ROUGH CARPENTRY.
- C. Ceiling suspension systems for acoustical tile or panels and lay in gypsum board panels:
 - 1. Section 09 51 00, ACOUSTICAL CEILINGS.
 - 2. 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. Gypsum board ceiling suspension systems.
3. Shaft wall framing.
4. Furring channels.
5. Channels (rolled steel).

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, minimum 20 gauge, 0.8 mm (0.0329-inch) thick bare metal (33 mil). Provide thickness appropriate to spacing, load, deflection and limiting heights per manufacturer's recommendations.
 - 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. Provide 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. Slip-Type Head Joints: Where indicated, provide one of the following in thickness not less than indicated for studs and in width to accommodate depth of studs:
 - 1. Single Long-Leg Runner System: ASTM C 645 top runner with 51-mm- (2-inch-) deep flanges, installed with studs friction fit into top runner and with continuous bridging located within 305 mm (12 inches) of the top of studs to provide lateral bracing.
 - 2. Double-Runner System: ASTM C 645 top runners, inside runner with 51-mm- (2-inch-) deep flanges and fastened to studs, and outer runner sized to friction fit inside runner.
 - 3. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes due to deflection of structure above.
- F. Firestop Tracks: Manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
- G. 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 25 gauge, 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 25 gauge, 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 SUSPENDED CEILING SYSTEM FOR GYPSUM BOARD

- 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.

2.5 FASTENERS, CLIPS, AND OTHER METAL ACCESSORIES

- A. ASTM C754, except as otherwise specified.
- B. For fire rated construction: Type and size same as used in fire rating test.
- C. Fasteners for steel studs thicker than 0.84 mm (0.033-inch) thick. Use ASTM C954 steel drill screws of size and type recommended by the manufacturer of the material being fastened.
- D. Clips: ASTM C841 (paragraph 6.11), manufacturer's standard items. Clips used in lieu of tie wire shall have holding power equivalent to that provided by the tie wire for the specific application.

- E. Concrete ceiling hanger inserts (anchorage for hanger wire and hanger straps): Steel, zinc-coated (galvanized), manufacturers standard items, designed to support twice the hanger loads imposed and the type of hanger used.
- F. Tie Wire and Hanger Wire:
 - 1. ASTM A641, soft temper, Class 1 coating.
 - 2. Gage (diameter) as specified in ASTM C754 or ASTM C841.
- G. Attachments for Wall Furring:
 - 1. Manufacturers standard items fabricated from zinc-coated (galvanized) steel sheet.
 - 2. For concrete or masonry walls: Metal slots with adjustable inserts or adjustable wall furring brackets. Spacers may be fabricated from 1 mm (0.0396-inch) thick galvanized steel with corrugated edges.
- H. Power Actuated Fasteners: Type and size as recommended by the manufacturer of the material being fastened.

PART 3 - EXECUTION

3.1 INSTALLATION CRITERIA

- A. Where fire rated construction is required for walls, partitions, columns, beams and floor-ceiling assemblies, the construction shall be same as that used in fire rating test.
- B. Construction requirements for fire rated assemblies and materials shall be as shown and specified, the provisions of the Scope paragraph (1.2) of ASTM C754 and ASTM C841 regarding details of construction shall not apply.

3.2 INSTALLING STUDS

- A. Install studs in accordance with ASTM C754, except as otherwise shown or specified.
- B. Space studs not more than 610 mm (24 inches) on center.
- C. Cut studs 6 mm to 9 mm (1/4 to 3/8-inch) less than floor to underside of structure overhead when extended to underside of structure overhead.
- D. Where studs are shown to terminate above suspended ceilings, provide bracing as shown or extend studs to underside of structure overhead.
- 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. At existing plaster ceilings and where shown, studs may terminate at ceiling as shown.
- G. Openings:
 - 1. Frame jambs of openings in stud partitions and furring with two studs placed back to back or as shown.
 - 2. Fasten back to back studs together with 9 mm (3/8-inch) long Type S pan head screws at not less than 600 mm (two feet) on center, staggered along webs.
 - 3. Studs fastened flange to flange shall have splice plates on both sides approximately 50 X 75 mm (2 by 3 inches) screwed to each stud with two screws in each stud. Locate splice plates at 600 mm (24 inches) on center between runner tracks.
- H. Fastening Studs:
 - 1. Fasten studs located adjacent to partition intersections, corners and studs at jambs of openings to flange of runner tracks with two screws through each end of each stud and flange of runner.
 - 2. Do not fasten studs to top runner track when studs extend to underside of structure overhead.
- I. Chase Wall Partitions:
 - 1. Locate cross braces for chase wall partitions to permit the installation of pipes, conduits, carriers and similar items.
 - 2. Use studs or runners as cross bracing not less than 63 mm (2-1/2 inches wide).
- J. Form building seismic or expansion joints with double studs back to back spaced 75 mm (three inches) apart plus the width of the seismic or expansion joint.
- K. Form control joint, with double studs spaced 13 mm (1/2-inch) apart.

3.3 INSTALLING WALL FURRING FOR FINISH APPLIED TO ONE SIDE ONLY

- A. In accordance with ASTM C754, or ASTM C841 except as otherwise specified or shown.
- B. Refer to partition types on the drawings for UL Design numbers and fire ratings.
- C. 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.
- D. 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.
- E. 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. Refer to partition types on the drawings for UL Design numbers and fire ratings.
- 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.

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 600 mm (24-inch) centers for gypsum board anchorage.
- B. 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.
- C. 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.
- D. Existing concrete construction exposed or concrete on steel decking:
 - 1. Use power actuated fasteners either eye pin, threaded studs or drive pins for type of hanger attachment required.
 - 2. Install fasteners at approximate mid height of concrete beams or joists. Do not install in bottom of beams or joists.
- 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):
 - 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 09 22 16

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SECTION 09 29 00 - GYPSUM BOARD

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies installation and finishing of interior gypsum board.

1.2 RELATED WORK

- A. Installation of steel framing members for walls, partitions, furring, soffits, and ceilings:
 - 1. Section 05 40 00, COLD-FORMED METAL FRAMING
 - 2. Section 09 22 16, NON-STRUCTURAL METAL FRAMING.
- B. Exterior glass mat gypsum board sheathing and soffits: Section 06 16 00, SHEATHING.
- C. Acoustical insulation: Section 07 21 13, THERMAL INSULATION.
- D. Acoustical sealants: Section 07 92 00, JOINT SEALANTS.

1.3 TERMINOLOGY

- A. Definitions and description of terms shall be in accordance with ASTM C11, C840, and as specified.
- B. Underside of Structure Overhead: In spaces where steel trusses or bar joists are shown, the underside of structure overhead shall be the underside of the floor or roof construction supported by the trusses or bar joists.
- C. "Yoked": Gypsum board cut out for opening with no joint at the opening (along door jamb or above the door).

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Gypsum board, each type.
 - 2. Cementitious board.

3. Trim.
4. Finishing materials.
5. Typical shaft wall assembly.
6. Typical fire rated assembly and column fireproofing, indicating details of construction same as that used in fire rating test.
7. Fire rating test, each fire rating required for each assembly.

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
C1396-06	Gypsum Board
E84-08	Surface Burning Characteristics of Building Materials

- C. Underwriters Laboratories Inc. (UL):

Latest Edition Fire Resistance Directory

- D. Inchcape Testing Services (ITS):
Latest Editions Certification Listings

PART 2 - PRODUCTS

2.1 GYPSUM BOARD

- A. Gypsum Board: ASTM C1396, Type X, 16 mm (5/8 inch) thick unless shown otherwise. Shall contain a minimum of 20 percent recycled gypsum.
- B. Shaft Wall Liner Panels:
1. ASTM C1396, Type X.
 2. Coreboard for shaft walls 300, 400, 600 mm (12, 16, or 24 inches) wide by required lengths, 25 mm (one inch) thick with paper faces treated to resist moisture.
- C. Water Resistant Gypsum Backing Board: ASTM C620, Type X, 16 mm (5/8 inch) thick.
- D. Impact Resistant Gypsum Backing Board: ASTM C1629, Level 3, Type X, 16 mm (5/8 inch) thick.
- E. 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 CEMENTITIOUS BACKER UNITS

- A. ANSI A118.9 and ASTM C 1288 or 1325, with manufacturer's standard edges.
- B. Use cementitious backer units in maximum available lengths.
- C. Backer unit meet or exceed the following additional physical properties:
1. Water absorption: ASTM C948, less than 20 percent by weight.
- D. Confirm to ASTM C1178/C1178M, Optional System for Cementitious Backer Units.

2.3 TRIM ACCESSORIES

- A. ASTM C1047, except form of 0.39 mm (0.015 inch) thick zinc coated steel sheet.
- B. Flanges not less than 22 mm (7/8 inch) wide with punchouts or deformations as required to provide compound bond.

C. Types:

1. Corner beads.
2. Edge trim.
3. Control joints.

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. 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 galvanized steel, 13 mm (1/2 inch) minimum diameter washers.
 3. ASTM C954 for steel 1 mm (0.033 inch) thick.
 4. ASTM C1002 for steel framing less than 0.0329 inch thick.
- F. Clips: Zinc-coated (galvanized) steel; gypsum board manufacturer's standard items.

2.5 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
 1. Interior Gypsum Board: Paper.
 2. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
 3. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

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.
 - 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 assemblies:
 - 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. No offset in exposed face of walls and partitions will be permitted because of single-ply and two-ply application requirements.

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. Electrical and Telecommunications Boxes:

1. Seal annular spaces between electrical and telecommunications receptacle boxes and gypsum board partitions.

J. Trim Accessories:

1. Set trim accessories plumb, level and true to line, neatly mitered at corners and intersections, and securely attach to supporting surfaces as specified.

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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. Control Joints:
 - a. Refer to ASTM C 840 requirements for control-joint locations.
 - b. Locate at both side jambs of openings if gypsum board is not "yoked". Use one system throughout.
 - c. Not required for wall lengths less than 9000 mm (30 feet).
 - d. Extend control joints the full height of the wall or length of soffit/ceiling membrane.
 5. Edge Trim:
 - 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 CAVITY SHAFT WALL

- A. Coordinate assembly with Section 09 22 16, NON-STRUCTURAL METAL FRAMING, for erection of framing and gypsum board.
- B. Conform to UL Design No. U438 or FM WALL CONSTRUCTION 12-2/HR (Nonbearing for two-hour fire rating. 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. Two hour wall:

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

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

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

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

3.4 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 FINISHING OF GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- 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. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- D. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- E. Finish joints, edges, corners, and fastener heads in accordance with ASTM C840. Use Level 5 finish for all finished areas open to public view.
- F. 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 gypsum board construction. After the installation of hanger rods, hanger wires, supports, equipment, conduits, piping and similar work, seal remaining openings and maintain the integrity of the smoke barrier and fire rated construction. Sanding is not required of non decorated surfaces.

3.6 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 or fire protection equivalent to the fire rated construction and STC equivalent to the sound rated construction.

END OF SECTION 09 29 00

SECTION 09 30 13 - CERAMIC TILING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies porcelain and glass tile for the following applications:
 - 1. Floors.
 - 2. Walls.

1.2 RELATED WORK

- A. Sealing of joints where specified: Section 07 92 00, JOINT SEALANTS.
- B. Cementitious backer board: Section 09 29 00, GYPSUM BOARD.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples:
 - 1. Porcelain tile: Each type, color, patterns and size.
 - 2. Glass tile: Each color, size and pattern.
 - 3. Metal trim: Each type, color, and size.
 - 4. Waterproofing isolation membrane.
- C. Product Data:
 - 1. Ceramic and porcelain tile, marked to show each type, size, and shape required.
 - 2. Chemical resistant mortar and grout (epoxy).
 - 3. Dry-set Portland cement mortar and grout.
 - 4. Trim.
 - 5. Elastomeric membrane and bond coat.
 - 6. Leveling compound.
 - 7. Latex-Portland cement mortar and grout.
 - 8. Commercial Portland cement grout.
 - 9. Waterproofing isolation membrane.

1.4 DELIVERY AND STORAGE

- A. Deliver materials in containers with labels legible and intact and grade-seals unbroken.
- B. Store material to prevent damage or contamination.

1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in text by basic designation only.
- B. American National Standards Institute (ANSI):
 - 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
 - A108.13-05 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
 - A118.10-05 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):

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
C979-05 Pigments for Integrally Colored Concrete
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 MANUFACTURERS

- A. Product: Provide tile products listed in the Finish Materials Schedule on the drawings, no substitutions.

2.2 TILES

- 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 IV, 6000 revolutions.
 - 3. Slip Resistant Tile for Floors:
 - a. Coefficient of friction, when tested in accordance with ASTM C1028, required for level of performance:
 - 1) Not less than 0.7 (wet condition) for bathing areas.
 - 4. Mosaic tile may be mounted or joined together by a resinous bonding material along tile edges.
 - 5. 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.
 - 6. Factory-Applied Temporary Protective Coating:
 - a. Protect exposed face surfaces (top surface) of tile against adherence of mortar and grout by pre-coating with a continuous film of petroleum paraffin wax, applied hot.
 - b. Do not coat unexposed tile surfaces.
 - c. Pre-wax tiles set or grouted with latex modified mortars.
- B. Porcelain Tile:
 - 1. Composition: Colorbody porcelain.
 - 2. Edge: Rectified.
 - 3. Trim Units: None.
- C. Glass Tile:
 - 1. Composition: Hand-poured glass.
 - 2. Edge: Reverse beveled.
 - 3. Mounting: Paper-faced sheets.
 - 4. Trim Units: None.

2.3 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.
- G. Elastomeric Waterproofing Membrane and Bond Coat:
 - 1. TCA F122-02.
 - 2. ANSI A118.10.
 - 3. One component polyurethane, liquid applied material having the following additional physical properties:
 - a. Hardness: Shore "A" between 40-60.
 - b. Elongation: Between 300-600 percent.
 - c. Tensile strength: Between 40-60 psig.
 - d. No volatile compounds.
 - 4. Coal tar modified urethanes are not acceptable.
- H. Waterproofing Isolation Membrane:
 - 1. Sheet System TCA F122-02.
 - 2. Optional System to elastomeric waterproof membrane.
 - 3. Composite sheet consisting of ASTM D5109, Type II, Grade I Chlorinated Polyethylene (CM) sheet reinforced on both sides with a non-woven polyester fiber.
 - 4. Designed for use in wet areas as an isolation and positive waterproofing membranes for thin-set bonding of sheet to substrate and thin-set bonding of ceramic and porcelain tile or marble to sheet. Suited for both horizontal and vertical applications.

5. Conform to the following additional physical properties:

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

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

2.4 GROUTING MATERIALS

A. Chemical-Resistant Grout:

1. Epoxy grout, ANSI A118.3.
2. Sanded grout mixture for joints 3.2 mm (1/8 inch) and wider.
3. Job colored grout is not acceptable.

2.5 PATCHING AND LEVELING COMPOUND

A. Portland cement base, polymer-modified, self-leveling compound, manufactured specifically for resurfacing and leveling concrete floors. Products containing gypsum are not acceptable.

B. Shall have minimum following physical properties:

1. Compressive strength - 25 MPa (3500 psig) per ASTM C109/C109M.
2. Flexural strength - 7 MPa (1000 psig) per ASTM C348 (28 day value).
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.

2.6 TRIM

- A. General:
 - 1. Conform to applicable requirements of adjoining floor and wall tile.
 - 2. Embedded leg perforated and deformed for keying to mortar.
- B. Flooring Transition Between Ceramic Tile and Other Materials:
 - 1. Ball-and-socket hinged profile with sloped exposed surface, tapered leading edge, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.
 - 2. Material and Finish: Satin anodized aluminum.
- C. Cove Trim:
 - 1. Profile with integrated rigid, recycled PVC trapezoid-perforated anchoring legs, connected at a 90-degree angle by a soft CPE cove-shaped section with 11/16 inch (18 mm) radius that forms the visible surface.
 - 2. Material and Finish: PVC, refer to drawings for color selection.
- D. Cap Trim:
 - 1. Bullnose-type profile with symmetrically rounded visible surface with 1/4 inch (6 mm) radius, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.
 - 2. Material and Finish: PVC, refer to drawings for color selection.

2.7 WATER

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

2.8 CLEANING COMPOUNDS

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

2.9 POLYETHYLENE SHEET

- A. Polyethylene sheet conforming to ASTM D4397.
- B. Nominal thickness: 0.15 mm (six mils).
- C. Use sheet width to minimize joints.

PART 3 - EXECUTION

3.1 ENVIRONMENTAL REQUIREMENTS

- A. Maintain ambient temperature of work areas at not less than 16 degree C (60 degrees F), without interruption, for not less than 24 hours before installation and not less than three days after installation.
- B. Maintain higher temperatures for a longer period of time where required by manufacturer's recommendation and ANSI Specifications for installation.
- C. Do not install tile when the temperature is above 38 degrees C (100 degrees F).
- D. Do not install materials when the temperature of the substrate is below 16 degrees C (60 degrees F).
- E. Do not allow temperature to fall below 10 degrees C (50 degrees F) after fourth day of completion of tile work.

3.2 ALLOWABLE TOLERANCE

- A. Variation in plane of sub-floor, including concrete fills leveling compounds and mortar beds:
 - 1. Not more than 1 in 500 (1/4 inch in 10 feet) from required elevation where Portland cement mortar setting bed is used.
 - 2. Not more than 1 in 1000 (1/8 inch in 10 feet) where dry-set Portland cement, and latex-Portland cement mortar setting beds and chemical-resistant bond coats are used.

B. Variation in Plane of Wall Surfaces:

1. Not more than 1 in 400 (1/4 inch in eight feet) from required plane where Portland cement mortar setting bed is used.
2. Not more than 1 in 800 (1/8 inch in eight feet) where dry-set or latex-Portland cement mortar or organic adhesive setting materials is used.

3.3 SURFACE PREPARATION

A. 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. 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.

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- 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 polyethylene 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.
 - G. Existing Floors and Walls:
 - 1. Remove existing composition floor finishes and adhesive. Prepare surface by grinding, chipping, self-contained power blast cleaning or other suitable mechanical methods to completely expose uncontaminated concrete or masonry surfaces. Follow safety requirements of ANSI A10.20.
 - 2. Remove existing concrete fill or topping to structural slab. Clean and level the substrate for new setting bed and waterproof membrane or cleavage membrane.
 - 3. Where new tile bases are required to finish flush with plaster above or where they are extensions of similar bases in conjunction with existing floor tiles cut channel in floor slab and expose rough wall construction sufficiently to accommodate new tile base and setting material.

3.4 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 floor tile in elastomeric bond coat over elastomeric membrane ANSI 108. 13, TCA System F122 in showers.
3. 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.
4. Set wall tile installed over concrete backer board in latex-Portland cement mortar, ANSI A108.1B.
5. 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.

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9. Walls:
- a. Cover walls and partitions, including pilasters, furred areas, and freestanding columns from floor to ceiling, or from floor to nominal wainscot heights shown with tile.
 - b. Finish reveals of openings with tile, except where other finish materials are shown or specified.
 - c. Finish wall surfaces behind and at sides of casework and equipment, except those units mounted in wall recesses, with same tile as scheduled for room proper.
10. Joints:
- a. Keep all joints in line, straight, level, perpendicular and of even width unless shown otherwise.
 - b. Make joints 2 mm (1/16 inch) wide for glazed wall tile 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.

3.5 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).

3.6 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.

3.7 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).

3.8 CERAMIC AND PORCELAIN TILE INSTALLED WITH ELASTOMERIC BOND COAT

- A. Surface Preparation: Prepare surfaces as specified in paragraph 3.3G
- B. Installation of Elastomeric Membrane: ANSI A108.13 and TCA F122-02.
 - 1. Prime surfaces, where required, in accordance with manufacturer's instructions.
 - 2. Install first coat of membrane material in accordance with manufacturer's instructions, in thickness of 0.75 to 1.3 mm (30 to 50 mils).
 - 3. Extend material over flashing rings of drains and turn up vertical surfaces not less than 100 mm (four inches) above finish floor surface.
 - 4. When material has set, recoat areas with a second coat of elastomeric membrane material for a total thickness of 1.3 to 1.9 mm (50 to 75 mils).
 - 5. After curing test for leaks with 25 mm (one inch) of water for 24 hours.
- C. Installation of Tile in Elastomeric Membrane:
 - 1. Spread no more material than can be covered with tile before material starts to set.
 - 2. Apply tile in second coat of elastomeric membrane material in accordance with the coating manufacturer's instructions in lieu of aggregate surfacing specified in ASTM C1127. Do not install top coat over tile.

3.9 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. Epoxy Grout: ANSI A108.6.

3.10 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.

3.11 CLEANING

- A. Thoroughly sponge and wash tile. Polish glazed surfaces with clean dry cloths.
- B. Methods and materials used shall not damage or impair appearance of tile surfaces.
- C. The use of acid or acid cleaners on glazed tile surfaces is prohibited.
- D. Clean tile grouted with epoxy grout and tile set in elastomeric bond coat as recommended by the manufacturer of the grout and bond coat.

3.12 PROTECTION

- A. Keep traffic off tile floor, until grout and setting material is firmly set and cured.
- B. Where traffic occurs over tile floor, cover tile floor with not less than 9 mm (3/8 inch) thick plywood, wood particle board, or hardboard securely taped in place. Do not remove protective cover until time for final inspection. Clean tile of any tape, adhesive and stains.

END OF SECTION 09 30 13

SECTION 09 51 00 - ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The work of this section includes:
 - 1. Metal ceiling suspension systems.
 - 2. Acoustical ceiling panels.

1.2 RELATED WORK

- A. Gypsum board ceiling suspension systems: Section 09 22 16, NON-STRUCTURAL METAL FRAMING.
- B. Linear Metal Ceilings: Section 09 54 23, LINEAR METAL CEILINGS.

1.3 SUBMITTAL

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples:
 - 1. Acoustical ceiling panels, each type, with label indicating conformance to specification requirements, including units specified to match existing.
- C. Manufacturer's Literature and Data:
 - 1. Ceiling suspension system, each type, showing complete details of installation, including suspension system specified to match existing and upward access system details for concealed grid systems.
 - 2. Acoustical ceiling panels, each type.

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. Aluminum sheet.
 - 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 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 shall be 24 mm (15/16 inch) with not less than 8 mm (5/16 inch) panel bearing surface.

2. Fabricate wall molding and other special molding from the same material with same exposed width and finish as the exposed grid members.
3. On exposed metal surfaces apply baked-on enamel flat texture finish in color to match adjacent acoustical units unless specified otherwise in the Interior Materials and Finish Schedules.

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. 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.
- C. 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 Kg Pound	Hot-rolled Kg Pound
38	1 1/2	215.4 475	508 1120
50	2	267.6 590	571.5 1260

2.6 ACOUSTICAL UNITS

- A. Acoustical Ceiling Panels:

1. Ceiling panels shall meet minimum 37% bio-based content in accordance with USDA Bio-Preferred Product requirements.
2. ASTM E1264, weighing 3.6 kg/m² (3/4 psf) minimum for mineral fiber panels or tile.
3. Class A Flame Spread: ASTM 84
4. Minimum NRC (Noise Reduction Coefficient): 0.55 unless specified otherwise: ASTM C423.
5. Minimum CAC (Ceiling Attenuation Class): 35-45 range unless specified otherwise: ASTM E413.
6. Manufacturers standard finish, minimum Light Reflectance (LR) coefficient of 0.75 on the exposed surfaces, unless specified otherwise.
7. Anti-microbial treatment and providing guaranteed resistance against growth of mold/mildew and Gram-positive and Gram-negative odor/stain-causing bacteria.
8. Dimensions: 612 by 612 by 19 mm (24 by 24 by 3/4 inches).
9. Grid Face: 24 mm (15/16 inch).
10. Edge: Beveled tegular.
11. Color: White.

- B. ASTM E1264 Classification: Type IV Units - mineral base with membrane-faced overlay, Form 2 - water felted, minimum 16 mm (5/8 inch) thick. Apply over the paint coat on the face of the unit a poly (vinyl) chloride overspray having a flame spread index of 25 or less when tested in accordance with ASTM E84.

2.7 ACCESS IDENTIFICATION

- A. Markers:

1. Use colored markers with pressure sensitive adhesive on one side.
2. Make colored markers of paper or plastic, 6 to 9 mm (1/4 to 3/8 inch) in diameter.

- B. Use markers of the same diameter throughout building.

- C. Color Code: Use following color markers for service identification:

Color	Service
Red	Sprinkler System: Valves and Controls
Green	Domestic Water: Valves and Controls
Yellow	Chilled Water and Heating Water
Orange	Ductwork: Fire Dampers
Blue	Ductwork: Dampers and Controls
Black	Gas: Laboratory, Medical, Air and Vacuum

PART 3 - EXECUTION

3.1 CEILING TREATMENT

- A. Install acoustic panels 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.
- E. Existing ceiling:
1. Where extension of existing ceilings occur, match existing.
 2. Where acoustical units are salvaged and reinstalled or joined, use salvaged units within a space. Do not mix new and salvaged units within a space which results in contrast between old and new acoustic units.
 3. Comply with specifications for new acoustical panels for new panels required to match appearance of existing units.

3.2 CEILING SUSPENSION SYSTEM INSTALLATION

A. General:

1. Install metal suspension system for acoustical ceiling 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 m² (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. 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.

3.3 ACOUSTICAL PANEL INSTALLATION

- A. Cut acoustic panels 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 09 51 00

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SECTION 09 54 23 - LINEAR METAL CEILINGS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section includes:
 - 1. Decorative, linear, formed metal ceiling panels mechanically mounted on a ceiling suspension system.

1.2 RELATED WORK

- A. Acoustical Insulation: Section 07 21 13, THERMAL INSULATION
- B. Acoustical Ceilings: Section 09 51 00, ACOUSTICAL CEILINGS.

1.3 QUALITY CONTROL

- A. Coordination of Work: Coordinate layout and installation of linear metal ceiling units and suspension system components with other work supported by, or penetrating through, ceilings, including light fixtures, HVAC equipment, fire-suppression system components and partition systems:
 - 1. Sprinkler heads and light fixtures: Shall typically penetrate center of a panel width.
 - 2. HVAC Air Outlets and Inlets: Shall be planned to occur within center of panel systems or provide for equal distance on each side parallel to length of panels

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Product Data:
 - 1. Manufacturer's standard details and fabrication methods.
 - 2. Data on finishing, hardware, components, and accessories.
 - 3. Recommendations for maintenance and cleaning of finish surfaces.

C. Shop Drawings:

1. Submit complete composite fabrication, and installation shop drawings including associated components.
2. Identify panel sections, baffles, edge trim, lighting trim, air diffuser sections and trim, sprinkler head locations and trim, other component parts, not included in manufacturer's product data, by name and material and showing design, construction, installation, and anchorage.
3. Layout and installation details, including relation to adjacent work such as walls and bulkheads.
4. Composite reflected ceiling plans, at 1:50 (1/4 inch) scale, showing location of all accessories, mechanical and electrical components. Indicate following:
 - a. Joint pattern.
 - b. Ceiling suspension members.
 - c. Method of attaching hangers to building structure.
 - d. Ceiling-mounted items including light fixtures, air outlets and inlets, speakers, sprinkler heads, and access panels. Special moldings at walls, column penetrations, and other junctures with adjoining construction.
5. Detail sections of typical composite members, at wall surfaces, mechanical diffusers and grilles, sprinkler heads, and light fixtures.

D. Samples:

1. Submit 300 x 300 mm (12 x 12 inch) sample of each system of each color and finish including the following items:
 - a. Linear metal panel.
 - b. Each exposed molding and trim sections.
 - c. Suspension system members.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Materials: Deliver to site in manufacturer's original unopened containers with brand name and type clearly marked.
- B. Materials: Carefully handle and store in dry, watertight enclosures.
- C. Immediately before installation, linear metal ceiling units shall be stored for not less than 48 hours at same temperature and relative humidity as space where they will be installed to assure temperature and moisture conditions in accordance with manufacturer's recommendations.

1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referred to in text by basic designation only.
- B. American Architectural Manufacturers Association (AAMA):
 - AAMA 605-98.....High Performance Organic Coatings on Architectural Extrusions and Panels
- C. American Society for Testing and Materials (ASTM):
 - A641/641M-03Zinc-coated (Galvanized) Carbon Steel Wire.
 - A653/A653M-07Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.
 - B209/B209M-07Aluminum and Aluminum-Alloy Sheet and Plate
 - C635-07Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings
 - C636-06Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels
 - E90-04Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions
 - E580-06Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Seismic Restraint
- D. National Association of Architectural Metal Manufacturers (NAAMM)
- E. Metal Finishes Manual (1988)

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Uniform temperature of not less than 16 °C, (60 °F) nor more than 27 °C, (80 °F) and a relative humidity of not more than 70 percent shall be maintained for a period of 48 hours before, during, and for 48 hours after installation of linear metal ceiling units. After above period, room temperature shall not fall below 13 °C (55 °F).

1.8 SCHEDULING

- A. Interior finish work such as plastering, gypsum board finishing, painting, concrete and terrazzo work shall be complete and dry before installation. Mechanical, electrical, and other work above ceiling line shall be completed and heating, ventilating, and air conditioning systems shall be installed and operating in order to maintain temperature and humidity requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Linear Metal Ceiling System, General:
 - 1. Sheet Metal Characteristics: Form metal panels from sheet metal free from surface blemishes where exposed to view in finished unit. Do not use materials whose exposed surfaces exhibit pitting, seam marks, roller marks, stains, discolorations, or other imperfections.
 - 2. Fabrication: Die-form linear metal panels into units standard with manufacturer and finished as specified herein.
 - 3. Sound-Absorptive Pads: 52 mm (2-inch) acoustical batt insulation. Width and length to fill completely between carriers, joined at center of a panel.
- B. Accessories: Stabilizer bars, clips, splices, hold down clips, as required for suspended grid system.
- C. Linear Metal Panels:
 - 1. General: Formed to snap on and be securely retained on carriers without separate fasteners.
 - 2. Aluminum Panels: ASTM B209/B209m, roll-formed sheet, alloy 3005-H26, complying with following requirements:
 - a. Minimum Nominal Thickness: 0.40 mm (0.020 inch).
 - b. Panel Width: 102 mm (4-inches).
 - c. Panel Depth: 16 mm (5/8-inch).
 - d. Finish: Vinyl film, simulated wood finish.
 - 3. Closure: No closure pieces to be provided.
- D. Suspension Systems, General:
 - 1. Standard for Metal Suspension Systems: Provide manufacturer's standard types, structural classifications, and finishes indicated that comply with ASTM C635 requirements.
 - 2. Universal hat shaped 0.97 mm (0.038 inch) roll-formed aluminum section with hook shaped tabs spaced to receive ceiling panels at 52 mm (2 inch) on center and 21.4 mm (27/32 inch) apart. Support holes spaced 102 mm (4 inch) on center.
 - 3. Finish: Factory applied black enamel
- E. Anchors: Type as recommended by manufacturer. Size for five times design load indicated in ASTM C635, Table 1, Direct Hung, unless otherwise indicated.

- F. Wire for Carriers, Hangers, and Ties: ASTM A641/A641m, Class 1, zinc coating, soft temper.
 - 1. Gage: Minimum 12 gage. Shall support a minimum of 1330 N, (300 pounds ultimate vertical load without failure of supporting material or attachment.
- G. Hanger Rods: Mild steel, zinc coated, or protected with rust-inhibitive paint.
- H. Flat Hangers: Mild steel, zinc coated, or protected with rust-inhibitive paint.
- I. Angle Hangers: Angles with legs not less than 22 mm (7/8 inch) wide, formed with 0.82 mm (0.0365 inch) galvanized steel sheet complying with ASTM A653/A653m, Coating Designation G90, with bolted connections and 7.6 mm (5/16 inch) diameter bolts.
- J. Edge Moldings and Trim: Manufacturer's standard molding for edges and penetrations of ceiling.
- K. Carriers: Comply with ASTM A653/A653m, cold-rolled, electro-galvanized, 0.375 mm (0.0209 inch) (25 gage) minimum nominal thickness steel.

2.2 FINISHES

- A. Comply with NAAMM "Metal Finishes Manual".
- B. Protect mechanical finishes on exposed surfaces from damage by application of strippable, temporary protective covering before shipment.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent ceiling units not acceptable. Noticeable variations in same piece not acceptable.
- D. Aluminum Finishes:
 - 1. Lacquered Mill Finish: AA-M10C10R1X.
 - a. Organic Coating: Manufacturer's standard, clear, organic coating.

2.3 ACCESS IDENTIFICATION

- A. Markers:
 - 1. Use colored markers with pressure sensitive adhesive on one side.
 - 2. Make colored markers of paper or plastic, 6 to 9 mm (1/4 to 3/8 inch) in diameter.
- B. Use markers of the same diameter throughout building.

- C. Color Code: Use following color markers for service identification:

Color	Service
Red	Sprinkler System: Valves and Controls
Green	Domestic Water: Valves and Controls
Yellow	Chilled Water and Heating Water
Orange	Ductwork: Fire Dampers
Blue	Ductwork: Dampers and Controls
Black	Gas: Laboratory, Medical, Air and Vacuum

PART 3 - EXECUTION

3.1 INSPECTION

- A. Ceiling Areas: Conform with details, dimensions and tolerances shown on approved linear metal ceiling system composite reflected ceiling plan shop drawings.
- B. Conditions which may adversely affect linear metal ceiling system installation shall be brought to Contractors attention, for repair, prior to commencement of linear metal ceiling system installation. Do not start ceiling installation until affected area has been repaired to Installer's satisfaction.
- C. Where linear metal ceiling system is installed adjacent to masonry, washdown of adjacent masonry shall be completed prior to erection of ceiling system to prevent damage to material finish by cleaning materials.

3.2 PREPARATION

- A. Measure each ceiling area and establish layout of linear metal panel units to balance border widths at opposite edges of each ceiling. Avoid using units less than half wide at borders.

3.3 INSTALLATION

- A. Standard for Installation of Ceiling Suspension Systems: Comply with ASTM C636 and ASTM E580 as applicable to linear metal panel ceiling suspension system.
- B. Suspend ceiling hangers from building structural members and as follows:
 - 1. Install hangers plumb, free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers where required to avoid obstructions and offset resulting horizontal forces by bracing, counter splaying, or other equally effective means.

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2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
 3. Secure hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for structure to which hangers are attached as well as for type of hanger involved, and in a manner that will not cause them to deteriorate or fail because of age, corrosion, and elevated temperatures.
 4. Space hangers not more than 1200 mm (48 inches) on center along each member supported directly from hangers, unless otherwise shown.
- C. Install edge moldings at edge of each linear metal ceiling area and at locations where edge of units would otherwise be exposed after completion of Work. Level moldings with ceiling suspension system to level tolerance of 3 mm (1/8 inch) in 3600 mm (12 feet).
1. Masonry and Concrete: Fasten with machine screws into lead-shield-type anchors drilled into construction.
 2. Hollow Masonry or Stud Construction: Fasten with toggle bolts or similar self-expanding screw anchors.
- D. Scribe and cut metal panel units for accurate fit at borders and at interruptions and penetrations by other work through ceilings. Stiffen edges of cut units as required to eliminate evidence of buckling or variations in flatness exceeding referenced standards for stretcher-leveled metal sheet.
- E. Align joints in adjacent courses to form uniform, straight joints parallel to room axis in both directions, unless otherwise-shown.
- F. Install panels with butt joints using internal concealed panel splices and in joint configurations shown in reflected ceiling plan.
- G. Install acoustical insulation blankets at right angle to panels so that they do not hang unsupported.

3.4 CLEANING

- A. Following installation, dirty or discolored surfaces of linear metal ceiling units shall be cleaned, in accordance with manufacturer's written recommendations, and left free from defects. Units that are damaged or improperly installed shall be removed and new units provided as directed.

3.5 PROTECTION

- A. Protect linear metal ceiling systems from damage until final inspection and acceptance.

END OF SECTION 09 54 23

SECTION 09 65 13 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the installation of rubber base and PVC flooring transition strips.

1.2 RELATED WORK

- A. Stainless steel base on casework: Section 06 40 23, INTERIOR ARCHITECTURAL WOODWORK.
- B. Integral base with sheet flooring: Section 09 65 16, RESILIENT SHEET 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. Manufacturer's recommendations for adhesives.
 - 3. Application and installation instructions.
- C. Samples:
 - 1. Base: 150 mm (6 inches) long, each type and color.
 - 2. Flooring transition strips: 150 mm (6 inches) long, each type and color.

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)
F1861-08 Resilient Wall Base

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, 100 mm (4 inches) high, Thermoplastics, Group 2-layered.
- B. Styles: Refer to the Materials Schedule on the drawings for colors and styles.
 - 1. Cove.
 - 2. Decorative profile.

2.3 PVC FLOORING TRANSITION STRIPS

- A. Performance and Technical Data:
 - 1. Hardness - ASTM D 2240 - Not less than 85 Shore A.
 - 2. Abrasion Resistance - ASTM D 3389 - 0.22 mg/cycle.
 - 3. Slip Resistance - ASTM D 2047 - Exceeds Federal Standards and ADA recommendations of .6 for flat surfaces.
 - 4. Fire Resistance: ASTM E 648/NFPA 253 (Critical Radiant Flux) - Class 1.
- B. Styles: Refer to the Materials Schedule on the drawings for colors and styles.

2.4 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 COR.
- B. Submit proposed installation deviation from this specification to the COR indicating the differences in the method of installation.
- C. The COR reserves the right to have test portions of material installation removed to check for non-uniform adhesion and spotty adhesive coverage.

3.3 PREPARATION

- A. Examine surfaces on which material is to be installed.
- B. Fill cracks, pits, and dents with leveling compound.
- C. Level to 3 mm (1/8 inch) maximum variations.
- D. Do not use adhesive for leveling or filling.
- E. Grind, sand, or cut away protrusions; grind high spots.
- F. Clean substrate area of oil, grease, dust, paint, and deleterious substances.

- G. Substrate area dry and cured. Perform manufacturer's recommended bond and moisture test.
- H. Preparation of existing installation:
 - 1. Remove existing base including adhesive.
 - 2. Do not use solvents to remove adhesives.
 - 3. Prepare substrate as specified.

3.4 BASE INSTALLATION

- A. Location:
 - 1. Unless otherwise specified or shown, where base is scheduled, install base over toe space of base of casework, lockers, laboratory, pharmacy furniture island cabinets and where other equipment occurs.
 - 2. Extend base scheduled for room into adjacent closet, alcoves, and around columns.
- B. Application:
 - 1. Apply adhesive uniformly with no bare spots.
 - 2. Set base with joints aligned and butted to touch for entire height.
 - 3. Before starting installation, layout base material to provide the minimum number of joints with no strip less than 600 mm (24 inches) length.
 - a. Short pieces to save material will not be permitted.
 - b. Locate joints as remote from corners as the material lengths or the wall configuration will permit.
- C. 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 FLOORING TRANSITION STRIPS INSTALLATION

- A. Prepare surfaces to receive transition strips in accordance with manufacturer.

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, 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.
- 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 COR.
- 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 09 65 13

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SECTION 09 65 16 - RESILIENT SHEET FLOORING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section specifies the installation of homogeneous sheet flooring including:
 - 1. Integral cove base: Installed at intersection of floor and vertical surfaces.
 - 2. Chemically welded seams.

1.2 RELATED WORK

- A. Resilient wall base and transitions: Section 09 65 13, RESILIENT BASE AND ACCESSORIES.

1.3 QUALITY CONTROL-QUALIFICATION

- A. The Contractor shall submit certification that:
 - 1. Installer is approved by manufacturer of materials and has technical qualifications, experience, trained personnel, and facilities to install specified items.
 - 2. Manufacturer's product submitted has been in satisfactory operation, on three installations similar and equivalent in size to this project for three years. Submit list of installations.
- B. The sheet vinyl floor coverings shall meet fire performance characteristics as determined by testing products, per ASTM test method, indicated below by Underwriters Laboratories, Inc. (UL) or another recognized testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Critical Radiant Flux: 0.45 watts per sq. cm or more, Class I, per ASTM E648.
 - 2. Smoke Density: Less than 450 per ASTM E662.
- C. The floor covering manufacturer shall certify that products supplied for installation comply with local regulations controlling use of volatile organic compounds (VOC's).

1.4 SUBMITTALS

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

B. Manufacturer's Literature and Data:

1. Description of resilient sheet flooring and accessories to be provided.
2. Fire performance characteristics.
3. Resilient sheet flooring manufacturer's recommendations for adhesives, weld rods, sealants, and underlayment.
4. Application and installation instructions.

C. Samples:

1. Sheet material, 300 by 300 mm (12 by 12 inch), of each color and pattern with a welded seam using proposed welding rod.
2. Cap strip and fillet strip, 300 mm (12 inches) for integral base.

D. Shop Drawings: Layout of joints showing patterns where joints are expressed, and type and location of obscure type joints. Indicate orientation of directional patterns.

1.5 PROJECT CONDITIONS

- A. Maintain temperature of floor materials and room, where work occurs, above 18° C (65° F) and below 38 °C (100° F) for 48 hours before, during and for 48 hours after installation. After above period, room temperature shall not fall below 13° C (55° F).
- B. Construction in or near areas to receive flooring work shall be complete, dry and cured. Do not install resilient flooring over slabs until they have been cured and are sufficiently dry to achieve a bond with adhesive. Follow flooring manufacturer's recommendations for bond and moisture testing.
- C. Building shall be permanently enclosed. Schedule construction so that floor receives no construction traffic when completed.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to site in original sealed packages or containers; labeled for identification with manufacturer's name and brand.
- B. Deliver sheet flooring full width roll, completely enclosed in factory wrap, clearly marked with the manufacturer's number, type and color, production run number and manufacture date.
- C. Store materials in weathertight and dry storage facility. Protect from damage due to handling, weather, and construction operations before, during and after installation. Store sheet flooring on end with ambient temperatures maintained as recommended by manufacturer.
- D. Store sheet flooring on end.

- E. Move sheet vinyl floor coverings and installation accessories into spaces where they will be installed at least 48 hours in advance of installation.

1.7 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society For Testing Materials (ASTM):
 - E648-09 Critical Radiant Flux of Floor-Covering Systems Using a Radiant Energy Source
 - E662-09 Specific Optical Density of Smoke Generated by Solid Materials
 - F710-08 Practice for Preparing Concrete Floors and Other Monolithic Floors to Receive Resilient Flooring
 - F1869-04 Moisture Vapor Emission Rate of Concrete Subfloor using Anhydrous Calcium Chloride
 - F1913-04 Sheet Vinyl Flooring without Backing
 - F2170-09 Determining Relative Humidity in Concrete Floor Slabs using In-situ Probes
- C. Resilient Floor Covering Institute (RFCI):
Recommended Work Practices for Removal of Resilient Floor Coverings.

1.8 SCHEDULING

- A. Interior finish work such as plastering, drywall finishing, concrete, terrazzo, ceiling work, and painting work shall be complete and dry before installation. Mechanical, electrical, and other work above ceiling line shall be completed. Heating, ventilating, and air conditioning systems shall be installed and operating in order to maintain temperature and humidity requirements.

PART 2 - PRODUCTS

2.1 SHEET VINYL FLOORING

- A. Sheet Vinyl Floor Coverings: Homogeneous sheet flooring, antimicrobial.
- B. Wearlayer and Overall Thickness: 2.03 mm (0.080 inch).

C. Physical Construction:

1. Sheet flooring shall conform to ASTM F1913.
2. Static Load Limit: 750 psi.
3. Electrical Resistance, EN1815: ≤ 2 kv.
4. Flooring Radiant Panel Test (ASTM-E-648) $\geq .45$ watts/cm², Class I.
5. N.B.S. Smoke Chamber Test (ASTM-E-662) <450 .
6. Static Coefficient of Friction: Meet ADA Guidelines.

D. Each color and pattern of sheet flooring shall be of same production run.

E. Colors and Patterns: Refer to the Materials Schedule on the drawings.

F. Seamless-Installation Method: Chemically bonded.

2.2 SEAMLESS INSTALLATION ACCESSORIES

A. Chemical-Bonding Compound: Manufacturer's product for chemically bonding seams.

1. Bonding compound shall have a VOC content of 510 g/L or less.

2.3 ADHESIVES

A. Floor and Base Adhesive: Type recommended by sheet flooring material manufacturer for conditions of use.

B. Water resistant type recommended by the sheet flooring manufacturer for the conditions of use. VOC not to exceed 50g/L

2.4 BASE CAP STRIP AND COVE STRIP

A. Extruded vinyl compatible with the sheet flooring.

B. Cap strip "J" shape with feathered edge flange approximately 25 mm (one inch) wide; top designed to receive sheet flooring with 13 mm (1/2 inch) flange lapping top of flooring

C. Cove strip 70 mm (2-3/4 inch) radius.

2.5 LEVELING COMPOUND (FOR CONCRETE FLOORS)

A. Provide cementitious products with latex or polyvinyl acetate resins in the mix.

2.6 PRIMER (FOR CONCRETE SUBFLOORS)

- A. As recommended by the adhesive or sheet flooring manufacturer.

2.7 SEALANT

- A. As specified in Section 07 92 00, JOINT SEALANTS.
- B. Compatible with sheet flooring.

PART 3 - EXECUTION

3.1 PROJECT CONDITIONS

- A. Maintain temperature of sheet flooring above 36 °C (65 °F), for 48 hours before installation.
- B. Maintain temperature of rooms where sheet flooring work occurs above 36 °C (65 °F), for 48 hours, before installation and during installation.
- C. After installation, maintain temperature at or above 36 °C (65 °F.)
- D. Wet construction in or near areas to receive sheet flooring is complete, dry and cured.

3.2 SUBFLOOR PREPARATION

- A. Concrete Subfloors: Verify that concrete slabs comply with ASTM F710.
 - 1. Installer shall examine surfaces on which resilient sheet flooring is to be installed, and shall advise Contractor, in writing, of areas which are unacceptable for installation of flooring material. Installer shall advise Contractor which methods are to be used to correct conditions that will impair proper installation. Installation shall not proceed until unsatisfactory conditions have been corrected.
 - 2. Slab substrates dry, free of curing compounds, sealers, hardeners, and other materials which would interfere with bonding of adhesive. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by Resilient Floor Covering Institute recommendations in manual RFCI-MRP.
- B. Broom or vacuum clean substrates to be covered by sheet vinyl floor coverings immediately before installation. Following cleaning, examine substrates to determine if there is visually any evidence of moisture, alkaline salts, carbonation, or dust.

- C. Primer: If recommended by flooring manufacturer, prior to application of adhesive, apply concrete slab primer in accordance with manufacturer's directions.
- D. Correct conditions which will impair proper installation, including trowel marks, pits, dents, protrusions, cracks or joints.
- E. Fill cracks, joints, depressions, 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 joint lines.
- F. Clean floor of oil, paint, dust and deleterious substances. Leave floor dry and cured free of residue from existing curing or cleaning agents.
- G. Moisture Testing: Perform moisture and pH test as recommended by the flooring and adhesive manufacturers. Perform test locations starting on the deepest part of the concrete structure. Proceed with installation only after concrete substrates meet or exceed the manufacturer's requirements. In the absence of specific guidance from the flooring or adhesive manufacturer the following requirements are to be met:
 - 1. Perform moisture vapor emission tests in accordance with ASTM F1869. Proceed with installation only after substrates have a maximum moisture-vapor-emission rate of 1.36 kg of water/92.9 sq. m (3lb of water/1000 sq. ft.) in 24 hours.
 - 2. Perform concrete internal relative humidity testing using situ probes in accordance with ASTM F2170. Proceed with installation only after concrete reaches maximum 75 percent relative humidity level measurement.
- H. Preparation shall include the removal of existing resilient floor and existing adhesive. Do not use solvents to remove adhesives. Coordinate with Asbestos Abatement Section if asbestos abatement procedures will be involved.
- I. Remove existing resilient flooring and adhesive completely in accordance with Resilient Floor Covering Institute recommendations in manual RFCI-WP. Solvents shall not be used.

3.3 INSTALLATION OF FLOORING

- A. Install work in strict compliance with manufacturer's instructions and approved layout drawings.
- B. Maintain uniformity of sheet vinyl floor covering direction and avoid cross seams.

- C. Arrange for a minimum number of seams and place them in inconspicuous and low traffic areas, but in no case less than 150 mm (6 inches) away from parallel joints in flooring substrates.
- D. Match edges of resilient floor coverings for color shading and pattern at seams.
- E. Where resilient sheet flooring abuts other flooring material floors shall finish level.
- F. Extend sheet vinyl floor coverings into toe spaces, door reveals, closets, and similar openings.
- G. Inform the COR of conflicts between this section and the manufacturer's instructions or recommendations for auxiliary materials, or installation methods, before proceeding.
- H. Install sheet in full coverage adhesives.
 - 1. Air pockets or loose edges will not be accepted.
 - 2. Trim sheet materials to touch in the length of intersection at pipes and vertical projections; seal joints at pipe with waterproof cement or sealant.
- I. Keep joints to a minimum; avoid small filler pieces or strips.
- J. Follow manufacturer's recommendations for seams at butt joints. Do not leave any open joints that would be readily visible from a standing position.
- K. Follow manufacturer's recommendations regarding pattern match, if applicable.
- L. Seamless Installation:
 - 1. Chemically Bonded Seams: Bond seams with chemical-bonding compound to permanently fuse sections into a seamless flooring. Prepare seams and apply compound to produce tightly fitted seams without gaps, overlays, or excess bonding compound on flooring surfaces.
- M. Installation of Edge Strips:
 - 1. Locate edge strips under center lines of doors unless otherwise indicated.
 - 2. Set aluminum strips in adhesive, anchor with lead anchors and stainless steel Phillips screws.
- N. Integral Cove Base Installation:
 - 1. Integral base shall be 100 mm (4 inches) high.
 - 2. Set preformed fillet strip to receive base.
 - 3. Install the base with adhesive; terminate expose edge with the cap strip.
 - 4. Form internal and external corners to the geometric shape generated by the cove at either straight or radius corners.

5. Solvent weld joints as specified for the flooring. Seal cap strip to wall with an adhesive type sealant.
6. Unless otherwise specified or shown where sheet flooring is scheduled, provide integral base at intersection of floor and vertical surfaces. Provide sheet flooring and base scheduled for room on floors and walls under and behind areas where casework, laboratory and pharmacy furniture and other equipment occurs, except where mounted in wall recesses.

3.4 CLEANING

- A. Clean small adhesive marks during application of sheet flooring and base before adhesive sets, excessive adhesive smearing will not be accepted.
- B. Remove visible adhesive and other surface blemishes using methods and cleaner recommended by floor covering manufacturers.
- C. Clean and polish materials per flooring manufacturer's written recommendations.
- D. Do not wash floor until after period recommended by floor covering manufacturer and then prepare in accordance with manufacturer's recommendations.
- E. Upon completion, COR shall inspect floor and base to ascertain that work was done in accordance with manufacturer's printed instructions.
- F. Perform initial maintenance according to flooring manufacturer's written recommendations.

3.5 PROTECTION

- A. Protect installed flooring as recommended by flooring manufacturer against damage from rolling loads, other trades, or placement of fixtures and furnishings.
- B. Keep traffic off sheet flooring for 24 hours after installation.
- C. Where construction traffic is anticipated, cover sheet flooring with reinforced kraft paper properly secured and maintained until removal is authorized by the COR.

END OF SECTION 09 65 16

SECTION 09 68 00 - CARPETING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Section specifies carpet tile, edge strips, adhesives, and other items required for complete installation.

1.2 RELATED WORK

- A. Resilient wall base and transitions: Section 09 65 13, RESILIENT BASE AND ACCESSORIES.

1.3 QUALITY ASSURANCE

- A. Carpet installed by mechanics certified by the Floor Covering Installation Board.
- B. Certify and label the carpet that it has been tested and meets criteria of CRI IAQ Carpet Testing Program for indoor air quality.

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. Manufacturer's catalog data and printed documentation stating physical characteristics, durability, resistance to fading and flame resistance characteristics for each type of carpet material and installation accessory.
 - 2. Manufacturer's printed installation instructions for the carpet, including preparation of installation substrate, seaming techniques and recommended adhesives and tapes.
- C. Samples:
 - 1. Carpet: Full size "Production Quality" samples of carpets, showing quality, pattern and color listed in the Materials Schedule on the drawings.
- D. Shop Drawings: Installers layout plan showing seams and cuts for sheet carpet and carpet module.

E. Close Out Documents:

1. Maintenance Data: Carpet manufacturer's maintenance instructions describing recommended type of cleaning equipment and material, spotting and cleaning methods and cleaning cycles.

1.5 DELIVERY AND STORAGE

- A. Deliver carpet in manufacturer's original wrappings and packages clearly labeled with manufacturer's name, brand, name, size, dye lot number and related information.
- B. Deliver adhesives in containers clearly labeled with manufacturer's name, brand name, number, installation instructions, safety instructions and flash points.
- C. Store in a clean, dry, well ventilated area, protected from damage and soiling. Maintain storage space at a temperature above 16 degrees C (60 degrees F) for 2 days prior to installation.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Areas in which carpeting is to be installed shall be maintained at a temperature above 16 degrees C (60 degrees F) for 2 days before installation, during installation and for 2 days after installation. A minimum temperature of 13 degrees C (55 degrees F) shall be maintained thereafter for the duration of the contract. Traffic or movement of furniture or equipment in carpeted area shall not be permitted for 24 hours after installation. Other work which would damage the carpet shall be completed prior to installation of carpet.

1.7 APPLICABLE PUBLICATIONS

- A. Publication 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)

ANSI/NSF 140-10 Sustainable Carpet Assessment Standard
- C. American Association of Textile Chemists and Colorists (AATCC)

AATCC 16-04..... Colorfastness to Light
AATCC 129-10..... Colorfastness to Ozone in the Atmosphere under High Humidities
AATCC 134-11..... Electric Static Propensity of Carpets
AATCC 165-08..... Colorfastness to Crocking: Textile Floor Conerings-AATCC Crockmeter Method

- D. American Society for Testing and Materials (ASTM)
- ASTM D1335-05 Tuft Bind of Pile Yarn Floor Coverings
 - ASTM D3278-96 (R2004) ... Flash Point of Liquids by Small Scale Closed-Cup Apparatus
 - ASTM D5116-10 Determinations of Organic Emissions from Indoor Materials/Products
 - ASTM D5252-05 Operation of the Hexapod Tumble Drum Tester
 - ASTM D5417-05 Operation of the Vettermann Drum Tester
 - ASTM E648-10 Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
- E. The Carpet and Rug Institute (CRI)
- CRI 104-11 Installation of Commercial Carpet

PART 2 - PRODUCTS

2.1 CARPET TILE

- A. Physical Characteristics:
1. Carpet free of visual blemishes, streaks, poorly dyed areas, fuzzing of pile yarn, spots or stains and other physical and manufacturing defects.
 2. Manufacturers standard construction commercial carpet:
 - a. Modular Tile: Refer to the Materials Schedule on the drawings.

2.2 ACCESSORIES ADHESIVE AND CONCRETE PRIMER

- A. General: Provide products as recommended by the carpet tile manufacturer.
- B. Adhesive and Concrete Primer: Waterproof, resistant to cleaning solutions, steam and water, nonflammable, complies with air-quality standards as specified. Adhesives flashpoint minimum 60 degrees C (140 degrees F), complies with ASTM D 3278.
- C. Seam Adhesives: Waterproof, non-flammable and non-staining.
- D. Seaming Tape: Permanently resistant to carpet cleaning solutions, steam, and water.
- E. Leveling Compound (for concrete floors): Provide Portland cement bases polymer modifier with latex or polyvinyl acetate resin manufactured specifically for resurfacing and leveling concrete floors. Products containing gypsum are not acceptable.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

- A. Examine surfaces on which carpeting is to be installed.
- B. Clean floor of oil, waxy films, paint, dust and deleterious substances that prevent adhesion, leave floor dry and cured, free of residue from curing or cleaning agents and existing carpet materials.
- C. Correct conditions which will impair proper installation, including trowel marks, pits, dents, protrusions, cracks or joints.
- D. Fill cracks, joints depressions, 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 joint lines.
- E. Test new concrete subfloor prior to adhesive application for moisture and surface alkalinity per CRI 104 Section 6.3.1 or per ASTM E1907.

3.2 CARPET INSTALLTION

- A. Do not install carpet until work of other trades including painting is complete and dry.
- B. Install in accordance with CRI 104 direct glue down installation.
 - 1. Relax carpet in accordance with Section 6.4.
 - 2. Comply with indoor air quality recommendations noted in Section 6.5.
 - 3. Maintain temperature in accordance with Section 15.3.
- C. Secure carpet to subfloor of spaces with adhesive applied as recommended by carpet manufacturer.
- D. Follow carpet manufacturer's recommendations for matching pattern and texture directions.
- E. Cut openings in carpet where required for installing equipment, pipes, outlets, and penetrations.
 - 1. Bind or seal cut edge of sheet carpet and replace flanges or plates.

2. Use additional adhesive to secure carpets around pipes and other vertical projections.

F. Carpet Modules:

1. Install per CRI 104, Section 13, Adhesive Application.
2. Lay carpet modules with pile in same direction unless specified other wise.
3. Install carpet modules so that cleaning methods and solutions do not cause dislocation of modules.
4. Lay carpet modules uniformly to provide tight flush joints free from movement when subject to traffic.

3.3 EDGE STRIPS INSTALLATION

- A. Install edge strips over exposed carpet edges adjacent to uncarpeted finish flooring.
- B. Anchor metal strips to floor with suitable fasteners. Apply adhesive to edge strips, insert carpet into lip and press it down over carpet.
- C. Anchor vinyl edge strip to floor with adhesive apply adhesive to edge strip and insert carpet into lip and press lip down over carpet.

3.4 PROTECTION AND CLEANING

- A. Remove waste, fasteners and other cuttings from carpet floors.
- B. Vacuum carpet and provide suitable protection. Do not use polyethylene film.
- C. Do not permit traffic on carpeted surfaces for at least 48 hours after installation. Protect the carpet in accordance with CRI 104.
- D. Do not move furniture or equipment on unprotected carpeted surfaces.
- E. Just before final acceptance of work, remove protection and vacuum carpet clean.

END OF SECTION 09 68 00

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SECTION 09 91 00 - PAINTING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Section specifies field painting.
- B. Section specifies prime coats which may be applied in shop under other sections.
- C. Painting includes shellacs, stains, varnishes, coatings specified, and striping or markers and identity markings.

1.2 RELATED WORK

- A. Shop prime painting of steel and ferrous metals:
 - 1. Division 05 – METALS
 - 2. Division 08 – OPENINGS
 - 3. Division 21 – FIRE SUPPRESSION
 - 4. Division 22 – PLUMBING
 - 5. Division 23 – HEATING, VENTILATION AND AIR-CONDITIONING
 - 6. Division 26 – ELECTRICAL
 - 7. Division 27 - COMMUNICATIONS,
 - 8. Division 28 – ELECTRONIC SAFETY AND SECURITY
- B. Asphalt and concrete pavement marking: Section 32 17 23, PAVEMENT MARKINGS.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Before work is started, or sample panels are prepared, submit manufacturer's literature, 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. Each coating system is to be from a single manufacturer. All coats on a particular substrate must be from a single manufacturer.

C. Sample Panels:

1. After painters' materials have been approved and before work is started submit sample panels showing each type of finish and color specified.
2. Panels to show color: Composition board, 100 by 250 by 3 mm (4 inch by 10 inch by 1/8 inch).
3. Attach labels to panel stating the following:
 - a. Federal Specification Number or manufacturers name and product number of paints used.
 - b. Product type and color.
 - c. Name of project.
4. Strips showing not less than 50 mm (2 inch) wide strips of undercoats and 100 mm (4 inch) wide strip of finish coat.

D. Manufacturers' Certificates indicating compliance with specified requirements:

1. Manufacturer's paint substituted for Federal Specification paints meets or exceeds performance of paint specified.

1.4 DELIVERY AND STORAGE

A. Deliver materials to site in manufacturer's sealed container marked to show following:

1. Name of manufacturer.
2. Product type.
3. Batch number.
4. Instructions for use.
5. Safety precautions.

B. In addition to manufacturer's label, provide a label legibly printed as following:

1. Federal Specification Number, where applicable, and name of material.
2. Surface upon which material is to be applied.
3. If paint or other coating, state coat types; prime, body or finish.

C. Maintain space for storage, and handling of painting materials and equipment in a neat and orderly condition to prevent spontaneous combustion from occurring or igniting adjacent items.

D. Store materials at site at least 24 hours before using, at a temperature between 18 and 30 degrees C (65 and 85 degrees F).

1.5 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. Commercial Item Description (CID):
- A-A-1555 Water Paint, Powder (Cementitious, White and Colors) (WPC) (cancelled)
- E. Federal Specifications (Fed Spec):
- TT-P-1411A Paint, Copolymer-Resin, Cementitious (For Waterproofing Concrete and Masonry Walls) (CEP)
- F. Master Painters Institute (MPI):
- No. 1-07 Aluminum Paint (AP)
- No. 4-07 Interior/ Exterior Latex Block Filler
- No. 10-07 Exterior Latex, Flat (AE)
- No. 22-07 Aluminum Paint, High Heat (up to 590° - 1100F) (HR)
- No. 50-07 Interior Latex Primer Sealer
- No. 94-07 Exterior Alkyd, Semi-Gloss (EO)
- No. 95-07 Fast Drying Metal 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)
- G. 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. Aluminum Paint (AP): MPI 1.
- B. Interior Latex Block Filler: MPI 4.
- C. Exterior Latex, Flat (AE): MPI 10.
- D. High Heat Resistant Coating (HR): MPI 22.
- E. Interior Latex Primer Sealer: MPI 50.
- F. Exterior Alkyd, Semi-Gloss (EO): MPI 94.
- G. Fast Drying Metal Primer: MPI 95.
- H. Interior High Performance Latex, MPI Gloss Level 2(LF): MPI 138.
- I. Interior High Performance Latex, MPI Gloss Level 3 (LL): MPI 139.
- J. Plastic Tape:
 - 1. Pressure sensitive adhesive back.
 - 2. Widths as shown.
- K. Identity markers options:
 - 1. Pressure sensitive vinyl markers.
 - 2. Snap-on coil plastic markers.

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.

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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 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. Remove loose mortar in masonry work.
 4. Replace mortar and fill open joints, holes, cracks and depressions with new mortar specified in Section 04 05 13, MASONRY MORTARING and Section 04 05 16, MASONRY GROUTING. Do not fill weep holes. Finish to match adjacent surfaces.
 5. Neutralize concrete floors to be painted by washing with a solution of 1.4 Kg (3 pounds) of zinc sulfate crystals to 3.8 L (1 gallon) of water, allow to dry three days and brush thoroughly free of crystals.
 6. Repair broken and spalled concrete edges with concrete patching compound to match adjacent surfaces as specified in CONCRETE Sections. Remove projections to level of adjacent surface by grinding or similar methods.
- F. Gypsum 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 COR.
- 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 COR, 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. Provide tinted primers as recommended by the manufacturer for colors listed in the Interior Materials Schedule.

3.6 EXTERIOR FINISHES

- A. Steel and Ferrous Metal:
 - 1. Two coats of MPI 94 (Exterior Alkyd, Semi-Gloss (EO)) on exposed surfaces, except on surfaces over 94 degrees C (200 degrees F).
 - 2. One coat of MPI 22 (High Heat Resistant Coating (HR)) on surfaces over 94 degrees K (200 degrees F) and on surfaces of boiler stacks and engine exhaust pipes.
- B. Machinery without factory finish except for primer: One coat MPI 94 (Exterior Alkyd, Semi-Gloss (EO)).

3.7 INTERIOR FINISHES

- A. Apply following finish coats over prime coats in spaces or on surfaces specified in the Room Finish Schedule on the drawings.
- B. Metal Work:
 - 1. Apply to exposed surfaces; including unfinished steel structure and decking, metal doors and frames, lintels, stairs and handrails.
 - 2. Ferrous Metal, Galvanized Metal, and Other Metals Scheduled:
 - a. Primer: If not factory primed, provide one coat of MPI 95 (Fast Drying Metal Primer).
 - b. Intermediate and Finish Coat: Two coats of MPI 139 (Interior High Performance Latex, MPI Gloss Level 3 (LL)).
- C. Gypsum Board:
 - 1. Ceilings and Bulkhead Soffits:
 - a. Primer: One coat of MPI 50 (Interior Latex Primer Sealer).
 - b. Intermediate and Finish Coat: Two coats of MPI 138 (Interior High Performance Latex, MPI Gloss Level 2 (LF)).
 - 2. Walls:
 - a. Primer: One coat of MPI 50 (Interior Latex Primer Sealer).
 - b. Intermediate and Finish Coat: Two coats of MPI 139 (Interior High Performance Latex, MPI Gloss Level 3 (LL)).
- D. Masonry and Concrete Walls:
 - 1. Primer: One coat of MPI 4 (Interior Latex Block Filler).
 - 2. Intermediate and Finish Coat: Two coats of MPI 139 (Interior High Performance Latex, MPI Gloss Level 3 (LL)).

3.8 REFINISHING EXISTING PAINTED SURFACES

- A. Clean, patch and repair existing surfaces as specified under surface preparation.
- B. Remove and reinstall items as specified under surface preparation.
- C. Remove existing finishes or apply separation coats to prevent non compatible coatings from having contact.
- D. Patched or Replaced Areas in Surfaces and Components: Apply spot prime and body coats as specified for new work to repaired areas or replaced components.

- E. Except where scheduled for complete painting apply finish coat over plane surface to nearest break in plane, such as corner, reveal, or frame.
- F. Refinish areas as specified for new work to match adjoining work unless specified or scheduled otherwise.
- G. Sand or dull glossy surfaces prior to painting.
- H. Sand existing coatings to a feather edge so that transition between new and existing finish will not show in finished work.

3.9 PAINT COLOR

- A. Color and gloss of finish coats is specified in the Interior Materials Schedule on the drawings.
- B. For additional requirements regarding color see Articles, REFINISHING EXISTING PAINTED SURFACE and MECHANICAL AND ELECTRICAL FIELD PAINTING SCHEDULE.
- C. Coat Colors:
 - 1. Color of priming coat: Lighter than body coat.
 - 2. Color of body coat: Lighter than finish coat.
 - 3. Color prime and body coats to not show through the finish coat and to mask surface imperfections or contrasts.
- D. Painting, Caulking, Closures, and Fillers Adjacent to Casework:
 - 1. Paint to match color of casework where casework has a paint finish.
 - 2. Paint to match color of wall where casework is stainless steel or plastic laminate.

3.10 MECHANICAL AND ELECTRICAL WORK FIELD PAINTING SCHEDULE

- A. Field painting of mechanical and electrical consists of cleaning, touching-up abraded shop prime coats, and applying prime, body and finish coats to materials and equipment if not factory finished in space scheduled to be finished.
- B. In spaces not scheduled to be finish painted in the Interior Finish Schedule 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.

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- 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 the Interior Materials Schedule to match surrounding surfaces.
 - 2. Paint colors as specified in the Interior Materials Schedule except for following:
 - a. White - Exterior unfinished surfaces of enameled plumbing fixtures. Insulation coverings on breeching and uptake inside boiler house, drums and drum-heads, oil heaters, condensate tanks and condensate piping.
 - b. Gray - Heating, ventilating, air conditioning and refrigeration equipment (except as required to match surrounding surfaces), and water and sewage treatment equipment and sewage ejection equipment.
 - c. Aluminum Color: Ferrous metal on outside of boilers and in connection with boiler settings including supporting doors and door frames and fuel oil burning equipment, and steam generation system (bare piping, fittings, hangers, supports, valves, traps and miscellaneous iron work in contact with pipe).
 - d. Federal Safety Red: Exposed fire protection piping hydrants, post indicators, electrical conducts containing fire alarm control wiring, and fire alarm equipment.
 - e. Federal Safety Orange: .Entire lengths of electrical conduits containing feeders 600 volts or more.
 - f. Color to match brickwork sheet metal covering on breeching outside of exterior wall of boiler house.
 - I. Apply paint systems on properly prepared and primed surface as follows:
 - 1. Exterior Locations:
 - a. Apply two coats of MPI 94 (Exterior Alkyd, Semi-gloss (EO)) to the following ferrous metal items:
 - 1) Vent and exhaust pipes with temperatures under 94 degrees C (200 degrees F), roof drains, fire hydrants, post indicators, yard hydrants, exposed piping and similar items.

2. Interior Locations:

- a. Apply two coats of MPI 47 (Interior Alkyd, Semi-Gloss (AK)) to following items:
 - 1) Metal under 94 degrees C (200 degrees F) of items such as bare piping, fittings, hangers and supports.
 - 2) Equipment and systems such as hinged covers and frames for control cabinets and boxes, cast-iron radiators, electric conduits and panel boards.
 - 3) Heating, ventilating, air conditioning, plumbing equipment, and machinery having shop prime coat and not factory finished.
- b. Apply 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) Exterior of boilers and ferrous metal in connection with boiler settings including supporting members, doors and door frames and fuel oil burning equipment.
 - 2) Steam line flanges, bare pipe, fittings, valves, hangers and supports over 94 degrees K (200 degrees F).
 - 3) Engine generator exhaust piping and muffler.
- c. Paint electrical conduits containing cables rated 600 volts or more using two coats of MPI 94 (Exterior Alkyd, Semi-gloss (EO)) in the Federal Safety Orange color in exposed and concealed spaces full length of conduit.

3. Other exposed locations:

- a. Metal surfaces, except aluminum, of cooling towers exposed to view, including connected pipes, rails, and ladders: Two coats of MPI 1 (Aluminum Paint (AP)).
- b. Cloth jackets of insulation of ducts and pipes in connection with plumbing, air conditioning, ventilating refrigeration and heating systems: One coat of MPI 50 (Interior Latex Primer Sealer) and one coat of MPI 10 (Exterior Latex, Flat (AE)).

3.11 BUILDING AND STRUCTURAL WORK FIELD PAINTING

- A. Painting and finishing of interior and exterior work except as specified under the following paragraph.
 - 1. Painting and finishing of new and existing work including colors and gloss of finish selected is specified in Materials Schedule and Interior Finish Schedule on the drawings.
 - 2. Painting of disturbed, damaged and repaired or patched surfaces when entire space is not scheduled for complete repainting or refinishing.
 - 3. Painting of ferrous metal and galvanized metal.

4. Identity painting and safety painting.

B. Building and Structural Work not Painted:

1. Prefinished items:
 - a. Casework, doors, metal panels, wall covering, and similar items specified factory finished under other sections.
2. Finished surfaces:
 - a. Hardware except ferrous metal.
 - b. Anodized aluminum, stainless steel, chromium plating, copper, and brass, except as otherwise specified.
 - c. Signs, fixtures, and other similar items integrally finished.
3. Concealed surfaces:
 - a. Inside duct shafts, interstitial spaces, pipe basements, and above ceilings, 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. Except where specifically specified to be painted.
7. Metal safety treads and nosings.
8. Gaskets.
9. Concrete curbs, gutters, pavements, retaining walls, exterior exposed foundations walls and interior walls in pipe basements.
10. Face brick.

11. Structural steel encased in concrete, masonry, or other enclosure.
12. Structural steel to receive sprayed-on fire proofing.
13. Ceilings, walls, columns in interstitial spaces.
14. Ceilings, walls, and columns in pipe basements.

3.12 IDENTITY PAINTING SCHEDULE

A. Identify designated service in accordance with ANSI A13.1, unless specified otherwise, on exposed piping, piping above removable ceilings, piping in accessible pipe spaces, interstitial spaces, and piping behind access panels.

1. Legend may be identified using 2.1 G options or by stencil applications.
2. Apply legends adjacent to changes in direction, on branches, where pipes pass through walls or floors, adjacent to operating accessories such as valves, regulators, strainers and cleanouts a minimum of 12 000 mm (40 feet) apart on straight runs of piping. Identification next to plumbing fixtures is not required.
3. Locate Legends clearly visible from operating position.
4. Use arrow to indicate direction of flow.
5. Identify pipe contents with sufficient additional details such as temperature, pressure, and contents to identify possible hazard. Insert working pressure shown on drawings where asterisk appears for High, Medium, and Low Pressure designations as follows:
 - a. High Pressure - 414 kPa (60 psig) and above.
 - b. Medium Pressure - 104 to 413 kPa (15 to 59 psig).
 - c. Low Pressure - 103 kPa (14 psig) and below.
 - d. Add Fuel oil grade numbers.
6. Legend name in full or in abbreviated form as follows:

<u>PIPING</u>	<u>COLOR OF EXPOSED PIPING</u>	<u>COLOR OF BACKGROUND</u>	<u>COLOR OF LETTERS</u>	<u>LEGEND ABBREVIATIONS</u>
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
Liquid Supply		Yellow	Black	Liq Sup
Reuse Water		Yellow	Black	Reuse Wtr
Cold Water (Domestic)	White	Green	White	C.W. Dom
Hot Water (Domestic)				
Supply	White	Yellow	Black	H.W. Dom
Return	White	Yellow	Black	H.W. Dom Ret
Tempered Water	White	Yellow	Black	Temp. Wtr
Ice Water				
Supply	White	Green	White	Ice Wtr
Return	White	Green	White	Ice Wtr Ret
Reagent Grade Water		Green	White	RG

Reverse Osmosis	Green	White	RO
Sanitary Waste	Green	White	San Waste
Sanitary Vent	Green	White	San Vent
Storm Drainage	Green	White	St Drain
Pump Drainage	Green	White	Pump Disch
Chemical Resistant Pipe			
Waste	Yellow	Black	Acid Waste
Vent	Yellow	Black	Acid Vent
Atmospheric Vent	Green	White	ATV
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
Hot Water Return Domestic/Solar Water

H.W. Sup Dom/SW
H.W. Ret Dom/SW

7. Electrical Conduits containing feeders over 600 volts, paint legends using 50 mm (2 inch) high black numbers and letters, showing the voltage class rating. Provide legends where conduits pass through walls and floors and at maximum 6100 mm (20 foot) intervals in between. Use labels with yellow background with black border and words "Danger High Voltage Class, ____ Volts".
8. See Sections for methods of identification, legends, and abbreviations of the following:
 - a. Medical Gases and vacuum lines: Section 22 62 00, VACUUM SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES / Section 22 63 00, GAS SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES.
 - b. 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 28.33, CONDUITS AND BACKBOXES 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.

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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 semi-gloss 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.

3.13 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 09 91 00

SECTION 10 14 00 - SIGNAGE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies interior signage for room numbers, directional signs, code required signs, identification signs and temporary interior signs.
- B. This section also specifies exterior medical center identification signs, parking and traffic signs.
- C. This section does not include exterior illuminated dimensional letter signage.

1.2 RELATED WORK

- A. Exterior dimensional letter signage: Section 10 14 19, DIMENSIONAL LETTER SIGNAGE.
- B. Electrical: Related Electrical Specification Sections, Division 26.

1.3 MANUFACTURER'S QUALIFICATIONS

- A. Sign manufacturer shall provide evidence that they regularly and presently manufacture signs similar to those specified in this section as one of their principal products.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 00, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- B. Samples: Sign panels and frames, with letters and symbols, each type. Submit 2 sets. One set of samples will be retained by COR, other returned to Contractor.
 - 1. Sign Panel, 200 mm x 250 mm (8 inches x 10 inches), with letters.
 - 2. Color samples of each color, 150 mm x 150 mm (6 inches x 6 inches). Show anticipated range of color and texture.
 - 3. Sample of typeface, arrow and symbols in a typical full size layout.

C. Manufacturer's Literature:

1. Showing the methods and procedures proposed for the concealed anchorage of the signage system to each surface type.
2. Manufacturer's printed specifications, anchorage details, installation and maintenance instructions.

D. Samples: Sign location plan, showing location, type and total number of signs required.

E. Shop Drawings: Scaled for manufacture and fabrication of sign types. Identify materials, show joints, welds, anchorage, accessory items, mounting and finishes.

F. Full size layout patterns for dimensional letters.

1.5 DELIVERY AND STORAGE

A. Deliver materials to job in manufacturer's original sealed containers with brand name marked thereon. Protect materials from damage.

B. Package to prevent damage or deterioration during shipment, handling, storage and installation. Maintain protective covering in place and in good repair until removal is necessary.

C. Deliver signs only when the site and mounting services are ready for installation work to proceed.

D. Store products in dry condition inside enclosed facilities.

1.6 APPLICABLE PUBLICATIONS

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

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

- B209-07 Aluminum and Aluminum-Alloy Sheet and Plate
B221-06 Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire,
Shapes, and tubes

C. Federal Specifications (Fed Spec):

- MIL-PRF-8184F Plastic Sheet, Acrylic, Modified.
MIL-P-46144C..... Plastic Sheet, Polycarbonate

1.7 MINIMUM SIGN REQUIREMENTS

A. Permanent Rooms and Spaces:

1. Tactile and Braille Characters, raised minimum 0.793 mm (1/32 in). Characters shall be accompanied by Grade 2 Braille.
2. Type Styles: Characters shall be uppercase, Helvetica Medium, Helvetica Medium Condensed and Helvetica Regular.
3. Character Height: Minimum 16 mm (5/8 in) high, Maximum 50 mm (2 in).
4. Symbols (Pictograms): Equivalent written description shall be placed directly below symbol, outside of symbol's background field. Border dimensions of symbol background shall be minimum 150 mm (6 in) high.
5. Finish and Contrast: Characters and background shall be eggshell, matte or other non-glare finish with adequate contrast with background.
6. Mounting Location and Height: As shown. Mounted on wall adjacent to the latch side of the door and to avoid door swing and protruding objects.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Signs of type, size and design shown on the drawings and as specified.
- B. Signs complete with lettering, framing and related components for a complete installation.
- C. Provide graphics items as completed units produced by a single manufacturer, including necessary mounting accessories, fittings and fastenings.
- D. Do not scale drawings for dimensions. Contractor to verify and be responsible for all dimensions and conditions shown by these drawings. COR to be notified of any discrepancy in drawing, in field directions or conditions, and/or of any changes required for all such construction details.
- E. The Sign Contractor, by commencing work of this section, assumes overall responsibility, as part of his warranty of work, to assure that assemblies, components and parts shown or required within the work of the section, comply with the Contract Documents. The Contractor shall further warrant: That all components, specified or required to satisfactorily complete the installation are compatible with each other and with conditions of installations.

2.2 PRODUCTS

- A. Aluminum:
 - 1. Sheet and Plate: ASTM B209.
 - 2. Extrusions and Tubing: ASTM B221.
- B. Cast Acrylic Sheet: MIL-PRF-8184F; Type II, class 1, Water white non-glare optically clear. Matt finish water white clear acrylic shall not be acceptable.
- C. Polycarbonate: Mil-P-46144C; Type I, class 1.
- D. Vinyl: 0.1 mm thick machine cut, having a pressure sensitive adhesive and integral colors.
- E. Concrete Post Footings: See Section 03 30 00, CAST-IN-PLACE CONCRETE, Cast-in-place Concrete.
- F. Steel: See Section 05 12 00, STRUCTURAL STEEL FRAMING.

2.3 SIGN STANDARDS

- A. Topography:
 - 1. Type Style: Helvetica Medium and Helvetica Medium Condensed. Initial caps or all caps as indicated in Sign Message Schedule.
 - 2. Arrow: See graphic standards in drawings.
 - 3. Letter spacing: See graphic standards on drawings.
 - 4. Letter spacing: See graphic standards on drawings.
 - 5. All text, arrows, and symbols to be provided in size, colors, typefaces and letter spacing shown. Text shall be a true, clean, accurate reproduction of typeface(s) shown. Text shown in drawings are for layout purposes only; final text for signs is listed in Sign Message Schedule.
- B. Project Colors and Finishes: Match existing, verify with COR.

2.4 INTERIOR SIGN TYPES

- A. General:
 - 1. The interior sign system is comprised of sign type families that are identified by a letter and number (IN-XX) which identify a particular group of signs based on VA Guidelines. An additional number identifies a specific type of sign within that family (IN-XX.XX).

B. Interchangeable Component System:

1. Sign Type Families: 03, 09, and 14.
2. Interior sign system capable of being arranged in a variety of configurations with a minimum of attachments, devices and connectors.
 - a. Interchangeable nature of the system shall allow for changes of graphic components of the installed sign, without changing sign in its entirety.
 - b. Component Sign System is comprised of the following primary components:
 - 1) Rail Back utilizing horizontal rails, spaced to allow for uniform, modular sizing of sign types.
 - 2) Rail Insert mounted to back of Copy Panels to allow for attachment to Rail Back.
 - 3) Copy Panels, made of a variety of materials to allow for different graphic needs.
 - 4) End Caps which interlock to Rail Back to enclose and secure changeable Copy Panels.
 - 5) Joiners and Accent Joiners connect separate Rail Backs together.
 - 6) Top Accent Bars which provide decorative trim cap that encloses the top of sign or can connect the sign to a Type 03 Room Number Sign.
 - c. Rail Back, Rail Insert and End Caps in anodized extruded aluminum to allow for tight tolerances and consistent quality of fit and finish.
 - d. Signs in system shall be convertible in the field to allow for enlargement from one size to another in height and width through use of Joiners or Accent Joiners, which connect Rail Back panels together blindly, providing a butt joint between Copy Panels. Accent Joiners shall connect Rail Backs together with a visible 3 mm (1/8") horizontal rib, flush to the adjacent copy insert surfaces.
 - e. Sign configurations shall vary in width from 225 mm (9 inches) to 2050 mm (80 inches), and have height dimensions of 50 mm (2 inches), 75 mm (3 inches), 150 mm (6 inches), 225 mm (9 inches) and 300 mm (12 inches). Height shall be increased beyond 300 mm (12 inches), by repeating height module in full or in part.
3. Rail Back functions as internal structural member of sign using 6063T5 extruded aluminum and anodized black.
 - a. Shall accept an extruded aluminum or plastic insert on one sign or on both sides, depending upon sign type.
 - b. Shall be convertible in field to allow for connection to other Rail Back panels, so that additive changes can be made to sign unit.
 - c. Rail shall allow for a variety of mounting devices including wall mounting for screw-on applications, using pressure sensitive tape, freestanding mount, ceiling mount and other mounting devices as needed.

-
4. Rail Insert functions as a mounting device for Copy Panels on to the Rail Back. The Rail Insert mounts to the back of the Copy Panel with adhesive suitable for use with the particular copy insert material.
 - a. Shall allow Copy Panels to slide or snap into the horizontal Rail Back for ease of changeability.
 - b. Shall mount to the back of the Copy Panel with adhesive suitable for use with particular Copy Panel material.
 5. Copy Panels shall accept various forms of copy and graphics, and attaches to the Rail Back with the Rail Insert. Copy Panels shall be either ABS plastic with integral color or an acrylic lacquer finish; photo polymer; or, acrylic.
 - a. Interchangeable by sliding horizontally from either side of sign, and to other signs in system of equal or greater width or height.
 - b. Cleanable without use of special chemicals or cleaning solutions.
 - c. Copy Insert Materials.
 - 1) ABS Inserts - 2.3 mm (.090 inches) extruded ABS plastic core with .07 mm (.003 inches) acrylic cap bonded during extrusion/texturing process. Pressure bonded to extruded Rail Insert using adhesive. Background color is either integral or painted in acrylic lacquer. ABS inserts finished in a chromium industries #HM335RA texture pattern to prevent glare.
 - 2) Photo polymer Inserts - 3 mm (.125 inches) phenolic photo polymer with raised copy etched to 2.3 mm (.0937 inches), bonded to an ABS plastic or extruded aluminum insert with adhesive. Background color is painted in acrylic enamel.
 - 3) Changeable Paper/ Insert Holder - Extruded insert holder with integral Rail Insert for connection with structural back panel in 6063T5 aluminum with a black anodized finish. Inserts into holder are paper with a clear 0.7 mm (.030 inches) textured cover. Background color is painted in acrylic lacquer.
 - 4) Acrylic - 2 mm (.080 inches) non-glare acrylic. Pressure bonded to extruded Rail Insert using adhesive. Background color is painted in acrylic lacquer or acrylic enamel.
 - 5) Extruded 6063T5 aluminum with a black anodized finish Insert Holder with integral Rail Insert for connection with Structural Back Panel to hold a 0.7 mm (.030 inches) textured polycarbonate insert and a Sliding Tile which mounts in the Inset Holder and slides horizontally.
 - 6) End Caps - Extruded using 6063T5 aluminum with a black anodized. End Caps interlock with Rail Back with clips to form an integral unit, enclosing and securing the changeable Copy Panels, without requiring tools for assembly.
 - a) Shall be interchangeable to either end of sign and to other signs in the system of equal height.

- b) Mechanical fasteners can be added to the End Caps that will secure it to Rail Back to make sign tamper resistant.
- 7) Joiners - Extruded using 6063T5 aluminum with a black anodized finish. Rail Joiners connect Rail Backs together blindly, providing a butt joint between Copy Inserts.
- 8) Accent Joiners - Extruded using 6063T5 aluminum with a mirror polished finish. Joiner shall connect Rail Backs together with a visible 3 mm (.125 inches) horizontal rib, flush to the adjacent Copy Panel surfaces.
- 9) Top Accent Rail - Extruded using 6063T5 aluminum with a mirror polished finish. Rail shall provide 3 mm (.125 inches) high decorative trim cap, which butts flush to adjacent Copy Panel and encloses top of Rail Back and Copy Panel.
- 10) Typography
 - a) Vinyl First Surface Copy (non-tactile) - Applied Vinyl copy.
 - b) Subsurface Copy Inserts - Textured 1 mm (.030 inches) clear polycarbonate face with subsurface applied Vinyl copy. Face shall be back sprayed with paint and laminated to an extruded aluminum carrier insert.
 - c) Integral Tactile Copy Inserts - phenolic photo polymer etched with 2.3 mm (.0937 inches) raised copy.
 - d) Silk-screened First Surface Copy (non-tactile) - Injection molded or extruded ABS plastic or aluminum insert with first surface applied enamel silk-screened copy.

C. Sign Type Family 01, 02.01 thru 02.05, 08, and 09:

- 1. All text and graphics are to be first surface silk-screened.
- 2. IN-01.12 & IN-01.13: Refer to Sign Type 03 specification for tactile and Braille portion of sign.
- 3. IN-02.4: All text and graphics are to be first surface vinyl letters.
- 4. IN-01.1: Preparation of artwork for reproduction of "fire and emergency evacuation maps" is by manufacturer.

D. Sign Type Families 03:

- 1. Tactile sign is to be made from a material that provides for letters, numbers and Braille to be integral with sign plaque material such as: photosensitive polyamide resin, etched metal, sandblasted phenolic or embossed material. Do not apply letters, numbers and Braille with adhesive.
- 2. Numbers, letters and Braille to be raised 0.793 mm (.0312 inches) from the background surface. The draft of the letters, numbers and Braille to be tapered, vertical and clean.

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3. Braille dots are to conform with standard dimensions for literary Braille; (a) Dot base diameter: 1.5 mm (.059 inches) (b) Inter-dot spacing: 2.3 mm (.090 inches) (c) Horizontal separation between cells: 6.0 mm (.241 inches) (d) Vertical separation between cells: 10.0 mm (.395 inches)
 4. Entire assembly is painted in specified color. After painting, apply white or other specified color to surface of the numbers and letters. Entire sign is to have a protective clear coat sealant applied.
 5. Complete sign is to have an eggshell finish (11 to 19 degree on a 60 degree glossmeter).
- E. Sign Type Family 04 and 11:
1. All text and graphics are to be first surface applied vinyl letters.
 2. IN-04: When a Type IN-04 is to be mounted under a Type IN03, a connecting Accent Joiner is to be used to create a singular integrated sign.
- F. Sign Type 05:
1. Text if added to Copy Insert module to be first surface applied vinyl letters.
- G. Sign Type Family 06 and 07:
1. All text and graphics are to be first surface applied vinyl letters except for under sliding tile.
 2. Protect text, which is covered by sliding tile, so tile does not wear away letters.
- H. Sign Type Family 12 and 13:
1. All text and graphics are to be first surface applied vinyl letters.
 2. IN-12: Provide felt, cork or similar material on bottom of desk mounting bracket to protect counter surfaces.
- I. Sign Type Family 19:
1. Dimensional letters are mill or laser cut acrylic in the size and thickness noted in the drawings.
 2. Draft of letters is perpendicular to letters face.
 3. All corners such as where a letter stem and bar intersect are to be square so the letter form is accurately reproduced.
 4. Paint letters with acrylic polyurethane in specified color and finish.

2.5 EXTERIOR SIGN TYPES

- A. Handicap Parking Stall:
1. Fabricated

2.6 TEMPORARY INTERIOR SIGNS

A. Temporary Interior Signs:

1. Fabricated from 50 kg (110 pound) matte finished white paper cut to 100 mm (4 inch) wide by 300 mm (12 inch) long. Punched 3 mm (.125 inch) hole with edge of hole spaced 13 mm (.5 inch) in from edge and centered on 100 mm (4 inch) side. Reinforce hole on both sides with suitable material that prevents tie from pulling through hole. Ties are steel wire 0.3 mm (0.120 inch) thick attached to tag with twist leaving 150 mm (6 inch) long free ends.
2. Mark architectural room number on sign, with broad felt marker in clearly legible numbers or letters that identify room, corridor or space as shown on floor plans.
3. Install temporary signs to all rooms that have a room, corridor or space number. Attach to door frame, door knob or door pull.
 - a. Doors that do not require signs are: corridor doors in corridor with same number, folding doors or partitions, toilet doors, bathroom doors within and between rooms, closet doors within rooms, communicating doors in partitions between rooms with corridor entrance doors.
 - b. Replace and missing damaged or illegible signs.

2.7 FABRICATION

- A. Design components to allow for expansion and contraction for a minimum material temperature range of 56 °C (100 °F), without causing buckling, excessive opening of joints or over stressing of adhesives, welds and fasteners.
- B. Form work to required shapes and sizes, with true curve lines and angles. Provide necessary rebates, lugs and brackets for assembly of units. Use concealed fasteners whenever and wherever possible.
- C. Shop fabricate so far as practicable. Joints fastened flush to conceal reinforcement, or welded where thickness or section permits.
- D. Contact surfaces of connected members be true. Assembled so joints will be tight and practically unnoticeable, without use of filling compound.
- E. Signs shall have fine, even texture and be flat and sound. Lines and miters sharp, arises unbroken, profiles accurate and ornament true to pattern. Plane surfaces be smooth flat and without oil-canning, free of rack and twist. Maximum variation from plane of surface plus or minus 0.3 mm (0.015 inches). Restore texture to filed or cut areas.
- F. Level or straighten wrought work. Members shall have sharp lines and angles and smooth surfaces.

- G. Extruded members to be free from extrusion marks. Square turns and corners sharp, curves true.
- H. Drill holes for bolts and screws. Conceal fastenings where possible. Exposed ends and edges mill smooth, with corners slightly rounded. Form joints exposed to weather to exclude water.
- I. Finish hollow signs with matching material on all faces, tops, bottoms and ends. Edge joints tightly mitered to give appearance of solid material.
- J. All painted surfaces properly primed. Finish coating of paint to have complete coverage with no light or thin applications allowing substrate or primer to show. Finished surface smooth, free of scratches, gouges, drips, bubbles, thickness variations, foreign matter and other imperfections.
- K. Movable parts, including hardware, are to be cleaned and adjusted to operate as designed without binding or deformation of members. Doors and covers centered in opening or frame. All contact surfaces fit tight and even without forcing or warping components.
- L. Pre-assemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for re-assembly and coordinated installation.
- M. No signs are to be manufactured until final sign message schedule and location review has been completed by the COR & forwarded to contractor.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Protect products against damage during field handling and installation. Protect adjacent existing and newly placed construction, landscaping and finishes as necessary to prevent damage during installation. Paint and touch up any exposed fasteners and connecting hardware to match color and finish of surrounding surface.
- B. Mount signs in proper alignment, level and plumb according to the sign location plan and the dimensions given on elevation and sign location drawings. Where otherwise not dimensioned, signs shall be installed where best suited to provide a consistent appearance throughout the project. When exact position, angle, height or location is in doubt, contact COR for clarification.
- C. Contractor shall be responsible for all signs that are damaged, lost or stolen while materials are on the job site and up until the completion and final acceptance of the job.

- D. Remove or correct signs or installation work COR determines as unsafe or as an unsafe condition.
- E. At completion of sign installation, clean exposed sign surfaces. Clean and repair any adjoining surfaces and landscaping that became soiled or damaged as a result of installation of signs.
- F. Locate signs as shown on the Sign Location Plans.
- G. Certain signs may be installed on glass. A blank glass back up is required to be placed on opposite side of glass exactly behind sign being installed. This blank glass back up is to be the same size as sign being installed.
- H. Contractor will be responsible for verifying that behind each sign location there are no utility lines that will be affected by installation of signs. Any damage during installation of signs to utilities will be the sole responsibility of the Contractor to correct and repair.
- I. Furnish inserts and anchoring devices which must be set in concrete or other material for installation of signs. Provide setting drawings, templates, instructions and directions for installation of anchorage devices which may involve other trades.

END OF SECTION 10 14 00

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SECTION 10 14 19 - DIMENSIONAL LETTER SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Illuminated, fabricated channel dimensional characters.

1.2 RELATED WORK

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General Electrical Requirements and items, which are common to sections of Division 26.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Product Data: For each type of product.
- C. Shop Drawings: For dimensional letter signs.
 - 1. Include fabrication and installation details and attachments to other work.
 - 2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
 - 3. Show message list, typestyles, graphic elements, and layout for each sign.
 - 4. Show locations of electrical service connections.
 - 5. Include diagrams for power, signal, and control wiring.
- D. Samples: For each exposed product and for each color and texture specified.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Manufacturer to design structure and anchorage of dimensional character signage.

- B. Thermal Movements: For exterior fabricated channel dimensional characters, allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 67 deg C (120 deg F), ambient; 100 deg C (180 deg F), material surfaces.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 DIMENSIONAL CHARACTERS

- A. Fabricated Channel Characters: Translucent face with metal side returns, formed free from warp and distortion; with uniform faces, sharp corners, and precisely formed lines and profiles; internally braced for stability and for securing fasteners; and as follows.
 - 1. Illuminated Characters: Backlighting character construction with fluorescent tube, LED, or neon tube lighting including transformers, insulators, and other accessories for operability, with provision for servicing and concealing connections to building electrical system. Use tight or sealed joint construction to prevent unintentional light leakage. Space lamps apart from each other and away from character surfaces as needed to illuminate evenly.
 - 2. Character Material: Sheet or plate aluminum.
 - 3. Translucent Face Sheet: Acrylic sheet with integral color as selected by Architect from manufacturer's full range.
 - 4. Character Height: As indicated on the drawings.
 - 5. Finishes:
 - a. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard, in color as selected by Architect from manufacturer's full range.
 - 6. Mounting: Manufacturer's standard for size and design of characters.
 - a. Hold characters at manufacturer's recommended distance from wall surface.

2.3 DIMENSIONAL CHARACTER MATERIALS

- A. Acrylic Sheet: ASTM D 4802, Type UVF (UV filtering).

2.4 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:
 - 1. Use concealed fasteners and anchors unless indicated to be exposed.
 - 2. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.
 - 3. Exposed Metal-Fastener Components, General:
 - a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
- B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.5 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
 - 1. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
 - 2. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
 - 3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
 - 4. Internally brace signs for stability and for securing fasteners.
 - 5. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
- B. Brackets: Fabricate brackets, fittings, and hardware for bracket-mounted signs to suit sign construction and mounting conditions indicated. Modify manufacturer's standard brackets as required.
 - 1. Aluminum Brackets: Factory finish brackets with baked-enamel or powder-coat finish to match sign-background color unless otherwise indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
 - 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
 - 2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
 - 3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- B. Mounting Methods:
 - 1. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.
- C. Remove temporary protective coverings and strippable films as signs are installed.

END OF SECTION 10 14 19

SECTION 10 21 23 - CUBICLE CURTAINS AND TRACKS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies cubicle curtain track (CCT), intravenous support assembly (IV), cubicle curtains and shower curtains.

1.2 RELATED WORK

- A. Shower curtain rods and hooks: 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:
 - 1. One 300 mm (12 inch) long piece of cubicle curtain track with carrier access and end stop.
 - 2. One clip anchor for fastening track to grid system of acoustical ceilings. One curtain carrier.
 - 3. One intravenous support assembly consisting 300 mm (12 inch) long pieces of track, carrier assembly, and bottle pendant.
- C. Shop Drawings: Showing layout of tracks and method of anchorage.
- D. Manufacturer's Literature and Data:
 - 1. Cubicle curtain track.
 - 2. Intravenous support assembly.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Deliver material in original package marked to identify the contents, brand name, and the name of the manufacturer or supplier.
- B. Store in dry and protected location. Store so as to not bend or warp the tracks.

- C. Do not open packages until contents are needed for installation, unless verification inspection is required.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - B221-06 Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
 - B456-03 Electrodeposited Coatings for Copper Plus Nickel Plus Chromium and Nickel Plus Chromium
- C. The National Association of Architectural Metal Manufacturers (NAAMM):
 - AMP 500 Series Metal Finishes Manual

PART 2 - PRODUCTS

2.1 CUBICLE CURTAIN TRACKS

- A. Cubicle Curtain Tracks: Channel tracks, surface mounted type, extruded aluminum, ASTM B221, alloy 6063, temper T5 or T6, channel shaped, with smooth inside raceway for curtain carriers. White baked acrylic enamel finish. Straight and bent (12-inch radius) sections.
- B. Curtain Carriers: Nylon or delrin carriers, with either nylon or delrin wheels on metal, delrin, or nylon axles. Equip each carrier with either stainless steel, chromium plated brass or steel hooks with swivel, or nickel chromium plated brass or stainless steel bead chain and hook assembly, or delrin carriers may have moulded on delrin hooks. Hook for bead chain may be the same material and finish as the bead chain or may be chromium plated steel. Provide 2.2 carriers for every 300 mm (one foot) of each section of each track length, plus one additional carrier.
- C. End Stop Connectors, Splices and Other Fittings: Fabricate from the same material with the same finish as the tracks or from nylon.
 - 1. At end of each section of track, make provision for insertion and removal of carriers. Design to prevent accidental removal of carrier. Any operating mechanism shall be removable with common tools.

- D. Hangers: Tegular edge grid clip. Provide appropriate attachment accessories as required for ceiling grid members. Design fittings to be compatible with design of tracks and to safely transmit the track load to the hangers.

2.2 INTRAVENOUS SUPPORT ASSEMBLY

- A. Assembly includes track, carrier assembly, bottle holding pendant, curved track sections and curved connectors, and all components and accessories required for a working installation.
- B. Track, Fittings and Hangers: Same as cubicle curtains.
- C. Carrier Assembly: Assembly shall include a body made of either stainless steel or aluminum, and be equipped with four ball bearing nylon wheels and lockstop to insure insulation of carrier from track. Equip carrier with a positive locking device to hold carrier stationary when in use. Provide with either a stainless steel, or chromium plated brass hook for support of bottle holding pendent.
- D. Bottle Holding Pendent: Equip with a minimum of three, stainless steel, chromium plated steel, or chromium plated brass arms connected to adjustable shaft of same material. Adjustable shaft shall permit bottle holding hub to adjust from full height to approximately 1800 mm (six feet), 75 mm (three inches) above finished floor. Provide shaft with a built-in locking device for vertical height adjustments. Locking device shall be activated by push button or similar easily operated one hand control.

2.3 CURTAINS

- A. General: Fabrics and mesh to pass NFPA 701.
- B. Cubicle Curtain Fabric: Curtain manufacturer's standard, 100 percent polyester, inherently and permanently flame resistant, stain resistant, and antimicrobial.
 - 1. Product: Provide the products listed in the Finish Materials Schedule on the drawings.
- C. Shower Curtain Fabric: Polyester-reinforced vinyl fabric; flame resistant, stain resistant, and antimicrobial.
 - 1. Product: Provide the products listed in the Finish Materials Schedule on the drawings.
- D. Mesh Top: Not less than 508-mm (20-inch) high mesh top of No. 50 nylon mesh.
- E. Curtain Grommets: Two-piece, rolled-edge, rustproof, nickel-plated brass; spaced not more than 6-inches o.c.; machined into top hem.

2.4 CURTAIN FABRICATION

- A. Fabricate curtains to comply with the following requirements:
1. Width: Equal to track length from which curtain is hung plus 10 percent added fullness, but not less than 12 inches added fullness.
 2. Cubicle curtains to have mesh top.
 3. Shower Curtain Length: Equal to floor-to-ceiling height, minus 1/2 inch above the finished floor at bottom.
 4. Top Hem: Not less than 1 inch and not more than 1-1/2 inches wide, triple thickness, reinforced with integral web, and double lock stitched.
 5. Bottom Hem: Not less than 1 inch and not more than 1-1/2 inches wide, double thickness and double lock stitched.
 6. Side Hems: Not less than 1/2 inch and not more than 1-1/4 inches wide, with double turned edges, and single lock stitched.
 7. Vertical Seams: Not less than 1/2 inch wide, double turned and double stitched.

2.5 FASTENERS

- A. Exposed Fasteners, Screws and Bolts: Stainless steel or chromium/nickel plated brass.
- B. Concealed Fasteners, Screws and Bolts: Hot-dip galvanized (except in high moisture areas use stainless steel).
- C. Metal Clips: Anchor curtain tracks to exposed grid of lay-in acoustical tile ceilings, with concealed metal (butterfly) type or two piece snap locking type ceiling clip of high strength spring steel. When it is not possible to install the metal ceiling clip, the cubicle curtain track may be screwed to the ceiling grid.
- D. Provide tamper resistant fasteners in the Psych Holding Rooms.

2.6 FINISHES

- A. Aluminum: Finish numbers for aluminum specified are in accordance with The Aluminum Association's Designation System. AA-C22A31 finish chemically etched medium matte, with clear anodic coating, Class II Architectural, 0.4 mils thick.
- B. Chrome/Nickel Plating: Satin or polished finish as specified, ASTM B546, minimum thickness of chromium plate as follows:
1. 0.2 mil on copper alloys.
 2. 0.4 mil on steel.

2.7 FABRICATION

- A. Weld and grind smooth joints of fabricated components.
- B. Form tracks and bends of lengths that will produce the minimum number of joints. Make track sections up to 4800 mm (16 feet) without joints. Form corner bend on a 300 mm (12 inch) radius.
- C. Provide steel anchor plates, supports, and anchors for securing components to building construction.
- D. Form flat surface without distortion.
- E. Shop assemble components and package complete with anchors and fittings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install tracks after finish painting and ceiling finishing operations are complete.
- B. Install track level and securely anchor to the ceiling grid to form a rigid installation.
- C. Anchor surface mounted curtain tracks directly to exposed grid of lay-in acoustical tile ceilings with suitable fasteners, spaced approximately 600 mm (24 inches) on center.
- D. Anchor surface mounted curtain tracks to concrete, plaster and gypsum board ceilings with a minimum of 3 mm (1/8-inch) diameter fastenings or concealed clips spaced not more than 900 mm (three feet) on center.
- E. Securely fasten end stop caps to prevent their being forced out by the striking weight of carriers.
- F. Anchor surface mounted intravenous track directly to support system above ceiling as shown.
- G. Remove damaged or defective components and replace with new components or repair to the original condition.

3.2 ACCEPTANCE

- A. Track shall be installed neat, rigid, plumb, level and true, and securely anchored to the overhead construction.
- B. Carrier units shall operate smoothly and easily over the full range of travel.

END OF SECTION 10 21 23

SECTION 10 26 00 - WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies corner guards, bumper rails, handrails, and high impact wall covering.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: Show design and installation details.
- C. Manufacturer's Literature and Data: For each product.
- D. Test Reports: Showing that resilient material complies with specified fire and safety code requirements.

1.3 DELIVERY AND STORAGE

- A. Deliver materials to the site in original sealed packages or containers marked with the name and brand, or trademark of the manufacturer.
- B. Protect from damage from handling and construction operations before, during and after installation.
- C. Store in a dry environment of approximately 21° C (70 degrees F) for at least 48 hours prior to installation.

1.4 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM)
 - A167-99(R2009) Stainless and Heat-Resisting Chromium-Nickel Steel
Plate, Sheet, and Strip
 - B221-08 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
E84-09 Surface Burning Characteristics of Building Materials

C. The National Association of Architectural Metal Manufacturers (NAAMM)

AMP 500-06 Metal Finishes Manual

D. Society of American Automotive Engineers (SAE)

J 1545-05 Instrumental Color Difference Measurement for Exterior
Finishes

E. 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.

C. Resilient Material:

1. Extruded and injection molded acrylic vinyl or extruded polyvinyl chloride meeting following requirements:
 - a. Minimum impact resistance of 1197 ps (25 ft lbs per sq.ft) when tested in accordance with ASTM D256 (Izod impact, ft.lbs. per inch notch).
 - b. Class 1 fire rating when tested in accordance with ASTM E84, having a maximum flame spread of 25 and a smoke developed rating of 450 or less.
 - c. Rated self extinguishing when tested in accordance with ASTM D635.
 - d. Material shall be labeled and tested by Underwriters Laboratories or other approved independent testing laboratory.
 - e. Integral color with all colored components matched in accordance with SAE J 1545 to within plus or minus 1.0 on the CIE-LCH scales.
 - f. Same finish on exposed surfaces.

2.2 CORNER GUARDS

- A. Resilient, Shock-Absorbing Corner Guards (Denoted as CG-1): Surface mounted.
 - 1. Snap-on corner guard formed from resilient material, minimum 2 mm (0.078-inch) thick, free floating on a continuous 1.6 mm (0.063-inch) thick extruded aluminum retainer. Provide appropriate mounting hardware, cushions and base plates as required.
 - 2. Profile: 76 mm (3-inch) wings, 6.4 mm (1/4-inch) radius nose.
 - 3. Height: 2438 mm (96-inches) high.
 - 4. Provide factory fabricated end closure caps at top and bottom of surface mounted corner guards.
 - 5. Mounting: Mechanically fastened retainer.
- B. Stainless Steel Corner Guards (Denoted as CG-2): Surface mounted.
 - 1. Fabricate of 1.6 mm (0.0625-inch) thick stainless steel. Form guards of dimensions and to contour shown.
 - 2. Profile: 89 mm (3-1/2 inch) wings, 6.4 mm (1/4-inch) radius nose.
 - 3. Height: 2438 mm (96-inches) high
 - 4. Mounting: Adhesive.

2.3 BUMPER RAILS

- A. Resilient Bumper Rails:
 - 1. Resilient Bumper Rails: Snap-on covers of resilient material, minimum 2 mm (0.078-inch) thick, shall be free-floated on a continuous, extruded aluminum retainer, minimum 1.8 mm (0.072-inch) thick, anchored to wall at maximum 760 mm (30 inches) on center.
 - 2. Provide bumper rails with prefabricated and closure caps, inside and outside corners, concealed splices, cushions, mounting hardware and other accessories as required. End caps and corners shall be field adjustable to assure close alignment with bumper rails. Screw or bolt closure caps to aluminum retainer.
 - 3. Provide color matched brackets extending rail 56 mm (2-3/16 inch) from wall.
 - 4. Profiles:
 - a. Wall Mounted Bumper Rails (Denoted as BR-1): 203 mm (8-inch) high by 19 mm (3/4-inch) deep.
 - b. Bracket Mounted Bumper Rails (Denoted as BR-2): 102 mm (4-inch) high by 19.6 mm (3/4-inch) deep.

2.4 HANDRAILS

A. Resilient Handrails:

1. Handrail/Bumper Guard Combination: Snap-on covers of resilient material, minimum 2 mm (0.078-inch) thick, shall be free-floated on a continuous, extruded aluminum retainer, minimum 1.8 mm (0.072-inch) thick, anchored to wall at maximum 760 mm (30 inches) on center.
2. Profile: 140-mm (5-1/2 inch) high with rounded top and bottom.
3. Provide handrails with prefabricated and closure caps, inside and outside corners, concealed splices, cushions, mounting hardware and other accessories as required. End caps and corners shall be field adjustable to assure close alignment with handrails and wall guards (crash rails). Screw or bolt closure caps to aluminum retainer.
4. Provide color matched brackets extending rail 56 mm (2-3/16 inch) from wall.

2.5 HIGH IMPACT WALL COVERING

- A. Fabricate from vinyl acrylic or polyvinyl chloride resilient material minimum 6mm (0.06 inch) thick designed specially for interior use.
- B. 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. Provide tamper-resistant fasteners in Psych Holding Rooms.
- B. Where type, size, spacing or method of fastening is not shown or specified, submit shop drawings showing proposed installation details.
- C. Adhesive: As recommended by manufacturer

2.7 FINISH

- A. In accordance with NAAMM AMP 500 series.
- B. Aluminum:
 1. Concealed aluminum: Mill finish as fabricated, uniform in color and free from surface blemishes.
- C. Stainless Steel: Refer to the Materials Schedule on the drawings.

- D. Resilient Material: Embossed texture and color in accordance with SAE J 1545 and as shown on the Interior Materials and Finish Schedules.

PART 3 - INSTALLATION

3.1 RESILIENT CORNER GUARDS

- A. Install corner guards on walls in accordance with manufacturer's instructions.

3.2 STAINLESS STEEL CORNER GUARDS

- A. Mount guards on external corners of interior walls, partitions and columns as shown.
- B. 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.

3.3 RESILIENT HANDRAILS AND BUMPER RAILS

- A. Secure guards to walls with brackets and fasteners in accordance with manufacturer's details and instructions.

3.4 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. Apply with adhesive in controlled environment according to manufacture's recommendations.
- D. 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 10 26 00

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SECTION 10 28 00 - TOILET, BATH, AND JANITORIAL ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies manufactured items usually used in toilets, baths, break rooms and at sinks in related spaces.
- B. Items Specified:
 - 1. Grab bars.
 - 2. Toilet tissue dispensers.
 - 3. Sanitary-napkin disposal.
 - 4. Baby changing stations.
 - 5. Paper towel dispensers.
 - 6. Metal framed mirrors.
 - 7. Glove box holder.
 - 8. Shower curtain rods and hooks.
 - 9. Folding shower seats.
 - 10. Robe hooks.
 - 11. Mop and broom racks.
- C. This section also includes installation of the following Government Furnished Items:
 - 1. Hand sanitizer dispensers.
 - 2. Soap dispensers.
 - 3. Sharps disposal containers.

1.2 RELATED WORK

- A. Shower Curtains: Section 10 21 23, CUBICLE CURTAINS AND TRACKS.

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. Metal framed mirrors, showing shelf where required, fillers, and design and installation of units when installed on ceramic tile wainscots and offset surfaces.

3. Shower Curtain rods, showing required length for each location.
4. Grab bars, showing design and each different type of anchorage.
5. Show material and finish, size of members, and details of construction, installation and anchorage of mop racks.

C. Manufacturer's Literature and Data:

1. All accessories specified.
2. Show type of material, gages or metal thickness in inches, finishes, and when required, capacity of accessories.

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 weather-tight and dry storage facility.
- B. Protect from damage from handling, weather and construction operations before, during and after installation in accordance with manufacturer's instructions.

1.7 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
- C. The National Association of Architectural Metal Manufacturers (NAAMM):
- AMP 500 Series Metal Finishes Manual
 - AMP 500-505-88 Metal Finishes Manual and Finishes for Stainless Steel
- D. American Welding Society (AWS):
- D10.4-86 (R2000) Welding Austenitic Chromium-Nickel Stainless Steel Piping and Tubing
- E. Federal Specifications (Fed. Specs.):
- A-A-3002 Mirrors, Glass
 - FF-S-107C (2) Screw, Tapping and Drive
 - 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. Phenolic Panel: Solid phenolic-core panel material with melamine facing on both sides fused to substrate during panel manufacture (not separately laminated), and with eased and polished edges.
- G. Glass:
 - 1. ASTM C1036, Type 1, Class 1, Quality q2, for mirrors.

2.2 FASTENERS

- A. Exposed Fasteners: Stainless steel or chromium plated brass, finish to match adjacent surface. Provide tamper resistant fasteners Psych Holding rooms.
- 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. AA-C22A41: Chemically etched medium matte, with clear anodic coating, Class I Architectural, 0.7-mil thick.
 - 2. AA-C22A44: Chemically etched medium matte with electrolytically deposited metallic compound, integrally colored coating Class I Architectural, 0.7-mil thick finish. Dyes will not be accepted.
- C. AA-M32: Mechanical finish, medium satin.
 - 1. Chromium Plating: ASTM B456, satin or bright as specified, Service Condition No. SC2.
 - 2. Stainless Steel: NAAMM AMP 503, finish number 4.
 - 3. Ferrous Metal:
 - a. Shop Prime: Clean, pretreat and apply one coat of primer and bake.
 - b. Finish: Over primer apply two coats of alkyd or phenolic resin enamel, and bake.

2.4 FABRICATION - GENERAL

- A. 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.
- L. Provide tamper-resistant fasteners for all exposed and semi-exposed fasteners in the Psych Holding rooms and Psych Toilet.

2.5 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the products listed below or equal.

2.6 GRAB BARS (denoted as GB# on the drawings)

- A. Grab Bars:
 - 1. Description: Stainless steel grab bars with concealed mountings.
 - 2. Configuration: Refer to the Accessory Schedule on the drawings.
- B. Fed. Spec WW-P-541/8B, Type IV, bars, surface mounted, Class 2, grab bars and ASTM F446.
- C. Stainless steel: Grab bars, flanges, mounting plates, supports, screws, bolts, and exposed nuts and washers.
- D. Bars: Fabricate from 1-1/2 inch outside diameter tubing. Stainless steel, minimum 0.0478 inch thick.
 - 1. 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.
 - 2. Continuous weld intermediate support to the grab bar.
 - 3. Anti-Ligature Closure Plate: Provide 11 gauge stainless steel closure plates at the Psych Toilet.
- E. Flange for Concealed Mounting:
 - 1. Minimum of 0.1046 inch thick, approximately 3 inch diameter by 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.
 - 3. Provide tamper-resistant fasteners at the Psych Toilet.

2.7 TOILET TISSUE DISPENSERS (denoted as TTD# on the drawings)

- A. Dual Roll Toilet Tissue Dispenser: TTD1.
 - 1. Description: Diecast aluminum bracket with removable non-controlled delivery spindles.
 - 2. Mounting: Surface mounted.
 - 3. Capacity: Two standard core toilet tissue rolls.
- B. Anti-Ligature Toilet Tissue Dispenser: TTD2.
 - 1. Description: Stainless steel construction, flange welded to recessed holder. Provide tamper-resistant fasteners.
 - 2. Mounting: Recessed.
 - 3. Capacity: One standard core toilet tissue roll.

2.8 SANITARY NAPKIN DISPOSALS (denoted as SND# on the drawings)

- A. Sanitary-Napkin Disposal Unit: SND1
 - 1. Mounting: Surface mounted.
 - 2. Door or Cover: Self-closing, disposal-opening cover and hinged face panel with tumbler lockset.
 - 3. Receptacle: Removable.
 - 4. Material and Finish: Stainless steel, No. 4 finish (satin).

2.9 BABY CHANGING STATION (denoted as BCS# on the drawings)

- A. Diaper-Changing Station: BCS1
 - 1. Description: Horizontal unit that opens by folding down from stored position and with child-protection strap.
 - 2. Engineered to support a minimum of 113-kg (250-lb) static load when opened.
 - 3. Mounting: Surface mounted, with unit projecting not more than 4 inches (100 mm) from wall when closed.
 - 4. Operation: By pneumatic shock-absorbing mechanism.
 - 5. Material and Finish: HDPE in manufacturer's standard color.
 - 6. Liner Dispenser: Built in.

2.10 PAPER TOWEL DISPENSERS (denoted as PTD# on the drawings)

- A. Surface Mounted Paper Towel Dispenser: PTD1.
 - 1. Description: Stainless steel cabinet with sloping top.
 - 2. Capacity: 400 sheets of C-fold paper toweling.

3. Provide door with spring tension cam lock or tumbler lock, keyed alike.

B. Anti-Ligature Paper Towel Dispenser: PTD2.

1. Basis-of-Design Product: Behavioral Safety Products Model No. RS840 or equal.
2. Description: Recessed 16 gauge stainless steel shelving.

2.11 METAL FRAMED MIRRORS (denoted as M# on the drawings)

A. Metal Framed Mirrors:

1. Mirror Types:
 - a. M1: Lavatory Mirror, 24x36 inch.
 - b. M2: Full-Length Mirror, 24x60 inch.
2. Description: Angle framed mirror.
3. Frame Material: Stainless steel, polished.
4. Mirror Material: 1/4-inch mirrored glass.
5. Mounting: Concealed, designed to support mirror tight to wall.

B. Mirror Type M3: Security Mirrors

1. Size: 24x36 inch.
2. Frame: 14 gauge stainless steel, seamless construction, with exposed surfaces in architectural satin finish. Mirror material held to frame by fiberboard backing.
3. Mirror: Mirror is 20 gauge, stainless steel polished to a No. 8 architectural finish. Stretcher leveled for uniform finish. Very bright – excellent reflectivity, very slight polish grain.
4. Secure to wall with pin-head torx machine screws (included) at holes provided in flange.

2.12 GLOVE BOX HOLDER (denoted as GBH# on the drawings)

A. Glove Box Holder:

1. Description: Holder for three glove boxes (provided by others).
2. Material: Clear PETG plastic.
3. Size: 15-1/2 inch H x 11-1/4 inch W x 4-1/8 inch D.
4. Mounting: Holes for surface mounting.

2.13 SHOWER CURTAIN RODS AND HOOKS (denoted as SC1 on the drawings)

A. Provide shower curtain rod and hook

B. Shower Curtain Rods:

1. Description: 1-1/4-inch OD; fabricated from nominal 0.05-inch thick stainless steel.
2. Mounting Flanges: Stainless-steel flanges designed for concealed fasteners.
3. Finish: No. 4 (satin).

C. Shower Curtain Hooks:

1. Description: Stainless steel spring wire clip with snap fastener. Rollers are brass with nickel plating. Five rollers per hook. Can be used with 1" and 1¼" diameter curtain rods.

2.14 SHOWER SEATS (denoted as SS# on the drawings)

A. Folding Shower Seat: SS1

1. Description: Folding L-shaped seat, designed for wheelchair access.
2. Seat: Phenolic or polymeric composite of slat-type or one-piece construction.
3. Mounting Mechanism: Stainless steel, No. 4 finish (satin).
4. Color: Architect to select from manufacturer's full range.

2.15 COAT HOOKS (denoted as CH# on the drawings)

A. Coat Hooks: CH1

1. Description: Three nail head coat hooks on a flat bar rack.
2. Overall Dimensions: 18-inch w x 2 5/8-inch d x 2-inch h.
3. Hook Size: 1-inch dia. head, 5/8-inch dia. shaft, 2 1/2-inch depth.
4. Material and Finish: Brushed aluminum.
5. Mounting: Exposed.

B. Anti-Ligature Hooks: CH2

1. Description: Anti-ligature coat hook, magnetic safety hook that releases when more than 26 lbs. of force is applied.
2. Material and Finish: Powder coated high strength polycarbonate.
3. Mounting: Exposed, provide tamper-resistant fasteners.

2.16 MOP AND BROOM HOLDER (denoted as MBH# on the drawings)

A. Mop and Broom Holder: MBH1

1. Description: Unit with shelf, hooks, and holders suspended beneath shelf.
2. Length: 40-inches.

3. Hooks: Five.
4. Mop/Broom Holders: Four, spring-loaded, rubber hat, cam type.
5. Material and Finish: Stainless steel, No. 4 finish (satin).

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before starting work notify COR in writing of any conflicts detrimental to installation or operation of units.
- B. Verify with the COR 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. Install accessories in accordance with the manufacturer's printed instructions and ASTM F446.
- C. Install accessories plumb and level and securely anchor to substrate.
- D. 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.
- E. 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.
- F. Align mirrors, dispensers and other accessories even and level, when installed in battery.
- G. Install accessories to prevent striking by other moving, items or interference with accessibility.
- H. Install accessories in Psych rooms 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 10 28 00

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SECTION 10 44 13 - FIRE EXTINGUISHER CABINETS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section covers recessed fire extinguisher cabinets.
 - 1. Fire extinguishers to be provided by VA.

1.2 RELATED WORK

- A. Field Painting: Section 09 91 00, PAINTING.
- B. Installation of fire alarm: Section 28 31 00, FIRE DETECTION AND ALARM.

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.
- B. Style: Full glazed door.

- C. Size cabinet to contain a 9.5L (2-1/2 gal) pressurized water fire extinguisher (provided by VA).

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.
- C. Fire extinguisher installed by VA.
- D. Fire alarm installed by others.

END OF SECTION 10 44 13

SECTION 10 51 33 – SOLID PHENOLIC LOCKERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes solid phenolic lockers.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data.
- C. Shop Drawings: For solid phenolic lockers. Include plans, elevations, sections, details, attachments to other work, and locker identification system and numbering sequence.
- D. Samples: For each exposed finish.

1.3 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install lockers until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Accessibility Requirements: For lockers indicated to be accessible, comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines, ICC A117.1, and VA Barrier Free Design Guide.

2.2 SOLID PHENOLIC LOCKERS

- A. Construction Style: Z-Style (as shown on the drawings), flush overlay.

- B. Unit Size: 457 mm (18-inches) wide by 457 mm (18-inches) deep by 1829 mm (72-inches) high (less base and slope top).
- C. Locker Body: Fabricated from solid phenolic composite material. Exposed edges to have straight profile and to be eased to remove sharpness.
 - 1. Tops, bottoms, and intermediate shelves: 13 mm (1/2-inch) thick solid phenolic composite material. Three 3/8" (10mm) diameter ventilation holes to be provided on "Z" type intermediary shelves.
 - 2. Locker backs and sides: 8 mm (3/8-inch) thick solid phenolic composite material.
- D. Locker Doors: Fabricated from solid phenolic composite material. Exposed edges to have straight profile and to be eased to remove sharpness.
 - 1. Thickness: 13 mm (1/2-inch) thick.
 - 2. Corners: Rounded.
 - 3. Vents: Slot vents as shown on the drawings.
- E. End Panels and Fillers: Match style, material, construction, and finish of solid phenolic doors.
- F. Continuously Sloping Tops: Fabricated from 13 mm (1/2-inch) thick solid phenolic composite material for installation over lockers with separate flat tops. Fabricate tops in lengths as long as practical, without visible fasteners at splice locations. Provide fasteners, supports, and closures, as follows:
 - 1. Closures: Vertical-end type.

2.3 MATERIALS

- A. Panel Material:
 - 1. Material is composed of melamine-impregnated decorative surface papers that are fused under extreme heat and pressure with a wide ranging number of phenolic resin saturated kraft core papers. Material is ideal for places where heavy use and frequent cleaning is expected.
 - 2. Fire Rating: Standard solid phenolic core or panel material shall meet fire Class B resistance per ASTM E84.
 - 3. Colors:
 - a. Core: Black.
 - b. Locker Interior: White.
 - c. Locker Exterior: To be selected from manufacturer's full range.
- B. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

- C. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- D. Wood Support Base: 51-by-102-mm, actual-size (2-by-4-inch nominal-size) lumber treated with manufacturer's standard preservative-treatment.

2.4 HARDWARE

- A. General: Provide manufacturer's standard locker hardware complying with the requirements in this Section.
- B. Cam Padlock Hasp: Surface mounted, steel; finished to match other locker hardware.
- C. Frameless Hinges (European Type): Fully concealed, self-closing, nickel-plated steel, with not less than 125 degrees of opening. Provide three hinges for each door.
- D. Wire Pulls: Back mounted; 102 mm (4 inches) long, 8 mm (5/16 inch) in diameter.
- E. Hooks: Manufacturer's standard. Attach hooks with at least two fasteners.
 - 1. Provide one double-prong ceiling hook for each hanging compartment.
- F. Exposed Hardware Finishes: Polished chrome unless otherwise indicated.

2.5 ACCESSORIES

- A. Number Plates: 38-mm- (1-1/2-inch-) diameter, etched, embossed, or stamped, aluminum plates with black numbers and letters at least 13 mm (1/2 inch) high. Identify lockers in sequence indicated on Drawings.

2.6 BENCHES

- A. Pedestal-Leg Locker Benches: Bench supported by pedestal legs, minimum of two pedestals for each bench, with overall height of 457 mm (18 inches) measured from top of bench to floor, as follows:
 - 1. Metal Pedestal Legs: 20 mm (1-1/2-inch-) painted steel tube.
 - 2. Bench Tops: 32 mm (3/4 inches) deep; solid core phenolic composite.
 - a. Width: 381 mm (15 inches).
 - b. Length: 1219 mm (48 inches).

2.7 FABRICATION

- A. Fabricate components square, rigid, without warp, and with finished faces flat and free of scratches and chips. Accurately factory machine components for attachments. Make joints tight and true.
- B. Accessible Lockers: Fabricate as follows:
 - 1. Where hooks are provided, locate no higher than 1219 mm (48 inches) above the floor.
- C. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
- D. Shop cut openings, to maximum extent possible, to receive hardware, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install wood support base.
- B. Install lockers level, plumb, and true; use concealed shims.
- C. Connect groups of lockers together with manufacturer's standard fasteners, through predrilled holes, with no exposed fasteners on face frames. Fit lockers accurately together to form flush, tight, hairline joints.
- D. Install lockers without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings, providing unencumbered operation. Complete installation of hardware and accessory items as indicated.
 - 1. Installation Tolerance: No more than 3 mm in 2400-mm (1/8 inch in 96-inch) sag, bow, or other variation from a straight line. Shim as required with concealed shims.
- E. Locker Anchorage: Fasten lockers through wood locker base, at ends, and not more than 910 mm (36 inches) o.c. with No. 8 flush-head wood screws sized for 25-mm (1-inch) penetration into wood base.

- F. Scribe and cut corner and filler panels to fit adjoining work using fasteners concealed where practical. Repair damaged finish at cuts.
- G. Attach sloping-top units to lockers, with end panels covering exposed ends.
- H. Install number plates after lockers are in place.
- I. Anchor locker benches to floors.

END OF SECTION 10 51 33

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SECTION 12 48 13 - ENTRANCE FLOOR GRILLES AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes recessed entrance floor grilles and frames.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: Show design and installation details.
- C. Manufacturer's Literature and Data: For each product.
- D. Samples: For each tread rail and insert.
- E. Closeout Documents:
 - 1. Maintenance data.

PART 2 - PRODUCTS

2.1 ENTRANCE FLOOR GRILLES AND FRAMES - GENERAL

- A. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities, ICC A117.1 and VA guidelines.
- B. Standard rolling load performance is 400 lb./wheel with larger loading requirements as specified (load applied to a solid 5" x 2" wide polyurethane wheel, 1000 passes without damage).
- C. Single Source Responsibility: Obtain floor mats, grilles and frames from one source of a single manufacturer.

2.2 FLOOR GRILLES

- A. Aluminum Floor Grilles: Provide manufacturer's standard floor grilles with extruded members, top-surfaced tread rails, and as follows:
 - 1. Tread Rail Spacing: 50-mm (2-inches) o.c. with 6.4-mm (1/4-inch) wide openings between treads.
 - 2. Tread Rail Height: 45-mm (1-3/4 inches).
 - 3. Aluminum Color: Mill finish.
 - 4. Tread Inserts: Exterior carpet shall be solution dyed polypropylene fibers with 50/50 blend of 600/12-denier multi filament and 595/D1 monofilament. The texturized fibers shall have ultraviolet blockers and color as an integral part of the filament. Each carpet fiber and monofilament shall be fusion-bonded to a rigid two-ply backing to prevent fraying and supplied in continuous splice-free lengths. Carpet weight shall be 32-oz./yd².
 - 5. Colors, Textures, and Patterns of Inserts: Refer to the Materials Schedule on the drawings for basis-of-design material.
- B. Level Bed Applications: Provide manufacturer's standard, vinyl cushion support system.

2.3 FRAMES

- A. Recessed Frames: ASTM B 221M (ASTM B 221). Manufacturer's standard extrusion.
 - 1. Color: Mill finish.

2.4 FABRICATION

- A. Floor Grilles: Shop fabricate units to greatest extent possible in sizes indicated. Unless otherwise indicated, provide single unit for each mat installation; do not exceed manufacturer's recommended maximum sizes for units that are removed for maintenance and cleaning. Where joints in mats are necessary, space symmetrically and away from normal traffic lanes. Miter corner joints in framing elements with hairline joints or provide prefabricated corner units without joints.
- B. Coat concealed surfaces of aluminum frames that contact cementitious material with manufacturer's standard protective coating.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install recessed grille frames to comply with manufacturer's written instructions. Set grille tops at height recommended by manufacturer for most effective cleaning action; coordinate tops of grille surfaces with bottoms of doors that swing across grilles to provide clearance between door and grille.

3.2 PROTECTION

- A. After completing frame installation and concrete work, provide temporary filler of plywood or fiberboard in recesses and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and Project is near Substantial Completion.

END OF SECTION 12 48 13

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SECTION 14 92 00 - PNEUMATIC TUBE SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the extension of the existing pneumatic tube distribution system.
- B. Furnish all engineering, materials and labor for a complete pneumatic tube distribution system (hereinafter referred to as the "System"). The system shall be integrated with the existing pneumatic tube system incorporating multi-tasking and LAN capability.
- C. The system contractor shall work with the General Contractor and all trades to insure coordination for system "right-of-way".

1.2 SOLE SOURCE JUSTIFICATION

- A. Swisslog has been justified by the VA as the sole source manufacturer for the pneumatic tube distribution system. No substitutions will be accepted.

1.3 RELATED WORK

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General Electrical Requirements and items, which are common to sections of Division 26.

1.4 QUALITY ASSURANCE

- A. All work will be completed in a workmanlike manner, complete in all respects, including all items specified herein and as may be necessary for the satisfactory installation and operation of the specified system.
- B. The system contractor shall regularly and presently manufacture the computer controlled material distribution equipment as specified herein as one of their principle products.
- C. The equipment furnished shall be the product of the system contractor and will be installed by skilled mechanics under direct employment and supervision of the Contractor.
- D. The system contractor shall be totally responsible for the engineering, manufacture, installation and guarantee of the specified system.
- E. All electrical equipment shall be provided with Underwriters Laboratory (UL) labels, and all wiring shall be in conformance with NEC requirements and local codes.

1.5 WORK INCLUDED IN THIS SECTION

- A. The system contractor shall provide proper information for coordination of all associated work excluded from this Section.
- B. The system contractor shall provide and install all low voltage control wiring and connections necessary for the proper operation of the system.

1.6 WORK EXCLUDED FROM THIS SECTION

- A. The system contractor shall perform all the work for the successful operation of the system except the following, which shall be accomplished by other trades.
- B. Architectural enclosures for equipment where required.
- C. Cutting and patching or painting required for installation of equipment and/or system right-of-way.
- D. Removal, relocation and/or replacement of other equipment, fixtures, ceilings, conduit, pipe, required for the right-of-way and installation of system in existing building, if applicable.
- E. Providing and installing sleeves where required to penetrate floors and walls.
- F. Patching of sleeves and openings where required.
- G. Painting of exposed tube and unfinished exposed surfaces where required.
- H. Electrical power as follows:
 - 1. A local power source through a factory installed duplex receptacle within each station and transfer unit.
 - 2. Provide temporary power to facilitate testing when required.
- I. Unloading, safe, dry and adequate storage space for materials on the job site during construction.
- J. Hoisting/elevator/crane services for equipment and personnel during construction.
- K. Sealing of sprayed fire-retarding insulation in close proximity to any system equipment.
- L. Existing ceiling and wall removal, replacement or repair to match existing surroundings.
- M. Cleaning of all plaster, mortar, paint and other debris in or on the system equipment resulting from other trades.
- N. Repairing, replacing or repainting of equipment damaged by other trades.

1.7 SUBMITTALS

- A. Submit in accordance with specification Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- B. Shop Drawings:
 - 1. Provide complete dimensioned drawings that indicate tube routing, right-of-way, methods of suspending and anchoring tube, station details, equipment locations and detailed dimensions of all major components.
 - 2. Include a riser of tube routing and electrical wiring detail.
- C. Manufacturer's Literature and Data: Showing illustrations and description of system to be furnished. Mark literature to indicate items to be furnished.
- D. Closeout Documents: Provide as-built drawings and operating and maintenance manuals at project completion.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION - GENERAL

- A. The System will be 6" PTS tube system consisting of tubing, stations, transfer units, blower packages, carriers and a control center. The system shall tie into existing system with 6 stations. A minimum of two storage pipes shall be provided between the zones.
- B. The dispatching, routing, spacing and storage of carriers shall be directed by the control center to provide automatic unattended transmission of carriers between all stations.
- C. Provide shortest route vacuum-pressure travel. Transactions between stations shall process to the closest turn around point to the destination.
- D. To dispatch a carrier from a station, the operator will place the latched carrier in the dispatcher, select the destination address and press the "send" push button at the station.
- E. Allow multiple carriers in transit within the system. Allow the station dispatchers to be simultaneously loaded and destinations selected. Automatically process all carriers until the system is clear.
- F. The modular construction of the system components shall permit changes and the addition of stations as Department of Veterans Affairs (VA) requirements change.

- G. Provide automatic empty carrier redistribution. There will be two empty carrier groups, one for regular carriers and one for biohazard carriers. Allow any station with excess carriers to select automatic return which will direct empty carriers anywhere in the system on a most needed basis. The need will be determined by the ratio of assigned carriers to present carriers. Empty carriers can be requested at any station through a special function on the station keypad.
- H. Allow individual station or zone shutdown without affecting remainder of system.
- I. Carriers shall be rejected at the source station if they cannot be delivered to the destination station. The route to the destination station is checked twice to insure that all sections of the system are operating properly before the carrier is dispatched. The system shall use "Dynamic Prioritization" based on wait time to adjust transaction priorities in the system.
- J. Carriers in process shall be delivered to either the source or destination station if a failure occurs in the route while they are in transit.

2.2 EQUIPMENT

A. Tubing and Bends:

- 1. Tubing shall be 6" outside diameter, 16 gauge, cold rolled, electric welded steel, flash removed, degreased and hot dip galvanized.
- 2. Form bends of same material on a center line radius of not less than 48 inches. Maintain a uniform cross-section free from wrinkles and distortions. No expanded bends shall be allowed in the system.
- 3. Cut all ends square, deburred, file and mandrel when cutting tube.
- 4. Use solid steel or split steel sleeves for rigid joints. Use split sleeves at all equipment connections. All sleeves shall be of the same gage as the tubing.
- 5. Seal joints with suitable airtight compound.
- 6. Support tubing with suitable hangers and supports as follows:
 - a. Every ten (10) feet
 - b. At every floor of vertical runs
 - c. At each bend
 - d. At equipment connections
 - e. At center bend radius - sway brace
- 7. Hangers shall be pre-threaded zinc plated rod screwed into the appropriate device attached to the building structure. Tube clamps or channels fastened to the rod shall support the tubing.

B. Transfer Units:

- 1. Transfer units enable a transmission tube connection from one tube to any one of several tubes, providing the tubing network for routing carriers between stations.

2. Install with split sleeves. Sway brace against motion.
3. Allow complete and clear access to service mechanical and electrical components.
4. Include non-contact sensor for notification of carrier location.
5. Direction change through unit shall be gradual using curved tube section.
6. All visible metal surfaces shall be galvanized steel, aluminum, or finished with a factory painted electrostatically applied, baked-on, powder coat finish.
7. Transfer units shall be provided as required in 1 to 2 ports, 1 to 4 ports and 1 to 6 ports.

C. Stations:

1. Provide wall recessed down receive style stations.
2. Provide a self supporting enclosure with a minimum of mechanical and electrical equipment for installation during the initial stages of construction.
3. Mechanical and electrical operating components shall not be installed in the enclosure until the last stages of building construction to prevent damage. A trim frame will be provided for final mating to the wall.
4. All mechanical and electrical components shall be accessible and removable for repair or replacement.
5. Electronic control units shall be solid state plug-in units for fast replacement and shall be interchangeable with units in other stations.
6. All visible metal surfaces shall be factory painted. Bright metal finish parts shall be stainless steel brushed aluminum or chrome plated.
7. Carrier dispatcher shall contain one carrier at a time and be independent of receiver. A carrier can be waiting dispatch while another carrier is being received. The dispatcher shall prevent more than one carrier from dispatching at the same time.
8. Carrier receiver shall be independent of dispatcher and contain open storage capability for four carriers.
9. Receiver overload shall shut down station's dispatcher and receiver. A message shall indicate overload. Condition shall automatically reset upon carrier removal from receiver. Station dispatcher and receiver shall be readily accessible without having to open and close doors.
10. Empty carriers' storage shall be integral to the station and provide space for not less than four carriers.
11. Provide air-cushion delivery into station.
12. Station Control Panel shall contain:
 - a. Membrane Keypad - for destination and special function selection
 - b. Liquid Crystal Display with 80 characters - for message display
 - c. Send/Enter key - to activate dispatch after destination selection or data for special functions
 - d. Cancel/Clear key - to allow for transaction cancellation or clearing of display during special function activation
 - e. Special function key - to request special features
 - f. Directory - listing station addresses
 - g. Instruction Compartment - for operating and special function instructions.

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- h. Discrete rejection messages shall be provided for
 - 1) Dispatching station off
 - 2) Dispatching station not in service
 - 3) Receiving station full
 - 4) Receiving station does not exist
 - 5) Receiving station off
 - 6) Receiving station not in service
 - 7) Selection not permitted
 - i. Messages will be displayed for the following conditions:
 - 1) Incoming carriers at the receiving station
 - 2) To return surplus carriers when the receiving station has a specified surplus over its assigned number of carriers
 - 3) To empty a station receiver when it is full
 - 4) Receiving station not receiving - traffic forwarded to another station
 - 5) To broadcast when the system or a portion of the system will be off for preventive maintenance
 - j. The following special functions shall be selectable from each station and shall be password protected at the station.
 - 1) Transaction Tracking
 - 2) Secured Transaction
 - 3) Emergency Shutdown
 - 4) Stat Priority
 - 5) Alternate Destination
 - 6) Incoming Carrier Query
 - 7) Station On/Off
 - 8) Carrier Inventory Adjustment
 - 9) Station Diagnostics
13. The standard station dispatcher shall be capable of dispatching a six (6) pound payload.
14. The station drive motors and position switches shall be available from any local industrial supplier.
- D. Carriers:
- 1. Provide a total of 8. Provide 4 red "bio-hazard" carriers for specimens and 4 clear carriers for other items.
 - a. Molded plastic
 - b. Full access side opening and self-latching upon closure
 - c. Bid-directional
 - d. Replaceable wear bands and latches.

- e. Capable of carrying: Specimens, medications, x-ray film, 1,000 ml IV bags filled up to 100 cc's.
- E. Wiring and Cabling: Provide all necessary wiring and cabling for a complete system.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to drawings for location of each station.
- B. Assemble and install the system and components in strict accordance with Contract Documents, applicable codes and regulations, approved shop drawings and manufacturer's recommendations.
- C. Anchor and fasten system and components to building construction as required for a stable, secure installation. Closely fit and join all parts of the system and finished components exposed view, providing a neat uniform appearance.

3.2 SYSTEM TESTING AND ACCEPTANCE

- A. Prior to a formal system performance test, Contractor shall perform preliminary tests, verifying all components are in full operational condition or carrier dispatch and receive between all possible station combinations.
- B. The Contractor shall provide written notification to the Architect/Engineer thirty (30) days in advance of the schedule system performance test. Contractor shall provide all personnel, equipment, and instruments required for such examination.
- C. In the presence of the Architect and VA, the Contractor shall perform all operational tests, inspecting system components and verifying equipment is installed and operating in proper condition, according to the intent of the contract.
- D. The VA's representative shall sign a written statement indicating that the system has been turned over and accepted by the VA.

3.3 INSTRUCTIONS

- A. The system manufacturer shall provide all necessary instructions in the use, operation, and maintenance of the system to personnel designated by the VA. The training program shall consist of the following:
- B. Operator training classes for all persons expected to use the system.

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- C. Maintenance training on job site for VA assigned maintenance personnel. The VA shall assign at least two (2) persons to accompany Contractor start-up technicians during final system checkout procedures.
 - D. Maintenance reorientation programs shall be available at the Manufacturer's dedicated Training Facility at no cost. Cost of transportation, room and board shall be provided by the VA.
 - E. The system manufacturer shall provide three (3) sets of operating and maintenance manuals including:
 - 1. System components and part descriptions
 - 2. Starting and stopping procedures
 - 3. General operating instructions
 - 4. Specific maintenance and troubleshooting instructions
 - 5. Recommended service schedule for adjustment, lubrication and inspection.
 - 6. Recommended spare parts inventory
 - F. The system manufacturer shall provide three (3) sets of as-built drawings for instruction and future reference by the customer.

END OF SECTION 14 92 00