
P R O J E C T M A N U A L

VOLUME 1 OF 2

Chalmers P. Wylie ACC Build Specialty Care Center



VA PROJ NO. 757-200
CBLH PROJ. NO. : 18900.00
April 25, 2014

BID AND CONSTRUCTION



DEPARTMENT OF VETERANS AFFAIRS

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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 Chalmers P. Wylie Ambulatory Care Center, Specialty Care Addition located at 420 North James Road, Columbus, Ohio 43219, as required by drawings and specifications.
- B. Visits to the site by Bidders may be made only during the pre-bid conference to occur on the date noted on the Bid Solicitation.
- C. Offices of CBLH Design, Inc., as Architect-Engineers, will render certain technical services during construction. Such services shall be considered as advisory to the Government and shall not be construed as expressing or implying a contractual act of the Government without affirmations by Contracting Officer or his duly authorized representative.
- D. Before placement and installation of work subject to tests by testing laboratory retained by 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.
- E. All employees of general contractor and subcontractors shall comply with VA security management program and obtain permission of the VA police, be identified by project and employer, and restricted from unauthorized access.
- F. Prior to commencing work, general contractor shall provide proof that a OSHA designated "competent person" (CP) (29 CFR 1926.20(b)(2)) will maintain a presence at the work site whenever the general or subcontractors are present.
- G. Training:
 - 1. All employees of general contractor or subcontractors shall have the 10-hour or 30-hour OSHA Construction Safety course and other relevant competency training, as determined by RE/COR acting as the Construction Safety Officer with input from the facility Construction Safety Committee.
 - a. General Contractor Superintendent and Competent Person: 30 hours.
 - b. All other Workers: 10 hours.

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

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

1.2 STATEMENT OF BID ITEM(S)

- A. DESCRIPTION OF WORK: BID ITEM 1 (BASE BID): Build Specialty Care Addition: Work includes general construction, alterations, walks, grading, drainage, mechanical and electrical work, necessary removal of existing structures, and construction and certain other items as shown and described in the specifications and drawings. Work to be completed within 570 calendar days after receipt of Notice to Proceed. It is the intent of the Government that award will be made on the Base Bid, however, should the bids for the base bid exceed the funds available, award may be made on any one of the following alternate items, in descending order of priority.
- B. BID ITEM 2 (ALTERNATE NO.1): All work in BID ITEM # 1, BASE BID except REMOVE interior build-out portion of general trades, mechanical and electrical work for area primarily north of Column Line 0.8 as shown and described in the specifications and drawings. Work to be completed within 525 calendar days after receipt of Notice to Proceed.
- C. BID ITEM 3 (ALTERNATE NO. 2): All work in BID ITEM #1, BASE BID except REMOVE all work as specified in BID ITEM 2 (ALTERNATE NO. 1) AND REMOVE exterior shell and related general trades, mechanical, electrical and civil work for areas primarily north of Column Line 4 as shown and described in the specifications and drawings. Work to be completed within 495 calendar days after receipt of Notice to Proceed.

1.3 SPECIFICATIONS AND DRAWINGS FOR CONTRACTOR

- A. AFTER AWARD OF CONTRACT, 1 electronic set of specifications and drawings will be furnished in PDF format.
- B. Additional sets of drawings may be made by the Contractor, at Contractor's expense, from the electronic set furnished by Issuing Office.

1.4 CONSTRUCTION SECURITY REQUIREMENTS

- A. Security Plan:
1. The security plan defines both physical and administrative security procedures that will remain effective for the entire duration of the project.
 2. The General Contractor is responsible for assuring that all sub-contractors working on the project and their employees also comply with these regulations.

B. Security Procedures:

1. General Contractor's employees shall not enter the project site without appropriate badge. They may also be subject to inspection of their personal effects when entering or leaving the project site. Individuals on site more than two weeks will obtain a flash badge through the COR. Other employees without a badge will sign in and out at the job trailer and obtain a name tag on a daily basis. Badges and name tags will be worn at all times by contractor's personnel. Employees with name tags will be escorted by badged personnel at all times. All badges will be turned in to the COR upon the completion of the project.
2. For working outside the "regular hours" as defined in the contract, The General Contractor shall give 3 days notice to the Contracting Officer's Representative so that arrangements can be provided for the employees. This notice is separate from any notices required for utility shutdown described later in this section.
3. No photography of VA premises is allowed without written permission of the Contracting Officer's Representative.
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: (Not used in this Project)

D. Key Control:

1. The General Contractor shall provide duplicate keys and lock combinations to the Contracting Officer's Representative 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 cores to the VA locksmith for permanent installation. See Section 08 71 00, DOOR HARDWARE and coordinate.

E. Document Control:

1. Before starting any work, the General Contractor/Sub Contractors shall submit an electronic security memorandum describing the approach to following goals and maintaining confidentiality of "sensitive information".
2. The General Contractor is responsible for safekeeping of all drawings, project manual and other project information. This information shall be shared only with those with a specific need to accomplish the project.

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

F. Motor Vehicle Restrictions

1. Contractors and their employees will park in designated "Contractor" parking areas or in the employee parking areas. At no time will contractors park in veteran parking areas.
2. Contractor loading and unloading will be authorized near the employee entrance during off hours or at the loading dock area. Vehicles in these areas will be attended at all times. Coordinate deliveries in advance for loads needing more than 15 minutes to unload with the COR and the Warehouse.

1.5 FIRE SAFETY

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

1. American Society for Testing and Materials (ASTM):
E84-2009.....Surface Burning Characteristics of Building
Materials
2. National Fire Protection Association (NFPA):
10-2010.....Standard for Portable Fire Extinguishers
30-2008.....Flammable and Combustible Liquids Code

- 51B-2009.....Standard for Fire Prevention During Welding,
Cutting and Other Hot Work
- 70-2011.....National Electrical Code
- 101-2012.....Life Safety Code
- 241-2009.....Standard for Safeguarding Construction,
Alteration, and Demolition Operations
- 3. Occupational Safety and Health Administration (OSHA):
 - 29 CFR 1926.....Safety and Health Regulations for Construction
- 4. VHA Directive 2005-007
- B. Fire Safety Plan: Establish and maintain a fire protection program in accordance with 29 CFR 1926. Prior to start of work, prepare a plan detailing project-specific fire safety measures, including periodic status reports, and submit to COR and Facility Safety Officer for review for compliance with VHA Directive 2005-007, NFPA 101 and NFPA 241. Prior to beginning work, all employees of the contractor and/or any subcontractors shall undergo a safety briefing provided by the general contractor's competent person per OSHA requirements. This briefing shall include information on the construction limits, VAMC safety guidelines, means of egress, break areas, work hours, locations of restrooms, use of VAAC equipment, etc. Provide documentation to the COR that all construction workers have undergone contractor's safety briefing.
- C. Site and Building Access: Maintain free and unobstructed access to facility emergency services and for fire, police and other emergency response forces in accordance with NFPA 241.
- D. Separate temporary facilities, such as trailers, storage sheds, and dumpsters, from existing buildings and new construction by distances in accordance with NFPA 241. For small facilities with less than 6 m (20 feet) exposing overall length, separate by 3m (10 feet).
- E. Temporary Construction Partitions:
 - 1. Install and maintain temporary construction partitions to provide smoke-tight 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 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, $\frac{3}{4}$ hour fire/smoke rated doors with self-closing devices. Tape and paint temporary partitions on the side seen by Veterans.
 - 2. Install two-hour temporary construction partitions as shown on drawings to maintain integrity of existing exit stair enclosures, exit passageways, fire-rated enclosures of hazardous areas,

- horizontal exits, smoke barriers, vertical shafts and openings enclosures.
3. Close openings in smoke barriers and fire-rated construction to maintain fire ratings. Seal penetrations with listed through-penetration firestop materials in accordance with Section 07 84 00, FIRESTOPPING.
- F. Temporary Heating and Electrical: Install, use and maintain installations in accordance with 29 CFR 1926, NFPA 241 and NFPA 70.
- G. Means of Egress: Do not block exiting for occupied buildings, including paths from exits to roads. Minimize disruptions and coordinate with COR.
- H. Egress Routes for Construction Workers: Maintain free and unobstructed egress. Inspect daily. Report findings and corrective actions weekly to COR.
- I. Fire Extinguishers: Provide and maintain extinguishers in construction areas and temporary storage areas in accordance with 29 CFR 1926, NFPA 241 and NFPA 10.
- J. Flammable and Combustible Liquids: Store, dispense and use liquids in accordance with 29 CFR 1926, NFPA 241 and NFPA 30.
- K. Standpipes: (not used in this Project)
- 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. All existing or temporary fire protection systems (fire alarms, sprinklers) located in construction areas shall be tested as coordinated with the Ambulatory Care Center. Parameters for the testing and results of any tests performed shall be recorded by the Ambulatory Care Center and copies provided to the COR.
- N. Smoke Detectors: Prevent accidental operation. Provide temporary covers as needed and remove them at end of work operations each day. Coordinate with COR.
- O. Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with COR. Obtain permits from facility Safety Officer or COR at least 24 hours in advance. Designate contractor's responsible project-site fire prevention program manager to permit hot work. The General Contractor will request a Hot Work Permit for any work associated with a flame, spark or the possibility of

causing the above. The contractor will supply a fully trained fire watch when this work is performed with a fire extinguisher within reach.

- 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 Officer.
- 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 and as defined within the specifications. 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. Contractor will perform fire watch duties anytime it is required by the COR. Fire watch personnel will be trained as per NFPA and The Joint Commission requirements. Fire watch is required when portion of the fire alarm system is offline for more than four (4) hours in any twenty-four (24) hour period and when work is being performed that requires a hot work permit.
- V. Contractor will order and store at contractor's expense any long lead items that have potential to delay or impede the completion of construction.
- W. Contractor will submit daily work and safety reports on the VA forms to the COR by the next regularly scheduled work day by 2:30pm. Logs will be submitted electronically.
- X. Weekly construction and coordination update meetings will be held with the VA COR, VA Contracting Specialist and other representatives of the design team at the jobsite or in the VA building as appropriate. Meetings will be attended by the Contractor's COR and Project Superintendent.
- Y. The General Contractor will maintain all MSDS sheets on site as per OSHA and VA Regulations.
- Z. No area outside the construction area will be used for staging unless approved by the VA COR.

1.6 OPERATIONS AND STORAGE AREAS

- A. The Contractor shall confine all operations (including storage of materials) on Government premises to areas authorized or approved by the COR. 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 Ambulatory Care Center applicable to their conduct.
- F. Execute work so as to interfere as little as possible with normal functioning of the Ambulatory Care 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. Work that interferes with Ambulatory Care Center operations such as noise, vibration, power outages, odors, etc. will be prohibited during normal working hours. This determination will be made by the COR and no additional cost to the government will be authorized.
 - 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 five work

- days. Provide unobstructed access to Ambulatory Care Center areas required to remain in operation.
3. Where access by Ambulatory Care Center personnel to vacated portions of buildings is not required, storage of Contractor's materials and equipment will be permitted subject to fire and safety requirements.
- G. 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 Ambulatory Care Center Director, COR and Contractor, as follows:

Phase 1: Activation: 30 days

Phase 1: Construction: 60 days:

1. Provide temporary MRI quench vent
2. Relocate MRI chiller
3. Provide work required for owner relocated oxygen tank
4. Provide temporary interior partitions and construct permanent gypsum board partitions, with insulation and gypsum board finished and painted on occupied side of partition where addition abuts existing building on the first and second floors to allow for the removal of the existing exterior curtainwall.

Phase 2: Construction: 330 days

1. Remainder of construction work, except work in Corridor 1B030 and IAQ management plan - before construction

Phase 3: Construction: 30 days

1. IAQ management plan - before construction
2. Demolition of existing radiology reception desk and remainder of work in Corridor 1B030

- H. Project exterior construction limits will be vacated by Government in accordance with the above phasing beginning immediately after date of Notice to Proceed and area is turned over to the contractor.
1. The building will be occupied by Ambulatory Care Center personnel for various periods of construction. Work in occupied areas to include public corridors and occupied spaces shall be performed during off hours unless approved by COR.
 2. 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 Ambulatory Care 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 Ambulatory Care Center operations will continue during the construction period.

- I. Construction Fence: Before construction operations begin, Contractor shall provide a chain link construction fence, 2.1m (seven feet) minimum height, around the construction area indicated on the drawings. Provide gates as required for access with necessary hardware, including hasps and padlocks. Fasten fence fabric to terminal posts with tension bands and to line posts and top and bottom rails with tie wires spaced at maximum 375mm (15 inches). Bottom of fences shall extend to 25mm (one inch) above grade. Remove the fence when directed by COR.
- J. When a construction area is turned over to Contractor, Contractor shall accept entire responsibility therefore.
 - 1. Contractor shall maintain a minimum temperature of 4 degrees C (40 degrees F) at all times, except as otherwise specified.
 - 2. Contractor shall maintain in operating condition existing fire protection and alarm equipment. In connection with fire alarm equipment, Contractor shall make arrangements for pre-inspection of site with Fire Department or Company (Department of Veterans Affairs or municipal) whichever will be required to respond to an alarm from Contractor's employee or watchman.
- K. Utilities Services: Maintain existing utility services for Ambulatory Care Center at all times. Provide temporary facilities, labor, materials, equipment, connections, and utilities to assure uninterrupted services. Where necessary to cut existing water, steam, gases, sewer or air pipes, or conduits, wires, cables, etc. of utility services or of fire protection systems and communications systems (including telephone), they shall be cut and capped at suitable places where shown; or, in absence of such indication, where directed by COR.
 - 1. No utility service such as water, gas, steam, sewers or electricity, or fire protection systems and communications systems may be interrupted without prior approval of COR. Electrical work shall be accomplished with all affected circuits or equipment de-energized. When an electrical outage cannot be accomplished, work on any energized circuits or equipment shall not commence without the Ambulatory Care 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. All electrical work will conform to facility Lock Out/Tag Out and Arc Flash policies.
2. Contractor shall submit a request for minor interruptions of any such services to the COR, in writing, 2 working days in advance of proposed interruption. Request shall state reason, date, exact time of, and approximate duration of such interruption.
 3. Contractor will be advised (in writing) of approval of request, or of which other date and/or time such interruption will cause least inconvenience to operations of Ambulatory Care Center. Interruption time approved by Ambulatory Care Center may occur at other than Contractor's normal working hours.
 4. Major interruptions of any system must be requested, in writing, at least 15 calendar days prior to the desired time and shall be performed as directed by the COR.
 5. In case of a contract construction emergency, service will be interrupted on approval of COR. Such approval will be confirmed in writing as soon as practical.
 6. Whenever it is required that a connection fee be paid to a public utility provider for new permanent service to the construction project, for such items as water, sewer, electricity, gas or steam, payment of such fee shall be the responsibility of the Government and not the Contractor.
 7. Shutdowns can be mandated at the discretion of the Contracting Officer to take place after normal business hours, including Saturdays and Sundays, with no additional cost to the Government. Contractor shall thoroughly investigate impact of shutdowns on patient care and staff functions prior to proceeding with shutdown.
- L. Abandoned Lines: All service lines such as wires, cables, conduits, ducts, pipes and the like, and their hangers or supports, which are to be abandoned but are not required to be entirely removed, shall be sealed, capped or plugged. The lines shall not be capped in finished areas, but shall be removed and sealed, capped or plugged in ceilings, within furred spaces, in unfinished areas, or within walls or partitions; so that they are completely behind the finished surfaces.
- M. To minimize interference of construction activities with flow of Ambulatory Care Center traffic, comply with the following:

1. Keep roads, walks and entrances to grounds, to parking and to occupied areas of buildings clear of construction materials, debris and standing construction equipment and vehicles. Wherever excavation for new utility lines cross existing roads, at least one lane must be open to traffic at all times.
 2. Method and scheduling of required cutting, altering and removal of existing roads, walks and entrances must be approved by the COR.
- N. Coordinate the work for this contract with other construction operations as directed by COR. This includes the scheduling of traffic and the use of roadways, as specified in Article, USE OF ROADWAYS.

1.7 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, shades, etc., required by drawings to be either reused or relocated, or both.
 3. Shall note any discrepancies between drawings and existing conditions at site.
 4. Shall designate areas for working space, materials storage and routes of access to areas within buildings where alterations occur and which have been agreed upon by Contractor and COR.
- B. Any items required by drawings to be either reused or relocated or both, found during this survey to be nonexistent, or in opinion of COR, to be in such condition that their use is impossible or impractical, shall be furnished and/or replaced by Contractor with new items in accordance with specifications which will be furnished by Government. Provided the contract work is changed by reason of this subparagraph B, the contract will be modified accordingly, under provisions of clause entitled "DIFFERING SITE CONDITIONS" (FAR 52.236-2) and "CHANGES" (FAR 52.243-4 and VAAR 852.236-88).
- C. Re-Survey: Thirty days before expected partial or final inspection date, the Contractor and COR together shall make a thorough re-survey of the areas of buildings involved. They shall furnish a report on conditions then existing, of resilient flooring, doors, windows, walls and other

surfaces as compared with conditions of same as noted in first condition survey report:

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

D. Protection: Provide the following protective measures:

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

1.8 INFECTION PREVENTION MEASURES

- A. Pre-Construction Risk Assessment Infection Control / Safety Construction Permit will be issued by the COR. Permits will be posted at the entrance to the construction area. More than one permit may be issued for a construction project if the work is located in separate areas requiring separate classes. See attached Pre-Construction Risk Assessment for Infection Control/Safety Construction Measures.
- B. Implement the requirements of VAACC'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.
- C. Establish and maintain a dust control program as part of the contractor's infection preventive measures in accordance with the guidelines provided by ICRA Group. Prior to start of work, prepare a plan detailing project-specific dust protection measures, including periodic status reports, and submit to COR for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
 1. All personnel involved in the construction or renovation activity shall be educated and trained in infection prevention measures established by the Ambulatory Care Center.

- D. Ambulatory Care 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 Ambulatory Care 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 VAACC 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 Ambulatory Care Center, along with assistance from the contractor, shall conduct an environmental assessment to find and eliminate the source.
- E. 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 Ambulatory Care Center and Contractor's workers, the Contractor shall:
 - a. Provide dust proof 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 Ambulatory Care 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 Ambulatory Care 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 Ambulatory Care 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 Ambulatory Care 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 Ambulatory Care 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 Ambulatory Care Center. When, approved, debris shall be hauled in enclosed dust proof containers or wrapped in plastic and sealed with duct tape. No sharp objects should be allowed to cut through the plastic. Wipe down the exterior of the containers with a damp rag to remove dust. All equipment, tools, material, etc. transported through occupied areas shall be made free from dust and moisture by vacuuming and wipe down.
- 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, flooring, etc.
3. All new air ducts shall be cleaned prior to final inspection.

1.9 DISPOSAL AND RETENTION

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

1. Reserved items which are to remain property of the Government are noted on drawings or in specifications as items to be stored. Items that remain property of the Government shall be removed or dislodged from present locations in such a manner as to prevent damage which would be detrimental to re-installation and reuse. Store such items where directed by COR. In general items turned over to the Government will be turned over at the storage containers near the Engineering Building.
2. Items not reserved shall become property of the Contractor and be removed by Contractor from Ambulatory Care 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: (Not Used in this Project)

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

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

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

- 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," (Not used in this project)

1.11 RESTORATION

- A. Remove, cut, alter, replace, patch and repair existing work as necessary to install new work. Except as otherwise shown or specified, do not cut, alter or remove any structural work, and do not disturb any ducts, plumbing, steam, gas, or electric work without approval of the COR. Existing work to be altered or extended and that is found to be defective in any way, shall be reported to the COR before it is disturbed. Materials and workmanship used in restoring work, shall conform in type and quality to that of original existing construction, except as otherwise shown or specified.
- B. Upon completion of contract, deliver work complete and undamaged. Existing work (walls, ceilings, partitions, floors, mechanical and electrical work, lawns, paving, roads, walks, etc.) disturbed or removed as a result of performing required new work, shall be patched, repaired, reinstalled, or replaced with new work, and refinished and left in as good condition as existed before commencing work.
- C. At Contractor's own expense, Contractor shall immediately restore to service and repair any damage caused by Contractor's workmen to existing piping and conduits, wires, cables, etc., of utility services or of fire protection systems and communications systems (including telephone)

which are indicated on drawings and which are not scheduled for discontinuance or abandonment.

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

1.12 PHYSICAL DATA

- A. Data and information furnished or referred to below is for the Contractor's information. The Government shall not be responsible for any interpretation of or conclusion drawn from the data or information by the Contractor.
1. The indications of physical conditions on the drawings and in the specifications are the result of site investigations by Dempsey/Surveying/Company.
- 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 Ambulatory Care Center, CTL Engineering, Inc., and shall be considered part of the contract documents.
- D. Government does not guarantee that other materials will not be encountered nor that proportions, conditions or character of several materials will not vary from those indicated by explorations. Bidders are expected to examine site of work and logs of borings; and, after investigation, decide for themselves character of materials and make their bids accordingly. Upon proper application to Department of Veterans Affairs, bidders will be permitted to make subsurface explorations of their own at site.

1.13 PROFESSIONAL SURVEYING SERVICES

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

1.14 LAYOUT OF WORK

- A. The Contractor shall lay out the work from Government established base lines and bench marks, indicated on the drawings, and shall be responsible for all measurements in connection with the layout. The

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

- B. Establish and plainly mark 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 addition, 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, 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 tops and 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".

1.15 AS-BUILT DRAWINGS

- A. The contractor shall maintain one full size set 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 one approved completed set of as-built drawings to the COR within 15 calendar days after each completed phase and after the acceptance of the project by the COR.
- D. Paragraphs A, B, & C shall also apply to all shop drawings.
- E. As-builts will be reviewed at each project meeting.

1.16 USE OF ROADWAYS

- A. For hauling, use only established public roads and roads on Ambulatory Care 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.

1.17 COR'S FIELD OFFICE (NOT USED ON THIS PROJECT)

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, feedwater heaters and auxiliary equipment must be operated as a complete system and be fully maintained by operating personnel. Boiler water must be given complete and continuous chemical treatment.
- B. Prior to final inspection, the equipment or parts used which show wear and tear beyond normal, shall be replaced with identical replacements, at no additional cost to the Government.
- C. This paragraph shall not reduce the requirements of the mechanical and electrical specifications sections.

1.19 TEMPORARY USE OF EXISTING ELEVATORS

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

- Contractor may use elevators Nos. S1 for special nonrecurring time intervals when permission is granted. Personnel for operating elevators will not be provided by the Department of Veterans Affairs.
2. Contractor covers and provides maximum protection of following elevator components:
 - a. Entrance jambs, heads soffits and threshold plates.
 - b. Entrance columns, canopy, return panels and inside surfaces of car enclosure walls.
 - c. Finish flooring.
 3. 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 USE OF NEW ELEVATORS (NOT USED IN THIS PROJECT)

1.21 TEMPORARY TOILETS

- A. Provide at location directed by COR within the construction fence, (quantity of toilets based upon 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.

1.22 AVAILABILITY AND USE OF UTILITY SERVICES

- A. The Government shall make all reasonably required amounts of utilities available to the Contractor from existing outlets and supplies, as specified in the contract. The amount to be paid by the Contractor for chargeable electrical services shall be the prevailing rates charged to the Government. The Contractor shall carefully conserve any utilities furnished without charge.
- B. The Contractor, at Contractor's expense and in a workmanlike manner satisfactory to the Contracting Officer, shall install and maintain all necessary temporary connections and distribution lines, and all meters required to measure the amount of electricity used for the purpose of determining charges. Before final acceptance of the work by the Government, the Contractor shall remove all the temporary connections, distribution lines, meters, and associated paraphernalia.
- C. Contractor shall install meters at Contractor's expense and furnish the Ambulatory Care Center a monthly record of the Contractor's usage of electricity as hereinafter specified.
- D. Heat: Furnish temporary heat necessary to prevent injury to work and materials through dampness and cold. Use of open salamanders or any temporary heating devices which may be fire hazards or may smoke and

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

1. Obtain heat by connecting to Ambulatory Care Center heating distribution system.

- a. Steam is available at no cost to Contractor.

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

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

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

1. Obtain water by connecting to the Ambulatory Care 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 Ambulatory Care Center's system.

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

1. Obtain steam for testing by connecting to the Ambulatory Care 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 Ambulatory Care Center's system.

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

1.23 NEW TELEPHONE EQUIPMENT

The contractor shall coordinate the work of installation of telephone equipment with COR.

1.24 TESTS

- A. Pre-test mechanical and electrical equipment and systems and make corrections required for proper operation of such systems before requesting final tests. Final test will not be conducted unless pre-tested.
- B. Conduct final tests required in various sections of specifications in presence of an authorized representative of the Contracting Officer. Contractor shall furnish all labor, materials, equipment, instruments, and forms, to conduct and record such tests.
- C. Mechanical and electrical systems shall be balanced, controlled and coordinated. A system is defined as the entire complex which must be coordinated to work together during normal operation to produce results for which the system is designed. For example, air conditioning supply air is only one part of entire system which provides comfort conditions for a building. Other related components are return air, exhaust air, steam, chilled water, refrigerant, hot water, controls and electricity, etc. Another example of a complex which involves several components of different disciplines is a boiler installation. Efficient and acceptable boiler operation depends upon the coordination and proper operation of fuel, combustion air, controls, steam, feedwater, condensate and other related components.
 - 1. Testing and balancing of each portion of a multiple phased project shall be performed at the completion of that phase along with a report to the COR. Testing and balancing of the entire project shall be completed of the contract and the final report shall be submitted to the COR. Retesting of areas may be necessary if one phase overlaps with another.
- 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.
- F. Coordinate with requirements of Specification Sections 019100, "GENERAL COMMISSIONING REQUIREMENTS" and 019151, "COMMISSIONING SYSTEMS MANUAL."

1.25 INSTRUCTIONS

- A. Contractor shall furnish Maintenance and Operating manuals (hard copies and electronic) and verbal instructions when required by the various sections of the specifications and as hereinafter specified.

- B. Manuals: Maintenance and operating manuals and one compact disc (four hard copies and one electronic copy each) for each separate piece of equipment shall be delivered to the COR. 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.

1.26 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 Ambulatory Care Center.
- C. Storage space for equipment will be provided by the Government and the Contractor shall be prepared to unload and store such equipment therein upon its receipt at the Ambulatory Care Center.
- D. Notify Contracting Officer in writing, 60 days in advance, of date on which Contractor will be prepared to receive equipment furnished by Government. Arrangements will then be made by the Government for delivery of equipment.
 - 1. Immediately upon delivery of equipment, Contractor shall arrange for a joint inspection thereof with a representative of the Government. At such time the Contractor shall acknowledge receipt of equipment described, make notations, and immediately furnish the Government representative with a written statement as to its condition or shortages.
 - 2. Contractor thereafter is responsible for such equipment until such time as acceptance of contract work is made by the Government.
- E. Equipment furnished by the Government will be delivered in a partially assembled (knock down) condition in accordance with existing standard commercial practices, complete with all fittings, fastenings, and appliances necessary for connections to respective services installed under contract. All fittings and appliances (i.e., couplings, ells, tees, nipples, piping, conduits, cables, and the like) necessary to make the connection between the Government furnished equipment item and the utility stub-up shall be furnished and installed by the contractor at no additional cost to the Government.
- F. Completely assemble and install the Government furnished equipment in place ready for proper operation in accordance with specifications and drawings.
- G. Furnish supervision of installation of equipment at construction site by qualified factory trained technicians regularly employed by the equipment manufacturer.
- H. Provide MEP connections, blocking and additional work required for proper installation of Government-furnished equipment.

1.27 RELOCATED EQUIPMENT/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. 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.

1.28 STORAGE SPACE FOR DEPARTMENT OF VETERANS AFFAIRS EQUIPMENT (NOT USED IN THIS PROJECT)

1.29 CONSTRUCTION SIGN

- A. Provide an exterior 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.

1.30 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.

1.31 PHOTOGRAPHIC DOCUMENTATION

A. During the construction period through completion, provide photographic documentation weekly of construction progress and at selected milestones.

B. Photographic documentation elements:

1. Each digital image shall be taken with a professional grade camera with minimum size of 6 megapixels (MP) capable of producing 200x250mm (8 x 10 inch) prints with a minimum of 2272 x 1704 pixels and 400x500mm (16 x 20 inch) prints with a minimum 2592 x 1944 pixels.
2. Indexing and navigation system (Not used on this project)
3. Documentation shall combine indexing and navigation system (Not used on this project)
4. Before construction, the building pad, adjacent streets, roadways, parkways, driveways, curbs, sidewalks, landscaping, adjacent utilities and adjacent structures surrounding the building pad and site shall be documented. Overlapping photographic techniques shall be used to insure maximum coverage. Indexing and navigation accomplished through interactive architectural drawings. If site work or pad preparation is extensive, this documentation may be required immediately before construction and at several pre-determined intervals before building work commences.
5. Construction progress for all trades shall be tracked at weekly intervals, ("Progressions"). Progression documentation shall track both the exterior and interior construction of the building. Exterior Progressions shall track 360 degrees around the site and each building. Interior Progressions shall track interior improvements beginning when stud work commences and continuing until Project completion.
6. As-built condition of pre-slab utilities and site utilities shall be documented prior to pouring slabs, placing concrete and/or backfilling. This process shall include all underground and in-slab utilities within the building(s) envelope(s) and utility runs in the immediate vicinity of the building(s) envelope(s). This may also include utilities enclosed in slab-on-deck in multi-story buildings. Overlapping photographic techniques shall be used to insure maximum coverage. Indexing and navigation accomplished through interactive site utility plans.

7. As-built conditions of mechanical, electrical, plumbing and all other systems shall be documented post-inspection and pre-insulation, sheet rock or dry wall installation. This process shall include all finished systems located in the walls and ceilings of all buildings at the Project. Overlapping photographic techniques shall be used to insure maximum coverage. Indexing and navigation accomplished through interactive architectural drawings.
8. As-built conditions of exterior skin and elevations shall be documented with an increased concentration of digital photographs as directed by the COR in order to capture pre-determined focal points, such as waterproofing, window flashing, radiused steel work, architectural or Exterior Insulation and Finish Systems (EIFS) detailing. Overlapping photographic techniques shall be used to insure maximum coverage. Indexing and navigation accomplished through interactive elevations or elevation details.
9. As-built finished conditions of the interior of each building including floors, ceilings and walls shall be documented at certificate of occupancy or equivalent, or just prior to occupancy, or both, as directed by the COR. Overlapping photographic techniques shall be used to insure maximum coverage. Indexing and navigation accomplished through interactive architectural drawings.
10. Miscellaneous events that occur during any Contractor site visit, or events captured by the Department of Veterans Affairs independently, shall be dated, labeled and inserted into a Section in the navigation structure entitled "Slideshows," allowing this information to be stored in the same "place" as the formal scope.
11. Customizable project-specific digital photographic documentation of other details or milestones. Indexing and navigation accomplished through interactive architectural plans.
12. Monthly (29 max/month) exterior progressions (360 degrees around the project) and slideshows (all elevations and building envelope). The slideshows allow for the inclusion of Department of Veterans Affairs pictures, aerial photographs, and timely images which do not fit into any regular monthly photopath.
13. Weekly (21 Max/week) Site Progressions - Photographic documentation capturing the project at different stages of construction. These progressions shall capture underground utilities, excavation, grading, backfill, landscaping and road construction throughout the duration of the project.

14. Regular (8 max/wall) interior progressions of all walls of the entire project to begin at time of substantial framed or as directed by the COR through to completion.
15. Detailed Exact-Built of all Slabs for all project slab pours just prior to placing concrete or as directed by the COR.
16. Detailed Interior exact built overlapping photos of the entire building to include documentation of all mechanical, electrical and plumbing systems in every wall and ceiling, to be conducted after rough-ins are complete, just prior to insulation and or drywall, or as directed by COR.
17. Finished detailed Interior exact built overlapping photos of all walls, ceilings, and floors to be scheduled by COR prior to occupancy.
18. In event a greater or lesser number of images than specified above are required by the COR, adjustment in contract price will be made in accordance with clause entitled "CHANGES" (FAR 52.243-4 and VAAR 852.236-88).

1.32 FINAL ELEVATION DIGITAL IMAGES (NOT USED)

1.33 HISTORIC PRESERVATION

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

1.34 VA TRIRIGA CPMS (NOT USED IN THIS PROJECT)

1.35 DATA CLOSET ACCESS

A representative of the VA is required to access the contractor on all occasions when the contractor needs to perform work in the data closets. The contractor will notify the COR a minimum of 3 working days before closet access is required. Contractor will notify the VA of proposed date of access, time of access, location of access and estimated duration. The COR will notify the Contractor if access is approved within 24 hours of requested closet access.

- - - E N D - - -

SECTION 01 32 16.14
CONSTRUCTION PROGRESS SCHEDULES

PART 1- GENERAL

1.1 DESCRIPTION:

- A. The Contractor shall develop a Construction Progress Schedule demonstrating fulfillment of the contract requirements, shall keep the Project Schedule up-to-date in accordance with the requirements of this section and shall utilize the plan for scheduling, coordinating and monitoring work under this contract (including all activities of subcontractors, equipment vendors and suppliers). Conventional Critical Path Method (CPM) and Precedence Diagramming Method (PDM) techniques will be utilized to satisfy both time and cost applications. All schedule data and reports required under this specification section shall be based upon regular total float, not relative total float schedules.
- B. Contractor shall not perform any work on site until the schedule associated with that work is first approved by the VA.

1.2 CONTRACTOR'S REPRESENTATIVE:

- A. The Contractor shall designate an authorized representative in the firm who will be responsible for the preparation of the contract schedule, review and report progress of the project with and to the Contracting Officer's representative.
- B. The Contractor's representative shall have direct project control and complete authority to act on behalf of the Contractor in fulfilling the requirements of this specification section and such authority shall not be interrupted throughout the duration of the project.

1.3 CONTRACTOR'S CONSULTANT:

- A. To prepare the schedule and electronic copy, which reflects the Contractor's project plan, the Contractor may engage an independent CPM consultant who is skilled in the time and cost application of scheduling using (PDM) schedule techniques for construction projects, the cost of which is included in the Contractor's bid; or prepared by Contractor's own qualified staff member.

1.4 COMPUTER PRODUCED SCHEDULES

- A. The contractor is responsible for the correctness and timeliness of the computer-produced reports. The Contractor is also responsible for the accurate and timely submittal of the updated project schedule and all CPM data necessary to produce the computer reports and payment request that is specified.

- B. The VA shall report errors in computer-produced reports to the Contractor's representative within ten calendar days from receipt of reports. The Contractor will reprocess the computer-produced reports and associated electronic copy, when requested by the Contracting Officer's representative, to correct errors which affect the payment and schedule for the project.

1.5 THE COMPLETE PROJECT SCHEDULE SUBMITTAL

- A. Within 14 calendar days after receipt of Notice to Proceed, the Contractor shall submit for the Contracting Officer's review; three blue line copies of the complete schedule on sheets of paper 765 x 1070 mm (30 x 42 inches). The submittal shall also include three copies of a computer-produced activity/event ID schedule showing project duration; phase completion dates; and other data, including event cost. Each activity/event on the computer-produced schedule shall contain as a minimum, but not limited to, activity/event ID, duration, phase completion dates; and other data including event cost. Each activity/event on the computer-produced schedule shall contain as a minimum, but not limited to, activity/event ID, duration, predecessor and successor relationships, trade code, area code, description, budget amount, early start date, early finish date, late start date, late finish date and total float. Work activity/event relationships shall be restricted to finish-to-start only, without lead or lag constraints. Activity/event date constraints, not required by the contract, will not be accepted unless submitted to and approved by the Contracting Officer. The contractor shall make a separate written detailed request to the Contracting Officer identifying these date constraints and secure the Contracting Officer's written approval before incorporating them into the schedule. The Contracting Officer's separate approval of the schedule shall not excuse the contractor of this requirement. Logic events (non-work) will be permitted where necessary to reflect proper logic among work events, but must have a zero duration. The complete working schedule shall reflect the Contractor's approach to scheduling the complete project. The final schedule in its original form shall contain no contract changes or delays which may have been incurred during the final schedule development period and shall reflect the Contractor's as-bid schedule. These changes/delays shall be entered at the first update after the final schedule has been approved. The Contractor should provide their requests for time and supporting time extension analysis for contract time as a result of contract

changes/delays, after this update, and in accordance with Article, ADJUSTMENT OF CONTRACT COMPLETION.

- B. Within 14 calendar days after receipt of the complete project schedule, the Contracting Officer or his representative, will accept or reject the schedule.
- C. The VA will process and return the approved baseline schedule data to the contractor for subsequent project schedule reporting and updating. This approved baseline schedule and the computer-produced schedule(s) generated there from shall constitute the approved baseline schedule until subsequently revised in accordance with the requirements of this section.
- D. The Complete Project Schedule will contain approximately 100 work activities/events.

1.6 WORK ACTIVITY/EVENT COST DATA

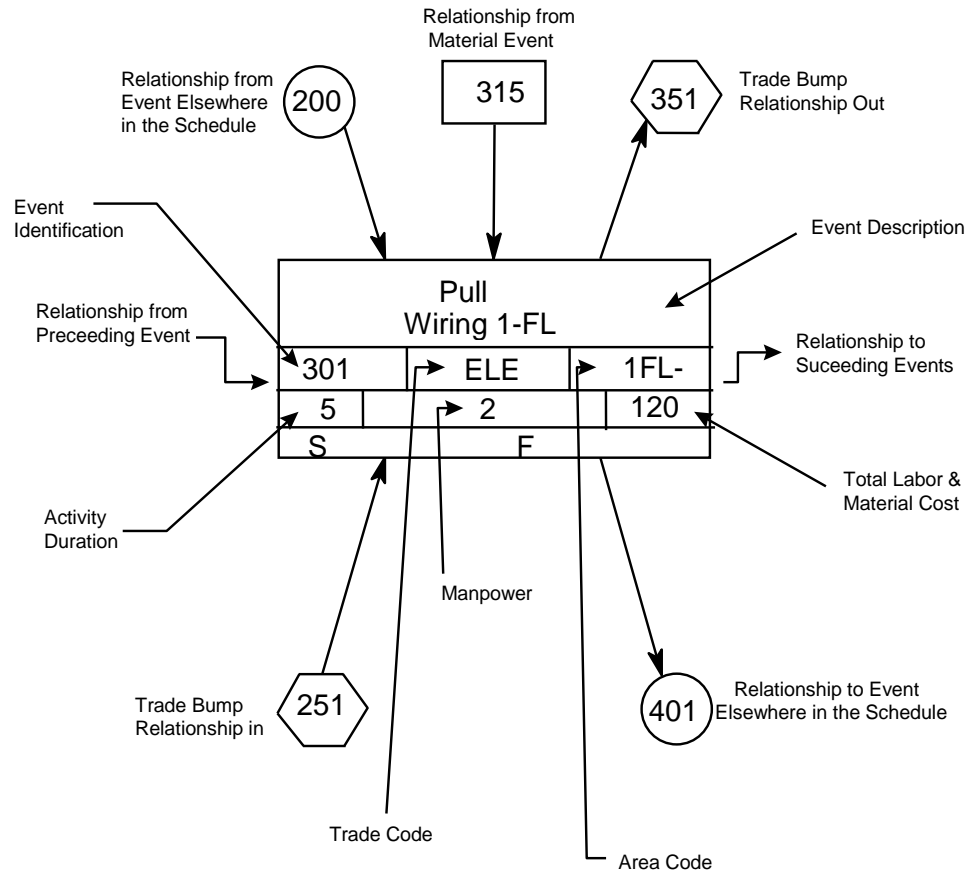
- A. The Contractor shall cost load all work activities/events except procurement activities. The cumulative amount of all cost loaded work activities/events (including alternates) shall equal the total contract price. Prorate overhead, profit and general conditions on all work activities/events for the entire project length. The contractor shall generate from this information cash flow curves indicating graphically the total percentage of work activity/event dollar value scheduled to be in place on early finish, late finish. These cash flow curves will be used by the Contracting Officer to assist him in determining approval or disapproval of the cost loading. In the event of disapproval, the Contractor shall revise and resubmit in accordance with Article, THE COMPLETE PROJECT SCHEDULE SUBMITTAL. Negative work activity/event cost data will not be acceptable, except on VA issued contract changes.
- B. In accordance with Article PERFORMANCE OF WORK BY THE CONTRACTOR in the GENERAL CONDITIONS, the Contractor shall submit, simultaneously with the cost per work activity/event of the construction schedule required by this Section, a responsibility code for all activities/events (referred to as "branches" in the GENERAL CONDITIONS) of the project for which the Contractor's forces will perform the work.
- C. The Contractor shall cost load work activities/events for all BID ITEMS. The sum of the cost loading for each bid item work activities/events shall equal the value of the item in the Contractors' Bid.
- D. Work activities/events for Contractor bond shall have a trade code and area code of BOND.

1.7 SCHEDULE REQUIREMENTS

- A. Show on the schedule the sequence and interdependence of work/activities/events required for complete performance of all items of work. In preparing the schedule, the Contractor shall:
1. Exercise sufficient care to produce a clear, legible and accurate schedule. Computer plotted schedules shall legibly display and plot all information required by the VA CPM activity/event legend or the computer plotted schedule will not be acceptable. If the computer plotted schedule is not found acceptable by the Contracting Officer's representative, then the schedule will need to be hand drafted and meet legibility requirements. Group activities related to specific physical areas of the project, on the schedule for ease of understanding and simplification. Provide a key plan on each schedule sheet showing the project area associated with the work activities/events shown on that sheet.
 2. Show the following on each work activity/event:
 - a. Activity/event ID number.
 - b. Concise description of the work represented by the activity/event. (35 characters or less including spaces preferred).
 - c. Performance responsibility or trade code (five alpha characters or less): GEN, MECH, ELEC, CARP, PLAST or other acceptable abbreviations.
 - d. Duration (in work days).
 - e. Cost (in accordance with Article, ACTIVITY/EVENT COST DATA of this section and less than \$9,999,999 per activity).
 - f. Work location or area code (five characters or less), descriptive of the area involved.
 - g. Manpower required (average number of men per day).
 - h. The SYMBOL LEGEND format shown below and on the drawing, CpM-1 (Sample CPM Schedule) is an example of an acceptable solution and shall be followed in preparing final schedules.

SYMBOL LEGEND

Show Schedule Diagram page number location(s) for all incoming/outgoing node connector(s).



3. Show activities/events as:
 - a. Contractor's time required for submittal of shop drawings, templates, fabrication, delivery and similar pre-construction work.
 - b. Contracting Officer's and Architect-Engineer's review and approval of shop drawings, equipment schedules, samples, template or similar items.
 - c. Interruption of VA Ambulatory Care Center utilities, delivery of Government furnished equipment, and rough-in drawings, project phasing and any other specification requirements.
 - d. Test, balance and adjust various systems and pieces of equipment, maintenance and operation manuals, instructions and preventive maintenance tasks.

- e. VA inspection and acceptance activity/event with a minimum duration of five work days at the end of each phase and immediately preceding any VA move activity/event required by the contract phasing for that phase. Schedule these activities/events so that only one phase is scheduled for completion within the same 30 consecutive calendar day period (except for those phases immediately preceding the final acceptance). Maintain this scheduling condition throughout the length of the contract unless waived by the Contracting Officer's representative in writing.
 - f. Bid items other than the Base Bid (ITEM 1) shall have trade codes corresponding to the appropriate bid item number (e.g., ITM 3, ITM 4 and other items).
- 4. Show not only the activities/events for actual construction work for each trade category of the project, but also trade relationships to indicate the movement of trades from one area, floor, or building, to another area, floor, or building, for at least five trades who are performing major work under this contract.
 - 5. Break up the work into activities/events of a duration no longer than 20 work days each, except as to non-construction activities/events (i.e., procurement of materials, delivery of equipment, concrete and asphalt curing) and any other activities/events for which the Contracting Officer may approve the showing of a longer duration. The duration for VA approval of any required submittal, shop drawing, or other submittals will not be less than 20 work days. The construction time as determined by the CPM schedule from early start to late finish for any sub-phase, phase or the entire project shall not exceed the contract time(s) specified or shown.
 - 6. Describe work activities/events clearly, so the work is readily identifiable for assessment of completion. Activities/events labeled "start," "continue," or "completion," are not specific and will not be allowed. Lead and lag time activities will not be acceptable.
 - 7. Uniquely number each activity/event with numbers ranging from 1 to 99998 only. The schedule should be generally numbered in sequence; left to right; top to bottom, and omitting numbers ending in 3, 6, and 9.
- B. Submit the following supporting data in addition to the schedule, activity/event ID schedule and electronic file(s). Failure of the Contractor to include this data will delay the review of the submittal until the Contracting Officer is in receipt of the missing data:
- 1. The proposed number of working days per week.

2. The holidays to be observed during the life of the contract (by day, month, and year).
 3. The planned number of shifts per day.
 4. The number of hours per shift.
 5. List the major construction equipment to be used on the site, describing how each piece relates to and will be used in support of the submitted schedule work activities/events.
 6. Provide a typed, double spaced, description at least one page in length, of the plan and your approach to constructing the project.
- C. To the extent that the schedule or any revised schedule shows anything not jointly agreed upon, it shall not be deemed to have been approved by the Contracting Officer. Failure to include any element of work required for the performance of this contract shall not excuse the Contractor from completing all work required within any applicable completion date of each phase regardless of the Contracting Officer's approval of the schedule.
- D. Electronic Copy Requirements and CPM Activity/Event Record
Specifications: Submit to the VA an electronic file(s) containing one file of the data required to produce a schedule, reflecting all the activities/events of the complete project schedule being submitted.

1.8 PAYMENT TO THE CONTRACTOR:

- A. Monthly, the contractor shall submit the AIA application and certificate for payment documents G702 and G703 reflecting updated schedule activities and cost data in accordance with the provisions of the following Article, PAYMENT AND PROGRESS REPORTING, as the basis upon which progress payments will be made pursuant to Article, PAYMENT UNDER FIXED-PRICE CONSTRUCTION CONTRACTS of the GENERAL CONDITIONS. The Contractor shall be entitled to a monthly progress payment upon approval of estimates as determined from the currently approved updated computer-produced, calendar-dated schedule unless, in special situations, the Contracting Officer permits an exception to this requirement. Monthly payment requests shall include: three copies of up to five different reports (inclusive of all pages) to the Contracting Officer's representative; a listing of all project schedule changes and associated data, made at the update; and an electronic file(s) of the resulting monthly updated schedule. These must be submitted with and substantively support the contractor's monthly application and certificate for payment request documents.
- B. When the Contractor fails or refuses to furnish to the Contracting Officer the information and schedule in electronic format, which, in the

sole judgment of the Contracting Officer, is necessary for processing the monthly progress payment, the Contractor shall not be deemed to have provided an estimate and supporting schedule data upon which progress payment may be made.

1.9 PAYMENT AND PROGRESS REPORTING

A. Weekly job site progress meetings shall be held on dates mutually agreed to by the Contracting Officer (or Contracting Officer's representative) and the Contractor. Contractor and the CPM consultant will be required to attend all weekly progress meetings. Presence of subcontractors during progress meeting is optional unless required by the Contracting Officer (or Contracting Officer's representative). The Contractor shall update the Project Schedule and all other data required by this section shall be accurately filled in and completed prior to the weekly progress meeting. The Contractor shall provide this information to the Contracting Officer or the VA representative in completed form three work days in advance of the progress meeting. Job progress will be reviewed to verify:

1. Actual start and/or finish dates for updated/completed activities/events.
2. Remaining duration for each activity/event started, or scheduled to start, but not completed.
3. Logic, time and cost data for change orders, and supplemental agreements that are to be incorporated into the schedule and computer-produced schedules. Changes in activity/event sequence and duration which have been made pursuant to the provisions of the following Article, ADJUSTMENT OF CONTRACT COMPLETION.
4. Percentage for completed and partially completed activities/events.
5. Logic and duration revisions required by this section of the specifications.
6. Activity/event duration and percent complete shall be updated independently.

B. The Contractor shall submit a narrative report as a part of his weekly review and update, in a form agreed upon by the Contractor and the Contracting Officer. The narrative report shall include a description of problem areas; current and anticipated delaying factors and their estimated impact on performance of other activities/events and completion dates; and an explanation of corrective action taken or proposed. This report is in addition to the daily reports pursuant to the provisions of Article, DAILY REPORT OF WORKERS AND MATERIALS in the GENERAL CONDITIONS.

- C. After completion of the joint review and the Contracting Officer's approval of all entries, the contractor will generate an updated computer-produced calendar-dated schedule and supply the Contracting Officer's representative with reports in accordance with the Article, COMPUTER PRODUCED SCHEDULES, specified.
- D. After completing the weekly schedule update, the contractor's scheduling consultant shall rerun all current period contract change(s) against the prior approved weekly project schedule. The analysis shall only include original workday durations and schedule logic agreed upon by the contractor and COR for the contract change(s). When there is a disagreement on logic and/or durations, the consultant shall use the schedule logic and/or durations provided and approved by the COR. After each update, the resulting electronic project schedule data file shall be appropriately identified and submitted to the VA in accordance to the requirements listed in Articles 1.4 and 1.7. This electronic submission is separate from the regular weekly project schedule update requirements and shall be submitted to the COR within fourteen (14) calendar days of completing the regular schedule update. Before inserting the contract changes durations, care must be taken to ensure that only the original durations will be used for the analysis, not the reported durations after progress. In addition, once the final schedule is approved, the contractor must recreate all manual progress payment updates on this approved schedule and associated reruns for contract changes in each of these update periods as outlined above for regular update periods. This will require detailed record keeping for each of the manual progress payment updates.
- E. After VA acceptance and approval of the final schedule, and after each weekly update, the contractor shall submit to the Contracting Officer three blue line copies of a revised complete schedule showing all completed and partially completed activities/events, contract changes and logic changes made on the intervening updates or at the first update on the final diagram. The Contracting Officer may elect to have the contractor do this on a less frequent basis, but it shall be done on a quarterly basis as a minimum.
- F. Following approval of the CPM schedule, the VA, the General Contractor, its approved CPM Consultant, COR office representatives, and all subcontractors needed, as determined by the SRE, shall meet to discuss the weekly updated schedule. The main emphasis shall be to address work activities to avoid slippage of project schedule and to identify any

necessary actions required to maintain project schedule during the reporting period. The Government representatives and the Contractor should conclude the meeting with a clear understanding of those work and administrative actions necessary to maintain project schedule status during the reporting period. This schedule coordination meeting will occur after each weekly project schedule update meeting utilizing the resulting schedule reports from that schedule update. If the project is behind schedule, discussions should include ways to prevent further slippage as well as ways to improve the project schedule status, when appropriate.

1.10 RESPONSIBILITY FOR COMPLETION

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

1.11 CHANGES TO THE SCHEDULE

- A. Within 30 calendar days after VA acceptance and approval of any updated computer-produced schedule, the Contractor will submit a revised schedule, the associated electronic copy, and a list of any activity/event changes including predecessors and successors for any of the following reasons:
 - 1. Delay in completion of any activity/event or group of activities/events, indicate an extension of the project completion by 20 working days or 10 percent of the remaining project duration, whichever is less. Such delays which may be involved with contract changes, strikes, unusual weather, and other delays will not relieve the Contractor from the requirements specified unless the conditions

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

1.12 ADJUSTMENT OF CONTRACT COMPLETION

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

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

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

- 1-1. Refer to Articles titled SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FAR 52.236-21) and, SPECIAL NOTES (VAAR 852.236-91), in GENERAL CONDITIONS.
- 1-2. For the purposes of this contract, samples, test reports, certificates, and manufacturers' literature and data shall also be subject to the previously referenced requirements. The following text refers to all items collectively as SUBMITTALS.
- 1-3. Submit for approval, all of the items specifically mentioned under the separate sections of the specification, with information sufficient to evidence full compliance with contract requirements. Materials, fabricated articles and the like to be installed in permanent work shall equal those of approved submittals. After an item has been approved, no change in brand or make will be permitted unless directed by COR.
 - A. Satisfactory written evidence is presented to, and approved by Contracting Officer, that manufacturer cannot make scheduled delivery of approved item or;
 - B. Item delivered has been rejected and substitution of a suitable item is an urgent necessity or;
 - C. Other conditions become apparent which indicates approval of such substitute item to be in best interest of the Government.
- 1-4. Forward submittals in sufficient time to permit proper consideration and approval action by Government. Time submission to assure adequate lead time for procurement of contract - required items. Delays attributable to untimely and rejected submittals will not serve as a basis for extending contract time for completion.
 - A. Use electronic submittal form furnished by the COR.
 - B. Product data, shop drawings and associated literature shall be submitted electronically.
- 1-5. Submittals will be reviewed for compliance with contract requirements by Architect-Engineer, and action thereon will be taken by COR on behalf of the Contracting Officer.
- 1-6. Upon receipt of submittals, Architect-Engineer will assign a file number thereto. Contractor, in any subsequent correspondence, shall refer to this file and identification number to expedite replies relative to previously approved or disapproved submittals.

- 1-7. The Government reserves the right to require additional submittals, whether or not particularly mentioned in this contract. If additional submittals beyond those required by the contract are furnished pursuant to request therefor by Contracting Officer, adjustment in contract price and time will be made in accordance with Articles titled CHANGES (FAR 52.243-4) and CHANGES - SUPPLEMENT (VAAR 852.236-88) of the GENERAL CONDITIONS.
- 1-8. Schedules called for in specifications and shown on shop drawings shall be submitted for use and information of Department of Veterans Affairs and Architect-Engineer. However, the Contractor shall assume responsibility for coordinating and verifying schedules. The Contracting Officer and Architect-Engineer assumes no responsibility for checking schedules or layout drawings for exact sizes, exact numbers and detailed positioning of items.
- 1-9. Submittals must be submitted by Contractor only and shipped prepaid or sent electronically. Contracting Officer assumes no responsibility for checking quantities or exact numbers included in such submittals.
 - A. Submit samples required by Section 09 06 00, SCHEDULE FOR FINISHES, in quadruplicate. Submit other samples in single units unless otherwise specified. Submit shop drawings, schedules, manufacturers' literature and data, and certificates electronically.
 - B. Submittals will receive consideration only when covered by Architect's submittal form and signed by Contractor. Form shall be sent via first class mail or electronically and shall contain the list of items, name of VA Ambulatory Care Center, name of Contractor, contract number, applicable specification paragraph numbers, applicable drawing numbers (and other information required for exact identification of location for each item), manufacturer and brand, ASTM or Federal Specification Number (if any) and such additional information as may be required by specifications for particular item being furnished. In addition, catalogs shall be marked to indicate specific items submitted for approval.
 1. A copy of the form must be enclosed with items, and any items received without identification form will be considered "unclaimed goods" and held for a limited time only.
 2. Each sample, certificate, manufacturers' literature and data shall be labeled to indicate the name and location of the VA Ambulatory Care Center, name of Contractor, manufacturer, brand, contract number and ASTM or Federal Specification Number as applicable and location(s) on project.

3. Required certificates shall be signed by an authorized representative of manufacturer or supplier of material, and by Contractor.
- C. In addition to complying with the applicable requirements specified in preceding Article 1.9, samples which are required to have Laboratory Tests (those preceded by symbol "LT" under the separate sections of the specification shall be tested, at the expense of Contractor, in a commercial laboratory approved by Contracting Officer.
1. Laboratory shall furnish Contracting Officer with a certificate stating that it is fully equipped and qualified to perform intended work, is fully acquainted with specification requirements and intended use of materials and is an independent establishment in no way connected with organization of Contractor or with manufacturer or supplier of materials to be tested.
 2. Certificates shall also set forth a list of comparable projects upon which laboratory has performed similar functions during past five years.
 3. Samples and laboratory tests shall be sent directly to approved commercial testing laboratory.
 4. Contractor shall send a copy of transmittal letter to both COR and to Architect-Engineer simultaneously with submission of material to a commercial testing laboratory.
 5. Laboratory test reports shall be sent directly to COR for appropriate action.
 6. Laboratory reports shall list contract specification test requirements and a comparative list of the laboratory test results. When tests show that the material meets specification requirements, the laboratory shall so certify on test report.
 7. Laboratory test reports shall also include a recommendation for approval or disapproval of tested item.
- D. If submittal samples have been disapproved, resubmit new samples as soon as possible after notification of disapproval. Such new samples shall be marked "Resubmitted Sample" in addition to containing other previously specified information required on label and in transmittal letter.
- E. Approved samples will be kept on file by the COR at the site until completion of contract, at which time such samples will be delivered to Contractor as Contractor's property. Where noted in technical sections of specifications, approved samples in good condition may be used in their proper locations in contract work. At completion of contract, samples that are not approved will be returned to Contractor only upon request and at Contractor's expense. Such request should be made prior to completion of the contract. Disapproved samples that are not

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

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

1. For each drawing required, submit one legible photographic paper or vellum reproducible.
 2. Reproducible shall be full size.
 3. Each drawing shall have marked thereon, proper descriptive title, including Ambulatory Care Center location, project number, manufacturer's number, reference to contract drawing number, detail Section Number, and Specification Section Number.
 4. A space 120 mm by 125 mm (4-3/4 by 5 inches) shall be reserved on each drawing to accommodate approval or disapproval stamp.
 5. Submit drawings, ROLLED WITHIN A MAILING TUBE, fully protected for shipment.
 6. One reproducible print of approved or disapproved shop drawings will be forwarded to Contractor.
 7. When work is directly related and involves more than one trade, shop drawings shall be submitted to Architect-Engineer under one cover.
- 1-10. Samples, shop drawings, test reports, certificates and manufacturers' literature and data, shall be submitted for approval to:

CBLH Design, Inc.
(Architect-Engineer)
7850 Freeway Circle
Suite 101
Middleburg Heights, Ohio 44130

- 1-11. At the time of transmittal to the Architect-Engineer, the Contractor shall also send a copy of the complete submittal directly to the COR.

- 1-12. Samples for approval shall be sent to Architect-Engineer, in care of COR at:

Chalmers P. Wylie VA Ambulatory Care Center
420 N. James Road
Columbus, Ohio 43219

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MATERIAL APPROVAL SUBMITTAL <i>(See Instructions on Reverse)</i>						
TO: (Contracting Officer)		FROM: (Contractor)			DATE (YYYYMMDD)	
CONTRACT NUMBER		SUBMISSION NUMBER			SUBMITTAL <input type="checkbox"/> NEW <input type="checkbox"/> RESUBMITTAL	
PREVIOUS SUBMISSION NUMBER			PROJECT NUMBER			
TO BE COMPLETED BY CONTRACTOR				FOR GOVERNMENT USE ONLY		
ITEM NO.	SPECIFICATION SECTION/ PARA NO./DRAWING NO.	DESCRIPTION OF MATERIAL <i>(Include Type, Model Number, Catalog Number, Mfg., etc.)</i>		AP- PROVED	DISAP- PROVED	SEE REVERSE
				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
BY COMPLETING THIS FORM, THE UNDERSIGNED CONTRACTOR CERTIFIES THAT THE MATERIAL COMPLIES WITH ALL SPECIFICATIONS OF SUBJECT CONTRACT.						
DATE (YYYYMMDD)		TYPE OR PRINT NAME AND TITLE		SIGNATURE		
FOR GOVERNMENT USE ONLY						
TO: (A/E)						
For Evaluation and Action						
DATE (YYYYMMDD)		TYPE OR PRINT NAME AND GRADE		SIGNATURE		
TO: (Project Engineer/COR)						
RECOMMEND		<input type="checkbox"/> APPROVAL <input type="checkbox"/> DISAPPROVAL AS INDICATED ABOVE AND SUBJECT TO ANY APPLICABLE COMMENTS ON THE REVERSE				
DATE (YYYYMMDD)		TYPE OR PRINT NAME AND GRADE		SIGNATURE		
TO: (VA Contracting Officer)						
<input type="checkbox"/> APPROVED <input type="checkbox"/> DISAPPROVED AS INDICATED ABOVE AND SUBJECT TO ANY APPLICABLE COMMENTS ON THE REVERSE SIDE. REQUEST RESUBMITTAL ON DISAPPROVED ITEMS WITHIN _____ DAYS OF DATE SHOWN BELOW.						
DATE (YYYYMMDD)		TYPE OR PRINT NAME AND GRADE		SIGNATURE		

SECTION 01 42 19
REFERENCE STANDARDS

PART 1 - GENERAL

1.1 DESCRIPTION

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

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

- A. The GSA Index of Federal Specifications, Standards and Commercial Item Descriptions, FPMR Part 101-29 and copies of specifications, standards, and commercial item descriptions cited in the solicitation may be obtained for a fee by submitting a request to - GSA Federal Supply Service, Specifications Section, Suite 8100, 470 East L'Enfant Plaza, SW, Washington, DC 20407, Telephone (202) 619-8925, Facsimile (202) 619-8978.
- B. If the General Services Administration, Department of Agriculture, or Department of Veterans Affairs issued this solicitation, a single copy of specifications, standards, and commercial item descriptions cited in this solicitation may be obtained free of charge by submitting a request to the addressee in paragraph (a) of this provision. Additional copies will be issued for a fee.

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

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

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

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

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

AA	Aluminum Association Inc. http://www.aluminum.org
AABC	Associated Air Balance Council http://www.aabchg.com
AAMA	American Architectural Manufacturer's Association http://www.aamanet.org
AAN	American Nursery and Landscape Association http://www.anla.org
AASHTO	American Association of State Highway and Transportation Officials http://www.aashto.org
AATCC	American Association of Textile Chemists and Colorists http://www.aatcc.org
ACGIH	American Conference of Governmental Industrial Hygienists http://www.acgih.org
ACI	American Concrete Institute http://www.aci-int.net
ACPA	American Concrete Pipe Association http://www.concrete-pipe.org
ACPPA	American Concrete Pressure Pipe Association http://www.acppa.org
ADC	Air Diffusion Council http://flexibleduct.org
AGA	American Gas Association http://www.aga.org
AGC	Associated General Contractors of America http://www.agc.org
AGMA	American Gear Manufacturers Association, Inc. http://www.agma.org
AHAM	Association of Home Appliance Manufacturers http://www.aham.org
AISC	American Institute of Steel Construction http://www.aisc.org
AISI	American Iron and Steel Institute http://www.steel.org
AITC	American Institute of Timber Construction http://www.aitc-glulam.org
AMCA	Air Movement and Control Association, Inc. http://www.amca.org
ANLA	American Nursery & Landscape Association http://www.anla.org

ANSI	American National Standards Institute, Inc. http://www.ansi.org
APA	The Engineered Wood Association http://www.apawood.org
ARI	Air-Conditioning and Refrigeration Institute http://www.ari.org
ASAE	American Society of Agricultural Engineers http://www.asae.org
ASCE	American Society of Civil Engineers http://www.asce.org
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers http://www.ashrae.org
ASME	American Society of Mechanical Engineers http://www.asme.org
ASSE	American Society of Sanitary Engineering http://www.asse-plumbing.org
ASTM	American Society for Testing and Materials http://www.astm.org
AWI	Architectural Woodwork Institute http://www.awinet.org
AWS	American Welding Society http://www.aws.org
AWWA	American Water Works Association http://www.awwa.org
BHMA	Builders Hardware Manufacturers Association http://www.buildershardware.com
BIA	Brick Institute of America http://www.bia.org
CAGI	Compressed Air and Gas Institute http://www.cagi.org
CGA	Compressed Gas Association, Inc. http://www.cganet.com
CI	The Chlorine Institute, Inc. http://www.chlorineinstitute.org
CISCA	Ceilings and Interior Systems Construction Association http://www.cisca.org
CISPI	Cast Iron Soil Pipe Institute http://www.cispi.org

CLFMI	Chain Link Fence Manufacturers Institute http://www.chainlinkinfo.org
CPMB	Concrete Plant Manufacturers Bureau http://www.cpmc.org
CRA	California Redwood Association http://www.calredwood.org
CRSI	Concrete Reinforcing Steel Institute http://www.crsi.org
CTI	Cooling Technology Institute http://www.cti.org
DHI	Door and Hardware Institute http://www.dhi.org
EGSA	Electrical Generating Systems Association http://www.egsa.org
EEI	Edison Electric Institute http://www.eei.org
EPA	Environmental Protection Agency http://www.epa.gov
ETL	ETL Testing Laboratories, Inc. http://www.etl.com
FAA	Federal Aviation Administration http://www.faa.gov
FCC	Federal Communications Commission http://www.fcc.gov
FPS	The Forest Products Society http://www.forestprod.org
GANA	Glass Association of North America http://www.cssinfo.com/info/gana.html/
FM	Factory Mutual Insurance http://www.fmglobal.com
GA	Gypsum Association http://www.gypsum.org
GSA	General Services Administration http://www.gsa.gov
HI	Hydraulic Institute http://www.pumps.org
HPVA	Hardwood Plywood & Veneer Association http://www.hpva.org
ICBO	International Conference of Building Officials http://www.icbo.org

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

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

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

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

IPCEA Insulated Power Cable Engineers Association

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

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

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

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

NBS National Bureau of Standards
See - NIST

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

NEC National Electric Code
See - NFPA National Fire Protection Association

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

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

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

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

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

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

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

NSF	National Sanitation Foundation http://www.nsf.org
NWWDA	Window and Door Manufacturers Association http://www.nwwda.org
OSHA	Occupational Safety and Health Administration Department of Labor http://www.osha.gov
PCA	Portland Cement Association http://www.portcement.org
PCI	Precast Prestressed Concrete Institute http://www.pci.org
PPI	The Plastic Pipe Institute http://www.plasticpipe.org
PEI	Porcelain Enamel Institute, Inc. http://www.porcelainenamel.com
PTI	Post-Tensioning Institute http://www.post-tensioning.org
RFCI	The Resilient Floor Covering Institute http://www.rfci.com
RIS	Redwood Inspection Service See - CRA
RMA	Rubber Manufacturers Association, Inc. http://www.rma.org
SCMA	Southern Cypress Manufacturers Association http://www.cypressinfo.org
SDI	Steel Door Institute http://www.steeldoor.org
IGMA	Insulating Glass Manufacturers Alliance http://www.igmaonline.org
SJI	Steel Joist Institute http://www.steeljoist.org
SMACNA	Sheet Metal and Air-Conditioning Contractors National Association, Inc. http://www.smacna.org
SSPC	The Society for Protective Coatings http://www.sspc.org
STI	Steel Tank Institute http://www.steeltank.com
SWI	Steel Window Institute http://www.steelwindows.com

TCA Tile Council of America, Inc.
 <http://www.tileusa.com>

TEMA Tubular Exchange Manufacturers Association
 <http://www.tema.org>

TPI Truss Plate Institute, Inc.
 583 D'Onofrio Drive; Suite 200
 Madison, WI 53719
 (608) 833-5900

UBC The Uniform Building Code
 See ICBO

UL Underwriters' Laboratories Incorporated
 <http://www.ul.com>

ULC Underwriters' Laboratories of Canada
 <http://www.ulc.ca>

WCLIB West Coast Lumber Inspection Bureau
 6980 SW Varns Road, P.O. Box 23145
 Portland, OR 97223
 (503) 639-0651

WRCLA Western Red Cedar Lumber Association
 P.O. Box 120786
 New Brighton, MN 55112
 (612) 633-4334

WWPA Western Wood Products Association
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SECTION 01 45 29
TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies materials testing activities and inspection services required during project construction to be provided by a Testing Laboratory retained by Department of Veterans.

1.2 APPLICABLE PUBLICATIONS:

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.
- B. American Association of State Highway and Transportation Officials (AASHTO):
 - T27-11.....Standard Method of Test for Sieve Analysis of Fine and Coarse Aggregates
 - T96-02 (R2006).....Standard Method of Test for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
 - T99-10.....Standard Method of Test for Moisture-Density Relations of Soils Using a 2.5 Kg (5.5 lb.) Rammer and a 305 mm (12 in.) Drop
 - T104-99 (R2007).....Standard Method of Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate
 - T180-10.....Standard Method of Test for Moisture-Density Relations of Soils using a 4.54 kg (10 lb.) Rammer and a 457 mm (18 in.) Drop
 - T191-02(R2006).....Standard Method of Test for Density of Soil In-Place by the Sand-Cone Method
- C. American Society for Testing and Materials (ASTM):
 - A325-10.....Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
 - A370-12.....Standard Test Methods and Definitions for Mechanical Testing of Steel Products
 - A416/A416M-10.....Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete
 - A490-12.....Standard Specification for Heat Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

- D1556-07.....Standard Test Method for Density and Unit Weight
of Soil in Place by the Sand-Cone Method
- D1557-09.....Standard Test Methods for Laboratory Compaction
Characteristics of Soil Using Modified Effort
(56,000ft lbf/ft³ (2,700 KNm/m³))
- D2166-06.....Standard Test Method for Unconfined Compressive
Strength of Cohesive Soil
- D2167-08).....Standard Test Method for Density and Unit Weight
of Soil in Place by the Rubber Balloon Method
- D2216-10.....Standard Test Methods for Laboratory
Determination of Water (Moisture) Content of
Soil and Rock by Mass
- D2974-07a.....Standard Test Methods for Moisture, Ash, and
Organic Matter of Peat and Other Organic Soils
- D3666-11.....Standard Specification for Minimum Requirements
for Agencies Testing and Inspecting Road and
Paving Materials
- D3740-11.....Standard Practice for Minimum Requirements for
Agencies Engaged in Testing and/or Inspection
of Soil and Rock as used in Engineering Design
and Construction
- D6938-10.....Standard Test Method for In-Place Density and
Water Content of Soil and Soil-Aggregate by
Nuclear Methods (Shallow Depth)
- E94-04(2010).....Standard Guide for Radiographic Examination
- E164-08.....Standard Practice for Contact Ultrasonic Testing
of Weldments
- E329-11c.....Standard Specification for Agencies Engaged in
Construction Inspection, Testing, or Special
Inspection
- E543-09.....Standard Specification for Agencies Performing
Non-Destructive Testing
- E605-93(R2011).....Standard Test Methods for Thickness and Density
of Sprayed Fire Resistive Material (SFRM)
Applied to Structural Members
- E709-08.....Standard Guide for Magnetic Particle Examination
- E1155-96(R2008).....Determining FF Floor Flatness and FL Floor
Levelness Numbers
- E. American Welding Society (AWS):
- D1.D1.1M-10.....Structural Welding Code-Steel

1.3 REQUIREMENTS:

- A. Accreditation Requirements: Construction materials testing laboratories must be accredited by a laboratory accreditation authority and will be required to submit a copy of the Certificate of Accreditation and Scope of Accreditation. The laboratory's scope of accreditation must include the appropriate ASTM standards (i.e.; E329, C1077, D3666, D3740, A880, E543) listed in the technical sections of the specifications. Laboratories engaged in Hazardous Materials Testing shall meet the requirements of OSHA and EPA. The policy applies to the specific laboratory performing the actual testing, not just the "Corporate Office."
- B. Inspection and Testing: Testing laboratory shall inspect materials and workmanship and perform tests described herein and additional tests requested by COR. When it appears materials furnished, or work performed by Contractor fail to meet construction contract requirements, Testing Laboratory shall direct attention of COR to such failure.
- C. Written Reports: Testing laboratory shall submit test reports to COR, Contractor, unless other arrangements are agreed to in writing by the COR. Submit reports of tests that fail to meet construction contract requirements on colored paper.
- D. Verbal Reports: Give verbal notification to COR immediately of any irregularity.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EARTHWORK:

- A. General: The Testing Laboratory shall provide qualified personnel, materials, equipment, and transportation as required to perform the services identified/required herein, within the agreed to schedule and/or time frame. The work to be performed shall be as identified herein and shall include but not be limited to the following:
 - 1. Observe fill and subgrades during proof-rolling to evaluate suitability of surface material to receive fill or base course. Provide recommendations to the COR regarding suitability or unsuitability of areas where proof-rolling was observed. Where unsuitable results are observed, witness excavation of unsuitable material and recommend to COR extent of removal and replacement of unsuitable materials and observe proof-rolling of replaced areas until satisfactory results are obtained.
 - 2. Provide full time observation of fill placement and compaction and field density testing in building areas and provide full time

observation of fill placement and compaction and field density testing in pavement areas to verify that earthwork compaction obtained is in accordance with contract documents.

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 D1557 Method.
2. Make field density tests in accordance with the primary testing method following ASTM D6938. 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. Fill and Backfill Material Gradation: One test per 100 cubic yards stockpiled or in-place source material. Gradation of fill and backfill material shall be determined in accordance with ASTM C136 or ASTM D422.
- D. Testing for Footing Bearing Capacity: Evaluate if suitable bearing capacity material is encountered in footing subgrade.
- E. Testing Materials: Test suitability of on-site and off-site borrow as directed by COR.

3.2 FOUNDATION CAISSONS:

- A. Concrete Testing: Test concrete including materials for concrete as required in Article, CONCRETE of this section, except make two test cylinders for each day's placement of concrete.
- B. Maintain a record of concrete used in each caisson. Compare records with calculated volumes.
- C. Inspect percussion hole in bottom of each caisson to determine that material is capable of supporting design load.
- D. Inspect sides and bottom of each caisson for compliance with contract documents.
- E. Submit a certified "Caisson Field Record" for each caisson, recording actual elevation at bottom of shaft; final center line location of top; variation of shaft from plumb; results of all tests performed; actual allowable bearing capacity of bottom; depth of socket into rock; levelness of bottom; seepage of water; still water level (if allowed to flood); variation of shaft (from dimensions shown); location and size of reinforcement, and evidence of seams, voids, or channels below the bottom. Verify the actual bearing capacity of the rock strata by the use of a calibrated penetrometer or other acceptable method.
- F. Caissons Bearing on Hardpan: Take undisturbed samples, suitable for tests required, from caisson bottom. Make auger probe to a depth of 2.5 meters (8 feet) below bottom and visually inspect and classify soil. Verify continuity of strata and thickness.
 - 1. Conduct the following test on each sample, and report results and evaluations to the COR:
 - a. Unconfined Compression Test (ASTM D2166).
 - b. Moisture Content (ASTM D2216).
 - c. Density.

3.3 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.

3.4 SITE WORK CONCRETE:

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 four cylinders for each 40 m³ (50 cubic yards) or less of each concrete type, and at least four cylinders for any one day's pour for each concrete type. After good concrete quality control has been established and maintained as determined by

- COR make four cylinders for each 80 m³ (100 cubic yards) or less of each concrete type, and at least four cylinders from 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 F_F and F_L in accordance with ASTM E1155. Calculate the actual overall F- numbers using the inferior/superior area method.
 - b. Perform all floor tolerance measurements within 48 hours after slab installation and prior to removal of shoring and formwork.
 - c. Provide the Contractor and the COR with the results of all profile tests, including a running tabulation of the overall F_F and F_L values for all slabs installed to date, within 72 hours after each slab installation.
 19. Other inspections:
 - a. Grouting under base plates.
 - b. Grouting anchor bolts and reinforcing steel in hardened concrete.
- C. Laboratory Tests of Field Samples:
1. Test compression test cylinders for strength in accordance with ASTM C39. For each test series, test one cylinder at 7 days and two cylinders 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 the average result of two cylinders, 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. Make one tensile and one bend test in accordance with ASTM A370 from each pair of samples obtained.
- C. Written report shall include, in addition to test results, heat number, manufacturer, type and grade of steel, and bar size.

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.

3.8 STRUCTURAL STEEL:

- A. General: Provide shop and field inspection and testing services to certify structural steel work is done in accordance with contract documents. Welding shall conform to AWS D1.1 Structural Welding Code.
- B. Prefabrication Inspection:
 - 1. Review design and shop detail drawings for size, length, type and location of all welds to be made.
 - 2. Approve welding procedure qualifications either by pre-qualification or by witnessing qualifications tests.
 - 3. Approve welder qualifications by certification or retesting.
 - 4. Approve procedure for control of distortion and shrinkage stresses.
 - 5. Approve procedures for welding in accordance with applicable sections of AWS D1.1.
- C. Fabrication and Erection:
 - 1. Weld Inspection:
 - a. Inspect welding equipment for capacity, maintenance and working condition.
 - b. Verify specified electrodes and handling and storage of electrodes in accordance with AWS D1.1.
 - c. Inspect preparation and assembly of materials to be welded for conformance with AWS D1.1.
 - d. Inspect preheating and interpass temperatures for conformance with AWS D1.1.
 - e. Measure 25 percent of fillet welds.
 - f. Welding Magnetic Particle Testing: Test in accordance with ASTM E709 for a minimum of:
 - 1) 20 percent of all shear plate fillet welds at random, final pass only.
 - 2) 20 percent of all continuity plate and bracing gusset plate fillet welds, at random, final pass only.
 - 3) 100 percent of tension member fillet welds (i.e., hanger connection plates and other similar connections) for root and final passes.
 - g. Welding Ultrasonic Testing: Test in accordance with ASTM E164 and AWS D1.1 for 100 percent of all full penetration welds, braced 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.

3.15 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.

3.16 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.

3.17 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.

3.18 TYPE OF TEST:

Approximate Number of Tests Required

A. Earthwork:

Laboratory Compaction Test, Soils:

(ASTM D1557)

50

Field Density, Soils (AASHTO T191, T205, or T238)

50

B. Landscaping:

Topsoil Test

5

C. Aggregate Base:

Laboratory Compaction, (ASTM D1557)	<u>30</u>
Field Density, (ASTM D1556)	<u>15</u>
Aggregate, Base Course Gradation (AASHTO T27)	<u>5</u>
Wear (AASHTO T96)	<u>5</u>
Soundness (AASHTO T104)	<u>5</u>
D. Asphalt Concrete:	
Field Density, (AASHTO T230)//ASTM D1188//	<u>18</u>
Aggregate, Asphalt Concrete Gradation (AASHTO T27)	<u>4</u>
Wear (AASHTO T96)	<u>4</u>
Soundness (AASHTO T104)	<u>4</u>
E. Concrete:	
Making and Curing Concrete Test Cylinders (ASTM C31)	<u>100</u>
Compressive Strength, Test Cylinders (ASTM C39)	<u>100</u>
Concrete Slump Test (ASTM C143)	<u>25</u>
Concrete Air Content Test (ASTM C173)	<u>15</u>
Unit Weight, Lightweight Concrete (ASTM C567)	<u>10</u>
Flatness and Levelness Readings (ASTM E1155) (number of days)	<u>2</u>
G. Masonry:	
Sampling and Testing Mortar, Comp. Strength (ASTM C780)	<u>5</u>
Sampling and Testing Grout, Comp. Strength (ASTM C1019)	<u>6</u>
Masonry Unit, Compressive Strength (ASTM C140)	<u>3</u>
H. Structural Steel:	
Ultrasonic Testing of Welds (ASTM E164)	<u>40</u>
Magnetic Particle Testing of Welds (ASTM E709)	<u>60</u>
Radiographic Testing of Welds (ASTM E94)	<u>2</u>
I. Sprayed-On Fireproofing:	
Thickness and Density Tests (ASTM E605)	<u>20</u>
J. Inspection:	
Technical Personnel (Man-days)	<u>30</u>
K. Technical Personnel: As directed by COR.	
1. Technicians to perform tests and inspection listed above. Laboratory will be equipped with concrete cylinder storage facilities, compression machine, cube molds, proctor molds, balances, scales,	

moisture ovens, slump cones, air meter, and all necessary equipment
for compaction control.

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SECTION 01 57 19
TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 - GENERAL

1.1 DESCRIPTION

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

7. Sanitary Wastes:

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

1.2 QUALITY CONTROL

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

1.3 REFERENCES

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

1.4 SUBMITTALS

- A. In accordance with Section, 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:
 - 1. Environmental Protection Plan: After the contract is awarded and prior to the commencement of the work, the Contractor shall meet with the COR to discuss the proposed Environmental Protection Plan and to develop mutual understanding relative to details of environmental protection. Not more than 20 days after the meeting, the Contractor shall prepare and submit to the COR for approval, a written and/or graphic Environmental Protection Plan including, but not limited to, the following:
 - a. Name(s) of person(s) within the Contractor's organization who is (are) responsible for ensuring adherence to the Environmental Protection Plan.
 - b. Name(s) and qualifications of person(s) responsible for manifesting hazardous waste to be removed from the site.
 - c. Name(s) and qualifications of person(s) responsible for training the Contractor's environmental protection personnel.
 - d. Description of the Contractor's environmental protection personnel training program.
 - e. A list of Federal, State, and local laws, regulations, and permits concerning environmental protection, pollution control, noise control and abatement that are applicable to the Contractor's proposed operations and the requirements imposed by those laws, regulations, and permits.

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

1.5 PROTECTION OF ENVIRONMENTAL RESOURCES

- A. Protect environmental resources within the project boundaries and those affected outside the limits of permanent work during the entire period of this contract. Confine activities to areas defined by the specifications and drawings.
- B. Protection of Land Resources: Prior to construction, identify all land resources to be preserved within the work area. Do not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, top soil, and land forms without permission from the COR. Do not fasten or attach ropes, cables, or guys to trees for anchorage unless specifically authorized, or where special emergency use is permitted.
 - 1. Work Area Limits: Prior to any construction, mark the areas that require work to be performed under this contract. Mark or fence

- isolated areas within the general work area that are to be saved and protected. Protect monuments, works of art, and markers before construction operations begin. Convey to all personnel the purpose of marking and protecting all necessary objects.
2. Protection of Landscape: Protect trees, shrubs, vines, grasses, land forms, and other landscape features shown on the drawings to be preserved by marking, fencing, or using any other approved techniques.
 - a. Box and protect from damage existing trees and shrubs to remain on the construction site.
 - b. Immediately repair all damage to existing trees and shrubs by trimming, cleaning, and painting with antiseptic tree paint.
 - c. Do not store building materials or perform construction activities closer to existing trees or shrubs than the farthest extension of their limbs.
 3. Reduction of Exposure of Unprotected Erodible Soils: Plan and conduct earthwork to minimize the duration of exposure of unprotected soils. Clear areas in reasonably sized increments only as needed to use. Form earthwork to final grade as shown. Immediately protect side slopes and back slopes upon completion of rough grading.
 4. Temporary Protection of Disturbed Areas: Construct diversion ditches, benches, and berms to retard and divert runoff from the construction site to protected drainage areas approved under paragraph 208 of the Clean Water Act.
 - a. Sediment Basins: Trap sediment from construction areas in temporary or permanent sediment basins that accommodate the runoff of a local civil(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 Government property to minimize erosion and to prevent sediment from entering nearby water courses or lakes.
 7. Manage and control spoil areas on Government property to limit spoil to areas shown 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 Ohio Air Pollution Statute, Rule, or Regulation 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 6:00 p.m. and 7:00 a.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	75
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.

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SECTION 01 58 16
TEMPORARY INTERIOR SIGNAGE

PART 1 GENERAL

DESCRIPTION

This section specifies temporary interior signs.

PART 2 PRODUCTS

2.1 TEMPORARY SIGNS

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

PART 3 EXECUTION

3.1 INSTALLATION

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

3.2 LOCATION

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

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SECTION 01 74 19
CONSTRUCTION WASTE MANAGEMENT

PART 1 - GENERAL

1.1 DESCRIPTION

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

1.2 RELATED WORK

- A. Section 02 41 00, DEMOLITION.
- B. Section 01 00 00, GENERAL REQUIREMENTS.

1.3 QUALITY ASSURANCE

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

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

1.4 TERMINOLOGY

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

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

1.5 SUBMITTALS

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES, furnish the following:
- B. Prepare and submit to the COR a written demolition debris management plan. The plan shall include, but not be limited to, the following information:
1. Procedures to be used for debris management.
 2. Techniques to be used to minimize waste generation.
 3. Analysis of the estimated job site waste to be generated:
 - a. List of each material and quantity to be salvaged, reused, recycled.
 - b. List of each material and quantity proposed to be taken to a landfill.

4. Detailed description of the Means/Methods to be used for material handling.
 - a. On site: Material separation, storage, protection where applicable.
 - b. Off site: Transportation means and destination. Include list of materials.
 - 1) Description of materials to be site-separated and self-hauled to designated facilities.
 - 2) Description of mixed materials to be collected by designated waste haulers and removed from the site.
 - c. The names and locations of mixed debris reuse and recycling facilities or sites.
 - d. The names and locations of trash disposal landfill facilities or sites.
 - e. Documentation that the facilities or sites are approved to receive the materials.
- C. Designated Manager responsible for instructing personnel, supervising, documenting and administer over meetings relevant to the Waste Management Plan.
- D. Monthly summary of construction and demolition debris diversion and disposal, quantifying all materials generated at the work site and disposed of or diverted from disposal through recycling.

1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced by the basic designation only. In the event that criteria requirements conflict, the most stringent requirements shall be met.
- B. U.S. Green Building Council (USGBC):
LEED Green Building Rating System for New Construction

1.7 RECORDS

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

PART 2 - PRODUCTS

2.1 MATERIALS

- A. List of each material and quantity to be salvaged, recycled, reused.
- B. List of each material and quantity proposed to be taken to a landfill.

- C. Material tracking data: Receiving parties, dates removed, transportation costs, weight tickets, tipping fees, manifests, invoices, net total costs or savings.

PART 3 - EXECUTION

3.1 COLLECTION

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

3.2 DISPOSAL

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

3.3 REPORT

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

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SECTION 01 81 11

SUSTAINABLE DESIGN REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 OBJECTIVES

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

proposing product substitutions and/or changes to specified processes.

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

1.3 RELATED DOCUMENTS

- A. Section 01 74 19 CONSTRUCTION WASTE MANAGEMENT
- B. Section 01 81 09 TESTING FOR INDOOR AIR QUALITY (not written yet)
- C. Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS

1.4 DEFINITIONS

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

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

1.5 SUBMITTALS

- A. Sustainable Design Submittals:
 - 1. Alternative Transportation: Provide manufacturer's cut sheets for all bike racks installed on site, including the total number of bicycle storage slots provided.
 - 2. Heat Island Effect:
 - a. Site Paving: Provide manufacturer's cut sheets for all impervious paving materials, highlighting the Solar Reflectance Index (SRI)

of the material. Also, provide cut sheets for all pervious paving materials.

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

9. Recycled Content: Submittals for all materials with recycled content (excluding MEP systems equipment and components) must include the following documentation: Manufacturer's product data, product literature, or a letter from the manufacturer verifying the percentage of post-consumer and pre-consumer recycled content (by weight) of each material or product
10. Interior Adhesives and Sealants: Submittals for all field-applied adhesives and sealants, which have a potential impact on indoor air, must include manufacturer's MSDSs or other Product Data highlighting VOC content.
 - a. Provide manufacturers' documentation verifying all adhesives used to apply laminates, whether shop-applied or field-applied, contain no urea-formaldehyde.
11. Interior Paints and Coatings: Submittals for all field-applied paints and coatings, which have a potential impact on indoor air, must include manufacturer's MSDSs or other Product Data highlighting VOC content
12. Floorcoverings:
 - a. Carpet Systems: Submittals for all carpet must include the following:
 - 1) A copy of an assessment from the Building for Environmental and Economic Sustainability (BEES) software model, either Version 3.0 or 4.0, with parameters of the model set as described by this specification section.
 - 2) Manufacturer's product data verifying that all carpet systems meet or exceed the testing and product requirements of the Carpet and Rug Institute Green Label Plus program.
13. Composite Wood and Agrifiber Binders: Submittals for all composite wood and agrifiber products (including but not limited to particleboard, wheatboard, strawboard, agriboard products, engineered wood components, solid-core wood doors, OSB, MDF, and plywood products) must include manufacturer's product data verifying that these products contain no urea-formaldehyde resins.
14. Entryway Systems: Provide manufacturer's cut sheets for all walk-off systems installed to capture particulates, including permanently installed grates, grilles, slotted systems, direct glue-down walk-off mats, and non-permanent roll-out mats.

15. Air Filtration: Provide manufacturer's cut sheets and product data highlighting the following:
 - a. Minimum Efficiency Reporting Value (MERV) for filtration media in all air handling units (AHUs) per ASHRAE HVAC Design Manual for Hospitals and Clinics.
 - b. Minimum Efficiency Reporting Value (MERV) for filtration media installed at return air grilles during construction if permanently installed AHUs are used during construction. See above for requirements
16. Mercury in Lighting: Provide manufacturer's cut sheets or product data for all fluorescent or HID lamps highlighting mercury content.
17. Lighting Controls: Provide manufacturer's cut sheets and shop drawing documentation highlighting all lighting controls systems components.
18. Thermal Comfort Controls: Provide manufacturer's cut sheets and shop drawing documentation highlighting all thermal comfort-control systems components.
19. Blended Cement: It is the intent of this specification to reduce CO₂ emissions and other environmentally detrimental effects resulting from the production of portland cement by requiring that all concrete mixes, in aggregate, utilize blended cement mixes to displace portland cement as specified in Section 03 30 00, CONCRETE typically included in conventional construction. Provide the following submittals:
 - a. Copies of concrete design mixes for all installed concrete
 - b. Copies of typical regional baseline concrete design mixes for all compressive strengths used on the Project
 - c. Quantities in cubic yards of each installed concrete mix
20. Gypsum Wall Board: Provide manufacturer's cut sheets or product data verifying that all gypsum wallboard products are moisture and mold-resistant.
21. Fiberglass Insulation: Provide manufacturer's cut sheets or product data verifying that fiberglass batt insulation contains no urea-formaldehyde.
22. Duct Acoustical Insulation: Provide manufacturer's cut sheets or product data verifying that mechanical sound insulation materials in air distribution ducts consists of an impervious, non-porous

coatings that prevent dust from accumulating in the insulating materials.

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

C. Construction Indoor Air Quality (IAQ) Management: Submittals must include the following:

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

4. Not more than 14 days after Substantial Completion provide the following:
 - a. Documentation verifying required replacement of air filtration media in all air handling units (AHUs) after the completion of construction and prior to occupancy and, if applicable, required installation of filtration during construction.
 - b. Minimum of 18 Construction photographs: Six photographs taken on three different occasions during construction of the SMACNA approaches employed, along with a brief description of each approach, documenting implementation of the IAQ management measures, such as protection of ducts and on-site stored or installed absorptive materials.
 - c. A copy of the report from testing and inspecting agency documenting the results of IAQ testing, demonstrating conformance with IAQ testing procedures and requirements defined in Section 01 81 09 "Testing for Indoor Air Quality."
 5. Construction IAQ Management Plan - Before Occupancy:
 - a. After construction ends, prior to occupancy and with all interior finishes installed, install new filtration media and perform a building flush-out by supplying a total air volume of 14,000 cubic feet of outdoor air per square foot (4,500 cubic meters of outdoor air per square meter) of floor area while maintaining an internal temperature of at least 60° F (15° C) and relative humidity no higher than 60%.
- D. Commissioning: See Section 01 91 00 "General Commissioning Requirements" for submittal requirements.

1.6 QUALITY ASSURANCE

- A. Preconstruction Meeting: After award of Contract and prior to the commencement of the Work, schedule and conduct meeting with Owner, Architect, and all Subcontractors to discuss the Construction Waste Management Plan, the required Construction Indoor Air Quality (IAQ) Management Plan, and all other Sustainable Design Requirements. The purpose of this meeting is to develop a mutual understanding of the Project's Sustainable Design Requirements and coordination of the Contractor's management of these requirements with the Contracting Officer and the Construction Quality Manager.

- B. Construction Job Conferences: The status of compliance with the Sustainable Design Requirements of these specifications will be an agenda item at all regular job meetings conducted during the course of work at the site.

PART 2 - PRODUCTS

2.1 PRODUCT ENVIRONMENTAL REQUIREMENTS

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

fixture performance requirements. Flow and flush rates shall not exceed the following:

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

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

K. HVAC Distribution Efficiency:

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

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

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

M. Recycled Content of Materials:

1. Provide building materials with recycled content such that post-consumer recycled content value plus half the pre-consumer recycled content value constitutes a minimum of 30% of the cost of materials used for the Project, exclusive of all MEP equipment, labor, and delivery costs. The Contractor shall make all attempts to maximize the procurement of materials with recycled content.
 - a. The materials in the following list must contain the minimum recycled content indicated:

Category	Minimum Recycled Content
Compost/mulch	100% post-consumer
Asphaltic Concrete Paving	25% post-consumer

Cast-in-Place Concrete	6% pre-consumer
CMU: Gray Block	20% pre-consumer
Steel Reinforcing Bars	90% combined
Structural Steel Shapes	90% combined
Steel Joists	75% combined
Steel Deck	75% combined
Steel Fabrications	60% combined
Steel Studs	30% combined
Steel Roofing	30% post-consumer
Aluminum Fabrications	35% combined
Rigid Insulation	20% pre-consumer
Batt insulation	30% combined

N. Biobased Content:

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

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SECTION 01 91 00

GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 COMMISSIONING 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 07, Division 21, Division 22, Division 23, Division 26, Division 27, Division 28, and Division 31 series sections of these specifications are intended to be provided in coordination with the commissioning services and are not intended to duplicate services. The Contractor shall coordinate the work required by individual specification sections with the commissioning services requirements specified herein.
- C. Where individual testing, adjusting, or related services are required in the project specifications and not specifically required by this commissioning requirements specification, the specified services shall be provided and copies of documentation, as required by those specifications shall be submitted to the VA and the Commissioning Agent to be indexed for future reference.
- D. Where training or educational services for VA are required and specified in other sections of the specifications, including but not limited to Division 07, Division 08, Division 21, Division 22, Division 23, Division 26, Division 27, Division 28, and Division 31 series sections of the specification, these services are intended to be provided in addition to the training and educational services specified herein.
- E. Commissioning is a systematic process of verifying that the building systems perform interactively according to the construction documents and the VA's operational needs. The commissioning process shall encompass and coordinate the system documentation, equipment startup, control system calibration, testing and balancing, performance testing

and training. Commissioning during the construction and post-occupancy phases is intended to achieve the following specific objectives according to the contract documents:

1. Verify that the applicable equipment and systems are installed in accordance with the 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.

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.
- B. In this project, 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 01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Section 01 81 11 SUSTAINABLE DESIGN REQUIREMENTS.

1.4 SUMMARY

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

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

C. The commissioning activities have been developed to support the United States Green Building Council's (USGBC) LEED™ rating program and to support delivery of project performance in accordance with the VA requirements developed for the project to support the following credits:

1. Commissioning activities and documentation for the LEED™ section on "Energy and Atmosphere" and the prerequisite of "Fundamental Building Systems Commissioning."
2. Commissioning activities and documentation for the LEED™ section on "Energy and Atmosphere" requirements for the "Enhanced Building System Commissioning" credit.
3. Activities and documentation for the LEED™ section on "Measurement and Verification" requirements for the Measurement and Verification credit.

1.5 ACRONYMS

List of Acronyms	
Acronym	Meaning
A/E	Architect / Engineer Design Team
AHJ	Authority Having Jurisdiction
ASHRAE	Association Society for Heating Air Condition and Refrigeration Engineers
BOD	Basis of Design
BSC	Building Systems Commissioning
CCTV	Closed Circuit Television
CD	Construction Documents
CMMS	Computerized Maintenance Management System
CO	Contracting Officer (VA)
COR	Contracting Officer's Representative
COBie	Construction Operations Building Information Exchange

List of Acronyms	
Acronym	Meaning
CPC	Construction Phase Commissioning
Cx	Commissioning
CxA	Commissioning Agent
CxM	Commissioning Manager
CxR	Commissioning Representative
DPC	Design Phase Commissioning
FPT	Functional Performance Test
GBI-GG	Green Building Initiative - Green Globes
HVAC	Heating, Ventilation, and Air Conditioning
LEED	Leadership in Energy and Environmental Design
NC	Department of Veterans Affairs National Cemetery
NCA	Department of Veterans Affairs National Cemetery Administration
NEBB	National Environmental Balancing Bureau
O&M	Operations & Maintenance
OPR	Owner's Project Requirements
PFC	Pre-Functional Checklist
PFT	Pre-Functional Test
SD	Schematic Design
SO	Site Observation
TAB	Test Adjust and Balance
VA	Department of Veterans Affairs
VAMC	VA Medical Center
VA CFM	VA Office of Construction and Facilities Management
VACO	VA Central Office
VA PM	VA Project Manager
VA-COR	VA Contracting Officer Representative
USGBC	United States Green Building Council

1.6 DEFINITIONS

Acceptance Phase Commissioning: Commissioning tasks executed after most construction has been completed, most Site Observations and Static Tests have been completed and Pre-Functional Testing has been completed and accepted. The main commissioning activities performed during this phase are verification that the installed systems are functional by conducting Systems Functional Performance tests and Owner Training.

Accuracy: The capability of an instrument to indicate the true value of a measured quantity.

Back Check: A back check is a verification that an agreed upon solution to a design comment has been adequately addressed in a subsequent design review

Basis of Design (BOD): The Engineer's Basis of Design is comprised of two components: the Design Criteria and the Design Narrative, these documents record the concepts, calculations, decisions, and product selections used to meet the Owner's Project Requirements (OPR) and to satisfy applicable regulatory requirements, standards, and guidelines.

Benchmarks: Benchmarks are the comparison of a building's energy usage to other similar buildings and to the building itself.. For example, ENERGY STAR Portfolio Manager is a frequently used and nationally recognized building energy benchmarking tool.

Building Information Modeling (BIM): Building Information Modeling is a parametric database which allows a building to be designed and constructed virtually in 3D, and provides reports both in 2D views and as schedules. This electronic information can be extracted and reused for pre-populating facility management CMMS systems. Building Systems Commissioning (BSC): NEBB acronym used to designate its commissioning program.

Calibrate: The act of comparing an instrument of unknown accuracy with a standard of known accuracy to detect, correlate, report, or eliminate by adjustment any variation in the accuracy of the tested instrument.

CCTV: Closed circuit Television. Normally used for security surveillance and alarm detections as part of a special electrical security system.

COBie: Construction Operations Building Information Exchange (COBie) is an electronic industry data format used to transfer information developed during design, construction, and commissioning into the Computer Maintenance Management Systems (CMMS) used to operate facilities. See the Whole Building Design Guide website for further information (<http://www.wbdg.org/resources/cobie.php>)

Commissionability: Defines a design component or construction process that has the necessary elements that will allow a system or component to be effectively measured, tested, operated and commissioned

Commissioning Agent (CxA): The qualified Commissioning Professional who administers the Cx process by managing the Cx team and overseeing the

Commissioning Process. Where CxA is used in this specification it means the Commissioning Agent, members of his staff or appointed members of the commissioning team. Note that LEED uses the term Commissioning Authority in lieu of Commissioning Agent.

Commissioning Checklists: Lists of data or inspections to be verified to ensure proper system or component installation, operation, and function. Verification checklists are developed and used during all phases of the commissioning process to verify that the Owner's Project Requirements (OPR) is being achieved.

Commissioning Design Review: The commissioning design review is a collaborative review of the design professionals design documents for items pertaining to the following: owner's project requirements; basis of design; operability and maintainability (O&M) including documentation; functionality; training; energy efficiency, control systems' sequence of operations including building automation system features; commissioning specifications and the ability to functionally test the systems.

Commissioning Issue: A condition identified by the Commissioning Agent or other member of the Commissioning Team that adversely affects the commissionability, operability, maintainability, or functionality of a system, equipment, or component. A condition that is in conflict with the Contract Documents and/or performance requirements of the installed systems and components. (See also - Commissioning Observation).

Commissioning Manager (CxM): A qualified individual appointed by the Contractor to manage the commissioning process on behalf of the Contractor.

Commissioning Observation: An issue identified by the Commissioning Agent or other member of the Commissioning Team that does not conform to the project OPR, contract documents or standard industry best practices. (See also Commissioning Issue)

Commissioning Plan: A document that outlines the commissioning process, commissioning scope and defines responsibilities, processes, schedules, and the documentation requirements of the Commissioning Process.

Commissioning Process: A quality focused process for enhancing the delivery of a project. The process focuses upon verifying and documenting that the facility and all of its systems, components, and assemblies are planned, designed, installed, tested, can be operated, and maintained to meet the Owner's Project Requirements.

Commissioning Report: The final commissioning document which presents the commissioning process results for the project. Cx reports include an executive summary, the commissioning plan, issue log, correspondence, and all appropriate check sheets and test forms.

Commissioning Representative (CxR): An individual appointed by a sub-contractor to manage the commissioning process on behalf of the sub-contractor.

Commissioning Specifications: The contract documents that detail the objective, scope and implementation of the commissioning process as developed in the Commissioning Plan.

Commissioning Team: Individual team members whose coordinated actions are responsible for implementing the Commissioning Process.

Construction Phase Commissioning: All commissioning efforts executed during the construction process after the design phase and prior to the Acceptance Phase Commissioning.

Contract Documents (CD): Contract documents include design and construction contracts, price agreements and procedure agreements. Contract Documents also include all final and complete drawings, specifications and all applicable contract modifications or supplements.

Construction Phase Commissioning (CPC): All commissioning efforts executed during the construction process after the design phase and prior to the Acceptance Phase Commissioning.

Coordination Drawings: Drawings showing the work of all trades that are used to illustrate that equipment can be installed in the space allocated without compromising equipment function or access for maintenance and replacement. These drawings graphically illustrate and dimension manufacturers' recommended maintenance clearances. On mechanical projects, coordination drawings include structural steel, ductwork, major piping and electrical conduit and show the elevations and locations of the above components.

Data Logging: The monitoring and recording of temperature, flow, current, status, pressure, etc. of equipment using stand-alone data recorders.

Deferred System Test: Tests that cannot be completed at the end of the acceptance phase due to ambient conditions, schedule issues or other conditions preventing testing during the normal acceptance testing period.

Deficiency: See "Commissioning Issue".

Design Criteria: A listing of the VA Design Criteria outlining the project design requirements, including its source. These are used during the design process to show the design elements meet the OPR.

Design Intent: The overall term that includes the OPR and the BOD. It is a detailed explanation of the ideas, concepts, and criteria that are defined by the owner to be important. The design intent documents are utilized to provide a written record of these ideas, concepts and criteria.

Design Narrative: A written description of the proposed design solutions that satisfy the requirements of the OPR.

Design Phase Commissioning (DPC): All commissioning tasks executed during the design phase of the project.

Environmental Systems: Systems that use a combination of mechanical equipment, airflow, water flow and electrical energy to provide heating, ventilating, air conditioning, humidification, and dehumidification for the purpose of human comfort or process control of temperature and humidity.

Executive Summary: A section of the Commissioning report that reviews the general outcome of the project. It also includes any unresolved issues, recommendations for the resolution of unresolved issues and all deferred testing requirements.

Functionality: This defines a design component or construction process which will allow a system or component to operate or be constructed in a manner that will produce the required outcome of the OPR.

Functional Test Procedure (FTP): A written protocol that defines methods, steps, personnel, and acceptance criteria for tests conducted on components, equipment, assemblies, systems, and interfaces among systems.

Industry Accepted Best Practice: A design component or construction process that has achieved industry consensus for quality performance and functionality. Refer to the current edition of the NEBB Design Phase Commissioning Handbook for examples.

Installation Verification: Observations or inspections that confirm the system or component has been installed in accordance with the contract documents and to industry accepted best practices.

Integrated System Testing: Integrated Systems Testing procedures entail testing of multiple integrated systems performance to verify proper

functional interface between systems. Typical Integrated Systems Testing includes verifying that building systems respond properly to loss of utility, transfer to emergency power sources, re-transfer from emergency power source to normal utility source; interface between HVAC controls and Fire Alarm systems for equipment shutdown, interface between Fire Alarm system and elevator control systems for elevator recall and shutdown; interface between Fire Alarm System and Security Access Control Systems to control access to spaces during fire alarm conditions; and other similar tests as determined for each specific project.

Issues Log: A formal and ongoing record of problems or concerns - and their resolution - that have been raised by members of the Commissioning Team during the course of the Commissioning Process.

Lessons Learned Workshop: A workshop conducted to discuss and document project successes and identify opportunities for improvements for future projects.

Maintainability: A design component or construction process that will allow a system or component to be effectively maintained. This includes adequate room for access to adjust and repair the equipment. Maintainability also includes components that have readily obtainable repair parts or service.

Manual Test: Testing using hand-held instruments, immediate control system readouts or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the 'observation').

Owner's Project Requirements (OPR): A written document that details the project requirements and the expectations of how the building and its systems will be used and operated. These include project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information.

Peer Review: A formal in-depth review separate from the commissioning review processes. The level of effort and intensity is much greater than a typical commissioning facilitation or extended commissioning review. The VA usually hires an independent third-party (called the IDIQ A/E) to conduct peer reviews.

Precision: The ability of an instrument to produce repeatable readings of the same quantity under the same conditions. The precision of an instrument refers to its ability to produce a tightly grouped set of values around the mean value of the measured quantity.

Pre-Design Phase Commissioning: Commissioning tasks performed prior to the commencement of design activities that includes project programming and the development of the commissioning process for the project

Pre-Functional Checklist (PFC): A form used by the contractor to verify that appropriate components are onsite, correctly installed, set up, calibrated, functional and ready for functional testing.

Pre-Functional Test (PFT): An inspection or test that is done before functional testing. PFT's include installation verification and system and component start up tests.

Procedure or Protocol: A defined approach that outlines the execution of a sequence of work or operations. Procedures are used to produce repeatable and defined results.

Range: The upper and lower limits of an instrument's ability to measure the value of a quantity for which the instrument is calibrated.

Resolution: This word has two meanings in the Cx Process. The first refers to the smallest change in a measured variable that an instrument can detect. The second refers to the implementation of actions that correct a tested or observed deficiency.

Site Observation Visit: On-site inspections and observations made by the Commissioning Agent for the purpose of verifying component, equipment, and system installation, to observe contractor testing, equipment start-up procedures, or other purposes.

Site Observation Reports (SO): Reports of site inspections and observations made by the Commissioning Agent. Observation reports are intended to provide early indication of an installation issue which will need correction or analysis.

Special System Inspections: Inspections required by a local code authority prior to occupancy and are not normally a part of the commissioning process.

Static Tests: Tests or inspections that validate a specified static condition such as pressure testing. Static tests may be specification or code initiated.

Start Up Tests: Tests that validate the component or system is ready for automatic operation in accordance with the manufactures requirements.

Systems Manual: A system-focused composite document that includes all information required for the owners operators to operate the systems.

Test Procedure: A written protocol that defines methods, personnel, and expectations for tests conducted on components, equipment, assemblies, systems, and interfaces among systems.

Testing: The use of specialized and calibrated instruments to measure parameters such as: temperature, pressure, vapor flow, air flow, fluid flow, rotational speed, electrical characteristics, velocity, and other data in order to determine performance, operation, or function.

Testing, Adjusting, and Balancing (TAB): A systematic process or service applied to heating, ventilating and air-conditioning (HVAC) systems and other environmental systems to achieve and document air and hydronic flow rates. The standards and procedures for providing these services are referred to as "Testing, Adjusting, and Balancing" and are described in the Procedural Standards for the Testing, Adjusting and Balancing of Environmental Systems, published by NEBB or AABC.

Thermal Scans: Thermographic pictures taken with an Infrared Thermographic Camera. Thermographic pictures show the relative temperatures of objects and surfaces and are used to identify leaks, thermal bridging, thermal intrusion, electrical overload conditions, moisture containment, and insulation failure.

Training Plan: A written document that details, in outline form the expectations of the operator training. Training agendas should include instruction on how to obtain service, operate, startup, shutdown and maintain all systems and components of the project.

Trending: Monitoring over a period of time with the building automation system.

Unresolved Commissioning Issue: Any Commissioning Issue that, at the time that the Final Report or the Amended Final Report is issued that has not been either resolved by the construction team or accepted by the VA. **Validation:** The process by which work is verified as complete and operating correctly:

1. First party validation occurs when a firm or individual verifying the task is the same firm or individual performing the task.
2. Second party validation occurs when the firm or individual verifying the task is under the control of the firm performing the task or has other possibilities of financial conflicts of interest in the resolution (Architects, Designers, General Contractors and Third Tier Subcontractors or Vendors).

3. Third party validation occurs when the firm verifying the task is not associated with or under control of the firm performing or designing the task.

Verification: The process by which specific documents, components, equipment, assemblies, systems, and interfaces among systems are confirmed to comply with the criteria described in the Owner's Project Requirements.

Warranty Phase Commissioning: Commissioning efforts executed after a project has been completed and accepted by the Owner. Warranty Phase Commissioning includes follow-up on verification of system performance, measurement and verification tasks and assistance in identifying warranty issues and enforcing warranty provisions of the construction contract.

Warranty Visit: A commissioning meeting and site review where all outstanding warranty issues and deferred testing is reviewed and discussed.

Whole Building Commissioning: Commissioning of building systems such as Building Envelope, HVAC, Electrical, Special Electrical (Fire Alarm, Security & Communications), Plumbing and Fire Protection as described in this specification.

1.7 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:

Systems To Be Commissioned	
System	Description
Fire Suppression	
Fire Sprinkler Systems	Wet pipe system.
Plumbing	
Domestic Water Distribution	Backflow preventers, filters.
Domestic Hot Water Distribution	Hot water mixing valves.

Systems To Be Commissioned	
System	Description
Plumbing Fixtures	Showers, water tempering valves, instruments and gages.
Medical Gas Systems	Medical compressor air, medical vacuum, and Oxygen. Medical Gas Alarm Systems.
HVAC	
Noise and Vibration Control	Noise and Vibration levels for critical equipment such as Air Handlers, chillers, etc.
Direct Digital Control System**	BACnet or similar Local Area Network (LAN), Operator Work Station hardware and software, terminal unit controller hardware and software, all sequences of operation, system accuracy and response time. Graphics, point mapping, trending, alarms. DDC control panels, network communications modules and wiring, and integration panels.
Chilled Water System**	Chilled water pumps and motors, variable speed drives, chiller motor/compressor, controls, instrumentation and safeties, isolation valves.
HVAC Terminal Unit Systems**	Terminal Units (VAV/CAV), radiant ceiling panels.
HVAC Air Handling Systems**	Fans, motors, Variable Speed Drives, cooling coils and control valves, heating coils and control valves, humidifiers, filters, dampers, safeties such as smoke detectors, freeze stats, and damper end-switches, controls, gages, and vibration isolation.
Heating Hot Water System**	Controls, instrumentation and gages, heating hot water pumps and motors, Variable Speed Drives, mixing valves.
Exhaust Fans	Fans, motors, Variable Speed Drives, controls and safeties.

Systems To Be Commissioned	
System	Description
Computer Room Air Conditioning Units (CRAC Units)	Fans, motors, Variable Speed Drives, cooling coils and control valves, heating coils and control valves, humidifiers, compressors and liquid-cooled condensers, filters, safeties, controls, gages, vibration isolation, condensate pumps, water/leak detection systems and alarms and shunt trip shutdown. Interface with facility DDC.
HVAC Water Treatment Systems	Closed-Circuits - including final water analysis.
Electrical	
Normal Power Distribution Systems	Grounding tests, coordination study review, major circuit breaker settings, meters and gages, and controls.
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.
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.
Essential Power Distribution Systems	Automatic transfer on loss of normal power, Grounding tests, coordination study review, major circuit breaker settings, meters and gages, and controls.
Lighting & Lighting Control** Systems	Control system hardware and software, scene settings, occupancy sensor interface, and unoccupied control.

Communications	
Facility Telecommunications and Data Distribution Systems	Witness 3rd party testing, review reports
Public Address & Mass Notification Systems	Witness 3rd party testing, review reports
Nurse Call	Nurse Call Systems
CATV	CATV
Electronic Safety and Security	
Fire Detection and Alarm System	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, mechanical system shutdown. (Witness 3rd party testing, review reports)
Access Control	Card access control systems
Table Notes	
** Denotes systems that LEED requires to be commissioned to comply with the LEED Fundamental Commissioning pre-requisite.	

1.8 COMMISSIONING TEAM

- A. The commissioning team shall consist of, but not be limited to, representatives of Contractor, including Project Superintendent and subcontractors, installers, schedulers, suppliers, and specialists deemed appropriate by the Department of Veterans Affairs (VA) and Commissioning Agent.
- B. Members Appointed by Contractor:
1. Contractor' Commissioning Manager: 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.
- C. 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. User: Representatives of the facility user and operation and maintenance personnel.
3. A/E: Representative of the Architect and engineering design professionals.

1.9 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.

1.10 CONTRACTOR'S COMMISSIONING RESPONSIBILITIES

- A. The Contractor shall assign a Commissioning Manager to manage commissioning activities of the Contractor, and subcontractors.
- B. The Contractor shall ensure that the commissioning responsibilities outlined in these specifications are included in all subcontracts and that subcontractors comply with the requirements of these specifications.
- C. The Contractor shall ensure that each installing subcontractor shall assign representatives with expertise and authority to act on behalf of the subcontractor and schedule them to participate in and perform commissioning team activities including, but not limited to, the following:
 1. Participate in commissioning coordination meetings.
 2. Conduct operation and maintenance training sessions in accordance with approved training plans.

3. Verify that Work is complete and systems are operational according to the Contract Documents, including calibration of instrumentation and controls.
4. Evaluate commissioning issues and commissioning observations identified in the Commissioning Issues Log, field reports, test reports or other commissioning documents. In collaboration with entity responsible for system and equipment installation, recommend corrective action.
5. Review and comment on commissioning documentation.
6. Participate in meetings to coordinate Systems Functional Performance Testing.
7. Provide schedule for operation and maintenance data submittals, equipment startup, and testing to Commissioning Agent for incorporation into the commissioning plan.
8. Provide information to the Commissioning Agent for developing commissioning plan.
9. Participate in training sessions for VA's operation and maintenance personnel.
10. Provide technicians who are familiar with the construction and operation of installed systems and who shall develop specific test procedures to conduct Systems Functional Performance Testing of installed systems.
11. Provide Systems Manual information as required per the "COMMISSIONING SYSTEMS MANUAL" SECTION 01 91 51.

1.11 COMMISSIONING AGENT'S RESPONSIBILITIES

- A. Organize and lead the commissioning team.
- B. Prepare the commissioning plan. See Paragraph 1.11-A of this specification Section for further information.
- C. Review and comment on selected submittals from the Contractor for general conformance with the Construction Documents. Review and comment on the ability to test and operate the system and/or equipment, including providing gages, controls and other components required to operate, maintain, and test the system. Review and comment on performance expectations of systems and equipment and interfaces between systems relating to the Construction Documents.
- D. At the beginning of the construction phase, conduct an initial construction phase coordination meeting for the purpose of reviewing the commissioning activities and establishing tentative schedules for

operation and maintenance submittals; operation and maintenance training sessions; TAB Work; Pre-Functional Checklists, Systems Functional Performance Testing; and project completion.

- E. Convene commissioning team meetings for the purpose of coordination, communication, and conflict resolution; discuss status of the commissioning processes. Responsibilities include arranging for facilities, preparing agenda and attendance lists, and notifying participants. The Commissioning Agent shall prepare and distribute minutes to commissioning team members and attendees within five workdays of the commissioning meeting.
- F. Observe construction and report progress, observations and issues. Observe systems and equipment installation for adequate accessibility for maintenance and component replacement or repair, and for general conformance with the Construction Documents.
- G. Prepare Project specific Pre-Functional Checklists and Systems Functional Performance Test procedures.
- H. Coordinate Systems Functional Performance Testing schedule with the Contractor.
- I. Witness selected systems startups.
- J. Verify selected Pre-Functional Checklists completed and submitted by the Contractor.
- K. Witness and document Systems Functional Performance Testing.
- L. Compile test data, inspection reports, and certificates and include them in the systems manual and commissioning report.
- M. Review and comment on operation and maintenance (O&M) documentation and systems manual outline for compliance with the Contract Documents. Operation and maintenance documentation requirements are specified in Paragraph 1.25, Section 01 00 00 GENERAL REQUIREMENTS.
- N. Review operation and maintenance training program developed by the Contractor. Verify training plans provide qualified instructors to conduct operation and maintenance training.
- O. Prepare commissioning Field Observation Reports.
- P. Prepare the Final Commissioning Report.
- Q. Return to the site at 10 months into the 12 month warranty period and review with facility staff the current building operation and the condition of outstanding issues related to the original and seasonal Systems Functional Performance Testing. Also interview facility staff and identify problems or concerns they have operating the building as

originally intended. Make suggestions for improvements and for recording these changes in the O&M manuals. Identify areas that may come under warranty or under the original construction contract. Assist facility staff in developing reports, documents and requests for services to remedy outstanding problems.

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

1.12 COMMISSIONING DOCUMENTATION

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

each system to be commissioned, including subsystems, or equipment and interfaces or interlocks with other systems. Systems Functional Performance Test Procedures will include a separate entry, with space for comments, for each item to be tested. Preliminary Systems Functional Performance Test Procedures will be provided to the VA, Architect/Engineer, and Contractor for review and comment. The Systems Performance Test Procedure will include test procedures for each mode of operation and provide space to indicate whether the mode under test responded as required. Each System Functional Performance Test procedure, regardless of system, subsystem, or equipment being tested, shall include, but not be limited to, the following:

1. Name and identification code of tested system.
 2. Test number.
 3. Time and date of test.
 4. Indication of whether the record is for a first test or retest following correction of a problem or issue.
 5. Dated signatures of the person performing test and of the witness, if applicable.
 6. Individuals present for test.
 7. Observations and Issues.
 8. Issue number, if any, generated as the result of test.
- C. Pre-Functional Checklists: The Commissioning Agent will prepare Pre-Functional Checklists. Pre-Functional Checklists shall be completed and signed by the Contractor, verifying that systems, subsystems, equipment, and associated controls are ready for testing. The Commissioning Agent will spot check Pre-Functional Checklists to verify accuracy and readiness for testing. Inaccurate or incomplete Pre-Functional Checklists shall be returned to the Contractor for correction and resubmission.
- D. Test and Inspection Reports: The Commissioning Agent will record test data, observations, and measurements on Systems Functional Performance Test Procedure. The report will also include recommendation for system acceptance or non-acceptance. Photographs, forms, and other means appropriate for the application shall be included with data. Commissioning Agent Will compile test and inspection reports and test and inspection certificates and include them in systems manual and commissioning report.

- E. Corrective Action Documents: The Commissioning Agent will document corrective action taken for systems and equipment that fail tests. The documentation will include any required modifications to systems and equipment and/or revisions to test procedures, if any. The Commissioning Agent will witness and document any retesting of systems and/or equipment requiring corrective action and document retest results.
- F. Commissioning Issues Log: The Commissioning Agent will prepare and maintain Commissioning Issues Log that describes Commissioning Issues and Commissioning Observations that are identified during the Commissioning process. These observations and issues include, but are not limited to, those that are at variance with the Contract Documents. The Commissioning Issues Log will identify and track issues as they are encountered, the party responsible for resolution, progress toward resolution, and document how the issue was resolved. The Master Commissioning Issues Log will also track the status of unresolved issues.
1. Creating an Commissioning Issues Log Entry:
 - a. Identify the issue with unique numeric or alphanumeric identifier by which the issue may be tracked.
 - b. Assign a descriptive title for the issue.
 - c. Identify date and time of the issue.
 - d. Identify test number of test being performed at the time of the observation, if applicable, for cross reference.
 - e. Identify system, subsystem, and equipment to which the issue applies.
 - f. Identify location of system, subsystem, and equipment.
 - g. Include information that may be helpful in diagnosing or evaluating the issue.
 - h. Note recommended corrective action.
 - i. Identify commissioning team member responsible for corrective action.
 - j. Identify expected date of correction.
 - k. Identify person that identified the issue.
 2. Documenting Issue Resolution:
 - a. Log date correction is completed or the issue is resolved.

- b. Describe corrective action or resolution taken. Include description of diagnostic steps taken to determine root cause of the issue, if any.
 - c. Identify changes to the Contract Documents that may require action.
 - d. State that correction was completed and system, subsystem, and equipment are ready for retest, if applicable.
 - e. Identify person(s) who corrected or resolved the issue.
 - f. Identify person(s) verifying the issue resolution.
- G. Final Commissioning Report: The Commissioning Agent will document results of the commissioning process, including unresolved issues, and performance of systems, subsystems, and equipment. The Commissioning Report will indicate whether systems, subsystems, and equipment have been properly installed and are performing according to the Contract Documents. This report will be used by the Department of Veterans Affairs when determining that systems will be accepted. This report will be used to evaluate systems, subsystems, and equipment and will serve as a future reference document during VA occupancy and operation. It shall describe components and performance that exceed requirements of the Contract Documents and those that do not meet requirements of the Contract Documents. The commissioning report will include, but is not limited to, the following:
- 1. Lists and explanations of substitutions; compromises; variances with the Contract Documents; record of conditions; and, if appropriate, recommendations for resolution. Design Narrative documentation maintained by the Commissioning Agent.
 - 2. Commissioning plan.
 - 3. Pre-Functional Checklists completed by the Contractor, with annotation of the Commissioning Agent review and spot check.
 - 4. Systems Functional Performance Test Procedures, with annotation of test results and test completion.
 - 5. Commissioning Issues Log.
 - 6. Listing of deferred and off season test(s) not performed, including the schedule for their completion.
- H. Addendum to Final Commissioning Report: The Commissioning Agent will prepare an Addendum to the Final Commissioning Report near the end of the Warranty Period. The Addendum will indicate whether systems, subsystems, and equipment are complete and continue to perform

according to the Contract Documents. The Addendum to the Final Commissioning Report shall include, but is not limited to, the following:

1. Documentation of deferred and off season test(s) results.
 2. Completed Systems Functional Performance Test Procedures for off season test(s).
 3. Documentation that unresolved system performance issues have been resolved.
 4. Updated Commissioning Issues Log, including status of unresolved issues.
 5. Identification of potential Warranty Claims to be corrected by the Contractor.
- I. Systems Manual: The Commissioning Agent will gather required information and compile the Systems Manual as provided by contractors. 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.

1.13 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.

1.14 COMMISSIONING PROCESS

- A. The Commissioning Agent will be responsible for the overall management of the commissioning process as well as coordinating scheduling of commissioning tasks with the VA and the Contractor. As directed by the VA, the Contractor shall incorporate Commissioning tasks, including, but not limited to, Systems Functional Performance Testing (including predecessors) with the Master Construction Schedule.
- B. Within 30 days of contract award, the Contractor shall designate a specific individual as the Commissioning Manager (CxM) 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 20 days of contract award, the Contractor shall ensure that each subcontractor designates specific individuals as Commissioning Representatives (CXR) 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.

1.15 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.

1.16 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 shall work with the Commissioning Agent and the VA to incorporate the commissioning activities into the construction schedule. The Commissioning Agent will provide sufficient information (including, but not limited to, tasks, durations and predecessors) 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 following any repairs to the equipment. Calibration tags shall be affixed or certificates readily available.

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PART 3 - EXECUTION

3.1 COMMISSIONING PROCESS ROLES AND RESPONSIBILITIES

A. The following table outlines the roles and responsibilities for the Commissioning Team members during the Construction Phase:

Construction Phase		CxA = Commissioning Agent COR = Contracting Officer's Representative A/E = Design Arch/Engineer PC = Prime Contractor O&M = Gov't Facility O&M						L = Lead P = Participate A = Approve R = Review O = Optional
Commissioning Roles & Responsibilities								
Category	Task Description	CxA	COR	A/E	PC	O&M	Notes	
Meetings	Construction Commissioning Kick Off meeting	L	A	P	P	O		
	Commissioning Meetings	L	A	P	P	O		
	Project Progress Meetings	P	A	P	L	O		
	Controls Meeting	L	A	P	P	O		
Coordination	Coordinate with [OGC's, AHJ, Vendors, etc.] to ensure that Cx interacts properly with other systems as needed to support the OPR and BOD.	L	A	P	P	N/A		
Cx Plan & Spec	Final Commissioning Plan	L	A	R	R	O		
Schedules	Duration Schedule for Commissioning Activities	L	A	R	R	N/A		
OPR and BOD	Maintain OPR on behalf of Owner	L	A	R	R	O		

Construction Phase		CxA = Commissioning Agent COR = Contracting Officer's Representative A/E = Design Arch/Engineer PC = Prime Contractor O&M = Gov't Facility O&M								L = Lead P = Participate A = Approve R = Review O = Optional
Category	Task Description	CxA	COR	A/E	PC	O&M	Notes			
Document Reviews	Maintain BOD/DID on behalf of Owner	L	A	R	R	O				
	TAB Plan Review	R	A	R	R	O				
	Submittal and Shop Drawing Review	R	A	R	L	O				
	Review Contractor Equipment Startup Checklists	R	A	R	R	N/A				
Site Observations	Review Change Orders, ASI, and RFI	R	A	R	R	N/A				
	Witness Factory Testing	P	A	P	L	O				
	Construction Observation Site Visits	L	A	R	R	O				
Functional Test Protocols										
	Final Pre-Functional Checklists	L	A	R	R	O				
	Final Functional Performance Test Protocols	L	A	R	R	O				
Technical Activities										
	Issues Resolution Meetings	P	A	P	L	O				
Reports and	Status Reports	L	A	R	R	O				

Construction Phase		CxA = Commissioning Agent COR = Contracting Officer's Representative A/E = Design Arch/Engineer PC = Prime Contractor O&M = Gov't Facility O&M						L = Lead P = Participate A = Approve R = Review O = Optional
Category	Task Description	CxA	COR	A/E	PC	O&M	Notes	
Logs	Maintain Commissioning Issues Log	L	A	R	R	O		

B. The following table outlines the roles and responsibilities for the Commissioning Team members during the Acceptance Phase:

Acceptance Phase		CxA = Commissioning Agent COR = Contracting Officer's Representative A/E = Design Arch/Engineer PC = Prime Contractor O&M = Gov't Facility O&M						L = Lead P = Participate A = Approve R = Review O = Optional
Category	Task Description	CxA	COR	A/E	PC	O&M	Notes	
Meetings	Commissioning Meetings	L	A	P	P	O		
	Project Progress Meetings	P	A	P	L	O		
	Pre-Test Coordination Meeting	L	A	P	P	O		
	Lessons Learned and Commissioning Report Review Meeting	L	A	P	P	O		
Coordination	Coordinate with [OGC's, AHJ, Vendors, etc.] to ensure that Cx interacts properly with other systems as needed to support OPR and BOD	L	P	P	P	O		

Acceptance Phase											
Commissioning Roles & Responsibilities		CxA = Commissioning Agent COR = Contracting Officer's Representative A/E = Design Arch/Engineer PC = Prime Contractor O&M = Gov't Facility O&M									
Category	Task Description	CxA	COR	A/E	PC	O&M	Notes				
Cx Plan & Spec	Maintain/Update Commissioning Plan	L	A	R	R	O					
Schedules	Prepare Functional Test Schedule	L	A	R	R	O					
OPR and BOD	Maintain OPR on behalf of Owner	L	A	R	R	O					
	Maintain BOD/DID on behalf of Owner	L	A	R	R	O					
Document Reviews											
	Review Completed Pre-Functional Checklists	L	A	R	R	O					
	Pre-Functional Checklist Verification	L	A	R	R	O					
	Review Operations & Maintenance Manuals	L	A	R	R	R					
	Training Plan Review	L	A	R	R	R					
	Warranty Review	L	A	R	R	O					
Site Observations	Review TAB Report	L	A	R	R	O					
	Construction Observation Site Visits	L	A	R	R	O					
	Witness Selected Equipment Startup	L	A	R	R	O					
Functional Test Protocols											
	TAB Verification	L	A	R	R	O					
	Systems Functional Performance Testing	L	A	P	P	P					
	Retesting	L	A	P	P	P					
Technical Activities											
	Issues Resolution Meetings	P	A	P	L	O					
	Systems Training	L	S	R	P	P					

Warranty Phase		CxA = Commissioning Agent COR = Contracting Officer's Representative A/E = Design Arch/Engineer PC = Prime Contractor O&M = Gov't Facility O&M							L = Lead P = Participate A = Approve R = Review O = Optional	
Commissioning Roles & Responsibilities										
Category	Task Description	CxA	COR	A/E	PC	O&M	Notes			
Reports and Logs	Post-Occupancy Warranty Checkup and review of Significant Outstanding Issues	L	A		R	P				
	Final Commissioning Report Amendment	L	A		R	R				
	Status Reports	L	A		R	R				

3.2 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.

c. The Commissioning Agent will submit the full startup plan to the VA and Contractor for review. Final approval will be by the VA.

- d. 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. Two 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.

3.3 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.

3.5 DDC SYSTEM TRENDING FOR COMMISSIONING

- A. Trending is a method of testing as a standalone method or to augment manual testing. The Contractor shall trend any and all points of the system or systems at intervals specified below.
- B. Alarms are a means to notify the system operator that abnormal conditions are present in the system. Alarms shall be structured into three tiers - Critical, Priority, and Maintenance.
 - 1. Critical alarms are intended to be alarms that require the immediate attention of and action by the Operator. These alarms shall be displayed on the Operator Workstation in a popup style window that is graphically linked to the associated unit's graphical display. The popup style window shall be displayed on top of any active window within the screen, including non DDC system software.
 - 2. Priority level alarms are to be printed to a printer which is connected to the Operator's Work Station located within the engineer's office. Additionally Priority level alarms shall be able to be monitored and viewed through an active alarm application. Priority level alarms are alarms which shall require reaction from the operator or maintenance personnel within a normal work shift, and not immediate action.
 - 3. Maintenance alarms are intended to be minor issues which would require examination by maintenance personnel within the following shift. These alarms shall be generated in a scheduled report automatically by the DDC system at the start of each shift. The generated maintenance report will be printed to a printer located within the engineer's office.
- C. The Contractor shall provide a wireless internet network in the building for use during controls programming, checkout, and commissioning. This network will allow project team members to more

effectively program, view, manipulate and test control devices while being in the same room as the controlled device.

- D. The Contractor shall provide graphical trending through the DDC control system of systems being commissioned. Trending requirements are indicated below and included with the Systems Functional Performance Test Procedures. Trending shall occur before, during and after Systems Functional Performance Testing. The Contractor shall be responsible for producing graphical representations of the trended DDC points that show each system operating properly during steady state conditions as well as during the System Functional Testing. These graphical reports shall be submitted to the 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	<40% RH >95% RH	10 min
Mixed Air Temperature	AI	15 Min	24 hours	3 days	N/A		
SA Temperature	AI	15 Min	24 hours	3 days	C	±5°F from SP	10 min
Leaving Preheat Coil Air Temperature	AI	15 Min	24 hours	3 days	N/A		
Leaving Cooling Coil Air Temperature	AI	15 Min	24 hours	3 days	N/A		
Preheat Water Temperature	AI	15 Min	24 hours	3 days	N/A		
Supply Air Humidity	AI	15 Min	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
Return Air CO2	AI	15 Min	24 hours	3 days	N/A		
Discharge Duct Static Pressure	AI	15 Min	24 hours	3 days	N/A	±5°F from SP	10 min
Supply Airflow Station	AI	15 Min	24 hours	3 days	N/A		
Return Airflow Station	AI	15 Min	24 hours	3 days	N/A	±5°F from SP	10 min
Mixed Airflow Station	AI	15 Min	24 hours	3 days	N/A		
Outside Airflow (Calculated)	AI	15 Min	24 hours	3 days	N/A	±5°F from SP	10 min
Supply Fan Status	DI	COV	24 hours	3 days	C	Status <> Command	10 min
Return Fan Status	DI	COV	24 hours	3 days	C	Status <> Command	10 Min
High Discharge Static Status	DI	COV	24 hours	3 days	P	True	1 min
Low Return Static Status	DI	COV	24 hours	3 days	P	True	1 min
Freeze Stat	DI	COV	24 hours	3 days	C	True	10 min
Discharge Fire/Smoke Damper Status	DI	COV	24 hours	3 days	P	Closed	1 min
Return Fire/Smoke Damper Status	DI	COV	24 hours	3 days	P	Closed	1 min
Discharge Fire/Smoke Detector Status	DI	COV	24 hours	3 days	P	Closed	1 min
Return Fire/Smoke Detector Status	DI	COV	24 hours	3 days	P	Closed	1 min
Supply Fan VFD Fault	DI	COV	24 hours	3 days	P	Closed	1 min
Return Fan VFD Fault	DI	COV	24 hours	3 days	P	Closed	1 min

Air Handling Unit Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Preheat Pump Status	DI	COV	24 hours	3 days	C	Status <> Command	10 min
Supply Fan VFD Hand/Off/Auto	DI	COV	24 hours	3 days	P	Closed	1 min
Return Fan VFD Hand/Off/Auto	DI	COV	24 hours	3 days	P	Closed	1 min
Pre-Filter Status	DI	COV	24 hours	3 days	P	Closed	1 min
Final Filter Status	DI	COV	24 hours	3 days	P	Closed	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		
HW Valve Position	AO	15 Min	24 hours	3 days	N/A		
Outside Air Damper	AO	15 Min	24 hours	3 days	N/A		
Mixed Air Damper	AO	15 Min	24 hours	3 days	N/A		
Exhaust Air Damper	AO	15 Min	24 hours	3 days	N/A		
Humidifier Valve	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		
Discharge Fire/Smoke Damper	DO	COV	24 hours	3 days	N/A		
Return Fire/Smoke Damper	DO	COV	24 hours	3 days	N/A		
Humidifier	DO	COV	24 hours	3 days	N/A		

Terminal Unit (VAV, CAV, etc.) Trending and Alarms							
Point	Type	Trend Interval	Operationa l 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
Space Humidity	AI	15 Min	12 hours	3 days	P	> 60% RH	5 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		

Radiant Ceiling Panel Trending and Alarms							
Point	Type	Trend Interval	Operationa l 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		
Radiant Ceiling Panel ON/OFF	DO	COV	12 hours	3 days	M	Status <> Command	30 min

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.

3.6 SYSTEMS FUNCTIONAL PERFORMANCE TESTING

- A. This paragraph applies to Systems Functional Performance Testing of systems for all referenced specification Divisions.
- B. Objectives and Scope: The objective of Systems Functional Performance Testing is to demonstrate that each system is operating according to the Contract Documents. Systems Functional Performance Testing facilitates bringing the systems from a state of substantial completion to full dynamic operation. Additionally, during the testing process, areas of noncompliant performance are identified and corrected, thereby improving the operation and functioning of the systems. In general, each system shall be operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part- and full-load, fire alarm and emergency power) where there is a specified system response. The Contractor shall verify each sequence in the sequences of operation. Proper responses to such modes and conditions as power failure, freeze condition, low oil pressure, no flow, equipment failure, etc. shall also be tested.
- C. Development of Systems Functional Performance Test Procedures: Before Systems Functional Performance Test procedures are written, the Contractor shall submit all requested documentation and a current list of change orders affecting equipment or systems, including an updated points list, program code, control sequences and parameters. Using the testing parameters and requirements found in the Contract Documents and approved submittals and shop drawings, the Commissioning Agent will develop specific Systems Functional Test Procedures to verify and document proper operation of each piece of equipment and system to be commissioned. The Contractor shall assist the Commissioning Agent in developing the Systems Functional Performance Test procedures as requested by the Commissioning Agent i.e. by answering questions about equipment, operation, sequences, etc. Prior to execution, the Commissioning Agent will provide a copy of the Systems Functional Performance Test procedures to the VA, the Architect/Engineer, and the Contractor, who shall review the tests for feasibility, safety, equipment and warranty protection.
- D. Purpose of Test Procedures: The purpose of each specific Systems Functional Performance Test is to verify and document compliance with the stated criteria of acceptance given on the test form.
Representative test formats and examples are found in the Commissioning

Plan for this project. (The Commissioning Plan is issued as a separate document and is available for review.) The test procedure forms developed by the Commissioning Agent will include, but not be limited to, the following information:

1. System and equipment or component name(s)
 2. Equipment location and ID number
 3. Unique test ID number, and reference to unique Pre-Functional Checklists and startup documentation, and ID numbers for the piece of equipment
 4. Date
 5. Project name
 6. Participating parties
 7. A copy of the specification section describing the test requirements
 8. A copy of the specific sequence of operations or other specified parameters being verified
 9. Formulas used in any calculations
 10. Required pretest field measurements
 11. Instructions for setting up the test.
 12. Special cautions, alarm limits, etc.
 13. Specific step-by-step procedures to execute the test, in a clear, sequential and repeatable format
 14. Acceptance criteria of proper performance with a Yes / No check box to allow for clearly marking whether or not proper performance of each part of the test was achieved.
 15. A section for comments.
 16. Signatures and date block for the Commissioning Agent. A place for the Contractor to initial to signify attendance at the test.
- E. Test Methods: Systems Functional Performance Testing shall be achieved by manual testing (i.e. persons manipulate the equipment and observe performance) and/or by monitoring the performance and analyzing the results using the control system's trend log capabilities or by standalone data loggers. The Contractor and Commissioning Agent shall determine which method is most appropriate for tests that do not have a method specified.
1. Simulated Conditions: Simulating conditions (not by an overwritten value) shall be allowed, although timing the testing to experience actual conditions is encouraged wherever practical.

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

- G. Sampling: No sampling is allowed in completing Pre-Functional Checklists. Sampling is allowed for Systems Functional Performance Test Procedures execution. The Commissioning Agent will determine the sampling rate. If at any point, frequent failures are occurring and testing is becoming more troubleshooting than verification, the Commissioning Agent may stop the testing and require the Contractor to perform and document a checkout of the remaining units, prior to continuing with Systems Functional Performance Testing of the remaining units.
- H. Cost of Retesting: The cost associated with expanded sample System Functional Performance Tests shall be solely the responsibility of the Contractor. Any required retesting by the Contractor shall not be considered a justified reason for a claim of delay or for a time extension by the Contractor.
- I. Coordination and Scheduling: The Contractor shall provide a minimum of 7 days' notice to the Commissioning Agent and the VA regarding the completion schedule for the Pre-Functional Checklists and startup of all equipment and systems. The Commissioning Agent will schedule Systems Functional Performance Tests with the Contractor and VA. The Commissioning Agent will witness and document the Systems Functional Performance Testing of systems. The Contractor shall execute the tests in accordance with the Systems Functional Performance Test Procedure.
- J. Testing Prerequisites: In general, Systems Functional Performance Testing will be conducted only after Pre-Functional Checklists have been satisfactorily completed. The control system shall be sufficiently tested and approved by the Commissioning Agent and the VA before it is used to verify performance of other components or systems. The air balancing and water balancing shall be completed before Systems Functional Performance Testing of air-related or water-related equipment or systems are scheduled. Systems Functional Performance Testing will proceed from components to subsystems to systems. When the proper performance of all interacting individual systems has been achieved, the interface or coordinated responses between systems will be checked.
- K. Problem Solving: The Commissioning Agent will recommend solutions to problems found, however the burden of responsibility to solve, correct and retest problems is with the Contractor.

3.7 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
 - 1. The cost for the contractor to retest during functional testing, if they are responsible for the issues, shall be theirs. If they are not responsible, any cost recovery for retesting costs shall be negotiated with the responsible parties.
 - 2. For issues identified, not related to any construction checklist or startup fault, the following shall apply: The CxA will direct the retesting of the equipment once at no "charge" to the Contractor for CxA time. However, the CxA's time for a second retest will be charged to the Contractor, who may choose to recover costs from the responsible Subcontractor.
 - 3. The time for the CxA to direct any retesting required because a specific construction checklist or start-up test item, reported to have been successfully completed, but determined during functional testing to be faulty, will be back charged to the Contractor, who

- may choose to recover costs from the party responsible for executing the faulty construction test.
4. The OA shall document and hold payment of Contractor's funds to compensate the Commissioning Team's efforts to retest or correct deficiencies that have occurred after the second failed test.
- 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.

3.8 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.
- C. The CxA shall schedule deferred testing through the CM/GC and owner. The CxA shall direct, witness and document the testing of equipment and systems. The Contractors/Sub-Contractors shall execute the tests. The TAB contractor's attendance is required for deferred testing and shall spot check air and water flows at the direction of the CxA.

3.9 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,

Division 28, and Division 31 sections. The Training and Demonstration shall include, but is not limited to, the following:

1. Review the Contract Documents.
2. Review installed systems, subsystems, and equipment.
3. Review instructor qualifications.
4. Review instructional methods and procedures.
5. Review training module outlines and contents.
6. Review course materials (including operation and maintenance manuals).
7. Review and discuss locations and other facilities required for instruction.
8. Review and finalize training schedule and verify availability of educational materials, instructors, audiovisual equipment, and facilities needed to avoid delays.
9. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

C. Training Module Submittals: The Contractor shall submit the following information to the VA and the Commissioning Agent:

1. Instruction Program: Submit two copies of outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module. At completion of training, submit two complete training manuals for VA's use.
2. Qualification Data: Submit qualifications for facilitator and/or instructor.
3. Attendance Record: For each training module, submit list of participants and length of instruction time.
4. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.
5. Demonstration and Training Recording:
 - a. 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.

- b. Video Format: Provide high quality color DVD color on standard size DVD disks.
 - c. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to show area of demonstration and training. Display continuous running time.
 - d. Narration: Describe scenes on video recording 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.
 - e. Submit two copies within seven days of end of each training module.
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. Training Coordination:

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

F. Instruction Program:

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

VA PROJECT NO. 757-200
CBLH PROJECT NO. 18900.00

indicating location, direction (by compass point), and elevation or
story of construction.

----- END -----

Project: VA Chalmers P. Wylie Ambulatory Care Center Specialty Care Addition **Date:** _____

Equipment / System: Air Handling Unit **Unit ID.:** RTU-12

Equipment Information

Information to be completed by Installing Contractor	
Equipment Name:	
Equipment Type:	
Manufacturer's Name:	
Supplier's Contact Info:	
Model #:	
Serial #:	
Location:	
Date Placed in Service:	
Date Warranty Expires:	

Pre-Functional Checklist Air Handling Unit

Installation / Start-up Requirements:

- Refer to manufacturer's Installation & Operation Manual and project documents for installation and start-up requirements.
- It is the Contractor's responsibility to provide start-up of equipment meeting the manufacturer's requirements.

Manufacturer's Start-Up Report:

- Attach a copy of the completed manufacturer's start-up report to this document.

Completion Sign-off:

The equipment / system installation, start-up and associated preliminary operational checkout has been completed and the equipment / system is ready for functional testing. All corrective work items identified are noted within the construction checklist and shall be completed prior to substantial completion of the system. None of the outstanding items preclude safe and reliable operation of the equipment.

Mechanical Contractor (Print Name & Company)

Signature

Date

ATC Contractor (Print Name & Company)

Signature

Date

Electrical Contractor (Print Name & Company)

Signature

Date

Review:

This completed construction checklist has been reviewed. Its completion is approved with the exceptions noted.

Construction Manager (Print Name & Company)

Signature

Date

/ Heapy Engineering
Commissioning Authority (Print Name & Company)

Signature

Date

Owner's Representative (Print Name & Company)

Signature

Date

Pre-Functional Checklist Air Handling Unit

Installation Verification

Construction Observer - Check when verified, provide comment if deficient. Contractor shall complete all open action items, sign and return the form to the Construction Manager

Check	Verified	Remark/Action	Item to Issues Log
Cabinet and General Installation			
Permanent labels affixed, including for fans			
Casing condition good: no dents, leaks, door gaskets installed.			
Access doors close tightly - no leaks			
Boot between duct and unit tight and in good condition			
Vibration isolation equipment installed & released from shipping locks for each fan			
Maintenance access acceptable for unit and components			
Sound attenuation installed (perforated interior liner)			
Thermal insulation properly installed (note thickness)			
Instrumentation installed according to specification (thermometers, pressure gages, flow meters, etc.)			
Clean up of equipment completed (Note where dirty)			
Filters installed. Replacement type and efficiency permanently affixed to housing			
Valves, Piping and Coils			
Pipe fittings complete and pipes properly supported			
Pipes properly insulated			
Strainers in place and clean			
No leaking apparent around fittings			
All coils are clean and fins are in good condition			
Condensate drain piping is trapped per drawings			
All condensate drain pans clean and slope to drain			
Valves properly labeled			
P/T plugs and isolation valves installed per drawings			
Valves installed in proper direction			
Controls			
<u>DDC sensors properly located and secure:</u> Supply Air Temp Sensor Mixed Air Temp. Sensor Return Air Temperature Sensor Duct Mounted Smoke Detector (return air duct)			

Pre-Functional Checklist Air Handling Unit

Check	Verified	Remark/Action	Item to Issues Log
Low limit freeze stat sensor installed properly (to cover each sq. ft of coil face with one linear foot of element) per sq. ft. of coil surface, with the bottom 6" of the coil must be covered and installed in accordance with manufacturer's installation instructions.			
Fans and Dampers			
Supply fan belt tension & alignment good			
Supply fan belts protective shrouds in place /secure			
Supply fan and motor properly lubricated			
Return/exhaust fan belt tension & alignment good			
Return/Exh. fan belts protective shrouds in place/secure			
Return/exhaust fan and motor properly lubricated			
Filters clean and tight fitting			
Filter pressure differential measuring device installed and functional (magnehelic, inclined manometer, etc.)			
All dampers close tightly			
All damper linkages have minimum play			
Ductwork			
Duct joint sealant properly installed			
Turning vanes in elbows at unit intake & discharge			
OSA intakes located away from pollutant sources & exhaust outlets			
Electrical			
Power disconnects are in place and labeled properly			
Safeties in place and operable			
Starter overload breakers installed and correct size			
Variable Frequency Drives			
Unit tagged with equipment controlled (ex; SF-1)			
VFD powered (wired to controlled equipment)			
VFD interlocked to control system devices (note input controlling device & units)			
Drive location not subject to excessive temperatures			
Drive location not subject to excessive moisture or dirt			
Drive size matches motor size			

Pre-Functional Checklist Air Handling Unit

Operational Checks

Construction Observer - Check when verified, provide comment if deficient. Contractor shall complete all open action items, sign and return the form to the Construction Manager.

Note: This form is not to be used in place of manufacturer's start-up, but as additional checks during the start-up process.

Check	Verified	Remark/Action	Item to Issues Log
Verify Supply & Exhaust Fan rotation in "Auto", "Hand" & "Bypass".			
All fan & motor bearings lubricated.			
Filters installed.			

END OF CHECKLIST

Project: VA Chalmers P. Wylie Ambulatory Care Center Specialty Care Addition **Date:** _____

Equipment / System: _____ **Unit ID.:** _____

Equipment Information

Information to be completed by Installing Contractor	
Equipment Name:	
Equipment Type:	
Manufacturer's Name:	
Supplier's Contact Info:	
Model #:	
Serial #:	
Location:	
Date Placed in Service:	
Date Warranty Expires:	

**Pre-Functional Checklist
Exhaust Fan**

Unit ID.: _____

Installation / Start-up Requirements:

- Refer to manufacturer's Installation & Operation Manual and project documents for installation and start-up requirements.
- It is the Contractor's responsibility to provide start-up of equipment meeting the manufacturer's requirements.

Manufacturer's Start-Up Report:

- Attach a copy of the completed manufacturer's start-up report to this document.

Completion Sign-off:

The equipment / system installation, start-up and associated preliminary operational checkout has been completed and the equipment / system is ready for functional testing. All corrective work items identified are noted within the construction checklist and shall be completed prior to substantial completion of the system. None of the outstanding items preclude safe and reliable operation of the equipment.

Mechanical Contractor (Print Name & Company)

Signature

Date

ATC Contractor (Print Name & Company)

Signature

Date

Test & Balance Contractor (Print Name & Company)

Signature

Date

Review:

This completed construction checklist has been reviewed. Its completion is approved with the exceptions noted.

Construction Manager (Print Name & Company)

Signature

Date

/ Heapy Engineering
Commissioning Authority (Print Name & Company)

Signature

Date

Owner's Representative (Print Name & Company)

Signature

Date

Unit ID.: _____

Pre-Functional Checklist Exhaust Fan

Installation Verification

Check	Verified	Remark/Action	Item to Issues Log
Cabinet and General Installation			
Permanent labels affixed			
Casing condition good: no dents, leaks, door gaskets installed			
Mountings checked and shipping bolts removed			
Vibration isolators installed			
Equipment guards installed			
Pulleys aligned			
Belt tension correct			
Plenums clear of debris			
Fans rotate freely			
Fire and balance dampers installed			
Back draft dampers installed, per drawings, and operate freely			
½" birdscreen installed at all exterior penetrations including wall and roof caps.			
Fan accessible for service?			
Electrical			
Electrical connections complete			
Disconnect switch installed			
Overload heaters in place			
Control connections complete			

Pre-Functional Checklist Exhaust Fan

Unit ID.: _____

Operational Checks

Note: This form is not to be used in place of manufacturer's start-up, but as additional checks during the start-up process.

Check	Verified	Remark/Action	Item to Issues Log
Installation			
<i>Cabinet and General Installation</i>			
Permanent labels affixed to the unit.			
Casing condition good: no dents, leaks, door gaskets installed.			
Access doors close tightly – no air leaks.			
Vibration isolators are installed & released from shipping blocks.			
Maintenance access is acceptable for unit and components.			
Sound attenuation is installed, if applicable.			
Thermal insulation properly installed (unit liner or double walled unit).			
Unit has been cleaned of dirt & debris.			
<i>Fans and Dampers</i>			
Fan and motor alignment has been checked and is correct.			
Fan belt tension & condition has been checked and is in good condition.			
Belt guards are in place and are secure.			
Fan and motor has been properly lubricated per manufacturer's manual.			
Filters are clean and tight fitting.			
Damper operates freely.			
<i>Electrical and Controls</i>			
Power disconnects are in place and labeled.			
All electric connections have been terminated.			
Proper grounding has been installed for components and unit.			
Safeties are in place, have been checked and are operable.			
Starter overload heaters are installed and are correctly sized.			
Control system interlocks terminated and are functional.			
<i>Test and Balance (TAB)</i>			
Installation of system and balancing devices allow balancing to be completed per specified NEBB or AABC procedures and contract documents.			

Pre-Functional Checklist Exhaust Fan

Unit ID.: _____

Final			
Manufacturer's startup process completed and documented attached to this form.			
Unit information such as serial number, model number, belt sizes, and filter sizes noted on start up documentation.			
Operation			
Verify the fan rotation is correct.			
Record full load running amps for each fan. _____ Nameplate FLA x _____ Service Factor = _____ Service Factor Amps. Motor shall operate below SFA value.			
Acceptable fan noise & vibration.			
Fan Operates Freely: shipping bolts removed from fan assemblies, sheave alignment verified, fan and motor bearings greased.			
Backdraft dampers stroke fully without binding.			
The supply fan HOA switch controls properly.			

END OF CHECKLIST

Project: VA Chalmers P. Wylie Ambulatory Care Center Specialty Care Addition **Date:** _____

Equipment / System: Fire Suppression System

Equipment Information

Information to be completed by Installing Contractor	
Compressor	
Equipment Name:	
Equipment Type:	
Manufacturer's Name:	
Supplier's Contact Info:	
Model #:	
Serial #:	
Location:	
Date Placed in Service:	
Date Warranty Expires:	
Dry Valve	
Equipment Name:	
Equipment Type:	
Manufacturer's Name:	
Supplier's Contact Info:	
Model #:	
Serial #:	
Location:	
Date Placed in Service:	
Date Warranty Expires:	

Pre-Functional Checklist Fire Suppression System

Installation / Start-up Requirements:

- Refer to manufacturer's Installation & Operation Manual and project documents for installation and start-up requirements.
- It is the Contractor's responsibility to provide start-up of equipment meeting the manufacturer's requirements.

Manufacturer's Start-Up Report:

- Attach a copy of the completed manufacturer's start-up report to this document.

Completion Sign-off:

The equipment / system installation, start-up and associated preliminary operational checkout have been completed and the equipment / system is ready for functional testing. All corrective work items identified are noted within the construction checklist and shall be completed prior to substantial completion of the system. None of the outstanding items preclude safe and reliable operation of the equipment.

Mechanical Contractor (Print Name & Company)

Signature

Date

Fire Suppression Contractor (Print Name & Company)

Signature

Date

Electrical Contractor (Print Name & Company)

Signature

Date

Review:

This completed construction checklist has been reviewed. Its completion is approved with the exceptions noted.

Construction Manager (Print Name & Company)

Signature

Date

/ Heapy Engineering
Commissioning Authority (Print Name & Company)

Signature

Date

Owner's Representative (Print Name & Company)

Signature

Date

Pre-Functional Checklist Fire Suppression System

Installation Verification

Construction Observer - Check when verified, provide comment if deficient. Contractor shall complete all open action items, sign and return the form to the Construction Manager.

Check	Verified	Remark/Action	Item to Issues Log
Installation			
General appearance, no visible damage			
All shipping brackets removed			
Pressure gages 1280 kPa (200psi) installed at each flow alarm switch, at the top of each sprinkler or standpipe riser, at each main drain connection.			
Signage installed for all valves, drain and test connections, alarm devices and piping.			
Water flow switches installed and set for between 30 and 45 seconds.			
All piping installed and aligned with natural building and other sprinkler lines.			
Provide test pipes in accordance with NFPA 13. Test pipes shall be valved and piped to discharge through proper orifice as specified above floor drains.			
Drain installed at the base of the riser, on valved sections and at other locations to allow for complete drainage of the system. Discharge riser outside over splash block, indirectly over storm sewer or as directed.			
Pressure switch installed, adjusted and wired.			
Valve supervisory switches installed and wired.			
All fire wall penetrations sealed.			
No air or water leaks in system.			
Electrical			
Wiring properly terminated. (Electrician)			
All wiring completed in accordance with requirements of the local AHJ and any applicable codes. (Electrician)			
All interlock wiring to the local fire panel complete. (Electrician)			
Provide 120 volt electrical connection to a non-switched dedicated electrical connection and equipped with an hourly run meter. (Electrician)			

Pre-Functional Checklist Fire Suppression System

Operational Checks

Construction Observer - Check when verified, provide comment if deficient. Contractor shall complete all open action items, sign and return the form to the Construction Manager.

Note: This form is not to be used in place of manufacturer's start-up, but as additional checks during the start-up process.

Check	Verified	Remark/Action	Item to Issues Log
Piping connections meet manufacturer's requirements.			
System water and air pressure within design requirements.			
Electrical connections are complete. (Electrician)			
All interlock wiring complete. (Electrician)			
Compressor maintains the operating pressure on the dry system and is capable of full recovery within 30 minutes of an emergency.			
Pressure switch activates by any flow of water equal to or in excess of the discharge of one sprinkler.			
"System Piping Integrity Test" performed per the manufacturers recommendations. (Pressure Leak Test.)			
Compressor does not short cycle.			
Compressor runs noise free.			
Verify the compressor is on Emergency Power. (Electrician)			

END OF CHECKLIST

Functional Test Report Air Handling Unit

1. System Information

Air Distribution Systems – Air Handling Unit			
List all equipment and components that are a part of this system.			
Equipment/Component	Tag	Floor Level	Room
Air Handling Unit	RTU-12		
Automatic Temperature Controls			

2. Attendees

Team Member	Company	Name
Owner		
Commissioning Authority	Heapy Engineering	
ATC Contractor		
HVAC Contractor		
TAB Contractor		

3. Sensor Calibration: Record the measured value and the DDC reading for each sensor.

Sensor	Deviation	Measured Value	DDC Value	Location Pass/Fail	Device Accepted Pass/Fail
Supply Air Temp.	+/- 1°F				
Return Air Temp.	+/- 1°F				
Mixed Air Temp.	+/- 1.5°F				
Supply Static Pressure	+/- 10%				
Return Humidity	+/- 3%				
Return CO ₂	+/-50 ppm				
Heating Coil Water Leaving Temp	+/- .5°F				
Return Static Pressure	+/- 10%				
Filter Differential Pressure	+/- 10%				

Note: Deviation is of measured value

4. Control Device Verification

Procedures:	1.	Verify Trend Log is set-up to track damper positions, valve positions, and VFD speeds.	<input type="checkbox"/>		
	2.	Manually shut unit off during control device testing.	<input type="checkbox"/>		
Device	Procedure / State		Site Observation	Pass	
Supply Fan VFD	Override the Supply Fan VFD to 0%		Observe VFD goes to 0% (0 Hz)	Yes <input type="checkbox"/>	No <input type="checkbox"/>
	Override the Supply Fan VFD to 50%,		Observe VFD goes to 50% (30 Hz)	Yes <input type="checkbox"/>	No <input type="checkbox"/>
	Override the Supply Fan to 100%.		Observe VFD goes to 100% (60Hz)	Yes <input type="checkbox"/>	No <input type="checkbox"/>
	Release all overrides.				
Device	Procedure / State		Site Observation	Pass	
Exhaust Fan VFD	Override the Exhaust Fan VFD to 0%		Observe VFD goes to 0% (0 Hz)	Yes <input type="checkbox"/>	No <input type="checkbox"/>
	Override the Exhaust Fan VFD to 50%,		Observe VFD goes to 50% (30 Hz)	Yes <input type="checkbox"/>	No <input type="checkbox"/>
	Override the Exhaust Fan to 100%.		Observe VFD goes to 100% (60Hz)	Yes <input type="checkbox"/>	No <input type="checkbox"/>
	Release all overrides.				
Device	Procedure / State		Site Observation	Pass	
Heating Valve	Override the Heating Valve to 0%		Observe Heating Valve goes to 0% and no leakage	Yes <input type="checkbox"/>	No <input type="checkbox"/>
	Override the Heating Valve to 50%,		Observe Heating Valve goes to 50%	Yes <input type="checkbox"/>	No <input type="checkbox"/>
	Override the Heating Valve to 100%.		Observe Heating Valve goes to 100%	Yes <input type="checkbox"/>	No <input type="checkbox"/>
	Release all overrides.				
Device	Procedure / State		Site Observation	Pass	
Outside Air Dampers	Override the Outside Air Dampers to 0%		Observe Outside Air Dampers goes to 0%	Yes <input type="checkbox"/>	No <input type="checkbox"/>
	Override the Outside Air Dampers to 50%,		Observe Outside Air Dampers goes to 50%	Yes <input type="checkbox"/>	No <input type="checkbox"/>
	Override the Outside Air Dampers to 100%.		Observe Outside Air Dampers goes to 100%	Yes <input type="checkbox"/>	No <input type="checkbox"/>
	Release all overrides.				
Device	Procedure / State		Site Observation	Pass	
Return Air Dampers	Override the Return Air Dampers to 0%		Observe Return Air Dampers goes to 0%	Yes <input type="checkbox"/>	No <input type="checkbox"/>
	Override the Return Air Dampers to 50%,		Observe Return Air Dampers goes to 50%	Yes <input type="checkbox"/>	No <input type="checkbox"/>
	Override the Return Air Dampers to 100%.		Observe Return Air Dampers goes to 100%	Yes <input type="checkbox"/>	No <input type="checkbox"/>
	Release all overrides.				

Device	Procedure / State	Site Observation	Pass	
Relief Air Dampers	Override the Relief Air Dampers to 0%	Observe Relief Air Dampers goes to 0%	Yes <input type="checkbox"/>	No <input type="checkbox"/>
	Override the Relief Air Dampers to 50%,	Observe Relief Air Dampers goes to 50%	Yes <input type="checkbox"/>	No <input type="checkbox"/>
	Override the Relief Air Dampers to 100%.	Observe Relief Air Dampers goes to 100%	Yes <input type="checkbox"/>	No <input type="checkbox"/>
	Release all overrides.			

5. Functional Test Procedures and Record

Air Distribution Systems – Air Handling Units				
Spec Section:	23 09 93.04 3.04	Mode:		
Test Procedure 1		Record environmental conditions.		
Record	Outdoor Air Temperature °F.	Return Air Temperature °F.		
	Outdoor Air Relative Humidity %	Return Air Relative Humidity %		
	Weather			
Test Procedure 2		Record control system settings.		
Record	Description	Design	Actual	
	Unoccupied Heating Setback Space Temperature Setpoint	55 °F	°F.	
	Unoccupied Heating Setback Space Temperature Deadband	2 °F	°F.	
	Minimum Outside Air CFM Setpoint - Normal	4100cfm	cfm	
	Minimum CO ₂ Setpoint	900ppm	ppm	
	Maximum CO ₂ Setpoint	1,000ppm	ppm	
	Mixed Air Low Limit Temperature Setpoint	55 °F	°F.	
	Hot Water Coil Pump OA Temperature Setpoint (if applicable)	35 °F	°F.	
	Hot Water Valve Night Setback Position	20%	°F.	
	Outside air Cooling Switchover Setpoint	55 °F	°F.	
	Outside air Heating/Cooling Switchover Deadband	2 °F	°F.	
	Economizer OA Lock-Out Setpoint	65 °F	°F.	
	<u>Supply Air Temperature Reset by ZT Schedule Limits</u>			
	High Room Temperature Deviation Setting	+2 °F	°F.	
	Low Room Temperature Deviation Setting	-2 °F	°F.	
	Supply Air High Limit Temperature Setting	95 °F	°F.	
	Supply Air Low Temperature Limit Setting	60 °F	°F.	

Functional Test Report
Air Handling Unit

	<u>Occupied Schedule</u>		
	Monday – Friday		
	Saturdays, Sundays and Holidays		
	Occupied Space Temperature Cooling Setpoint		
	Occupied Space Temperature Heating Setpoint		

*CALC = Exhaust Air CFM Setpoint = Outside Air CFM – Fixed Exhaust CFM – Positive Pressurization CFM.

Air Distribution Systems – Air Handling Units			
Spec Section:	23 09 93.04 3.02	Mode:	Unoccupied Mode – Setback and Setup Modes Inactive
Test Procedure 3	Verify supply fan, relief fan, and HW coil recirculating pump motor controllers are indexed to the "auto" position and safeties are "normal". Place system in the Unoccupied Mode. Adjust Unoccupied heating Setback Setpoint and Unoccupied Cooling Setup Setpoint, if necessary, to keep system from entering these modes of operation.		
Expected Response User Note: Check box () when verified.	Supply fan 'off'. (on/off)		<input type="checkbox"/>
	Relief fan 'off'. (on/off)		<input type="checkbox"/>
	Relief air damper closed. Position (open/closed)		<input type="checkbox"/>
	Outside air damper closed. Position %		<input type="checkbox"/>
	Return air damper open. Position %		<input type="checkbox"/>
	Chilled water coil control valve closed. Position %		<input type="checkbox"/>
	Hot water coil control valve 'closed' Position %		<input type="checkbox"/>
Record	Supply Air Temperature Setpoint °F.		
	Supply Air Temperature °F.		
	Return Air Temperature °F.		
	Return Air Relative Humidity %		
	Outside Air Temperature °F.		
	Outdoor Air Relative Humidity %		
	Mixed air temperature °F.		
Notes			

Air Distribution Systems – Air Handling Units			
Spec Section:	23 09 93.04 3.02	Mode:	Unoccupied Mode – Setback and Setup Modes Inactive
Test Procedure 4	Verify supply fan, relief fan, and HW coil recirculating pump motor controllers are indexed to the "auto" position and safeties are "normal". Place system in the Unoccupied Mode. Adjust Unoccupied heating Setback Setpoint and Unoccupied Cooling Setup Setpoint, if necessary, to keep system from entering these modes of operation. Simulate the outside air temperature below 55°F.		
Expected Response User Note: Check box (<input type="checkbox"/>) when verified.	Supply fan 'off'. (on/off)		<input type="checkbox"/>
	Relief fan 'off'. (on/off)		<input type="checkbox"/>
	Relief fan air damper closed. Position (open/closed)		<input type="checkbox"/>
	Outside air damper closed. Position %		<input type="checkbox"/>
	Return air damper open. Position %		<input type="checkbox"/>
	Chilled water coil control valve closed. Position %		<input type="checkbox"/>
	Hot water coil control valve goes to '20%' open. Position %		<input type="checkbox"/>
Record	Supply Air Temperature Setpoint °F.		
	Supply Air Temperature °F.		
	Return Air Temperature °F.		
	Return Air Relative Humidity %		
	Outside Air Temperature °F.		
	Outdoor Air Relative Humidity %		
	Mixed air temperature °F.		
Notes			

Air Distribution Systems – Air Handling Units		
Spec Section:	23 09 93.04 3.02	Mode: Unoccupied Mode – Heating Setback Mode Active
Test Procedure 5	Adjust the Unoccupied Heating Setback Temperature Setpoint above the space temperature to initiate the Unoccupied Heating Setback Mode. Adjust supply air temperature setpoint to allow HW Coil control valve to modulate open. Disable the Economizer Mode.	
Expected Response User Note: Check box (<input type="checkbox"/>) when verified.	Supply fan 'on'. VFD modulates fan speed to maintain supply static pressure setpoint.	<input type="checkbox"/>
	Relief fan 'off'. (on/off)	<input type="checkbox"/>
	Outside air damper 'closed'. Position %	<input type="checkbox"/>
	Return air damper 'open'. Position %	<input type="checkbox"/>
	Relief fan air damper 'closed'. Position (open/closed)	<input type="checkbox"/>
	Chilled water coil control valve 'closed'. Position %	<input type="checkbox"/>
	Hot water coil control valve goes to '20%' open. Position %	<input type="checkbox"/>
Record	Supply Air Temperature Setpoint °F.	
	Supply Air Temperature °F.	
	Return Air Temperature °F.	
	Return Air Relative Humidity %	
	Outside Air Temperature °F.	
	Outdoor Air Relative Humidity %	
	Mixed air temperature °F.	
Notes		

Air Distribution Systems – Air Handling Units		
Spec Section:	23 09 93.04 3.02	Mode: Unoccupied Mode – prior to Occupied Mode.
Test Procedure 6	While in the Unoccupied Mode return all setpoints to their design settings.	
Expected Response	Supply fan 'off'.	<input type="checkbox"/>
User Note: Check box (<input type="checkbox"/>) when verified.	Return fan 'off'.	<input type="checkbox"/>
	Outside air damper closed. Position %	<input type="checkbox"/>
	Return air damper open. Position %	<input type="checkbox"/>
	Relief air damper closed. Position (open/closed)	<input type="checkbox"/>
	DX cooling coil is off. (on/off)	<input type="checkbox"/>
	Hot water coil control valve 'closed' Position %	<input type="checkbox"/>
Notes		

Air Distribution Systems – Air Handling Units		
Spec Section:	23 09 93.04 3.02	Mode: Discharge Air Control Reset
Test Procedure 7	Review the reset schedule.	
Expected Response	The discharge air temperature is reset base on the Highest Room Temperature as follow (all setpoint are adjustable):	<input type="checkbox"/>
User Note: Check box (<input type="checkbox"/>) when verified.	RoomDev -2°F = 95°F DaTempSp RoomDev +2°F = 60°F DaTempSp	
Test Procedure 8	Simulate space temperature of 3°F. above setpoint. Discharge air setpoint should be 60°F.	
Expected Response	Record discharge air setpoint. °F.	<input type="checkbox"/>
User Note: Check box (<input type="checkbox"/>) when verified.		
Test Procedure 9	Simulate space temperature of 3°F below setpoint. Discharge air setpoint should be 95°F.	
Expected Response	Record discharge air setpoint. °F.	<input type="checkbox"/>
User Note: Check box (<input type="checkbox"/>) when verified.		
Test Procedure 10	Simulate space temperature equal to setpoint. Discharge air setpoint should be 77.5°F.	
Expected Response	Record discharge air setpoint. °F.	<input type="checkbox"/>
User Note: Check box (<input type="checkbox"/>) when verified.		
Notes		

Functional Test Report
Air Handling Unit

Air Distribution Systems – Air Handling Units			
Spec Section:	23 09 93.04 3.02	Mode:	Occupied Mode - Heating
Test Procedure 11	While in the Occupied Mode, adjust the supply air temperature setpoint above the active supply air temperature to sequence hot water heating coil control valve. Simulate Outside air temperature is below the heating setpoint.		
Expected Response User Note: Check box (<input type="checkbox"/>) when verified.	Supply fan 'on'. VFD runs at 100%. Speed %	<input type="checkbox"/>	
	Outside air damper 'open' delay to maintain outside minimum position setpoint. Position %	<input type="checkbox"/>	
	Return air damper 'open'. Position %	<input type="checkbox"/>	
	Relief air damper 'closed'. Position %	<input type="checkbox"/>	
	DX cooling coil is off. (on/off)	<input type="checkbox"/>	
	Hot water coil control valve modulates to maintain supply air temperature setpoint. Position %	<input type="checkbox"/>	
Record	Supply Air Temperature Setpoint °F.		
	Supply Air Temperature °F.		
	Return Air Temperature °F.		
	Return Air Relative Humidity %		
	Outside Air Temperature °F.		
	Outdoor Air Relative Humidity %		
	Mixed air temperature °F.		
	Outside air flow CFM		
	Building Pressure "wc.		
Notes			

Air Distribution Systems – Air Handling Units			
Spec Section:	23 09 93.04 3.02	Mode:	Occupied Mode – Cooling with Economizer
Test Procedure 12	While in the Occupied Mode, adjust the supply air temperature setpoint below the active supply air temperature to sequence dampers and dx cooling. And adjust the economizer setpoint above the actual outside air temperature. Simulate the outside air temperature above the cooling setpoint		
Expected Response User Note: Check box () when verified.	Supply fan 'on'. VFD runs at 100%. Speed %	<input type="checkbox"/>	
	Outside air damper 'open' delay to maintain discharge air setpoint. Position %	<input type="checkbox"/>	
	Return air damper modulates in conjunction with the outside air damper. Position %	<input type="checkbox"/>	
	DX cooling coil cycles 'On' as required to maintain the discharge air temperature to setpoint. Stage 1 (on/off) Stage 2 (on/off) Stage 3 (on/off) Stage 4 (on/off)	<input type="checkbox"/>	
	Hot water coil control valve shall 'close'. Position %	<input type="checkbox"/>	
	Record	Supply Air Temperature Setpoint °F. Supply Air Temperature °F. Return Air Temperature °F. Return Air Relative Humidity % Outside Air Temperature °F. Outdoor Air Relative Humidity % Mixed air temperature °F. Outside air flow CFM Building Pressure "wc.	
Notes			

Air Distribution Systems – Air Handling Units			
Spec Section:	23 09 93.04 3.02	Mode:	Occupied Mode – Cooling with Economizer & low mixed air temp
Test Procedure 13	While in the Occupied Mode, adjust the supply air temperature setpoint below the active supply air temperature to sequence dampers and dx cooling. Adjust the economizer setpoint above the actual outside air temperature. Simulate a low mixed air temperature. Simulate the outside air temperature above the cooling setpoint		
Expected Response User Note: Check box () when verified.	Supply fan 'on'. VFD runs at 100%. Speed %	<input type="checkbox"/>	
	Outside air damper 'open' delay to maintain mixed air low limit setpoint. Position % Mxed air low limit setpoint °F Mixed Air Temperature °F	<input type="checkbox"/>	
	Return air damper modulates in conjunction with the outside air damper. Position %	<input type="checkbox"/>	
	DX cooling coil cycles 'On' as required to maintain the discharge air temperature to setpoint. Stage 1 (on/off) Stage 2 (on/off) Stage 3 (on/off) Stage 4 (on/off)	<input type="checkbox"/>	
	Hot water coil control valve shall 'close'. Position %	<input type="checkbox"/>	
	Record	Supply Air Temperature Setpoint °F. Supply Air Temperature °F. Return Air Temperature °F. Return Air Relative Humidity % Outside Air Temperature °F. Outdoor Air Relative Humidity % Mixed air temperature °F. Outside air flow CFM Building Pressure "wc.	
Notes			

Air Distribution Systems – Air Handling Units			
Spec Section:	23 09 93.04 3.02	Mode:	Occupied Mode – Cooling no Economizer
Test Procedure 14	While in the Occupied Mode, adjust the supply air temperature setpoint below the active supply air temperature to sequence dampers and dx cooling. . And adjust the economizer setpoint below the actual outside air temperature. Simulate the outside air temperature above the cooling setpoint.		
Expected Response User Note: Check box (<input type="checkbox"/>) when verified.	Supply fan 'on'. VFD runs at 100%. Speed %	<input type="checkbox"/>	
	Outside air damper 'open' delay to maintain outside minimum position setpoint. Position %	<input type="checkbox"/>	
	Return air damper 'open'. Position %	<input type="checkbox"/>	
	DX cooling coil cycles 'On' as required to maintain the discharge air temperature to setpoint. Stage 1 (on/off) Stage 2 (on/off) Stage 3 (on/off) Stage 4 (on/off)	<input type="checkbox"/>	
	Hot water coil control valve shall 'close'. Position %	<input type="checkbox"/>	
Record	Supply Air Temperature Setpoint °F.		
	Supply Air Temperature °F.		
	Return Air Temperature °F.		
	Return Air Relative Humidity %		
	Outside Air Temperature °F.		
	Outdoor Air Relative Humidity %		
	Mixed air temperature °F.		
	Outside air flow CFM		
	Building Pressure "wc.		
Notes			

Air Distribution Systems – Air Handling Units			
Spec Section:	23 09 93.04 3.02	Mode:	HW Preheat Coil Pump Control (if applicable)
Test Procedure 15	Adjust the HW Coil Pump OA Temperature setpoint to cycle the pump 'on/off'.		
Expected Response User Note: Check box (<input type="checkbox"/>) when verified.	When outside air temperature is above the HW Coil Pump OA Temperature setpoint the pump is 'off'.	<input type="checkbox"/>	
	When outside air temperature is below the HW Coil Pump OA Temperature setpoint the pump is 'on'.	<input type="checkbox"/>	
Record	Outside Air Temperature °F.		
	Outside air pump enable setpoint °F.		
Notes			

Air Distribution Systems – Air Handling Units			
Spec Section:	23 09 93.04 3.02	Mode:	Building Pressure Control
Test Procedure 16	Vary the amount of outside air to match the exhaust requirements with any combination of fans operating. Economizer will modulate to maintain a slightly positive pressure.		
Expected Response User Note: Check box (<input type="checkbox"/>) when verified.	Disable exhaust fans in area. Record economizer response.		<input type="checkbox"/>
	Outside air damper position % Relief damper position % Outside airflow cfm Building Pressure in wc.		
	Enable exhaust fans in area. Record economizer response.		<input type="checkbox"/>
	Outside air damper position % Relief damper position % Outside airflow cfm Building Pressure in wc.		
Record	Relief Damper Offset %.		
Test Procedure 17	Vary the amount of outside air to match the exhaust requirements with any combination of fans operating. Economizer will modulate to maintain a slightly positive pressure. Simulate the a low mixed air temperature.		
Expected Response User Note: Check box (<input type="checkbox"/>) when verified.	Enable exhaust fans in area. Record economizer response.		<input type="checkbox"/>
	Outside air damper position % Relief damper position % Outside airflow cfm Building Pressure in wc.		
Notes			

Air Distribution Systems – Air Handling Units			
Spec Section:	23 09 93.04 3.02	Mode:	CO ₂ Control
Test Procedure 18	Adjust the CO ₂ setpoint to modulate economizer dampers with a(n) increase/decrease in ppm of CO ₂ .		
Expected Response User Note: Check box (<input type="checkbox"/>) when verified.	When CO ₂ ppm is 900 ppm or greater, economizer damper will open to minimum position (adjustable.) Position % Outside air flow cfm		<input type="checkbox"/>
	When CO ₂ ppm is 1000 ppm or greater, economizer damper will open to 50% position (adjustable.) Position % Outside air flow cfm		<input type="checkbox"/>
Record	Return Duct CO ₂ ppm.		
Notes			

Air Distribution Systems – Air Handling Units			
Spec Section:	23 09 93.04 3.02	Mode:	System Safeties & Alarms*
Test Procedure 19	Simulate freezestat 'trip' at low temperature limit cutout "Freezestats"		
Expected Response User Note: Check box () when verified.	Upon a freezestat 'trip' at the leaving side of the hot water coil, the supply and return fans are 'off' , the DX cooling is 'Off', the heating valve is '100%' and an alarm is issued at the operator workstation.		<input type="checkbox"/>
Test Procedure 20	Simulate supply duct high positive static pressure 'trip'.		
Expected Response User Note: Check box () when verified.	Upon a high positive static 'trip' the supply and return fans are 'off' , the DX cooling is 'Off', the heating valve is '100%' and an alarm is issued at the operator workstation.		<input type="checkbox"/>
Test Procedure 21	Simulate return duct high negative static pressure 'trip'.		
Expected Response User Note: Check box () when verified.	Upon a high negative static 'trip' the supply and return fans are 'off' , the DX cooling is 'Off', the heating valve is '100%' and an alarm is issued at the operator workstation.		<input type="checkbox"/>
Test Procedure 22	Simulate mixed air temperatures falling below 50 degrees F.		
Expected Response User Note: Check box () when verified.	Mixed air low limit control overrides Economizer damper signal to prevent mixed air temperature from falling below mixed air temperature setpoint.		<input type="checkbox"/>

*All safeties shall be active regardless of motor controller mode of operation.

Notes	
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Completion Sign-off:

Contractor (Print Name & Company)

Signature

Date

Approvals:

This completed functional test report has been reviewed and exceptions noted.

Commissioning Authority (Print Name & Company)

Signature

Date

Owner's Representative (Print Name & Company)

Signature

Date



Functional Test Report Exhaust Fans – DDC Time Clock

1. System Information

System: Exhaust Fans – Line Voltage T-Stat		
List all equipment and components that are a part of this system.		
Equipment/Component	Tag	Location
Exhaust Fan	EF-2	Roof
Exhaust Fan	EF-3	Roof
Exhaust Fan	EF-4	Roof
Exhaust Fan	EF-11	Roof
Exhaust Fan	EF-12	Roof
Exhaust Fan	EF-14	Roof
Exhaust Fan	EF-23	Art Storage Kiln
Exhaust Fan	EF-25	Roof

2. Attendees

Team Member	Company	Name
Owner		
Commissioning Authority	Heapy Engineering	
ATC Contractor		
HVAC Contractor		
TAB Contractor		

3. Functional Test Procedures

System: Exhaust Fans – DDC Timeclock				
Spec Section:		Mode:	Exhaust Mode.	
Test Procedure 1	Start the exhaust fan via an override or by adjusting the schedule.			
Expected Response User Note: Check box () when verified.	EF #	The Exhaust Fan starts	Exhaust Fan status indicates 'On' at the BMS	The backdraft damper opens (if applicable)
	EF-2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	EF-3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	EF-4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	EF-11	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	EF-12	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	EF-14	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	EF-23	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	EF-25	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Notes				

Functional Test Report
Exhaust Fan

System: Exhaust Fans – DDC Timeclock				
Spec Section:		Mode:	Off Mode.	
Test Procedure 2	Stop the exhaust fan via an override or by adjusting the schedule.			
Expected Response User Note: Check box () when verified.	EF #	The Exhaust Fan stops	Exhaust Fan status indicates 'Off' at the BMS	The backdraft damper closes (if applicable)
	EF-2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	EF-3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	EF-4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	EF-11	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	EF-12	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	EF-14	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	EF-23	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	EF-25	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Notes				

Functional Test Report
Exhaust Fan

System: Exhaust Fans – DDC Timeclock					
Spec Section:		Mode:	Alarm.		
Test Procedure 2	Start the exhaust fan via an override or by adjusting the schedule and fail the fan by shutting off the breaker or disconnect.				
Expected Response User Note: Check box () when verified.	EF #	The Exhaust Fan stops	Exhaust Fan status indicates 'Off' at the BMS	The backdraft damper closes (if applicable)	An alarm is generated at the BAS
	EF-2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	EF-3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	EF-4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	EF-11	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	EF-12	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	EF-14	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	EF-23	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	EF-25	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Notes					

Completion Sign-off:

Contractor (Print Name & Company)

Signature

Date

Approvals:

This completed functional test report has been reviewed and exceptions noted.

/ Heapy Engineering
Commissioning Authority (Print Name & Company)

Signature

Date

Owner's Representative (Print Name & Company)

Signature

Date

Section 01 91 51

COMMISSIONING SYSTEMS MANUAL

PART 1 - GENERAL

1.1 Related Documents

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 Summary

- A. The Systems Manual shall be a system-focused composite document that includes the operation manual, maintenance manual, and additional information of use to the Owner during the Occupancy and Operations Phase.

1.3 Commissioning Team

- A. During the Construction Phase the Commissioning Team shall review the Systems Manual for compliance with the Contract Documents and the Owner's Project Requirements.

1.4 Owner's Responsibilities

- A. Assign operations and maintenance personnel and schedule them to participate in commissioning team activities.
- B. Provide the Owner Project Requirements (OPR), and Basis of Design (BoD) documents, prepared by the design professionals and approved by Owner, to the CxA and each Contractor for use in developing the Systems Manual.

1.5 CM/GC Responsibilities

- A. The CM/GC shall be responsible for developing the Systems Manual and shall include all items involved in the project and capture the system and equipment data in either an electronic or printed version. In addition, printed operations, service, maintenance, spare parts list, and repair manuals shall be provided.

1.6 Commissioning Authority's (CxA's) Responsibilities

- A. The CxA shall be responsible for verifying the development of the Systems Manual.
- B. The CxA shall coordinate with operations and maintenance personnel in developing standard formats and divisions (responsible shops) to simplify future Systems Manual development.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 General

- A. The Systems Manual shall have multiple sections depending upon the number of systems focused upon during the Commissioning Process. The Systems Manual shall include a detailed table of contents with a notation as to storage location of the resource if not in the actual Systems Manual. The Systems Manual shall include:

Systems To Be Commissioned	
System	Description
Fire Suppression	
Fire Sprinkler Systems	Wet pipe system
Plumbing	
Plumbing Fixtures	Showers, water tempering valves, instruments and gages.
Medical Gas Systems	Medical compressor air, medical vacuum, and Oxygen. Medical Gas Alarm Systems.
HVAC	
Direct Digital Control System**	BACnet or similar Local Area Network (LAN), Operator Work Station hardware and software, terminal unit controller hardware and software, all sequences of operation, system accuracy and response time.
Chilled Water System**	Chilled water pumps and motors, variable speed drives, chiller motor/compressor, controls, instrumentation and safeties, isolation valves.
HVAC Air Handling Systems**	Terminal Units
HVAC Air Handling Systems**	Fans, motors, Variable Speed Drives, cooling coils and control valves, heating coils and control valves, humidifiers, filters, dampers, safeties such as smoke detectors, freeze stats, and damper end-switches, controls, gages, and vibration isolation.

Systems To Be Commissioned	
System	Description
Heating Hot Water System**	Controls, instrumentation and gages, heating hot water pumps and motors, Variable Speed Drives, mixing valves.
Exhaust Fans	Fans, motors, Variable Speed Drives, controls and safeties.
Computer Room Air Conditioning Units (CRAC Units)	Fans, motors, Variable Speed Drives, cooling coils and control valves, heating coils and control valves, humidifiers, compressors and liquid-cooled condensers, filters, safeties, controls, gages, vibration isolation, condensate pumps, water/leak detection systems and alarms and shunt trip shutdown.
HVAC Water Treatment Systems	Closed-Circuits - including shot feeders, and final water analysis.
Electrical	
Normal Power Distribution Systems	Grounding tests, coordination study review, major circuit breaker settings, meters and gages, and controls.
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.
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.
Essential Power Distribution Systems	Automatic transfer on loss of normal power, Grounding tests, coordination study review, major circuit breaker settings, meters and gages, and controls.
Lighting & Lighting Control** Systems	Control system hardware and software, scene settings, occupancy sensor interface, and unoccupied control.

3.2 Executive Summary (Facility Level)

- A. This section shall include an overall description of the building and its systems, including a listing of major capabilities and limitations imposed by the design or building code. The description shall include type of facility, general description (number of floors, gross area, net area, type of occupancy, etc.), and general system descriptions.
- B. A list of contractors, subcontractors, suppliers, architects, and engineers involved in the project along with their contact information shall be included in this section. See "Contact Info" tab of the Systems Manual General Information Spreadsheet.

3.3 Owner's Project Requirements - CxA to insert in Appendix A of the Cx Plan

- A. A copy of the final Owner's Project Requirements for the facility shall be available. This document shall be initially developed during the Pre-Design Phase and updated throughout the project by the Owner, Commissioning Authority, or design professionals.

3.4 Basis of Design (Facility Level) - CxA to insert in Appendix B of the Cx Plan

- A. This section shall include the final Basis of Design document at a facility level. This document shall be written by the design professionals during the Design Phase and updated by them to include any changes during the Construction Phase.

3.5 Construction Record Documents and Specifications (not included in Specific Systems Sections)

- A. This section shall include elements of the record set of Construction Documents (including specifications) that are not covered under specific systems and shall be updated to reflect the final installation. One record set may be maintained. The appropriate drawing number and page of the documents can be referenced.

3.6 Approved Submittals (not included in Specific System Sections)

- A. This section shall include a copy of the approved submittals (not included under specific systems) with all modifications and accessories clearly marked. In addition, any associated comments to the submittals shall be included.

3.7 Installed System/Assembly Documents (Facility Level)

- A. This section shall include a copy of the installed system and components with modifications and accessories clearly marked.

3.8 Facility Operating Procedures for all Normal, Abnormal, and Emergency Modes of Operation (Facility Level)

- A. This section shall include detailed operating procedures for the facility during normal, abnormal, and emergency modes of operation. This is not intended to be automatic control sequences, but general operating procedures. This shall include items such as building access during various situations (normal operation, after-hours operation, fire alarm, civil disturbance operation, emergency power operations, etc.).

3.9 Maintenance Procedures, Schedules, and Recommendations (Facility Level)

- A. This section shall include the manufacturer's recommendations for maintenance procedures and when maintenance shall be performed on systems not included in specific system sections.
- B. Use "PM Schedule" tab of the Systems Manual Equipment Information Spreadsheet.

3.10 A list of recommended operational record keeping procedures at the facility level, including sample forms, trend logs, or others, and a description of purpose and method for obtaining each.

- A. This section shall include direction to the operation and maintenance personnel as to what information needs to be documented and kept on the operation of the facility and why these records are important or will benefit the Owner or operations and maintenance personnel in the future. See "Equipment Record Keeping" tab of the Systems Manual Equipment Information Spreadsheet.

3.11 Ongoing Optimization (Facility Level)

- A. This section shall include guidance for the ongoing optimization of the facility. Included in the section shall be schedules of periodic benchmarking using checklists and tests developed for the original construction, procedures for archiving the Owner's Project Requirements and Basis of Design documents, and guidance on what to do when the Owner's Project Requirements are not achieved.

3.12 Attachments: Commissioning documents list and storage location.

3.13 System / Assembly

- A. This section shall include a description of the systems / assemblies covered in this section, including a listing of capabilities and limitations imposed by the design or building code.
 - 1. The description shall include type of system/assembly, general description, and schematics. See "Equipment Summary" tab of the Systems Manual Equipment Information Spreadsheet.
 - 2. A list of contractors, subcontractors, suppliers, and design professionals involved with this system along with their contact information shall be included. See "Contact Info" tab of the Systems Manual General Information Spreadsheet.

- B. Basis of Design (xxx System/Assembly Level) CxA to insert in Appendix B of the Cx Plan.
 - 1. This section shall include the final Basis of Design document (including the design intent) as related to the specific systems included in this section. This document shall be written by the design professionals during the Design Phase and updated by them to include any changes during the Construction Phase.
- C. Construction Record Documents and Specifications (xxx System/Assembly)
 - 1. This section shall include the record set of Construction Documents (including specifications) that shall be marked to reflect the final installation of the specific system/assembly included in this section. One record set may be maintained. The appropriate drawing numbers and pages of the documents can be referenced. See "Equipment Summary" tab of the Systems Manual Equipment Information Spreadsheet.
- D. Approved Submittals (xxx System/Assembly) - See "Equipment Summary" tab of the systems Manual Equipment Information Spreadsheet.
 - 1. This section shall include a copy of the approved submittals for the components associated with the system/assembly with all modifications and accessories clearly marked. In addition, any associated comments to the submittals shall be included.
- E. Installed System / Assembly Documents (xxx System/Assembly)
 - 1. This section shall include a copy of the installed system and components with modification and accessories clearly marked.
- F. Operating Procedures for all Normal, Abnormal and Emergency Modes of Operation (xxx System/Assembly)
 - 1. This section shall include detailed operating procedures for xxx systems/assemblies during normal, abnormal, and emergency modes of operation. This is not intended to be automatic control sequences, but general operating procedures.
- G. Maintenance Procedures, Schedules and Recommendations (xxx System/Assembly)
 - 1. Use "PM Schedule" tab of the Systems Manual Equipment Information Spreadsheet.
 - 2. This section shall include the manufacturer's recommendations for maintenance procedures and when maintenance should be performed.
- H. A list of recommended operational record-keeping procedures, including sample forms, trend logs, or others, and a rationale for each (xxx System/ Assembly) - See "Equipment Record Keeping" tab of the Systems Manual Equipment Information Spreadsheet.

1. This section shall include direction to the operations and maintenance personnel as to what information needs to be documented and kept on the operation of the systems and why these records are important or will benefit the Owner or operations and maintenance personnel in the future.

I. Ongoing Optimization (xxx System/Assembly)

1. This section shall include guidance for the ongoing optimization of the system/assembly. Included in the section shall be schedules of periodic benchmarking using checklists and tests developed for the original construction, procedures for maintaining the Owner's Project Requirements and Basis of Design documents, and guidance on what to do when the Owner's Project Requirements are not achieved.

J. Operations and Maintenance Manuals (xxx System/ Assembly)

1. This section shall include the manufacturer's printed operations and maintenance manuals for the specific equipment/components provided for the xxx system/ assembly.
2. Also included shall be a parts and recommended spare parts list (see "Spare Parts List" tab of the Systems Manual Equipment information spreadsheet), a troubleshooting guide for common situations, and one-line diagrams for each applicable system (Electrical and Technology Systems).

K. Training Records (xxx System/Assembly)

1. This section shall include information on training provided and attendees. In addition, information for ongoing training shall be provided. Contractor and CM to insert Training Agenda's, sign-in sheets, and information on suggested on-going training.

L. Commissioning Process Report for xxx System/ Assembly

1. This section shall include the Final Commissioning Process Report for the xxx system/assembly, including all test procedures, test results, and blank test forms. Commissioning Authority to insert Final Commissioning Report, Completed Functional Test Forms, Issues Logs and Blank Functional Test Forms.

3.14 Acceptance

A. Systems Manual shall be formally accepted by the Owner during the Construction Phase.

1. The general process for accepting the Systems Manual shall be:
 - a. The CM/GC tracks the Contractor submittals for the required documentation.
 - b. Within 60 days of submittal acceptance for a system or assembly, the CM/GC shall submit a draft Systems Manual to the Owner, Commissioning Authority, and design professionals.

- c. The Commissioning Authority shall consolidate the reviews and meets with the design professionals to discuss and resolve.
- d. The Contractor shall submit to the CM/GC changes to the accepted submittals throughout construction.
- e. 30 days prior to the first training session, the CM/GC shall submit the final Systems Manual to the Owner, Commissioning Authority, and design professionals.
- f. The Owner accepts the final Systems Manual based upon the recommendation of the Commissioning Authority.

3.15 Updated Systems Manual shall be formally accepted by the Owner during the Occupancy and Operations Phase. Systems Manual re-acceptance follows the same process as previously detailed.

END OF SECTION

Project Name: Ambulatory Care Center
Owner Name: VA

1. System/Assembly Executive Summary

Spec Section: 3.13 A.1

2. Equipment Summary

Spec Section: 3.13 A.1, C, D, & J

3. Preventative Maintenance Schedule

Spec section: 3.9 & 3.13 G

4. Preventative Maintenance Material

Spec section: 3.9 & 3.13 G

5. Spare Parts List

Spec section: 3.13 J.2

6. Equipment Record Keeping

Spec section: 3.10 & 3.13 H

7. Facilities Operating Procedure Form

Spec section: 3.8 & 3.13 F

8. Troubleshooting Procedure Form

Project Name: Ambulatory Care Center
Owner's Name: VA
Project Number: 2013-83018

SYSTEMS MANUAL SPEC SECTION(S): 01 91 51 3.13 A

Warranty Type:	Warranty Coverage:	Begin Date:	End Date:
Standard:			
Extended:			

Equipment Type:	Air Handling Unit
-----------------	-------------------

Schematics Location:

System Description: Include a listing of capabilities and limitations imposed by the design or building code.



Project Name: Ambulatory Care Center
Owner's Name: VA
Project Number: 2013-83018
Equipment Type: Air Handling Unit

[illegible]



VA
2013-83018
Air Handling Unit
UAL SPEC SECTION(S):01 91 51 3.9 & 3.13.G

[illegible]



Owner's Name : VA

Equipment Type: Air Handling Unit

SYSTEMS MANUAL SPEC SECTION(S): 01 91 51 3.9 & 3.13.G

[illegible]



SYSTEMS MANUAL SPEC SECTION(S):01 91 51 3.13 J.2

[illegible]



Owner's Name : VA

Equipment Type: Air Handling Unit

Recommended Equipment Record Keeping

[illegible]

Project Name : Ambulatory Care Center

Owner's Name : VA

Project Number : 2013-83018

Equipment Type: Air Handling Unit

SYSTEMS MANUAL SPEC SECTION(S):01 91 51 3.8 & 3.13 F

Equipment Start-up Procedures

Project Name : Ambulatory Care Center

Owner's Name : VA

Project Number : 2013-83018

Equipment Type: Air Handling Unit

SYSTEMS MANUAL SPEC SECTION(S):01 91 51 3.8 & 3.13 F

Equipment Shut-down Procedures

Project Name : Ambulatory Care Center
Owner's Name : VA
Project Number : 2013-83018
Equipment Type: Air Handling Unit

SYSTEMS MANUAL

**Trouble Shooting
Procedures**

Project Name : Ambulatory Care Center

Owner's Name : VA

Project Number : 2013-83018

Referenced Systems Manual Items:

Owner's Project Requirements -- See Appendix A of Commissioning Plan

Basis of Design -- See Appendix B of Commissioning Plan

Training Records -- See Appendix N of Commissioning Plan

Issues Log -- See Appendix K of Commissioning Plan

Completed Functional Test Forms -- See Appendix M of Commissioning Plan

Final Commissioning Report -- See Commissioning Plan

Tabs:

A. Systems Manual Responsibilities Matrix

B. Facility Executive Summary

Spec Section: 3.2

C. Contact Info

Spec section: 3.2 B & 3.13 A.2

D. Contract Document Acceptance Form

Spec section: 3.13 C

E. Systems Manual Acceptance Form

Spec section: 3.14 A & 3.15

F. Benchmarking & Optimization

Spec section: 3.11

G. Maintenance Agreement

Section	Description	Reviewed by Cx Agent	Prepared by				LEED Requirement	Recommended
			Construction Manager	Owner	Design Team	Contractors		
Index of Systems Manuals	Table of Contents/Index of Systems Manuals	X					X	
Owner's Project Requirements	Final Version	X		X	X		X	
Basis of Design	Final Version	X			X		X	
Facility Data:								
General Facility and System Description	Overall dimensions, number of floors, foundation types, expected number of occupants, facility category code, special building features, photographs, etc.		X		X		X	
Floor plans	Uncluttered floor plans that include only room numbers, type or function of space, and overall all facility dimensions.		X		X		X	
Utility Connection and Cutoff Plans	Provide utility site and floor plans that indicate the exterior and main interior connection and cutoff points for all utilities.		X	X	X	X		X
Extended Warranty Information	List all warranties included as part of construction for products, equipment, components and subcomponents whose duration exceeds one year. The Equipment Warranties Form located in the General Workbook of the Systems Manual is intended to be a means for the Owner to track Equipment Warranties and to be completed at the Owner's discretion.		X	X		X		X
Equipment Listing	A table that lists major equipment shown on design equipment schedules, item descriptions, locations, model numbers, name/address/phone of manufacturer, supplier, contractor, sub-contractor.		X			X	X	
HVAC Filters	Table that lists the quantity, type, size and location of each HVAC filter.					X	X	
Lighting Fixtures	Table that lists by room number, type of lighting fixture, number of lighting fixtures, type of bulbs/tubes, and number of bulbs/tubes. Include a facility summary of the total number of fixtures for each type, and number of bulbs/tubes for each type.		X	X		X		X
Plumbing Fixtures	Table that lists by room number, the number and type of plumbing and bathroom plumbing fixtures (sinks, water closets, urinals, showers, and drinking fountains).		X	X		X		X
Training Requirements	List of recommended training related to Primary Systems operation, maintenance, and repair of each installed systems that is available for the manufacturer of other source. Provide name/address/phone of point of contact.	X	X	X		X	X	
Recommended Operational Record-keeping procedures, forms, logs, rationale for each	Sample blank forms, logs, etc. with basic instructions for use.		X			X	X	
System Information								

Section	Description	Reviewed by Cx Agent	Prepared by				LEED Requirement	Recommended
			Construction Manager	Owner	Design Team	Contractors		
System Description	Narrative system description, including function, capacity, major components, etc.		X		X	X	X	
System Schematics, one-line diagrams, flow diagrams, etc.	Flow diagram indicating system liquid, air, or gas flow during normal conditions.		X		X		X	
Diagrammatic Plans	Floor plans indicating location of equipment and configuration of the system installation.		X		X		X	
Environmental Considerations	Listing of equipment that requires special operation, reporting, testing, analysis, or inspection to comply with federal state, and local environmental laws.		X		X	X	X	
Safety Information	List of all personnel hazards and equipment safety precautions.		X	X		X		X
Valve List	List of all valves associated with system. Show valve type, identification number, function, location and normal operating position.		X			X	X	
Start-up and Shut-down procedures	Step-by-step procedures to bring systems from static to operational configurations and from operating to shutdown status.		X			X	X	
Operating procedures/sequences for normal, abnormal, and emergency modes	Discussion of the normal operation and control of the system. Emergency operating instructions in the event of equipment malfunctions, fire, explosions, spills, or other contingencies.		X			X	X	
Operating instructions for integrated systems	Discussion of operating procedures for multiple, integrated systems.		X			X	X	
Ongoing Optimization Guide	Procedures for analyzing and maintaining optimal system operations.	X	X			X	X	
Schedules for calibrating sensors and actuators			X			X	X	
Manufacturer's Data								
Operation and Maintenance Data	O&M data package per the technical specifications	X	X	X	X	X	X	
Manufacturer's Equipment Information	Drawings, illustrations and product data furnished for the equipment and systems components.		X			X	X	
Training Materials		X	X	X	X	X	X	
Systems Manual Review		X	X	X	X	X	X	

SAMPLE

Project Name : Ambulatory Care Center
Owner's Name : VA
Project Number : 2013-83018
Facility Type :
Number of Floors :
Square Footage :

SYSTEMS MANUAL SPEC SECTION(S): 01 91 51 3.2 A

Facility Description: Overall description of the building and its systems, including a listing of major capabilities and limitations imposed by the design or building code.
General System Descriptions:



SYSTEMS MANUAL SPEC SECTION(S):01 91 51 3.2 B & 3.13 A.2

[illegible][illegible]



SYSTEMS MANUAL SPEC SECTION(S):01 91 51 3.2 B & 3.13 A.2

[illegible]

Project Name : Ambulatory Care Center
Owner's Name : VA
Project Number : 2013-83018

The following documents should be submitted to the Owner prior to completion of the project, per Systems Manual Spec Section 01 91 51 3.13 C:

1. The as-built contract drawings including all Division 22, 23, 26, 27, & 28. All Addenda and Bulletins should be included.
2. The as-built specifications including all Division 22, 23, 26, 27, & 28. All Addenda and Bulletins should be included.
3. All coordination drawings including all Division 22, 23, 26, 27, & 28.
4. All system single-line diagrams including all Division 22, 23, 26, 27, & 28.

Review

The above documents have been reviewed by the CM, the CxA, and the Owner. The Owner, by signing below, accepts and acknowledges the receipt of the above reviewed documents.

Construction Manager (Print Name & Company)

Signature

Date

Commissioning Authority (Print Name & Company)

Signature

Date

Owner's Representative (Print Name & Company)

Signature

Date

Project Name : Ambulatory Care Center
Owner's Name : VA
Project Number : 2013-83018

The Systems Manual should be submitted to the Owner prior to completion of the project, per the Systems Manual Spec Section 01 91 51 3.14 A & 3.15.

Contractors to submit training agenda, video taped training if applicable and attendance sheets to the CM and CxA within 14 days of completing the first training session. CM to forward to the owner to be inserted into the Systems Manual.

Review
The Systems Manual has been reviewed by the CM, the CxA, and the Owner. The Owner, by signing below, accepts and acknowledges the receipt of the above reviewed documents.

Construction Manager (Print Name & Company)

Signature

Date

Commissioning Authority (Print Name & Company)

Signature

Date

Owner's Representative (Print Name & Company)

Signature

Date

Heapy to insert BLANK Functional Test Forms HERE

Heapy recommends systems are retested annually to ensure proper operation and optimal performance for the systems that were commissioned (See Appendix F of the Commissioning Plan).

During annual retesting, sensors should be calibrated, all actuators should be verified to be properly operating including confirmation that the actuators stroke completely without binding, safeties are good working order, and sequences of operation are functioning properly. The blank Functional Testing Procedures that follow detail the annual retesting procedures.



The Table below is intended to be a means for the Owner to track Equipment Maintenance Agreements and to be completed at the Owner's discretion.

[illegible]



Ambulatory Care Center
VA
2013-83018

Ambulatory Care Center
VA
2013-83018

2

Project Name: Ambulatory Care Center

Owner Name: VA

1. System/Assembly Executive Summary

Spec Section: 3.13 A.1

2. Equipment Summary

Spec Section: 3.13 A.1, C, D, & J

3. Preventative Maintenance Schedule

Spec section: 3.9 & 3.13 G

4. Preventative Maintenance Material

Spec section: 3.9 & 3.13 G

5. Spare Parts List

Spec section: 3.13 J.2

6. Equipment Record Keeping

Spec section: 3.10 & 3.13 H

7. Facilities Operating Procedure Form

Spec section: 3.8 & 3.13 F

8. Troubleshooting Procedure Form

Project Name:

Ambulatory Care Center

Owner's Name:

VA

Project Number:

2013-83018

SYSTEMS MANUAL SPEC SECTION(S):

01 91 51 3.13 A

Warranty Type:	Warranty Coverage:	Begin Date:	End Date:
Standard:			
Extended:			

Equipment Type:	VAV Terminals
-----------------	---------------

Schematics Location:

System Description:

Include a listing of capabilities and limitations imposed by the design or building code.

The new addition to the VA ambulatory care center will be served by 46 additional VAV box's which are served by RTU-8, RTU-10, and RTU-12. All added VAV's will be provided with Hot water reheat.

Project Name:

Owner's Name:

Project Number:

Equipment Type:

Ambulatory Care Center

VA

2013-83018

VAV Terminals

SYSTEMS MANUAL SPEC SECTION(S):01 91 51 3.13 A.1, C, D, & J

UNIT INFORMATION					
UNIT #	UNIT LOCATION	MAINTAINED AREA	MODEL #	SERIAL #	UNIT DESCRIPTION
VAV-1					
VAV-2					
VAV-3					
VAV-4					
VAV-5					
VAV-6					
VAV-7					
VAV-8					
VAV-9					
VAV-10					
VAV-11					
VAV-12					
VAV-13					
VAV-14					
VAV-15					
VAV-16					
VAV-17					
VAV-18					
VAV-19					
VAV-20					
VAV-21					

Project Name: Ambulatory Care Center
Owner's Name: VA
Project Number: 2013-83018
Equipment Type: VAV Terminals

SYSTEMS MANUAL SPEC SECTION(S):01 91 51 3.13 A.1, C, D, & J

UNIT INFORMATION					
UNIT #	UNIT LOCATION	MAINTAINED AREA	MODEL #	SERIAL #	UNIT DESCRIPTION
VAV-22					
VAV-23					
VAV-24					
VAV-25					
VAV-26					
VAV-27					
VAV-28					
VAV-29					
VAV-30					
VAV-31					
VAV-32					
VAV-33					
VAV-34					
VAV-35					
VAV-36					
VAV-37					
VAV-38					
VAV-39					
VAV-40					
VAV-41					
VAV-42					

Project Name:

Owner's Name:

Project Number:

Equipment Type:

Ambulatory Care Center

VA

2013-83018

VAV Terminals

SYSTEMS MANUAL SPEC SECTION(S):01 91 51 3.13 A.1, C, D, & J

UNIT INFORMATION				
UNIT #	UNIT LOCATION	MAINTAINED AREA	MODEL #	SERIAL #
VAV-43				
VAV-44				
VAV-45A				
VAV-46A				



VA
2013-83018
VAV Terminals
UAL SPEC SECTION(S):01 91 51 3.9 & 3.13.G

[illegible]



SYSTEMS MANUAL SPEC SECTION(S):01 91 51 3.9 & 3.13.G

[illegible]



Ambulatory Care Center
 VA
 2013-83018
 VAV Terminals
 JAL SPEC SECTION(S):01 91 51 3.13 J.2

[illegible]



Owner's Name : VA

Equipment Type: VAV Terminals

SYSTEMS MANUAL SPEC SECTION(S):01 91 51 3.10 & 3.13.H

Legend - Data Type: BI=Binary Input, BO=Binary Output, AI=Analog Input, AO=Analog Output, AV=Analog Value, BV=Binary Value, RT=Run Time

Recommended Equipment Record Keeping

[illegible]

Project Name : Ambulatory Care Center

Owner's Name : VA

Project Number : 2013-83018

Equipment Type: VAV Terminals

SYSTEMS MANUAL SPEC SECTION(S):01 91 51 3.8 & 3.13 F

Equipment Start-up Procedures

Project Name : Ambulatory Care Center

Owner's Name : VA

Project Number : 2013-83018

Equipment Type: VAV Terminals

SYSTEMS MANUAL SPEC SECTION(S):01 91 51 3.8 & 3.13 F

Equipment Shut-down Procedures

Project Name : Ambulatory Care Center
Owner's Name : VA
Project Number : 2013-83018
Equipment Type: VAV Terminals

SYSTEMS MANUAL

**Trouble Shooting
Procedures**

SECTION 02 41 00
DEMOLITION

PART 1 - GENERAL

1.1 DESCRIPTION:

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

1.2 RELATED WORK:

- A. Demolition and removal of roads, walks, curbs, and on-grade slabs outside buildings to be demolished: Section 31 20 00, EARTH MOVING.
- B. Safety Requirements: GENERAL CONDITIONS Article, ACCIDENT PREVENTION.
- C. Disconnecting utility services prior to demolition: Section 01 00 00, GENERAL REQUIREMENTS.
- D. Reserved items that are to remain the property of the Government: Section 01 00 00, GENERAL REQUIREMENTS.
- E. Environmental Protection: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.
- F. Construction Waste Management: Section 017419 CONSTRUCTION WASTE MANAGEMENT.
- G. Infectious Control: Section 01 00 00, GENERAL REQUIREMENTS, Article 1.7, INFECTION PREVENTION MEASURES.

1.3 PROTECTION:

- A. Perform demolition in such manner as to eliminate hazards to persons and property; to minimize interference with use of adjacent areas, utilities and structures or interruption of use of such utilities; and to provide free passage to and from such adjacent areas of structures. Comply with requirements of GENERAL CONDITIONS Article, ACCIDENT PREVENTION.
- B. Provide safeguards, including warning signs, barricades, temporary fences, warning lights, and other similar items that are required for protection of all personnel during demolition and removal operations. Comply with requirements of Section 01 00 00, GENERAL REQUIREMENTS, Article PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES AND IMPROVEMENTS.
- C. Maintain fences, barricades, lights, and other similar items around exposed excavations until such excavations have been completely filled.
- D. Provide enclosed dust chutes with control gates from each floor to carry debris to truck beds and govern flow of material into truck. Provide overhead bridges of tight board or prefabricated metal construction at dust chutes to protect persons and property from falling debris.

- E. Prevent spread of flying particles and dust. Sprinkle rubbish and debris with water to keep dust to a minimum. Do not use water if it results in hazardous or objectionable condition such as, but not limited to; ice, flooding, or pollution. Vacuum and dust the work area daily.
- F. In addition to previously listed fire and safety rules to be observed in performance of work, include following:
 - 1. No wall or part of wall shall be permitted to fall outwardly from structures.
 - 2. Maintain at least one stairway in each structure in usable condition to highest remaining floor. Keep stairway free of obstructions and debris until that level of structure has been removed.
 - 3. Wherever a cutting torch or other equipment that might cause a fire is used, provide and maintain fire extinguishers nearby ready for immediate use. Instruct all possible users in use of fire extinguishers.
 - 4. Keep hydrants clear and accessible at all times. Prohibit debris from accumulating within a radius of 4500 mm (15 feet) of fire hydrants.
- G. Before beginning any demolition work, the Contractor shall survey the site and examine the drawings and specifications to determine the extent of the work. The contractor shall take necessary precautions to avoid damages to existing items to remain in place, to be reused, or to remain the property of the VAACC; 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 1.7 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 VAACC Property 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. Remove and legally dispose of all materials, other than earth to remain as part of project work, from any trash dumps shown. Materials removed shall become property of contractor and shall be disposed of in compliance with applicable federal, state or local permits, rules and/or regulations. All materials in the indicated trash dump areas, including above surrounding grade and extending to a depth of 1500mm (5feet) below surrounding grade, shall be included as part of the lump sum compensation for the work of this section. Materials that are located beneath the surface of the surrounding ground more than 1500 mm (5 feet), or materials that are discovered to be hazardous, shall be handled as unforeseen. The removal of hazardous material shall be referred to Hazardous Materials specifications.
- D. Remove existing utilities as indicated or uncovered by work and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the COR. When Utility lines are encountered that are not indicated on the drawings, the COR shall be notified prior to further work in that area.
- E. Items noted to be removed and reinstalled shall be removed without causing damage to the item, cleaned, and stored for reinstallation in new construction. Contractor shall be responsible for replacement of items to be reinstalled if damage occurs during removal or storage.

3.2 CLEAN-UP:

On completion of work of this section and after removal of all debris, leave site in clean condition satisfactory to COR. Clean-up shall include off the VAACC Property 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.

- - - E N D - - -

SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 DESCRIPTION:

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

1.2 RELATED WORK:

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

1.3 TESTING AGENCY FOR CONCRETE MIX DESIGN:

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

1.4 TOLERANCES:

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

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

1.5 REGULATORY REQUIREMENTS:

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

1.6 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Shop Drawings: Reinforcing steel: Complete shop drawings
- C. Mill Test Reports:
 1. Reinforcing Steel.
 2. Cement.
- D. Manufacturer's Certificates:
 1. Abrasive aggregate.
 2. 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. Expansion joint filler.
 10. Adhesive binder.
- E. Testing Agency for Concrete Mix Design: Approval request including qualifications of principals and technicians and evidence of active participation in program of Cement and Concrete Reference Laboratory (CCRL) of National Institute of Standards and Technology and copy of report of latest CCRL, Inspection of Laboratory.
- F. Test Report for Concrete Mix Designs: Trial mixes including water-cement fly ash ratio curves, concrete mix ingredients, and admixtures.

1.7 DELIVERY, STORAGE, AND HANDLING:

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

- 211.1-91(R2009).....Standard Practice for Selecting Proportions for
Normal, Heavyweight, and Mass Concrete
- 211.2-98(R2004).....Standard Practice for Selecting Proportions for
Structural Lightweight Concrete
- 214R-11.....Guide to Evaluation of Strength Test Results of
Concrete
- 301-10.....Standard Practice for Structural Concrete
- 304R-00(R2009).....Guide for Measuring, Mixing, Transporting, and
Placing Concrete
- 305.1-06.....Specification for Hot Weather Concreting
- 306.1-90(R2002).....Standard Specification for Cold Weather
Concreting
- 308.1-11.....Specification for Curing Concrete
- 309R-05.....Guide for Consolidation of Concrete
- 318-11.....Building Code Requirements for Structural
Concrete and Commentary
- 347-04.....Guide to Formwork for Concrete
- SP-66-04.....ACI Detailing Manual
- C. American National Standards Institute and American Hardboard Association
(ANSI/AHA):
 - A135.4-2004.....Basic Hardboard
- D. American Society for Testing and Materials (ASTM):
 - A82/A82M-07.....Standard Specification for Steel Wire, Plain,
for Concrete Reinforcement
 - A185/185M-07.....Standard Specification for Steel Welded Wire
Reinforcement, Plain, for Concrete
 - A615/A615M-09.....Standard Specification for Deformed and Plain
Carbon Steel Bars for Concrete Reinforcement
 - A653/A653M-11.....Standard Specification for Steel Sheet, Zinc
Coated (Galvanized) or Zinc Iron Alloy Coated
(Galvannealed) by the Hot Dip Process
 - A706/A706M-09.....Standard Specification for Low Alloy Steel
Deformed and Plain Bars for Concrete
Reinforcement
 - A767/A767M-09.....Standard Specification for Zinc Coated
(Galvanized) Steel Bars for Concrete
Reinforcement
 - A775/A775M-07.....Standard Specification for Epoxy Coated
Reinforcing Steel Bars

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

C666/C666M-03 (R2008)....Standard Test Method for Resistance of Concrete
to Rapid Freezing and Thawing

C881/C881M-10.....Standard Specification for Epoxy Resin Base
Bonding Systems for Concrete

C1107/1107M-11.....Standard Specification for Packaged Dry,
Hydraulic-Cement Grout (Non-shrink)

- C1315-11.....Standard Specification for Liquid Membrane
Forming Compounds Having Special Properties for
Curing and Sealing Concrete
- D6-95(R2011).....Standard Test Method for Loss on Heating of Oil
and Asphaltic Compounds
- D297-93(R2006).....Standard Methods for Rubber Products Chemical
Analysis
- D412-06AE2.....Standard Test Methods for Vulcanized Rubber and
Thermoplastic Elastomers - Tension
- D1751-04(R2008).....Standard Specification for Preformed Expansion
Joint Filler for Concrete Paving and Structural
Construction (Non-extruding and Resilient
Bituminous Types)
- D4263-83(2012).....Standard Test Method for Indicating Moisture in
Concrete by the Plastic Sheet Method.
- D4397-10.....Standard Specification for Polyethylene Sheeting
for Construction, Industrial and Agricultural
Applications
- E1155-96(R2008).....Standard Test Method for Determining F_F Floor
Flatness and F_L Floor Levelness Numbers
- F1869-11.....Standard Test Method for Measuring Moisture
Vapor Emission Rate of Concrete Subfloor Using
Anhydrous Calcium Chloride.
- E. American Welding Society (AWS):
D1.4/D1.4M-11.....Structural Welding Code - Reinforcing Steel
- F. Concrete Reinforcing Steel Institute (CRSI):
Handbook 2008
- G. National Cooperative Highway Research Program (NCHRP):
Report On.....Concrete Sealers for the Protection of Bridge
Structures
- H. U. S. Department of Commerce Product Standard (PS):
PS 1.....Construction and Industrial Plywood
PS 20.....American Softwood Lumber
- I. U. S. Army Corps of Engineers Handbook for Concrete and Cement:
CRD C513.....Rubber Waterstops
CRD C572.....Polyvinyl Chloride Waterstops

PART 2 - PRODUCTS:

2.1 FORMS:

- A. Wood: PS 20 free from loose knots and suitable to facilitate finishing concrete surface specified; tongue and grooved.
- B. Plywood: PS-1 Exterior Grade B-B (concrete-form) 16 mm (5/8 inch), or 20 mm (3/4 inch) thick for unlined contact form. B-B High Density Concrete Form Overlay optional.
- C. Permanent Steel Form for Concrete Slabs: Corrugated, ASTM A653, Grade E, and Galvanized, ASTM A653, G90. Provide venting where insulating concrete fill is used.
- D. 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.
- E. 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.
- F. Form Ties: Develop a minimum working strength of 13.35 kN (3000 pounds) when fully assembled. Ties shall be adjustable in length to permit tightening of forms and not have any lugs, cones, washers to act as spreader within form, nor leave a hole larger than 20 mm (3/4 inch) diameter, or a depression in exposed concrete surface, or leave metal closer than 40 mm (1 1/2 inches) to concrete surface. Wire ties not permitted. Cutting ties back from concrete face not permitted.

2.2 MATERIALS:

- A. Portland Cement: ASTM C150 Type I or II.
- B. Fly Ash: ASTM C618, Class C or F including supplementary optional requirements relating to reactive aggregates and alkalies, and loss on ignition (LOI) not to exceed 5 percent.
- C. Coarse Aggregate: ASTM C33.
 - 1. Size 67 or Size 467 may be used for footings and walls over 300 mm (12 inches) thick.
 - 2. Coarse aggregate for applied topping, encasement of steel columns, and metal pan stair fill shall be Size 7.
 - 3. Maximum size of coarse aggregates not more than one-fifth of narrowest dimension between sides of forms, one-third of depth of

slabs, nor three-fourth of minimum clear spacing between reinforcing bars.

- D. Lightweight Aggregates for Structural Concrete: ASTM C330, Table 1. Maximum size of aggregate not larger than one-fifth of narrowest dimension between forms, nor three-fourth of minimum clear distance between reinforcing bars. Contractor to furnish certified report to verify that aggregate is sound and durable, and has a durability factor of not less than 80 based on 300 cycles of freezing and thawing when tested in accordance with ASTM C666.
- E. Fine Aggregate: ASTM C33. Fine aggregate for applied concrete floor topping shall pass a 4.75 mm (No. 4) sieve, 10 percent maximum shall pass a 150 μ m (No. 100) sieve.
- F. Mixing Water: Fresh, clean, and potable.
- G. Admixtures:
1. Water Reducing Admixture: ASTM C494, Type A and not contain more chloride ions than are present in municipal drinking water.
 2. Water Reducing, Retarding Admixture: ASTM C494, Type D and not contain more chloride ions than are present in municipal drinking water.
 3. High-Range Water-Reducing Admixture (Superplasticizer): ASTM C494, Type F or G, and not contain more chloride ions than are present in municipal drinking water.
 4. Non-Corrosive, Non-Chloride Accelerator: ASTM C494, Type C or E, and not contain more chloride ions than are present in municipal drinking water. Admixture manufacturer must have long-term non-corrosive test data from an independent testing laboratory of at least one year duration using an acceptable accelerated corrosion test method such as that using electrical potential measures.
 5. Air Entraining Admixture: ASTM C260.
 6. Prohibited Admixtures: Calcium chloride, thiocyanate or admixtures containing more than 0.05 percent chloride ions are not permitted.
 7. Certification: Written conformance to the requirements above and the chloride ion content of the admixture prior to mix design review.
- H. Vapor Barrier: ASTM D4397, 0.38 mm (15 mil).
- I. Reinforcing Steel: ASTM A615, or ASTM A996, deformed, grade as shown.
- J. Welded Wire Fabric: ASTM A185.
- K. Reinforcing Bars to be Welded: ASTM A706.
- L. Galvanized Reinforcing Bars: ASTM A767.
- M. Epoxy Coated Reinforcing Bars: ASTM A775.

- N. 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).
- O. Supports, Spacers, and Chairs: Types which will hold reinforcement in position shown in accordance with requirements of ACI 318 except as specified.
- P. Expansion Joint Filler: ASTM D1751.
- Q. Sheet Materials for Curing Concrete: ASTM C171.
- R. Liquid Membrane-forming Compounds for Curing Concrete: ASTM C309, Type I, with fugitive dye, and shall meet the requirements of ASTM C1315. Compound shall be compatible with scheduled surface treatment, such as paint and resilient tile, and shall not discolor concrete surface.
- S. Abrasive Aggregate: Aluminum oxide grains or emery grits.
- T. Moisture Vapor Emissions & Alkalinity Control Sealer: 100% active colorless aqueous silicate solution concrete surface.
 - 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.
- U. 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.

V. Adhesive Binder: ASTM C881.

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

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

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

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. include dry unit weight of lightweight structural concrete.

3. Prepare a curve showing relationship between water-cement-fly ash ratio at 7-day and 28-day compressive strengths. Plot each curve using at least three specimens.

4. If the field experience method is used, submit complete standard deviation analysis.

B. Fly Ash Testing: Submit certificate verifying conformance with ASTM 618 initially with mix design and for each truck load of fly ash delivered from source. Submit test results performed within 6 months of submittal date. Notify COR immediately when change in source is anticipated.

1. Testing Laboratory used for fly ash certification/testing shall participate in the Cement and Concrete Reference Laboratory (CCRL) program. Submit most recent CCRL inspection report.

C. After approval of mixes no substitution in material or change in proportions of approval mixes 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. Fly ash shall not be used in high-early mix design.

TABLE I - CEMENT AND WATER FACTORS FOR CONCRETE

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

1. If trial mixes are used, the proposed mix design shall achieve a compressive strength 8.3 MPa (1200 psi) in excess of f'c. For concrete strengths above 35 Mpa (5000 psi), the proposed mix design shall achieve a compressive strength 9.7 MPa (1400 psi) in excess of f'c.
 2. Lightweight Structural Concrete. Pump mixes may require higher cement values.
 3. For concrete exposed to high sulfate content soils maximum water cement ratio is 0.44.
 4. Determined by Laboratory in accordance with ACI 211.1 for normal concrete or ACI 211.2 for lightweight structural concrete.
- 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	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	

**TABLE IV
AIR CONTENT OF LIGHTWEIGHT STRUCTURAL CONCRETE**

Nominal Maximum size of Total Air Content	Coarse Aggregate, mm's (Inches) Percentage by Volume
Greater than 10 mm (3/8 in) 4 to 8	10 mm (3/8 in) or less 5 to 9

- H. High early strength concrete, made with Type III cement or Type I cement plus non-corrosive accelerator, shall have a 7-day compressive strength equal to specified minimum 28-day compressive strength for concrete type specified made with standard Portland cement.
- I. Lightweight structural concrete shall not weigh more than air-dry unit weight shown. Air-dry unit weight determined on 150 mm by 300 mm (6 inch by 12 inch) test cylinders after seven days standard moist curing followed by 21 days drying at 23 degrees C \pm 1.7 degrees C (73.4 \pm 3 degrees Fahrenheit), and 50 (plus or minus 7) percent relative humidity. Use wet unit weight of fresh concrete as basis of control in field.
- J. 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 and concrete with a water/cement ratio below 0.50 use high-range water-reducing admixture (superplasticizer).

- K. Durability: Use air entrainment for exterior exposed concrete subjected to freezing and thawing and other concrete shown or specified. For air content requirements see Table III or Table IV.
- L. 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 38°C (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.
 1. Form boards and plywood forms may be reused for contact surfaces of exposed concrete only if thoroughly cleaned, patched, and repaired and COR approves their reuse.
 2. Provide forms for concrete footings unless COR determines forms are not necessary.
 3. Corrugated fiberboard forms: Place forms on a smooth firm bed, set tight, with no buckled cartons to prevent horizontal displacement, and in a dry condition when concrete is placed.
- B. Treating and Wetting: Treat or wet contact forms as follows:
 1. Coat plywood and board forms with non-staining form sealer. In hot weather, cool forms by wetting with cool water just before concrete is placed.
 2. Clean and coat removable metal forms with light form oil before reinforcement is placed. In hot weather, cool metal forms by thoroughly wetting with water just before placing concrete.
 3. Use sealer on reused plywood forms as specified for new material.
- C. Size and Spacing of Studs: Size and space studs, wales and other framing members for wall forms so as not to exceed safe working stress of kind

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

- D. Unlined Forms: Use plywood forms to obtain a smooth finish for concrete surfaces. Tightly butt edges of sheets to prevent leakage. Back up all vertical joints solidly and nail edges of adjacent sheets to same stud with 6d box nails spaced not over 150 mm (6 inches) apart.
- E. Lined Forms: May be used in lieu of unlined plywood forms. Back up form lining solidly with square edge board lumber securely nailed to studs with all edges in close contact to prevent bulging of lining. No joints in lining and backing 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 blue shingle or similar nails with thin flatheads.
- F. 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.
- G. 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, 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. 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.

2. Install sleeves in beams that are not shown, but are permitted by the COR, and require no structural changes, at no additional cost to the Government.
3. 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.
4. Provide recesses and blockouts in floor slabs for door closers and other hardware as necessary in accordance with manufacturer's instructions.

H. 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.
- B. Placing: Place reinforcement conforming to CRSI DA4, unless otherwise shown.
 1. Place reinforcing bars accurately and tie securely at intersections and splices with 1.6 mm (16 gauge) black annealed wire. Use epoxy-coated tie wire with epoxy-coated reinforcing. Secure reinforcing bars against displacement during the placing of concrete by spacers, chairs, or other similar supports. Portions of supports, spacers, and chairs in contact with formwork shall be made of plastic in areas that 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.
- C. Spacing: Minimum clear distances between parallel bars shall be equal to nominal diameter of bars. Minimum clear spacing is 25 mm (1 inch) or 1-1/3 times maximum size of coarse aggregate.
- D. 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.
 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.

3.3 VAPOR BARRIER:

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

3.4 SLABS RECEIVING RESILIENT COVERING

- A. Slab shall be allowed to cure for 6 weeks minimum prior to placing resilient covering. After curing, slab shall be tested by the Contractor for moisture in accordance with ASTM D4263 or ASTM F1869. Moisture content shall be less than 3 pounds per 1000 sf prior to placing covering.
- B. In lieu of curing for 6 weeks, Contractor has the option, at his own cost, to utilize the Moisture Vapor Emissions & Alkalinity Control Sealer as follows:
1. Sealer is applied on the day of the concrete pour or as soon as harsh weather permits, prior to any other chemical treatments for concrete slabs either on grade, below grade or above grade receiving resilient flooring, such as, sheet vinyl, vinyl composition tile, rubber, wood flooring, epoxy coatings and overlays.
 2. Manufacturer's representative 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.
 - a. Apply Sealer to concrete slabs as soon as final finishing operations are complete and the concrete has hardened sufficiently to sustain floor traffic without damage.
 - b. Spray apply Sealer at the rate of 20 m² (200 square feet) per gallon. Lightly broom product evenly over the substrate and product has completely penetrated the surface.
 - c. If within two (2) hours after initial application areas are subjected to heavy rainfall and puddling occurs, reapply Sealer product to these areas as soon as weather condition permits.

3.5 CONSTRUCTION JOINTS:

- A. Unless otherwise shown, location of construction joints to limit individual placement shall not exceed 24,000 mm (80 feet) in any horizontal direction, except slabs on grade which shall have construction joints shown. Allow 48 hours to elapse between pouring adjacent sections unless this requirement is waived by COR.
- B. Locate construction joints in suspended floors near the quarter-point of spans for slabs. Provide longitudinal keys as shown.

3.6 EXPANSION JOINTS AND CONTRACTION JOINTS:

- A. Clean expansion joint surfaces before installing premolded filler and placing adjacent concrete.
- B. Provide contraction (control) joints in floor slabs as indicated on the contract drawings. Joints shall be either formed or saw cut, to the indicated depth after the surface has been finished. Complete saw joints within 4 to 12 hours after concrete placement. Protect joints from intrusion of foreign matter.

3.7 PLACING CONCRETE:

- A. Preparation:
 - 1. Remove hardened concrete, wood chips, shavings and other debris from forms.
 - 2. Remove hardened concrete and foreign materials from interior surfaces of mixing and conveying equipment.
 - 3. Have forms and reinforcement inspected and approved by COR before depositing concrete.
 - 4. Provide runways for wheeling equipment to convey concrete to point of deposit. Keep equipment on runways which are not supported by or bear on reinforcement. Provide similar runways for protection of vapor barrier on coarse fill.
- B. Bonding: Before depositing new concrete on or against concrete which has been set, thoroughly roughen and clean existing surfaces of laitance, foreign matter, and loose particles.
 - 1. Preparing surface for applied topping:
 - a. Remove laitance, mortar, oil, grease, paint, or other foreign material by sand blasting. Clean with vacuum type equipment to remove sand and other loose material.
 - b. Broom clean and keep base slab wet for at least four hours before topping is applied.
 - c. Use a thin coat of one part Portland cement, 1.5 parts fine sand, bonding admixture; and water at a 50: 50 ratio and mix to achieve the consistency of thick paint. Apply to a damp base slab by

scrubbing with a stiff fiber brush. New concrete shall be placed while the bonding grout is still tacky.

- C. Conveying Concrete: Convey concrete from mixer to final place of deposit by a method which will prevent segregation. Method of conveying concrete is 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.
 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 its 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:

Follow the recommendations of ACI 305 or as specified to prevent problems in the manufacturing, placing, and curing of concrete that can adversely affect the properties and serviceability of the hardened concrete. Methods proposed for cooling materials and arrangements for protecting concrete shall be made in advance of concrete placement and approved by COR.

3.9 COLD WEATHER:

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

3.10 PROTECTION AND CURING:

- A. Conform to ACI 308: Initial curing shall immediately follow the finishing operation. Protect exposed surfaces of concrete from premature drying, wash by rain and running water, wind, mechanical injury, and excessively hot or cold temperatures. Keep concrete not covered with membrane or other curing material continuously wet for at least 7 days after placing, except wet curing period for high-early-strength concrete shall be not less than 3 days. Keep wood forms continuously wet to prevent moisture loss until forms are removed. Cure exposed concrete surfaces as described below. Other curing methods 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.
- 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.

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.
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.
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	F _F 25/F _L 20
b) Minimum local value	F _F 17/F _L 15
 - 2) Unshored suspended slabs:

a) Specified overall value	FF 25
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- b) Minimum local value FF 17
 - 3) 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) Unshored suspended slabs:
 - a) Specified overall value FF 30
 - b) Minimum local value FF 24
 - 3) 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 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 F_F/F_L numbers, that section shall be rejected and remedial measures shall be required. Sectional boundaries may be set at construction and contraction (control) joints, and not smaller than one-half bay.
- b. If composite value of entire slab installation, combination of all local results, measures less than either of specified overall F_F/F_L numbers, then whole slab shall be rejected and remedial measures shall be required.

14. Remedial Measures for Rejected Slabs: Correct rejected slab areas by grinding, planing, surface repair with underlayment compound or repair topping, retopping, or removal and replacement of entire rejected slab areas, as directed by 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 m^2 (7.5 percent per square foot) of area. Trowel concrete surface to smooth dense finish. After curing, rub treated surface with abrasive brick and water to slightly expose abrasive aggregate.

3.15 APPLIED TOPPING:

- A. Separate concrete topping on floor base slab of thickness and strength shown. Topping mix shall have a maximum slump of 200 mm (8 inches) for concrete containing a high-range water-reducing admixture (superplasticizer) and 100 mm (4 inches) for conventional mix. Neatly bevel or slope at door openings and at slabs adjoining spaces not receiving an applied finish.
- B. Placing: Place continuously until entire section is complete, struck off with straightedge, leveled with a highway straightedge or highway bull

float, floated and troweled by machine to a hard dense finish. Slope to floor drains as required. Do not start floating until free water has disappeared and no water sheen is visible. Allow drying of surface moisture naturally. Do not hasten by "dusting" with cement or sand.

3.16 PRECAST CONCRETE ITEMS:

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

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**SECTION 04 05 13
MASONRY MORTARING**

PART 1 - GENERAL

1.1 DESCRIPTION:

Section specifies mortar materials and mixes.

1.2 RELATED WORK:

- A. Mortar used in Section:
 - 1. Section 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:
 - Type M: Minimum 17230 kPa (2500 psi) at 28 days.
 - Type S: Minimum 12400 kPa (1800 psi) at 28 days.
 - Type N: Minimum 5170 kPa (750 psi) at 28 days.
 - 3. Cement:
 - a. Test for water soluble alkali (nonstaining) when nonstaining cement is specified.
 - b. Nonstaining cement shall contain not more than 0.03 percent water soluble alkali.
 - 4. Sand: Test for deleterious substances, organic impurities, soundness and grading.

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. Indicating that following items meet specifications:

- a. Portland cement.
- b. Mortar cement.
- c. Hydrated lime.
- d. Fine aggregate (sand).

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

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
C1329-05.....Mortar Cement

PART 2 - PRODUCTS

2.1 HYDRATED LIME

ASTM C207, Type S.

2.2 AGGREGATE FOR MASONRY MORTAR

A. ASTM C144.

2.3 BLENDED HYDRAULIC CEMENT

ASTM C595, Type IS, IP.

2.4 MORTAR CEMENT

ASTM C1329, Type N, S or M.

2.5 PORTLAND CEMENT

A. ASTM C150, Type I.

2.6 LIQUID ACRYLIC RESIN

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

2.7 WATER

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

2.8 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.

2.9 MASONRY MORTAR

A. Conform to ASTM C270.

B. Admixtures:

1. Do not use mortar admixtures, except for high bond mortar 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.

2.10 HIGH BOND MORTAR

A. Mixture by volume, one-part Portland cement, 1/4-part hydrated lime, three-parts sand, water, and liquid acrylic resin.

B. Mortar properties when tested in accordance with referenced specifications.

1. Compressive Strength, ASTM C109: Minimum 19,305 kPa (2800 psi), using 50 mm (2 inch) cubes.
2. Tensile Strength, ASTM C307: 3861 kPa Minimum (560 psi), using the 25mm (1 inch) briquettes.
3. Flexural Strength, ASTM C348: Minimum 6067 kPa (880 psi), using flexural bar.
4. Bond Strength, ASTM C321: Minimum 2965 kPa (430 psi), using crossed brick.

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.

3.2 MORTAR USE LOCATION

- A. Use Type S mortar for masonry containing vertical reinforcing bars.
- B. For brick veneer over frame back up walls, use Type N portland cement-lime mortar or Type S masonry cement or mortar cement mortar.
- C. Use Type N mortar for other masonry work, except as otherwise specified.

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SECTION 04 05 16
MASONRY GROUTING

PART 1 - GENERAL

1.1 DESCRIPTION:

Section specifies grout materials and mixes.

1.2 RELATED WORK:

A. Grout used in Section:

1. Section 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. Nonstaining cement shall contain not more than 0.03 percent water soluble alkali.

4. Sand: Test for deleterious substances, organic impurities, soundness and grading.

1.4 SUBMITTALS:

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

B. Certificates:

1. Indicating that following items meet specifications:

a. Portland cement.

b. Grout.

c. Hydrated lime.

d. Fine aggregate (sand).

e. Coarse aggregate for grout.

C. Laboratory Test Reports:

1. Grout, each type.
2. Admixtures.

D. Manufacturer's Literature and Data:

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

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING:

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

1.6 APPLICABLE PUBLICATIONS:

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

PART 2 - PRODUCTS

2.1 HYDRATED LIME:

ASTM C207, Type S.

2.2 AGGREGATE FOR MASONRY GROUT:

ASTM C404, Size 8.

2.3 BLENDED HYDRAULIC CEMENT:

ASTM C595, Type IS, IP.

2.4 PORTLAND CEMENT:

- A. ASTM C150, Type I.

2.5 LIQUID ACRYLIC RESIN:

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

2.6 WATER:

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

2.7 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.

- - - E N D - - -

SECTION 04 20 00
UNIT MASONRY

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies requirements for construction of masonry unit walls.

1.2 RELATED WORK

- A. Mortars and grouts: Section 04 05 13, MASONRY MORTARING, Section 04 05 16, MASONRY GROUTING.
- B. Steel lintels and shelf angles: Section 05 50 00, METAL FABRICATIONS.
- C. Flashing: Section 07 60 00, FLASHING AND SHEET METAL.
- D. Sealants and sealant installation: Section 07 92 00, JOINT SEALANTS.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS and PRODUCT DATA SAMPLES.
- B. Shop Drawings:
 - 1. Drawings, showing reinforcement, applicable dimensions and methods of hanging soffit or lintel masonry and reinforcing masonry for embedment of anchors for hung fixtures.
 - 2. Shop Drawings: Submit shop drawings for fabrication, bending, and placement of reinforcing bars. Comply with ACI 315. Show bar schedules, diagrams of bent bars, stirrup spacing, lateral ties and other arrangements and assemblies as required for fabrication and placement of reinforcement for unit masonry work.
- C. Certificates:
 - 1. Certificates signed by manufacturer, including name and address of contractor, project location, and the quantity, and date or dates of shipment of delivery to which certificate applies.
 - 2. Indicating that the following items meet specification requirements:
 - a. Solid and load-bearing concrete masonry units, including fire-resistant rated units.
 - 3. Testing laboratories facilities and qualifications of its principals and key personnel to perform tests specified.
- D. Manufacturer's Literature and Data:
 - 1. Anchors, ties, and reinforcement.
 - 2. Reinforcing bars.

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 PropertiesC34-03 Structural Clay Load-Bearing Wall Tile
 - C90-11.....Load-Bearing Concrete Masonry Units
 - C476-10.....Standard Specification for Grout for Masonry
 - C612-10.....Mineral Fiber Block and Board Thermal Insulation
 - D1056-07.....Flexible Cellular Materials - Sponge or Expanded Rubber
 - D2000-08.....Rubber Products in Automotive Applications
 - D3574-08.....Flexible Cellular Materials-Slab, Bonded, and Molded Urethane Foams
 - F1667-11.....Fasteners: Nails, Spikes and Staples
- C. Masonry Industry Council:
- Hot and Cold Weather Masonry Construction Manual-98 (R2000).
- D. Federal Specifications (FS):
- FF-S-107C-00.....Screws, Tapping and Drive
- E. 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).
- F. American Welding Society (AWS):
- SD1.4-11.....Structural Welding Code - Reinforcing

PART 2 - PRODUCTS

2.1 CONCRETE MASONRY UNITS

- A. Hollow and Solid Load-Bearing Concrete Masonry Units: ASTM C90.
1. Unit Weight: lightweight unless otherwise indicated.
 2. Fire rated units for fire rated partitions.
 3. Sizes: Modular.
 4. For molded faces used as a finished surface, use concrete masonry units with uniform fine to medium surface texture unless specified otherwise.

2.2 ANCHORS, TIES, AND REINFORCEMENT

- A. Steel Reinforcing Bars: ASTM A615M, deformed bars, grade as shown.

B. Joint Reinforcement:

1. Form from wire complying with ASTM A951.
2. Galvanized after fabrication.
3. Width of joint reinforcement 40 mm (0.16 inches) less than nominal width of masonry wall or partition.
4. Cross wires welded to longitudinal wires.
5. Joint reinforcement at least 3000 mm (10 feet) in length.
6. Joint reinforcement in rolls is not acceptable.
7. Joint reinforcement that is crimped to form drip is not acceptable.
8. Maximum spacing of cross wires 400 mm (16 inch) to longitudinal wires.
9. Ladder Design:
 - a. Longitudinal wires deformed 5 mm (0.20 inch) diameter wire.
 - b. Cross wires 4 mm (0.16 inch) diameter.
10. Trussed Design:
 - a. Longitudinal and cross wires not less than 4 mm (0.16 inch nominal) diameter.
 - b. Longitudinal wires deformed.
11. Multiple Wythes and Cavity wall ties:
 - a. Longitudinal wires 4 mm (0.16 inch), two in each wythe with ladder truss wires 4 mm (0.16 inch) overlay, welded to each longitudinal wire.
 - b. Longitudinal wires 4 mm (0.16 inch) with U shape 4 mm (0.16 inch) rectangular ties extending into other wythe not less than 75 mm (3 inches) spaced 400 mm o.c. (16 inches). Adjustable type with U shape tie designed to receive 4 mm (0.16 inch) pintle projecting into other wythe 75 mm (3 inches min.).

C. Adjustable 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.

D. 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).

2.3 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.

2.4 ACCESSORIES

- A. Weep Hole Wicks: Glass fiber ropes, 10 mm (3/8 inch) minimum diameter, 300 mm (12 inches) long.
- B. Box Board:
 1. Mineral Fiber Board: ASTM C612, Class 1.
 2. 25 mm (1 inch) thickness.
 3. Other spacing material having similar characteristics may be used subject to the COR's approval.
- C. Masonry Cleaner:
 1. Detergent type cleaner selected for each type masonry used.
 2. Acid cleaners are not acceptable.
 3. Use soapless type specially prepared for cleaning brick or concrete masonry as appropriate.
- D. Fasteners:
 1. Concrete Nails: ASTM F1667, Type I, Style 11, 19 mm (3/4 inch) minimum length.
 2. Masonry Nails: ASTM F1667, Type I, Style 17, 19 mm (3/4 inch) minimum length.
 3. Screws: FS-FF-S-107, Type A, AB, SF thread forming or cutting.

PART 3 - EXECUTION

3.1 JOB CONDITIONS

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

3.2 CONSTRUCTION TOLERANCES

- A. Lay masonry units plumb, level and true to line within the tolerances as per MSJC requirements and as follows:
- B. Maximum variation from plumb:
 - 1. In 3000 mm (10 feet) - 6 mm (1/4 inch).
 - 2. In 6000 mm (20 feet) - 10 mm (3/8 inch).
 - 3. In 12 000 mm (40 feet) or more - 13 mm (1/2 inch).
- C. Maximum variation from level:
 - 1. In any bay or up to 6000 mm (20 feet) - 6 mm (1/4 inch).
 - 2. In 12 000 mm (40 feet) or more - 13 mm (1/2 inch).
- D. Maximum variation from linear building lines:
 - 1. In any bay or up to 6000 mm (20 feet) - 13 mm (1/2 inch).
 - 2. In 12 000 mm (40 feet) or more - 19 mm (3/4 inch).
- E. Maximum variation in cross-sectional dimensions of columns and thickness of walls from dimensions shown:
 - 1. Minus 6 mm (1/4 inch).
 - 2. Plus 13 mm (1/2 inch).
- F. Maximum variation in prepared opening dimensions:
 - 1. Accurate to minus 0 mm (0 inch).
 - 2. Plus 6 mm (1/4 inch).

3.3 INSTALLATION GENERAL

- A. Keep finish work free from mortar smears or spatters, and leave neat and clean.
- B. Anchor masonry as specified in Paragraph, ANCHORAGE.
- C. Wall Openings:
 - 1. Fill hollow metal frames built into masonry walls and partitions solid with mortar as laying of masonry progresses.
 - 2. If items are not available when walls are built, prepare openings for subsequent installation.
- D. Tooling Joints:
 - 1. Do not tool until mortar has stiffened enough to retain thumb print when thumb is pressed against mortar.
 - 2. Tool while mortar is soft enough to be compressed into joints and not raked out.
 - 3. Finish joints in exterior face masonry work with a jointing tool, and provide smooth, water-tight concave joint unless specified otherwise.
 - 4. Tool Exposed interior joints in finish work concave unless specified otherwise.
- E. Partition Height:
 - 1. Extend partitions to height shown on Drawings.

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 or structural clay tile 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 (3 feet 4 inches) wide, unless shown otherwise.
5. Doors having overhead concealed door closers require a steel lintel, and a pocket for closer box.
6. Length for minimum bearing of 100 mm (6 inches) at ends.
7. Build masonry openings or arches over wood or metal centering and supports when steel lintels are not used.

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.
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, and exterior walls.
6. Use not less than 100 mm (4 inches) nominal thick masonry for free standing furring unless shown otherwise.
7. Do not abut existing plastered surfaces except suspended ceilings with new masonry partitions.

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. Temporary Formwork: Provide formwork and shores as required for temporary support of reinforced masonry elements.
- N. 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.
- O. 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.
- P. 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. 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 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. Locate joint reinforcement in mortar joints at 400 mm (16 inch) maximum vertical intervals.
4. 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.
5. Joint reinforcement is required in every other course of stack bond CMU masonry.

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 CMU CONTROL JOINTS.

- A. Provide 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 cross shaped shear keys in concrete masonry unit wythe with preformed compressible joint filler on each side of shear key unless otherwise specified.
 - 2. 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 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.

3.8 CONCRETE MASONRY

- 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. 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.
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 and exterior walls.
8. Lay concrete masonry units with full face shell mortar beds and fill head joint beds for depth equivalent to face shell thickness.
9. Lay concrete masonry units so that cores of units, that are to be filled with grout, are vertically continuous with joints of cross webs of such cores completely filled with mortar. Unobstructed core openings not less than 50 mm (2 inches) by 75 mm (3 inches).
10. Do not wedge the masonry against the steel reinforcing. Minimum 13 mm (1/2 inch) clear distance between reinforcing and masonry units.
11. Install deformed reinforcing bars of sizes shown.
12. Steel reinforcement, at time of placement, free of loose flaky rust, mud, oil, or other coatings that will destroy or reduce bond.
13. Steel reinforcement in place before grouting.
14. Minimum clear distance between parallel bars: One bar diameter.
15. Hold vertical steel reinforcement in place by centering clips, caging devices, tie wire, or other approved methods, vertically at spacings noted.
16. Support vertical bars near each end and at intermediate intervals not exceeding 192 bar diameters.
17. Reinforcement shall be fully encased by grout or concrete.
18. Splice reinforcement or attach reinforcement to dowels by placing in contact and secured or by placing the reinforcement within 1/5 of the required bar splice length.
19. Stagger splices in adjacent horizontal reinforcing bars. Lap reinforcing bars at splices a minimum of 40 bar diameters.
20. Grout cells of concrete masonry units, containing the reinforcing bars, solid as specified under grouting.
21. Cavity and joint horizontal reinforcement may be placed as the masonry work progresses.

3.9 POINTING

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

3.10 GROUTING

A. Preparation:

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

B. Placing:

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

C. Puddling Method:

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

D. Low Lift Method:

- 1. Construct masonry to a height of 1.5 m (5 ft) maximum before grouting.

2. Grout in one continuous operation and consolidate grout by mechanical vibration and reconsolidate after initial water loss and settlement has occurred.

E. High Lift Method:

1. Do not pour grout until masonry wall has properly cured a minimum of 4 hours.

2. Place grout in lifts not exceeding 1.5 m (5 ft).

3. Exception:

Where the following conditions are met, place grout in lifts not exceeding 3.86 m (12.67 ft).

a. The masonry has cured for at least 4 hours.

b. The grout slump is maintained between 254 and 279 mm (10 and 11 in).

c. No intermediate reinforced bond beams are placed between the top and the bottom of the pour height.

4. When vibrating succeeding lifts, extend vibrator 300 to 450 mm (12 to 18 inches) into the preceding lift to close any shrinkage cracks or separation from the masonry units.

3.11 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. 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.
- G. Anchoring: Anchor reinforced masonry work to supporting structure as indicated.
- H. Anchor reinforced masonry walls to non-reinforced masonry where they intersect.

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

H. High-Lift Grouting:

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

2. Provide cleanout holes in first course at all vertical cells which are to be filled with grout.
3. Use units with one face shell removed and provide temporary supports for units above, or use header units with concrete brick supports, or cut openings in one face shell.
4. Construct masonry to full height of maximum grout pour specified, prior to placing grout.
5. Limit grout lifts to a maximum height of 1.5 m (5 feet) and grout pour to a maximum height of 7.3 m (24 feet), for single wythe hollow concrete masonry walls, unless otherwise indicated.
6. Place vertical reinforcement before grouting. Place before or after laying masonry units, as required by job conditions. Tie vertical reinforcement to dowels at base of masonry where shown and thread CMU over or around reinforcement. Support vertical reinforcement at intervals not exceeding 192 bar diameters nor 3 m (10 feet).
7. Where individual bars are placed after laying masonry, place wire loops extending into cells as masonry is laid and loosed before mortar sets. After insertion of reinforcement bar, pull loops and bar to proper position and tie free ends.
8. Where reinforcement is prefabricated into cage units before placing, fabricate units with vertical reinforcement bars and lateral ties of the size and spacing indicated.
9. Place horizontal beam reinforcement as the masonry units are laid.
10. Embed lateral tie reinforcement in mortar joints where indicated. Place as masonry units are laid, at vertical spacing shown.
11. Where lateral ties are shown in contact with vertical reinforcement bars, embed additional lateral tie reinforcement in mortar joints. Place as shown, or if not shown, provide as required to prevent grout blowout or rupture of CMU face shells, but provide not less than 4.1 mm diameter (8 gage) wire ties spaced 400 mm (16 inches) o.c. for members with 500 mm (20 inches) or less side dimensions, and 200 mm (8 inches) o.c. for members with side dimensions exceeding 500 mm (20 inches).
12. Preparation of Grout Spaces: Prior to grouting, inspect and clean grout spaces. Remove dust, dirt, mortar droppings, loose pieces of masonry and other foreign materials from grout spaces. Clean reinforcement and adjust to proper position. Clean top surface of structural members supporting masonry to ensure bond. After final cleaning and inspection, close cleanout holes and brace closures to resist grout pressures.

13. Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist displacement of masonry units and breaking of mortar bond. Install shores and bracing, if required, before starting grouting operations.
14. Place grout by pumping into grout spaces unless alternate methods are acceptable to the COR.
15. Limit grout pours to sections which can be completed in one working day with not more than one hour interruption of pouring operation. Place grout in lifts which do not exceed 1.5 m (5 feet). Allow not less than 30 minutes, nor more than one hour between lifts of a given pour. Mechanically consolidate each grout lift during pouring operation.
16. Place grout in lintels or beams over openings in one continuous pour.
17. Where bond beam occurs more than one course below top of pour, fill bond beam course to within 25 mm (1 inch) of vertically reinforced cavities, during construction of masonry.
18. When more than one pour is required to complete a given section of masonry, extend reinforcement beyond masonry as required for splicing. Pour grout to within 38 mm (1-1/2 inches) of top course of first pour. After grouted masonry is cured, lay masonry units and place reinforcement for second pour section before grouting. Repeat sequence if more pours are required.

3.13 CLEANING AND REPAIR

A. General:

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

B. Concrete Masonry Units:

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

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SECTION 05 12 00
STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 DESCRIPTION:

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

1.2 RELATED WORK:

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

1.3 QUALITY ASSURANCE:

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

1.4 TOLERANCES:

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

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

1.5 DESIGN:

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

connections is subject to the review and acceptance of the COR. Submit structural calculations prepared and sealed by a qualified engineer registered in the state where the project is located. Submit calculations for review before preparation of detail drawings.

1.6 REGULATORY REQUIREMENTS:

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

1.7 SUBMITTALS:

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

1.8 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Institute of Steel Construction (AISC):
 - 1. AISC 360-10 Specification for Structural Steel Buildings
 - 3. AISC 303-10 Code of Standard Practice for Steel Buildings and Bridges
- C. American National Standards Institute (ANSI):
 - B18.22.1-65(R2008).....Plain Washers
 - B18.22M-81(R2000).....Metric Plain Washers
- D. American Society for Testing and Materials (ASTM):
 - A6/A6M-11.....Standard Specification for General Requirements
for Rolled Structural Steel Bars, Plates,
Shapes, and Sheet Piling
 - A36/A36M-08.....Standard Specification for Carbon Structural
Steel
 - A53/A53M-10.....Standard Specification for Pipe, Steel, Black
and Hot-Dipped, Zinc-Coated Welded and Seamless
 - A123/A123M-09.....Standard Specification for Zinc (Hot-Dip
Galvanized) Coatings on Iron and Steel Products

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

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. Structural Steel: ASTM A36, A242, A283, A572, Grade 50 A992.
- B. Structural Tubing: ASTM A500, Grade B.
- C. Structural Tubing: ASTM A501.
- D. Steel Pipe: ASTM A53, Grade B.
- E. Bolts, Nuts and Washers:
1. High-strength bolts, including nuts and washers: ASTM A325 or A490.
 2. Bolts and nuts, other than high-strength: ASTM A307, Grade A.

3. Plain washers, other than those in contact with high-strength bolt heads and nuts: ANSI Standard B18.22.1.

F. Zinc Coating: ASTM A123.

G. Galvanizing Repair Paint: Mil. Spec. MIL-P-21035.

PART 3 - EXECUTION

3.1 CONNECTIONS (SHOP AND FIELD):

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

3.2 FABRICATION:

Fabrication in accordance with Chapter M, AISC 360.

3.3 SHOP PAINTING:

- A. General: Shop paint steel with primer in accordance with AISC 303, Section 6.
- B. Shop paint for steel surfaces is specified in Section 09 91 00, PAINTING.
- C. Do not apply paint to following:
 - 1. Surfaces within 50 mm (2 inches) of joints to be welded in field.
 - 2. Surfaces which will be encased in concrete.
 - 3. Surfaces which will receive sprayed on fireproofing.
 - 4. Top flange of members which will have shear connector studs applied.
- D. Zinc Coated (Hot Dip Galvanized) per ASTM A123 (after fabrication):
Touch-up after erection: Clean and wire brush any abraded and other spots worn through zinc coating, including threaded portions of bolts and welds and touch-up with galvanizing repair paint.

3.4 ERECTION:

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

3.5 FIELD PAINTING:

- A. After erection, touch-up steel surfaces specified to be shop painted. After welding is completed, clean and prime areas not painted due to field welding.

B. Finish painting of steel surfaces is specified in Section 09 91 00,
PAINTING.

3.6 SURVEY:

Upon completion of finish bolting or welding on any part of the work,
and prior to start of work by other trades that 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.

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SECTION 05 31 00
STEEL DECKING

PART 1 - GENERAL

1.1 DESCRIPTION:

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

1.2 RELATED WORK:

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

1.3 DESIGN REQUIREMENTS:

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

1.4 SUBMITTALS:

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

1.5 QUALITY ASSURANCE:

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

1.6 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
- A36/A36M-08.....Standard Specification for Carbon Structural Steel
 - ASTM A1008/A1008M-12....Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
 - A653/A653M-11.....Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanized) by the Hot-Dip Process
 - C423-09a.....Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
- C. American Institute of Steel Construction (AISC):
- 360-10.....Specification for Structural Steel Buildings.
- D. American Iron and Steel Institute (AISI):
- S100-07.....North American Specification for the Design of Cold-Formed Steel Structural Members, 2007 Edition with Supplement 2.aisc
- E. American Welding Society (AWS):
- D1.3-08.....Structural Welding Code - Sheet Steel
- F. Factory Mutual (FM Global):
- 1. Loss Prevention Data Sheet 1-28: Wind Loads to Roof Systems and Roof Deck Securement
 - 2. Factory Mutual Research Approval Guide (2002)
- G. Military Specifications (Mil. Spec.)
- MIL-P-21035B.....Paint, High Zinc Dust Content, Galvanizing Repair

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. Steel Decking: ASTM A653, Structural Quality.

- B. Galvanizing: ASTM A653, G60.
- C. Galvanizing Repair Paint: Mil. Spec. MIL-P-21035B.
- D. Miscellaneous Steel Shapes: ASTM A36.
- E. Welding Electrode: E60XX minimum.
- F. Sheet Metal Accessories: ASTM A653, galvanized, unless noted otherwise.
Provide accessories of every kind required to complete the installation of metal decking in the system shown. Finish sheet metal items to match deck including, but not limited to, the following items:
 - 1. Metal Cover Plates: For end-abutting deck units, to close gaps at changes in deck direction, columns, walls and openings. Same quality as deck units but not less than 1.3 mm (18 gauge) sheet steel.
 - 2. Continuous Sheet Metal Edging: At openings, concrete slab edges and roof deck edges. Same quality as deck units but not less than 1.3 mm (18 gauge) steel. Side and end closures supporting concrete and their attachment to supporting steel shall be designed by the manufacturer to safely support the wet weight of concrete and construction loads. The deflection of cantilever closures shall be limited to 3 mm (1/8 inch) maximum.
 - 3. Metal Closure Strips: For openings between decking and other construction, of not less than 1.3 mm (18 gauge) sheet steel of the same quality as the deck units. Form to the configuration required to provide tight-fitting closures at open ends of flutes and sides of decking.
 - 4. Ridge and Valley Plates: Provide 1.3 mm (18 gauge), minimum 100 mm (4 inch) wide ridge and valley plates where roof slope exceeds 40 mm per meter (1/2 inch per foot).
 - 5. Cant Strips: Provide bent metal 45 degree leg cant strips where indicated on the Drawings. Fabricate cant strips from 1 mm (20 gauge) metal with a minimum 125 mm (5 inch) face width.
 - 6. Seat Angles for Deck: Provide where a beam does not frame into a column.
 - 7. Sump Pans for Roof Drains: Fabricated from single piece of minimum 1.9 mm (14 gauge) galvanized sheet steel with level bottoms and sloping sides to direct water flow to drain, unless otherwise shown. Provide sump pans of adequate size to receive roof drains and with bearing flanges not less than 75 mm (3 inches) wide. Recess pans not less than 38 mm (1 1/2 inches) below roof deck surface, unless otherwise shown or required by deck configuration. Holes for drains will be cut in the field.

2.2 REQUIREMENTS:

- A. Provide steel decking of the type, depth, gauge, and section properties as shown.
- B. Metal Form Deck - Type 1: Single pan fluted units utilized as a permanent form for reinforced concrete slabs. Comply with the depth and gauge requirements as shown on the Contract Documents.
 - 1. Finish: Galvanized G-60.
- C. Metal 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. Deep Rib (Type N) deck.
 - 3. Finish: Galvanized G-60.
- D. Do not use steel deck for hanging supports for any type or kind of building components including suspended ceilings, electrical light fixtures, plumbing, heating, or air conditioning pipes or ducts or electrical conduits.

PART 3 - EXECUTION

3.1 ERECTION:

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

of two welds per unit at each support. Where two units abut, fasten each unit individually to the supporting steel framework.

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

G. Cutting and Fitting:

1. Cut all metal deck units to proper length in the shop prior to shipping.
2. Field cutting by the metal deck erector is restricted to bevel cuts, notching to fit around columns and similar items, and cutting openings that are located and dimensioned on the Structural Drawings.
3. Other penetrations shown on the approved metal deck shop drawings but not shown on the Structural Drawings are to be located, cut and reinforced by the trade requiring the opening.
4. Make all cuts neat and trim using a metal saw, drill or punchout device; cutting with torches is expressly prohibited.
5. Do not make any cuts in the metal deck that are not shown on the approved metal deck drawings. If an additional opening not shown on

the approved shop drawings is required, submit a sketch, to scale, locating the required new opening and any other openings and supports in the immediate area. Do not cut the opening until the sketch has been reviewed and accepted by the Resident Engineer. Provide any additional reinforcing or framing required for the opening at no cost to the Government. Failure to comply with these requirements is cause for rejection of the work and removal and replacement of the affected metal deck.

6. Reinforcement at Openings: Provide additional metal reinforcement and closure pieces as required for strength, continuity of decking, and support of other work shown.

3.2 WELDING:

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.

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**SECTION 05 36 00
COMPOSITE METAL DECKING**

PART 1 - GENERAL

1.1 DESCRIPTION:

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

1.2 RELATED WORK:

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

1.3 DESIGN REQUIREMENTS:

- A. Design steel decking in accordance with American Iron And Steel Institute publication "Specifications for the Design of Cold Formed Steel Structural Members", except as otherwise shown or specified.
- B. Design all elements with the latest published version of applicable codes.

1.4 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: Shop and erection drawings showing decking unit layout, connections to supporting members, and information necessary to complete the installation as shown and specified, including supplementary framing, cant strips, cut openings, special jointing or other accessories. Show welding, side lap, closure, deck reinforcing and closure reinforcing details. Show openings required for work of other trades, including openings not shown on structural drawings. Indicate where temporary shoring is required to satisfy design criteria.
- C. Manufacturer's Literature and Data: Showing steel decking section properties and specifying structural characteristics as specified herein.
- D. Manufacturer's written recommendations for:
 - 1. Shape of decking section to be used.
 - 2. Cleaning of steel decking prior to concrete placement.
- E. Test Report - Establishing structural characteristics of composite concrete and steel decking system.
- F. Test Report - Stud base qualification.
- G. Welding power setting recommendation by shear stud manufacturer.
- H. Shear Stud Layouts: Submit drawings showing the number, pattern, spacing and configuration of the shear studs for each beam and girder.

- I. Certification: For each type and gauge of metal deck supporting concrete slab or fill, furnish certification of the specified fire ratings. Certify that the units supplied are U.L. listed as a "Steel Floor and Form Unit".

1.5 QUALITY ASSURANCE:

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

1.6 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only. Refer to the latest edition of all referenced Standards and codes.
- B. American Iron and Steel Institute (AISI):
Specification and Commentary for the Design of Cold-Formed Steel Structural Members (Latest Edition).
- C. American Society of Testing and Materials (ASTM):
A36/A36M-08.....Standard Specification for Carbon Structural Steel
A108-07.....Standard Specification for Steel Bars, Carbon, Cold Finished, Standard Quality
A653/A653M-10.....Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanized) by the Hot-Dip Process
- D. American Institute of Steel Construction (AISC):
1. 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)
- E. American Welding Society (AWS):
D1.1/D1.1M-10.....Structural Welding Code - Steel
D1.3/D1.3M-08.....Structural Welding Code - Sheet Steel
- F. Military Specifications (Mil. Spec.):
MIL-P-21035B.....Paint, High Zinc Dust Content, Galvanizing Repair

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. Steel Decking and all Flashings: ASTM A653, Structural Quality suitable for shear stud weld-through techniques.
- B. Galvanizing: ASTM A653, G60.

- C. Shear connector studs: ASTM A108, Grades 1015-1020, yield 350 Mpa (50,000 psi) minimum, tensile strength - 400 Mpa (60,000 psi) minimum, reduction of area 50 percent minimum. Studs of uniform diameter; heads shall be concentric and normal to shaft; stud, after welding free from any substance or defect which would interfere with its function as a shear connector. Studs shall not be painted or galvanized. Size of studs shall be as shown on drawings. Studs manufactured by a company normally engaged in the manufacture of shear studs and can furnish equipment suitable for weld-through installation of shear studs.
- D. Galvanizing Repair Paint: Mil. Spec. MIL-P-21035B.
- E. Miscellaneous Steel Shapes: ASTM A36.
- F. Welding Electrode: E60XX minimum.
- G. Sheet Metal Accessories: ASTM A653, galvanized, unless noted otherwise. Provide accessories of every kind required to complete the installation of metal decking in the system shown. Finish sheet metal items to match deck including, but not limited to, the following items:
 - 1. Metal Cover Plates: For end-abutting deck units, to close gaps at changes in deck direction, columns, walls and openings. Same quality as deck units but not less than 1.3 mm (18 gauge) sheet steel.
 - 2. Continuous sheet metal edging: at openings and concrete slab edges. Same quality as deck units but not less than 1.3 mm (18 gauge) steel. Side and end closures supporting concrete and their attachment to supporting steel shall be designed by the manufacturer to safely support the wet weight of concrete and construction loads. The deflection of cantilever closures shall be limited to 3 mm (1/8 inch) maximum.
 - 3. Metal Closure Strips: For openings between decking and other construction, of not less than 1.3 mm (18 gauge) sheet steel of the same quality as the deck units. Form to the configuration required to provide tight-fitting closures at open ends of flutes and sides of decking.
 - 4. Seat angles for deck: Where a beam does not frame into a column.

2.2 REQUIREMENTS:

- A. Steel decking depth, gage, and section properties to be as shown. Provide edges of deck with vertical interlocking male and female lip providing for a positive mechanical connection.
- B. Fabricate deck units with integral embossments to provide mechanical bond with concrete slab. In combination with concrete slab, capable of supporting total design loads on spans shown.
- C. Steel decking capable of safely supporting total, normal construction service loads without damage to decking unit.

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

PART 3 - EXECUTION

3.1 ERECTION:

- A. Do not start installation of metal decking until corresponding steel framework has been plumbed, aligned and completed and until temporary shoring, where required, has been installed. Remove any oil, dirt, paint, ice, water and rust from steel surfaces to which metal decking will be welded.
- B. Coordinate and cooperate with structural steel erector in locating decking bundles to prevent overloading of structural members.
- C. Do not use floor deck units for storage or working platforms until permanently secured. Do not overload deck units once placed. Replace any deck units that become damaged after erection and prior to casting concrete at no cost to the Government.
- D. Erect steel deck in accordance with manufacturer's printed instructions.
- E. Ship steel deck units to project in standard widths and cut to proper length.
- F. Provide steel decking in sufficient lengths to extend over 3 or more spans, except where structural steel layout does not permit.
- G. Place steel decking units on supporting steel framework and adjust to final position before being permanently fastening. Bring each unit to proper bearing on supporting beams. Place deck units in straight alignment for entire length of run of flutes and with close registration of flutes of one unit with those of abutting unit. Maximum space between ends of abutting units is 13 mm (1/2 inch). If space exceeds 13 mm (1/2 inch), install closure plates at no additional cost to Government.
- H. Ceiling hanger loops, if used, must be flattened or removed to obtain bearing of units on structural steel.
- I. Fastening Deck Units:

1. Fasten floor deck units to steel supporting members by not less than 16 mm (5/8 inch) diameter puddle welds or elongated welds of equal strength, spaced not more than 305 mm (12 inches) o.c. with a minimum of two welds per unit at each support. Where two units abut, fasten each unit individually to the supporting steel framework.
 2. Tack weld or use self-tapping No. 8 or larger machine screws at 915 mm (3 feet) o.c. for fastening end closures. Only use welds to attach longitudinal end closures.
 3. Weld side laps of adjacent floor deck units that span more than 1524 mm (5 feet). Fasten at midspan or 915 mm (3 feet) o.c., whichever is smaller.
- J. Welding to conform to AWS D1.3 and done by competent experienced welding mechanics.
- K. Areas scarred during erection and welds shall be thoroughly cleaned and touched-up with zinc rich galvanizing repair paint. Paint touch-up is not required for welds or scars that are to be in direct contact with concrete.
- L. Provide metal concrete stops at edges of deck as required.
- M. Cutting and Fitting:
1. Cut all metal deck units to proper length in the shop prior to shipping.
 2. Field cutting by the metal deck erector is restricted to bevel cuts, notching to fit around columns and similar items, and cutting openings that are located and dimensioned on the structural drawings.
 3. Other penetrations shown on the approved metal deck shop drawings but not shown on the structural drawings are to be located, cut and reinforced by the trade requiring the opening.
 4. Make all cuts neat and trim using a metal saw, drill or punchout device; cutting with torches is expressly prohibited.
 5. Do not make any cuts in the metal deck that are not shown on the approved metal deck drawings. If an additional opening not shown on the approved shop drawings is required, submit a sketch, to scale, locating the required new opening and any other openings and supports in the immediate area. Do not cut the opening until the sketch has been reviewed and accepted by the Resident Engineer. Provide any additional reinforcing or framing required for the opening at no cost to the Government. Failure to comply with these requirements is cause for rejection of the work and removal and replacement of the affected metal deck.

6. Reinforcement at Openings: Provide additional metal reinforcement and closure pieces as required for strength, continuity of decking and support of other work shown.

N. Installation of shear connector studs through previously installed metal deck to conform to AWS D1.1, Section 7, except all studs will be installed with automatically timed welding equipment and as specified below:

1. Do not place reinforcing steel temperature mesh or other materials and equipment which will interfere with stud installation on steel deck until shear connector studs are installed.
2. Steel deck sheets shall be free of oil, rust, dirt, and paint. Release water in deck's valley so that it does not become entrapped between deck and beam. Surface to which stud is to be welded shall be clean and dry.
3. Rest metal deck tightly upon top flange of structural member with bottom of deck rib in full contact with top of beam flange.
4. Weld studs only through a single thickness of deck. Place decking so that a butt joint is obtained. Place studs directly over beam web, where one row of studs are required.
5. Ferrules specially developed for the weld-through technique must be used. Ferrules shall be appropriate for size of studs used and be removed after welding.
6. Submit report of successful test program for stud base qualification as required by AWS D1.1, Appendix K.

3.2 CLEANING:

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

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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.

1.2 RELATED WORK:

- A. Structural steel framing: Section 05 12 00, STRUCTURAL STEEL FRAMING.
- B. Non-load-bearing metal stud framing assemblies: Section 09 22 16, NON-STRUCTURAL METAL FRAMING.
- D. 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: As indicated.
 2. Design framing systems to withstand design loads without deflections greater than the following:
 - a. Exterior Non-load-Bearing Curtain wall: Lateral deflection of 1/240 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 studs and accessories 16 gage and heavier: ASTM A653, structural steel, zinc coated G90, with a yield of 340 MPa (50 ksi) minimum.
- B. Sheet Steel for studs and accessories 18 gage and lighter: ASTM A653, structural steel, zinc coated G90, with a yield of 230 MPa (33 ksi) minimum.
- C. Galvanizing Repair Paint: MIL-P-21035B.

- D. Nonmetallic, Non-shrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, Portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C1107, with fluid consistency and a 30 minute working time.

2.2 WALL FRAMING:

- A. Steel Studs: Manufacturer's standard C-shaped steel studs of web depth indicated, with lipped flanges, and complying with the following:

- 1. Design Uncoated-Steel Thickness:

- 1.52 mm (0.0598 inch)

- (0.0747 inch)

- 2.66 mm (0.1046 inch)

- 2. Flange Width:

- (1-5/8 inches)

- (2 inches)

- (2-1/2 inches)

- 3. Web: Punched or Unpunched.

- 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.
8. 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 temporary bracing and leave in place until framing is permanently stabilized.

K. 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:

Touch-up damaged galvanizing with galvanizing repair paint.

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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. Support for Wall and Ceiling Mounted Items
 - 2. Frames
 - 3. Loose Lintels
 - 4. Steel Counter or Bench Top Frame and Leg

1.2 RELATED WORK

- A. Colors, finishes, and textures: Section 09 06 00, SCHEDULE FOR FINISHES.
- B. 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. Shop Drawings:
 - 1. Each item specified, showing complete detail, location in the project, material and size of components, method of joining various components and assemblies, finish, and location, size and type of anchors.
 - 2. Mark items requiring field assembly for erection identification and furnish erection drawings and instructions.
 - 3. Provide templates and rough-in measurements as required.
- C. Manufacturer's Certificates:
 - 1. Anodized finish as specified.
- D. Furnish setting drawings and instructions for installation of anchors to be preset into concrete and masonry work, and for the positioning of items having anchors to be built into concrete or masonry construction.

1.4 QUALITY ASSURANCE

- A. Each manufactured product shall meet, as a minimum, the requirements specified, and shall be a standard commercial product of a manufacturer regularly presently manufacturing items of type specified.
- B. Each product type shall be the same and be made by the same manufacturer.

- C. Assembled product to the greatest extent possible before delivery to the site.
- D. Include additional features, which are not specifically prohibited by this specification, but which are a part of the manufacturer's standard commercial product.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Mechanical Engineers (ASME):
 - B18.6.1-97.....Wood Screws
 - B18.2.2-87(R2005).....Square and Hex Nuts
- C. American Society for Testing and Materials (ASTM):
 - A36/A36M-08.....Structural Steel
 - A47-99(R2009).....Malleable Iron Castings
 - A48-03(R2008).....Gray Iron Castings
 - A53-10.....Pipe, Steel, Black and Hot-Dipped, Zinc-Coated
Welded and Seamless
 - A123-09.....Zinc (Hot-Dip Galvanized) Coatings on Iron and
Steel Products
 - A167-99(R2009).....Stainless and Heat-Resisting Chromium-Nickel
Steel Plate, Sheet and Strip
 - A269-10.....Seamless and Welded Austenitic Stainless Steel
Tubing for General Service
 - A307-10.....Carbon Steel Bolts and Studs, 60,000 PSI
Tensile Strength
 - B221-08.....Aluminum and Aluminum-Alloy Extruded Bars,
Rods, Wire, Shapes, and Tubes
 - B456-03(R2009).....Electrodeposited Coatings of Copper Plus Nickel
Plus Chromium and Nickel Plus Chromium
 - C1107-08.....Packaged Dry, Hydraulic-Cement Grout
(Nonshrink)
 - D3656-07.....Insect Screening and Louver Cloth Woven from
Vinyl-Coated Glass Yarns
 - F436-10.....Hardened Steel Washers
 - F468-10.....Nonferrous Bolts, Hex Cap Screws, and Studs for
General Use

F1667-11.....Driven Fasteners: Nails, Spikes and Staples

D. American Welding Society (AWS):

D1.1-10.....Structural Welding Code Steel

D1.2-08.....Structural Welding Code Aluminum

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

E. National Association of Architectural Metal Manufacturers (NAAMM)

AMP 521-01.....Pipe Railing Manual

AMP 500-06.....Metal Finishes Manual

MBG 531-09.....Metal Bar Grating Manual

MBG 532-09.....Heavy Duty Metal Bar Grating Manual

F. Structural Steel Painting Council (SSPC)/Society of Protective Coatings:

SP 1-04.....No. 1, Solvent Cleaning

SP 2-04.....No. 2, Hand Tool Cleaning

SP 3-04.....No. 3, Power Tool Cleaning

PART 2 - PRODUCTS

2.1 MATERIALS

A. Structural Steel: ASTM A36.

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

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

D. Steel Pipe: ASTM A53.

1. Galvanized for exterior locations.

2. Type S, Grade A unless specified otherwise.

3. NPS (inside diameter) as shown.

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

F. Malleable Iron Castings: A47.

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

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

I. Modular Channel Units:

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

2. Form channel within turned pyramid shaped clamping ridges on each side.

3. Provide case hardened steel nuts with serrated grooves in the top edges designed to be inserted in the channel at any point and be given a quarter turn so as to engage the channel clamping ridges. Provide each nut with a spring designed to hold the nut in place.
4. Factory finish channels and parts with oven baked primer when exposed to view. Channels fabricated of ASTM A525, G90 galvanized steel may have primer omitted in concealed locations. Finish screws and nuts with zinc coating.
5. Fabricate snap-in closure plates to fit and close exposed channel openings of not more than 0.3 mm (0.0125 inch) thick stainless steel.

J. Grout: ASTM C1107, pourable type.

K. Insect Screening: ASTM D3656.

2.3 HARDWARE

A. Rough Hardware:

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

B. Fasteners:

1. Bolts with Nuts:
 - a. ASME B18.2.2.
 - b. ASTM A307 for 415 MPa (60,000 psi) tensile strength bolts.
 - c. ASTM F468 for nonferrous bolts.
 - d. ASTM F593 for stainless steel.
2. Screws: ASME B18.6.1.
3. Washers: ASTM F436, type to suit material and anchorage.
4. Nails: ASTM F1667, Type I, style 6 or 14 for finish work.

2.4 FABRICATION GENERAL

A. Material

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

B. Size:

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

C. Connections

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

D. Fasteners and Anchors

1. Use methods for fastening or anchoring metal fabrications to building construction as shown or specified.
2. Where fasteners and anchors are not shown, design the type, size, location and spacing to resist the loads imposed without deformation of the members or causing failure of the anchor or fastener, and suit the sequence of installation.
3. Use material and finish of the fasteners compatible with the kinds of materials which are fastened together and their location in the finished work.
4. Fasteners for securing metal fabrications to new construction only, may be by use of threaded or wedge type inserts or by anchors for welding to the metal fabrication for installation before the concrete is placed or as masonry is laid.
5. Fasteners for securing metal fabrication to existing construction or new construction may be expansion bolts, toggle bolts, power

actuated drive pins, welding, self drilling and tapping screws or bolts.

E. Workmanship

1. General:

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

2. Welding:

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

3. Joining:

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

4. Anchors:

- a. Where metal fabrications are shown to be preset in concrete, weld 32 x 3 mm (1-1/4 by 1/8 inch) steel strap anchors, 150 mm (6 inches) long with 25 mm (one inch) hooked end, to back of member at 600 mm (2 feet) on center, unless otherwise shown.

- b. Where metal fabrications are shown to be built into masonry use 32 x 3 mm (1-1/4 by 1/8 inch) steel strap anchors, 250 mm (10 inches) long with 50 mm (2 inch) hooked end, welded to back of member at 600 mm (2 feet) on center, unless otherwise shown.
5. Cutting and Fitting:
- a. Accurately cut, machine and fit joints, corners, copes, and miters.
 - b. Fit removable members to be easily removed.
 - c. Design and construct field connections in the most practical place for appearance and ease of installation.
 - d. Fit pieces together as required.
 - e. Fabricate connections for ease of assembly and disassembly without use of special tools.
 - f. Joints firm when assembled.
 - g. Conceal joining, fitting and welding on exposed work as far as practical.
 - h. Do not show rivets and screws prominently on the exposed face.
 - i. The fit of components and the alignment of holes shall eliminate the need to modify component or to use exceptional force in the assembly of item and eliminate the need to use other than common tools.

F. Finish:

- 1. Finish exposed surfaces in accordance with NAAMM Metal Finishes Manual.
- 2. Aluminum: NAAMM AMP 501.
 - a. Mill finish, AA-M10, as fabricated, use unless specified otherwise.
 - b. Clear anodic coating, AA-C22A41, chemically etched medium matte, with Architectural Class 1, 0.7 mils or thicker.
 - c. Colored anodic coating, AA-C22A42, chemically etched medium matte with Architectural Class 1, 0.7 mils or thicker.
 - d. Painted: AA-C22R10.
- 3. Steel and Iron: NAAMM AMP 504.
 - a. Zinc coated (Galvanized): ASTM A123, G90 unless noted otherwise.
 - b. Surfaces exposed in the finished work:
 - 1) Finish smooth rough surfaces and remove projections.
 - 2) Fill holes, dents and similar voids and depressions with epoxy type patching compound.

c. Shop Prime Painting:

1) Surfaces of Ferrous metal:

- a) Items not specified to have other coatings.
- b) Galvanized surfaces specified to have prime paint.
- c) Remove all loose mill scale, rust, and paint, by hand or power tool cleaning as defined in SSPC-SP2 and SP3.
- d) Clean of oil, grease, soil and other detrimental matter by use of solvents or cleaning compounds as defined in SSPC-SP1.
- e) After cleaning and finishing apply one coat of primer as specified in Section 09 91 00, PAINTING.

2) Non ferrous metals: Comply with MAAMM-500 series.

4. Stainless Steel: NAAMM AMP-504 Finish No. 4.

5. Chromium Plating: ASTM B456, satin or bright as specified, Service Condition No. SC2.

G. Protection:

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

2.5 SUPPORTS

A. General:

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

B. For Wall Mounted Items:

- 1. For items supported by metal stud partitions.
- 2. Steel strip or hat channel minimum of 1.5 mm (0.0598 inch) thick.
- 3. Steel strip minimum of 150 mm (6 inches) wide, length extending one stud space beyond end of item supported.
- 4. Steel hat channels where shown. Flange cut and flattened for anchorage to stud.

5. Structural steel tube or channel for grab bar at water closets floor to structure above with clip angles or end plates formed for anchors.
6. Use steel angles for thru wall counters. Drill angle for fasteners at ends and not over 100 mm (4 inches) on center between ends.

2.6 FRAMES

A. Channel Door Frames:

1. Fabricate of structural steel channels of size shown.
2. Miter and weld frames at corners.
3. Where anchored to masonry or embedded in concrete, weld to back of frame at each jamb, 5 mm (3/16 inch) thick by 44 mm (1-3/4 inch) wide steel strap anchors with ends turned 50 mm (2 inches), and of sufficient length to extend at least 300 mm (12 inches) into wall. Space anchors 600 mm (24 inches) above bottom of frame and 600 mm (24 inches) o.c. to top of jamb. Weld clip angles to bottom of jambs and provide holes for expansion bolts.
4. Where anchored to concrete or masonry in prepared openings, drill holes at jambs for anchoring with expansion bolts. Weld clip angles to bottom of frame and provide holes for expansion bolt anchors as shown. Drill holes starting 600 mm (24 inches) above bottom of frame and 600 mm (24 inches) o.c. to top of jamb and at top of jamb. Provide pipe spacers at holes welded to channel.
5. Where closure plates are shown, continuously weld them to the channel flanges.
6. Weld continuous 19 x 19 x 3 mm (3/4 x 3/4 x 1/8 inch) thick steel angles to the interior side of each channel leg at the head and jambs to form a caulking groove.

2.7 LOOSE LINTELS

- ### **A.**
- Furnish lintels of sizes shown. Where size of lintels is not shown, provide the sizes scheduled on Drawings.

2.8 STEEL COUNTER OR BENCH TOP FRAME AND LEGS

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

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Set work accurately, in alignment and where shown, plumb, level, free of rack and twist, and set parallel or perpendicular as required to line and plane of surface.
- B. Items set into concrete or masonry.
 - 1. Provide temporary bracing for such items until concrete or masonry is set.
 - 2. Place in accordance with setting drawings and instructions.
 - 3. Build strap anchors, into masonry as work progresses.
- C. Set frames of covers, corner guards, and similar items flush with finish floor or wall surface and, where applicable, flush with side of opening.
- D. Field weld in accordance with AWS.
 - 1. Design and finish as specified for shop welding.
 - 2. Use continuous weld unless specified otherwise.
- E. Install anchoring devices and fasteners as shown and as necessary for securing metal fabrications to building construction as specified. Power actuated drive pins may be used except for removable items and where members would be deformed or substrate damaged by their use.
- F. Spot prime all abraded and damaged areas of zinc coating as specified and all abraded and damaged areas of shop prime coat with same kind of paint used for shop priming.
- G. Isolate aluminum from dissimilar metals and from contact with concrete and masonry materials as required to prevent electrolysis and corrosion.
- H. Secure escutcheon plate with set screw.

3.2 INSTALLATION OF SUPPORTS

- A. Anchorage to structure.
 - 1. Secure angles or channels and clips to overhead structural steel by continuous welding unless bolting is shown.
 - 2. Secure supports to concrete inserts by bolting or continuous welding as shown.
 - 3. Secure supports to mid height of concrete beams when inserts do not exist with expansion bolts and to slabs, with expansion bolts. unless shown otherwise.
 - 4. Secure steel plate or hat channels to studs as detailed.
- B. Supports for Wall Mounted items:

1. Locate center of support at anchorage point of supported item.
2. Locate support at top and bottom of wall hung cabinets.
3. Locate support at top of floor cabinets and shelving installed against walls.
4. Locate supports where required for items shown.

3.3 DOOR FRAMES

- A. Secure clip angles at bottom of frames to concrete slab with expansion bolts as shown.
- B. Level and plumb frame; brace in position required.
- C. At masonry, set frames in walls so anchors are built-in as the work progresses unless shown otherwise.
- D. Set frames in formwork for frames cast into concrete.
- E. Where frames are set in prepared openings, bolt to wall with spacers and expansion bolts.
- D. Secure removable supporting members in place with stainless steel bolts.
- E. Bolt gratings to supports.

3.4 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.

3.5 STEEL COMPONENTS FOR MILLWORK ITEMS

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

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.

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SECTION 06 10 00
ROUGH CARPENTRY

PART 1 - GENERAL

1.1 DESCRIPTION:

Section specifies wood blocking, sheathing, furring, nailers, and rough hardware.

1.3 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings showing framing connection details, fasteners, connections and dimensions.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING:

- A. Protect lumber and other products from dampness both during and after delivery at site.
- B. Pile lumber in stacks in such manner as to provide air circulation around surfaces of each piece.
- C. Stack plywood and other board products so as to prevent warping.
- D. Locate stacks on well drained areas, supported at least 150 mm (6 inches) above grade and cover with well ventilated sheds having firmly constructed over hanging roof with sufficient end wall to protect lumber from driving rain.

1.5 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in the text by basic designation only.
- B. American 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 Plywood Association (APA):
 - E30-07.....Engineered Wood Construction Guide
- D. 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
- F844-07.....Washers, Steel, Plan (Flat) Unhardened for General Use
- F1667-08.....Nails, Spikes, and Staples
- E. Federal Specifications (Fed. Spec.):
- MM-L-736C.....Lumber; Hardwood
- F. Commercial Item Description (CID):
- A-A-55615.....Shield, Expansion (Wood Screw and Lag Bolt Self Threading Anchors)
- G. Military Specification (Mil. Spec.):
- MIL-L-19140E.....Lumber and Plywood, Fire-Retardant Treated
- H. 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.
- C. Lumber Other Than Structural:
1. Unless otherwise specified, species graded under the grading rules of an inspection agency approved by Board of Review, American Lumber Standards Committee.
 2. Framing lumber: 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.

D. Sizes:

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

E. Moisture Content:

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

F. Fire Retardant Treatment:

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

G. Preservative Treatment:

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

2.2 PLYWOOD

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

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

C. Sheathing:

1. APA rated Exposure 1 or Exterior; panel grade CD or better.
2. Wall sheathing:

- a. Minimum 9 mm (11/32 inch) thick with supports 400 mm (16 inches) on center and 12 mm (15/32 inch) thick with supports 600 mm (24 inches) on center unless specified otherwise.
- b. Minimum 1200 mm (48 inches) wide at corners without corner bracing of framing.

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 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 or structural use panels.
- B. Fasteners:
 - 1. Nails.
 - a. Select nail size and nail spacing sufficient to develop adequate strength for the connection without splitting the members.
 - b. For sheathing, select length of nails sufficient to extend 25 mm (1 inch) into 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. 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.
- D. 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.

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SECTION 06 20 00
FINISH CARPENTRY

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies interior millwork.
- B. Items specified.
 - 1. Laminate clad wall and base cabinets
 - 2. Cabinet hardware.
 - 3. Solid surface material countertops, splashes and windowsills.
 - 4. Decorative glass panels.
 - 5. Metal reveal trim.

1.2 RELATED WORK

- A. Countertop Support Bracket: Section 05 50 00, METAL FABRICATIONS.
- B. Framing, furring and blocking: Section 06 10 00, ROUGH CARPENTRY.
- C. Color and texture of finish: Section 09 06 00, SCHEDULE FOR FINISHES.
- D. Electrical light fixtures and duplex outlets: Division 26, ELECTRICAL.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings:
 - 1. Millwork items - Half full size scale for sections and details 1:50 (1/4-inch) for elevations and plans.
 - 2. Show construction and installation.
- C. Samples:
 - 1. Plastic laminate finished plywood or particleboard, 3 by 3 inches.
 - 2. Exposed Cabinet Hardware: One unit for each type and finish.
 - 3. Solid Surface Material: 6-inch square, each color.
 - 4. Decorative Glass Panel: 3-inch square, each color, type, and pattern.
- D. Manufacturer's literature and data:
 - 1. Finish hardware

1.4 DELIVERY, STORAGE AND HANDLING

- A. Protect millwork from dampness, maintaining moisture content specified both during and after delivery at site.
- B. Store finishing millwork in weathertight well ventilated structures or in space in existing buildings designated by COR. Store at a minimum temperature of 21⁰C (70⁰F) for not less than 10 days before 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 of Testing and Materials (ASTM):
E84-07.....Surface Burning Characteristics of Building
Materials
- C. American Hardboard Association (AHA):
A135.4-04.....Basic Hardboard
- D. Builders Hardware Manufacturers Association (BHMA):
A156.9-03.....Cabinet Hardware
A156.11-04.....Cabinet Locks
A156.16-02.....Auxiliary Hardware
- E. National Particleboard Association (NPA):
A208.1-99.....Wood Particleboard
- F. Architectural Woodwork Institute (AWI):
Architectural Woodwork Quality Standards, Eighth Edition, Version 1.0,
2003.
- G. National Electrical Manufacturers Association (NEMA):
LD 3-05.....High-Pressure Decorative Laminates
- H. U.S. Department of Commerce, Product Standard (PS):
PS20-05.....American Softwood Lumber Standard
- I. Federal Specifications (Fed. Spec.):
A-A-1922A.....Shield Expansion
A-A-1936.....Contact Adhesive
FF-N-836D.....Nut, Square, Hexagon Cap, Slotted, Castle
FF-S-111D(1).....Screw, Wood
MM-L-736(C).....Lumber, Hardwood
- J. Solid Surface Fabricators Association
ISSFA-2.....Classifications and Standards for Solid
Surfacing Materialsb

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS

- A. Comply with the following:
1. Hardboard: AHA A135.4
 2. Medium Density Fiberboard: ANSI A208.2, Grade MD.
 3. Particle Board: ANSI A208.1, Grade M-2, 45#; Industrial Grade.

2.2 PLASTIC LAMINATE (HDPL)

- A. NEMA LD-3 (HPDL).

- B. Exposed decorative surfaces including both sides of cabinet doors, and for items having plastic laminate finish. Grade HGS (0.048-inch).

2.3 ADHESIVE

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

2.4 SOLID SURFACE MATERIAL (SSM)

- A. Homogeneous solid sheets of filled plastic resin.
- B. Comply with ANSI, SSI.

2.5 DECORATIVE GLASS PANELS (DG)

- A. Refer to Section 09 06 00 for additional requirements.

2.6 CABINET HARDWARE

- A. Hardware
 - 1. Cabinet Hardware: ANSI A156.9.
 - a. Door Pulls: B02011.
 - b. Adjustable Shelf Standards: B4061 with shelf rest B04083.
 - c. European style. Refer to Section 09 06 00.
 - 2. Cabinet Locks: ANSI A156.11.
 - a. Hinged Door: E07262.

2.7 FABRICATION

- A. General:
 - 1. Except as otherwise specified, use AWI Premium Grade for interior architectural woodwork.
- B. Plastic Laminate Cabinets:
 - 1. AWI Type of Cabinet Construction: Flush overlay.
 - 2. Laminate Cladding for Exposed Surfaces (HPDL): High-pressure decorative laminate complying with the following requirements:
 - a. Horizontal Surfaces Other Than Tops: Grade HGS (0.048-inch).
 - b. Vertical Surfaces: Grade HGS (0.048-inch).
 - c. Edges for Doors and Drawers: PVC self-edge tape, 3mm thick, color to match cabinet faces and selected by Architect.
 - d. Vertical Surfaces at Cabinet Fronts: PVC self-edge tape, 1mm thick, to match cabinet faces and selected by Architect.
 - 3. Materials for Semiexposed Surfaces:
 - a. Cabinet Bodies: High-pressure decorative laminate (0.020) Grade CLS (cabinet liner).
 - 1) Edges of Plastic-Laminate Shelves: Grade HGS 0.048 inch plastic laminate.

- 2) For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, Grade CLS (Cabinet liner).
 - 3) Drawer Sides and Backs and Subfronts: 1/2-inch nominal 7 ply hardwood veneer core plywood.
 - 4) Drawer Bottoms: 1/4-inch nominal hardwood veneer core plywood.
 - 5) Finish: Apply clear moisture resistant sealer to interior and exterior semi-exposed surfaces of drawer sides, back and bottom.
 - 6) Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High-pressure decorative laminate, Grade BKL (Backer).
 - 7) Colors, Patterns and Finishes: Provide materials and products that result in colors and textures scheduled in Section 09 06 00.
- C. Provide dust panels of 1/4-inch (6.4-mm) plywood or tempered hardboard above compartments and drawers, unless located directly under tops.
- D. Core: Medium density fiberboard (MDF) for flush cabinet doors and drawer fronts unless otherwise indicated.
- E. Core: Medium density fiberboard (MDF) or 45 pound industrial particle board for cabinet bodies unless otherwise indicated.

2.8 SOLID-SURFACING-MATERIAL COUNTERTOPS, AND WINDOWSILLS

- A. Grade: Premium.
- B. Solid-Surfacing-Material Thickness (SSM): 1/2-inch.
- C. Colors, Patterns and Finishes: Provide materials and products that result in colors of solid-surfacing material scheduled in Section 09 06 00.
- D. Fabricate tops, and sills in one piece, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication and finishing.
 1. Fabricate tops and sills with shop-applied edges of materials and configuration indicated.
 2. Fabricate tops with loose backsplashes for field application.

2.9 DECORATIVE GLASS PANELS

- A. Refer to Drawings for locations and mounting requirements.
- B. Colors, Patterns, Finishes: Provide materials and products that result in colors scheduled in Section 09 06 00.

2.10 METAL REVEAL TRIM

- A. Aluminum channel molding with "U" shaped profile.

- B. Metal Reveal Trim ML-1 with 1/2-inch reveal and ML-2 with 1/8-inch reveal.
- C. Finish: Provide materials and products that result in finish/color scheduled in Section 09 06 00.

PART 3 - EXECUTION

3.1 ENVIRONMENTAL REQUIREMENTS

- A. Maintain work areas and storage areas to a minimum temperature of 21⁰C (70⁰F) for not less than 10 days before and during installation of interior millwork.
- B. Do not install millwork in any room or space where wet process systems such as concrete, masonry, or plaster work is not complete and dry.

3.2 INSTALLATION

- A. Grade: Install woodwork to comply with requirements for the same grade specified for fabrication of type of woodwork involved.
- B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication to extent that it was not complete 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 (3 mm in 2400 mm).
- D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. 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.
- F. Wall and Base Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors 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 (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
 - 2. Fasten wall panels and shelves securely to walls.
 - 3. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches (400 mm) o.c.
- G. 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 (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
 3. Secure backsplashes to tops with concealed metal brackets at 16 inches (400 mm) o.c. and to walls with adhesive.
 4. Caulk space between backsplash and wall with sealant specified in Division 7 Section "Joint Sealants".
- H Window Sills: Refer to Drawings for locations and details.
- I. Touch up finishing work specified in this Section after installation of woodwork.
- J. Decorative Glass Panels: Install in accordance with manufacturer's written instructions and approved shop drawings.
1. Refer to Drawings for locations and details.

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 semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

3.4 CABINET AND HARDWARE SCHEDULE

- A. Provide cabinet hardware and accessory materials associated with architectural woodwork as schedule in Section 09 06 00.

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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.
- B. Acoustical insulation is identified by thickness and words "Acoustical Insulation".

1.2 RELATED WORK

- A. Insulation in connection with roofing and waterproofing: Section 07 22 00, ROOF AND DECK INSULATION.
- B. Safing insulation: Section 07 84 00, FIRESTOPPING.

1.3 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES .
- B. Manufacturer's Literature and Data:
 - 1. Insulation, each type used
 - 2. Adhesive, each type used.
 - 3. Tape
- C. Certificates: Stating the type, thickness and "R" value (thermal resistance) of the insulation to be installed.

1.4 STORAGE AND HANDLING:

- A. Store insulation materials in weathertight enclosure.
- B. Protect insulation from damage from handling, weather and construction operations before, during, and after installation.

1.5 APPLICABLE PUBLICATIONS:

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - C553-08.....Mineral Fiber Blanket Thermal Insulation for
Commercial and Industrial Applications
 - C578-10.....Rigid, Cellular Polystyrene Thermal Insulation
 - C591-09.....Unfaced Preformed Rigid Cellular
Polyisocynurate Thermal Insulation
 - C612-10.....Mineral Fiber Block and Board Thermal
Insulation

- C665-06.....Mineral Fiber Blanket Thermal Insulation for
Light Frame Construction and Manufactured
Housing
- C954-10.....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
- E84-10.....Surface Burning Characteristics of Building
Materials
- F1667-11.....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 reinforced	6 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 MASONRY CAVITY WALL INSULATION:

- A. Mineral Fiber Board: ASTM C612, Type II, faced with a vapor retarder having a perm rating of not more than 0.5.
- B. Polyurethane or Polyisocyanurate Board: ASTM C591, Type I, faced with a vapor retarder having a perm rating of not more than 0.5.

C. Polystyrene Board: ASTM C578, Type X.

2.3 PERIMETER INSULATION IN CONTACT WITH SOIL:

A. Polystyrene Board: ASTM C578, Type IV, V, VI, VII, or IX where covered by soil or concrete.

2.4 EXTERIOR FRAMING OR FURRING INSULATION:

A. Batt or Blanket: Optional.

B. Mineral Fiber: ASTM C665, Type II, Class C, Category I where framing is faced with gypsum board.

C. Mineral Fiber: ASTM C665, Type III, Class A where framing is not faced with gypsum board.

2.5 ACOUSTICAL INSULATION:

A. Mineral Fiber boards: ASTM C553, Type II, flexible, or Type III, semirigid (4.5 pound nominal density).

B. Mineral Fiber Batt or Blankets: ASTM C665. Maximum flame spread of 25 and smoke development of 450 when tested in accordance with ASTM E84.

C. Thickness as shown; of widths and lengths to fit tight against framing.

2.6 RIGID INSULATION:

A. On the inside face of exterior walls, spandrel beams, floors, bottom of slabs, and where shown.

B. Extruded Polystyrene: C578.

2.7 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.

2.8 ADHESIVE:

A. As recommended by the manufacturer of the insulation.

2.9 TAPE:

A. Pressure sensitive adhesive on one face.

B. Perm rating of not more than 0.50.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

A. Install insulation with the vapor barrier facing the heated side, unless specified otherwise.

- B. Install rigid insulating units with joints close and flush, in regular courses and with cross joints broken.
- C. Install batt or blanket insulation with tight joints and filling framing void completely. Seal cuts, tears, and unlapped joints with tape.
- D. Fit insulation tight against adjoining construction and penetrations, unless specified otherwise.

3.2 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 polystyrene board to surfaces with adhesive or Portland cement mortar mixed and applied in accordance with recommendations of insulation manufacturer.
- C. Bond mineral fiberboard, polyurethane or polyisocyanurate board to surfaces with adhesive as recommended by insulation manufacturer.

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 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 EXTERIOR FRAMING OR FURRING BLANKET INSULATION:

- A. Pack insulation around door frames and windows and in building expansion joints, door soffits and other voids. Pack behind outlets around pipes, ducts, and services encased in walls. Open voids are not permitted. Hold insulation in place with pressure sensitive tape.
- B. Lap vapor retarder flanges together over face of framing for continuous surface. Seal all penetrations through the insulation.
- C. Fasten blanket insulation between metal studs or framing and exterior wall furring by continuous pressure sensitive tape along flanged edges.
- D. Ceiling Insulation and Soffit Insulation:

1. At metal framing or ceilings suspension systems, install blanket insulation above suspended ceilings or metal framing at right angles to the main runners or framing. Tape insulation tightly together so no gaps occur and metal framing members are covered by insulation.
2. In areas where suspended ceilings adjoin areas without suspended ceilings, install either blanket, batt, or mineral fiberboard extending from the suspended ceiling to underside of deck or slab above. Secure in place to prevent collapse or separation of hung blanket, batt, or board insulation and maintain in vertical position. Secure blanket or batt with continuous cleats to structure above.

3.5 RIGID INSULATION ON SURFACE OF EXTERIOR WALLS, FLOORS, AND UNDERSIDE OF FLOORS:

- A. On the interior face of solid masonry and concrete walls, beams, beam soffits, underside of floors, and to the face of studs for interior wall finish where shown.
- B. Bond to solid vertical surfaces with adhesive as recommended by insulation manufacturer. Fill joints with adhesive cement.
- C. Use impaling pins for attachment to underside of horizontal surfaces. Space fastenings as required to hold insulation in place and prevent sagging.
- D. Fasten board insulation to face of studs with screws, nails or staples. Space fastenings not more than 300 mm (12 inches) apart. Stagger fasteners at joints of boards. Install at each corner.

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.

E. Where semirigid insulation is used which is not full thickness of cavity, adhere to one side of cavity maintaining continuity of insulation and covering penetrations or embedments in insulation.

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

PART 1 - GENERAL

1.1 DESCRIPTION

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

1.2 RELATED WORK

- A. General sustainable design documentation requirements: Section 01 81 13 SUSTAINABLE DESIGN REQUIREMENTS.
- B. Ethylene Interpolymer (KEE) Roofing, Section 07 54 16.
- C. Thermolastic Polyolefin (TPO) Roofing, Section 07 54 23.

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):
 - CC1289-10.....Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
 - E84-09.....Standard Test Method for Surface Burning Characteristics of Building Material
 - F1667-05.....Driven Fasteners: Nails, Spikes, and Staples
- D. National Roofing Contractors Association: Roofing and Waterproofing Manual
- E. 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. Refer to Drawings for additional information.

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.

1.6 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Product Data:
 - 1. Adhesive materials, each type.
 - 2. Roof insulation, each type.
 - 3. Cover board, each type.
 - 4. Fastening requirements.
- 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.
- D. Samples:
 - 1. Roof insulation, each type.
 - 2. Nails and fasteners, each type.
- E. Certificates:
 - 1. Indicating type, thermal conductance, and minimum and average thickness of insulation.
 - 2. Indicating materials and method of application of insulation system meet the requirements for specified roofing system.
- F. Laboratory Test Reports: Thermal values of insulation products.
- G. Layout of tapered roof system showing units required.
- H. Documentation of supervisors' and inspectors' qualifications.

1.7 DELIVERY, STORAGE AND MARKING

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

1.8 QUALITY ASSURANCE:

- A. Roof insulation on combustible or steel decks shall have a flame spread rating not greater than 75 and a smoke developed rating not greater than 150, exclusive of covering, when tested in accordance with ASTM E84.

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.
3. Insulation tested as part of a roof construction assembly shall bear UL labels attesting to the ratings specified herein.

PART 2 - PRODUCTS

2.1 ADHESIVE MATERIALS

- A. Adhesive Materials, General: Adhesive and sealant materials recommended by roofing system manufacturer for intended use, identical to materials utilized in approved listed roofing system, and compatible with roofing membrane.

1. Liquid-type adhesive materials shall comply with VOC limits of authorities having jurisdiction.
2. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. Plastic Foam Adhesives: 50 g/L.
 - b. Multipurpose Construction Adhesives: 70 g/L.
 - c. Contact Adhesives: 80 g/L.
 - d. Other Adhesives: 250 g/L.
 - e. Nonmembrane Roof Sealants: 300 g/L.
 - f. Sealant Primers for Nonporous Substrates: 250 g/L.
 - g. Sealant Primers for Porous Substrates: 775 g/L.

B. Primer: ASTM D41.

C. Bead-Applied Urethane Insulation Adhesive: Insulation manufacturer's recommended bead-applied, low-rise, one- or multicomponent urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.

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. Use only one insulation material for tapered sections. Use only factory-tapered insulation.
2. Cut to provide high and low points with crickets and slopes as shown.
3. Minimum thickness of tapered sections; 38 mm (1-1/2 inch).
4. Minimum slope 1:48 (1/4 inch per 12 inches).

2.3 INSULATION ACCESSORIES

A. Cover Board (For KEE Roofing System):

1. High density polyisocyanurate; 100 psi; ASTM C1289.

2.4 FASTENERS

A. Staples and Nails: ASTM F1667. Type as designated for item anchored and for substrate.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Comply with requirements of Division 07 roofing section.

3.2 PREPARATION

A. Comply with requirements of Division 07 roofing section.

3.3 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 for specified roofing system.

B. Insulation Thickness:

1. Thickness of roof insulation shown on drawings is nominal. Actual thickness shall provide the average thermal resistance "R" value of not less than that specified in Performance Requirements Article.
2. 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, fascias and similar items at no additional cost to the Government.
3. 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).
4. 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. Seal all cut edges at penetrations.

E. Cut to fit tight against penetrations.

F. Cover all insulation installed on the same day; comply with temporary protection requirements of Division 07 roofing section.

G. Installation Method:

1. Adhered Insulation:

- a. Prime substrate as required.
- b. Set each layer of insulation firmly in ribbons of bead-applied insulation adhesive.

2. Cover Board (For KEE Roofing System): Install cover boards over insulation with long joints in continuous straight lines with staggered end joints. Offset cover board joints from insulation joints minimum 150 mm (6 inches). Fasten cover boards according to "Adhered Insulation" requirements.

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SECTION 07 24 00
EXTERIOR INSULATION AND FINISH SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

Exterior Finish Systems specified in this section consist of an Exterior Insulation and Finish System (EIFS) applied over gypsum glass mat sheathing.

1.2 RELATED WORK

A. Glass-Mat Gypsum Sheathing; Section 09 20 00, GYPSUM BOARD.

1.3 SUBMITTALS

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

B. Samples:

Two 300 mm (one-foot) square samples of the EIFS finishes over glass mat sheathing identical to the proposed installation in thickness, color, texture, insulation, and workmanship.

C. Test Reports and Manufacturer's Literature

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.
3. Statement by Exterior Finish System manufacturer that all components of the system proposed for use on this project are approved by that manufacturer.
4. Statement by the Installer of the Exterior Finish System that they are experienced with the installation, having done at least three (3) projects using this system and can furnish names and locations of these projects if required.

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

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 WARRANTY

Exterior Finish system shall be warranted against water leakage past the weather resistive barrier and other defects in materials and workmanship, and shall be subject to the terms of Article "Warranty of Construction", FAR clause 52.246-21, except that the warranty period shall be ten years.

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):
 - B117-09.....Operating Salt Spray (Fog) Apparatus
 - C67-09.....Sampling and Testing Brick and Structural Clay Tile
 - C177-10.....Steady-State Heat Flux measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus
 - C578-10.....Rigid, Cellular Polystyrene Thermal Insulation
 - C1177.....Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing
 - C920-11.....Elastomeric Joint Sealants
 - D968-10.....Abrasion Resistance of Organic Coatings by Falling Abrasive
 - E84-10.....Surface Burning Characteristics of Building Materials
 - E96-10.....Water Vapor Transmission of Materials
 - E108-10.....Fire Tests of Roof Coverings
 - E330-02(R2010).....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

G90-10.....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 EXTERIOR INSULATION AND FINISH SYSTEM (EIFS)

- A. Description: The PB system consists 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
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.
Full Scale Wall Fire Test	ASTM E108	No significant surface flaming or propagation of vertical or lateral flames
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) Medium Impact Resistance// 5.65 to 10.1J 50-89 inch lbs
		High Impact Resistance// 10.2 to 17J (90-150 inch-lbs) Ultra High Impact Resistance// Over 17.1J (Over 150 inch-lbs.) - No broken reinforcing fabric
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.
Water Penetration	ASTM E331	No Water penetration
Abrasion Resistance	ASTM D968	500 liters of sand-slight smoothing - no loss of film integrity
Accelerated Weathering	ASTM G90	2000 hours. No deterioration
Salt Spray Resistance	ASTM B117	Withstand 300 hours. No deleterious effects.
Water Vapor	ASTM E96	Not more than 18 grains an hour per square foot.
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 glass-mat gypsum wall sheathing with adhesive applied in vertical notched trowel configuration.
- 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.

PART 3 EXECUTION

3.1 INSPECTION

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:
 - 1. Exterior Insulation and Finish System. 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. Exterior Insulation and Finish System: Apply sealant per EIFS manufacturer's recommendation. Do not seal locations intended for water drainage.

3.4 ACCESSORIES:

Install according to manufacturer's recommendation.

3.5 FINISH:

A. EXTERIOR INSULATION AND FINISH SYSTEM:

- 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 glass-mat system wall sheathing. 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. Apply adhesive using notched trowel.
- 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.
5. 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).
- a. Refer to Section 09 06 00 for finish and color.

3.6 CLEAN UP:

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

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SECTION 07 27 26
FLUID-APPLIED MEMBRANE AIR BARRIERS, VAPOR PERMEABLE

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies fluid-applied vapor-permeable membrane air barrier material and accessories used for exterior above grade wall assembly.

1.2 RELATED WORK

- A. General sustainable design documentation requirements: Section 01 81 13 SUSTAINABLE DESIGN REQUIREMENTS.
- B. 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.

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

- C920-10.....Standard Specification for Elastomeric Joint Sealants
- C1193-09.....Standard Guide for Use of Joint Sealants
- D412-06.....Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension
- D2369-10.....Standard Test Method for Volatile Content of Coatings
- E96/E96M-05.....Standard Test Methods for Water Vapor Transmission of Materials
- E162-09.....Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source
- E783-02.....Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors
- E1186-03(2009).....Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems
- E2178-03.....Standard Test Method for Air Permeance of Building Materials

E2357-05.....Standard Test Method for Determining Air
Leakage of Air Barrier Assemblies

3. U.S. Environmental Protection Agency (EPA)

40 CFR 59, Subpart D....National Volatile Organic Compound Emission
Standards for Consumer and Commercial Products

1.4 PERFORMANCE REQUIREMENTS

- A. General: Membrane air barrier shall be capable of performing as a continuous vapor- permeable air barrier and as a moisture drainage plane transitioned to adjacent flashings and discharging water to the building exterior. Membrane air barriers shall accommodate substrate movement and seal expansion and control joints, construction material transitions, opening transitions, penetrations, and perimeter conditions without moisture deterioration and air leakage exceeding performance requirements.
- B. Air-Barrier Assembly Air Leakage: Maximum 0.2 L/s x sq. m of surface area at 75 Pa (0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft.)per ASTM E 2357.
- C. Material Compatibility: Provide membrane air barrier materials that are compatible with one another and with adjacent materials under conditions of service and application required, as demonstrated by membrane air barrier manufacturer based on testing and field experience.

1.5 QUALIFICATIONS:

- A. Approvals: Approval by Contracting Officer is required of products and services of proposed manufacturers, and installers, and will be based upon submission by Contractor that:
- B. Manufacturer Qualifications: Manufacturer regularly and presently manufactures fluid-applied membrane air barrier material meeting section requirements as one of its principal products.
 - 1. Manufacturer's product submitted has been in satisfactory and efficient operation on five similar installations for at least five years.
 - a. Submit list of installations, include name and location of project and name of owner.
- C. Installer Qualifications: Installer has technical qualifications, experience, certifications, trained personnel, membrane air barrier manufacturer's approval, and facilities to install specified items.

1. Installer's applicators shall be trained and certified by manufacturer of air barrier system.
2. Installer's full time on-site field supervisor shall have completed three projects of similar scope within last year, be able to communicate verbally with Contractor, Architect, testing agency, and employees.

1.6 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 1. Fluid-applied membrane air barrier.
 2. Primer.
 3. Mastic.
 4. Counterflashing strip.
 5. Modified bituminous strip.
 6. Sprayed polyurethane foam sealant.
 7. Opening transition assembly.
 8. Joint sealant.
 9. Printed installation instructions for conditions specified.
- C. Certificates:
 1. Indicating membrane air barrier manufacturer's qualifications as specified.
 2. Indicating approval of installer by membrane air barrier manufacturer.
 3. Indicating qualifications of installer and installer's personnel.
 4. Indicating air barrier manufacturer's determination that proposed materials are chemically and adhesively compatible with adjacent materials.

1.7 COORDINATION:

- A. Coordinate installation of work of this Section with adjacent and related work to ensure provision of continuous, unbroken, durable air barrier system.

1.8 PRODUCT DELIVERY, STORAGE AND HANDLING:

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

1.9 ENVIRONMENTAL REQUIREMENTS:

Ambient Surface and Material Conditions: Not less than 4 degrees C (40 degrees F), during application of waterproofing, visibly dry, and complying with manufacturer's written instructions.

1.10 WARRANTY:

Warrant membrane air barrier installation against air and moisture leaks subject to terms of "Warranty of Construction", FAR clause 52.246-21, except that warranty period is two years.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Source Limitations: Obtain membrane air barrier materials and accessories from single manufacturer.

2.2 MEMBRANE AIR BARRIER:

A. Fluid-Applied, Vapor-Permeable Membrane Air Barrier: Elastomeric, modified bituminous or synthetic polymer membrane, meeting the following:

1. Air Permeance, ASTM E 2178: 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.
2. Vapor Permeance, ASTM E 96/E96M: Minimum 580 ng/Pa x s x sq. m (10 perms).
3. Elongation, Ultimate, ASTM D 412, Die C: 200 percent, minimum.
4. Combustion Characteristics: Flame spread, not greater than 25; smoke developed, not greater than 450, ASTM E 84.
5. Thickness of Membrane Air Barrier: Not less than 1.0 mm (40 mils), applied in single continuous coat.

2.3 ACCESSORY MATERIALS:

- A. Primer: Liquid waterborne primer meeting VOC requirements, recommended for substrate by membrane air barrier manufacturer.
- B. Counterflashing Sheet: Modified bituminous, 1.0-mm- (40-mil- thick self-adhering composite sheet consisting of 0.9 mm (36 mils) of rubberized asphalt laminated to polyethylene film.
- C. Substrate Patching Material: Manufacturer's standard trowel-grade filler material.
- D. Sprayed Polyurethane Foam Sealant: Foamed-in-place, 24- to 32-kg.cu. m (1.5- to 2.0-lb/cu. ft) density, with flame-spread index of 25 or less per ASTM E 162.

- E. Flexible Opening Transition: Cured low-modulus silicone extrusion with reinforcing ribs, sized to fit opening widths, designed for adhesion to or insertion into aluminum framing extrusions, and compatible with air barrier system materials and accessories.
- F. Joint Sealant: ASTM C 920, single-component, neutral-curing silicone; Class 100/50 (low modulus), Grade NS, Use NT related to exposure, approved by membrane air barrier manufacturer for adhesion and compatibility with membrane air barrier and accessories.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Surface Condition: Before applying membrane air barrier materials, ensure substrates are fully cured, smooth, clean, dry, and free from high spots, depressions, loose and foreign particles and other deterrents to adhesion.
- B. Verify concrete surfaces have cured for time period recommended by membrane air barrier manufacturer, free from release agents, concrete curing agents, and other contaminants.
- C. Verify masonry joints are flush and filled with mortar.

3.2 INTERFACE WITH OTHER WORK

- A. Commencement of Work: Commence work once membrane air barrier substrates are adequately protected from weather and will remain protected during remainder of construction.
- B. Sequencing of Work: Coordinate sequencing of work with work of other sections that form portions of building envelope air barrier to ensure that flashings and transition materials can be properly installed.
- C. Subsequent Work: Coordinate work with work of other sections installed subsequent to membrane air barrier to ensure complete inspection of installed membrane air barrier and sealing of membrane air barrier penetrations necessitated by subsequent work.

3.3 AIR BARRIER INSTALLATION

- A. General: Prepare substrates and install and apply air barrier components in accordance with air barrier manufacturer's written instructions consistent with manufacturer's qualifying tested assemblies.

3.4 PREPARATION

- A. Prepare and treat substrate in accordance with membrane air barrier manufacturer's written instructions.
- B. Mask adjacent finished surfaces.

- C. Remove contaminants and film-forming coatings from concrete.
- D. Remove projections and excess materials and fill voids with substrate patching material.
- E. Prepare and treat joints and cracks in substrate per ASTM C 1193 and membrane air barrier manufacturer's written instructions.
- F. Apply primer to substrates.

3.5 APPLICATION OF TRANSITION STRIPS

- A. Install transition strips and accessory materials according to membrane air barrier manufacturer's written instructions.
- B. Connect and seal membrane air barrier material to adjacent components of building air barrier system, including, but not limited to, roofing system air barrier, exterior glazing and window systems, curtain wall systems, door framing, and other openings.
- C. Flexible Opening Transition: Prime concealed perimeter frame surfaces of windows, storefronts, curtain walls, louvers, and doors. Apply flexible opening transition so that a minimum of 75 mm (3 inches) over coverage is achieved over each substrate.
 - 1. Fill gaps at perimeter of openings with foam sealant.
- D. Penetrations: Fill gaps at perimeter of penetrations with foam sealant. Seal transition strips around penetrating objects with termination mastic.
- E. Flashings: Seal top of through-wall flashings to membrane air barrier with continuous transitions strip of type recommended by membrane air barrier manufacturer for type of flashing.

3.6 FLUID AIR-BARRIER MEMBRANE INSTALLATION

- A. Apply fluid membrane air barrier material in full contact with substrate to produce a continuous seal with transition strips according to membrane air barrier manufacturers written instructions.
 - 1. Apply fluid membrane in thickness recommended by manufacturer, but not less than thickness specified in this section.
- B. Leave membrane air barrier exposed until tested and inspected by Owner's testing agency and approved by Resident Engineer.
- C. Correct deficient applications not passing tests and inspections, make necessary repairs, and retest as required to demonstrate compliance with requirements.

3.7 CLEANING AND PROTECTION

- A. Clean spills, stains, and overspray resulting application utilizing cleaning agents recommended by manufacturers of affected construction. Remove masking materials.
- B. Protect membrane air barrier from damage from subsequent work. Protect membrane materials from exposure to UV light in excess of that acceptable to membrane air barrier manufacturer; replace overexposed materials and retest.

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SECTION 07 40 00
ROOFING AND SIDING PANELS

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies insulated metal wall panel assembly with integral reveals, related metal trim, and integrated window system; composite metal panels, and corrugated metal panels.

1.2 RELATED WORK

- A. Color and texture of finish: Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Glazing: Section 08 80 00.

1.3 MANUFACTURER'S QUALIFICATIONS

Metal wall panels shall be products of a manufacturer regularly engaged in the fabrication and erection of metal panels of the type and design shown and specified.

1.4 WALL SYSTEMS INSTALLER QUALIFICATIONS

- A. Experienced Installer with minimum of 5 years experience with successfully completed projects of a similar nature and scope, and employing workers trained by manufacturer to install products of this Section.

1.5 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples: Metal panel, 150 mm (six inch) square, showing finish, each color and texture.
- C. Shop Drawings: Wall and roof panels, showing details of construction and installation. R value thickness and kind of material, closures, flashing, fastenings and related components and accessories.
- D. Manufacturer's Literature and Data: Wall panels.

1.6 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extend referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - A653/A653M-10 Steel Sheet, Zinc-Coated (Galvanized), or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - A924/A924M-10 Steel Sheet, Metallic Coated by the Hot-Dip Process

A1008/A1008M-10 Steel, Sheet, Cold-Rolled, Carbon, Structural,
High Strength Low Alloy
B209/209M-07 Aluminum and Aluminum Alloy Sheet and Plate
C591-09 Unfaced Preformed Rigid Cellular
Polyisocyanurate Thermal Insulation

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect products of composite wall panel system during shipping, handling, and storage to prevent staining, denting, deterioration of components or other damage.

1. Deliver, unload, store, and erect composite wall panel system and accessory items without misshaping panels or exposing panels to surface damage from weather or construction operations.

1.8 WARRANTY

A. Special Manufacturer's Warranty: On manufacturer's standard form, in which manufacturer agrees to repair or replace metal wall panel assemblies and window units that fail in materials and workmanship within two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 INSULATED METAL PANEL

A. Insulated Metal Panel Performance Requirements

1. General: Provide metal wall panel system meeting performance requirements as determined by application of specified tests by a qualified testing agency on manufacturer's standard assemblies.
2. Air Infiltration: Maximum 0.06 cfm/sq. ft. (0.3 L/s per sq. m) per ASTM E 283 at a static-air-pressure difference of 6.24 lbf/sq. ft. (300 Pa), using minimum 10-by-10 foot test panel that includes horizontal and vertical joints.
3. Water Penetration, Static Pressure: No uncontrolled water penetration per ASTM E 331 at a minimum static differential pressure of 15 lbf/sq. ft. (718 Pa), using minimum 10-by-10 foot test panel that includes horizontal and vertical joints.
4. Water Penetration, Static Pressure - 2 hour duration: Panel system shall demonstrate no water penetration when tested in accordance with ASTM E331 at 6.24 psf pressure differential for a two (2) hour duration to satisfy International Building Code, Section 1403.2.
5. Water Penetration, Dynamic Pressure: No uncontrolled water penetration per AAMA 501.1 at a minimum static differential pressure of 15 lbf/sq. ft. (718 Pa), using minimum 8-by-8 foot test panel that includes horizontal and vertical joints.

6. System Performance: A third party test report utilizing the standard ASTM E 283, E 331 and AAMA 501 procedures following the test protocol described in AAMA 508-07 must be submitted prior to bid. Test panel must include a horizontal joint, with an imperfect air barrier.
7. Water Absorption: Maximum 1.0 percent absorption rate by volume when tested according to ASTM C 209.
8. Structural Performance: Provide metal wall panel assemblies capable of withstanding the effects of indicated loads and stresses within limits and under conditions indicated, per ASTM E 72:
 - a. Wind Loads: Determine loads based on uniform pressure, importance factor, exposure category, and basic wind speed indicated on drawings.
 - b. Limits of Deflection: Composite wall panel system shall withstand scheduled wind pressure with the following allowable deflection:
 - 1) Maximum allowable deflection limited to L/180 deflection of panel perimeter normal to plane of wall with no evidence of failure.
 - c. Secondary Metal Framing: Design secondary metal framing according to AISI's "Standard for Cold-Formed Steel Framing-General Provisions."
 - 1) Flashing Seal Plate and IMV - Provide minimum 5-inch wide bearing surface for metal wall panels at the following locations:
 - (a) Horizontal Panel System: At vertical joints.
9. Thermal Movements: Allow for thermal movements from variations in both ambient and internal temperatures. Accommodate movement of support structure caused by thermal expansion and contraction.
10. Thermal Performance: Thermal-resistance (R) value indicated, per ASTM C 1363, with the following conditions:
 - a. 15 mph (24.1 km/h) exterior wind speed and still air on interior. Include side joint and standard fastening. Base R value reported on performance of specified panel, taking into account integral reveals and profiling with resultant reduction in panel insulation thickness.
11. Fire Performance Characteristics: Provide metal composite wall systems with the following fire-test characteristics determined

by indicated test standard as applied by UL or other testing and inspection agency acceptable to authorities having jurisdiction.

a. Surface-Burning Characteristics: Provide metal composite wall system panels with the following characteristics when tested per ASTM E 84.

- 1) Flame spread index: 25 or less.
- 2) Smoke developed index: 450 or less.

b. Intermediate Scale Multistory Fire Test: Representative mockup tested per NFPA 285.

B. Sheet Steel

1. Steel, Sheet, Galvanized Face Sheet: 0.030 inch thick.
2. Steel, Galvanized Liner Sheet: 0.019 inch thick.

C. Fasteners

1. Fasteners: Self-tapping screws, bolts, nuts, and other acceptable fasteners recommended by panel manufacturer. Where exposed fasteners cannot be avoided, supply corrosion-resistant fasteners with heads matching color of metal wall panels by means of factory-applied coating.

D. Vision Lites (Integrated Window System)

1. Integrated Window Units: Thermally-improved fixed aluminum window units designed to integrate with metal wall panel profile and secondary support system without receptor channels or other flashing. System to be tested integrated with panels. Sash to accept 1 inch (25 mm) insulating glass units.
 - a. Sightlines: Head: 3-inch (76 mm); Sill: 3-inch (76 mm); Mullions: 3 inch (76 mm).
 - b. Configuration: As indicated.
 - c. Frame: Weathered joints are shop assembled; thermally-improved 6063-T5 aluminum extrusions; Fully integrated with panel joiner; No receptors.

E. Thermal Insulating Materials

1. Insulation: Polyurethane Foam; Density 2.7 lb/cu.ft.
 - a. R-Value: Average 22.

F. Fabrication:

1. Insulated Core Metal Wall Panel System: Factory-foamed-in-place horizontal wall panel system consisting of exterior metal face sheet with interior metal liner panel, bonded to factory foamed-in-place core in thermally-separated profile, utilizing no glues or adhesives, with factory sealed tongue-and-groove and pressure-

- equalized rainscreen-designed horizontal joint, attached to supports using concealed fasteners.
- a. System is provided complete with window units.
 - b. System provided must match adjacent, existing system in manufacture, design, material, gage, finish, detail and installation.
2. Horizontal Panel - Horizontal Side Joint: Horizontal joints with positive drip edge, sloped drain shelf and integral venting to the exterior along the panel length to permit moisture drainage and to allow air to enter the pressure equalization chamber. Horizontal joint shall have a 2-3/8-inch baffle interlock and shall provide effective pressure equalization.
 3. Horizontal Panel - Vertical Panel to Panel Joint: Vertical joints for insulated metal panels shall be designed to allow moisture to be drained from the panel's horizontal joint. No end dam sealant is to be applied to the ends of the horizontal joint at the vertical joint location.
 - a. Flashing Seal Plate - A continuous back-up flash behind the vertical joint is required with two beads of field applied non-curing butyl sealant between the panel and back up flashing for each panel. The field applied non-curing butyl sealant shall be married to the panel's shop applied non-curing butyl sealant within the panel's side joint.
 - 1) Insulated Metal Vertical Joint (IMV) - Vertical joint shall include an integrated, insulated metal vertical joint. The insulated metal vertical joint shall be recessed 1-3/16" deep and be 5/8" wide. The insulated metal vertical joint should not add exterior sightlines, contain exposed metal edges or exposed wet seals. The insulated metal vertical joint shall be constructed of 6# density polyisocyanurate foam insulation adhered to a metal face of the same material, gage and color as the face of the panel.
 4. Panel Ends: Factory formed trimless ends, tabbed under panel horizontal shelf.
 5. Panel Width: Widths indicated.
 6. Panel Profile: Flat.
 7. Panel Reveals: 0.5" horizontal reveal
 8. Panel Thickness: 3.00 inch - T (76 mm), flat.
 9. Thermal-Resistance (R) Value: 3"-T flat - R-22.

10. Metal Wall Panel Accessories

- a. Metal Wall Panel Accessories, General: Provide complete metal wall panel assembly incorporating trim, copings, fasciae, parapet caps, soffits, sills, inside and outside corners, and miscellaneous flashings. Provide manufacturer's factory-formed clips, shims, flashings, gaskets, lap tapes, closure strips, and caps for a complete installation. Fabricate accessories in accordance with SMACNA Manual.
- b. Formed Flashing and Trim: Match material, thickness, and color of metal wall panel face sheets.
- c. Extrusion Trim: Provide manufacturer-provided extruded trim for the following locations and as indicated on Drawings:
 - 1) Base trim.
 - 2) Coping.
 - 3) Panel installation perimeter.
 - 4) Opening perimeters.

11. Sealants: Type recommended by metal wall panel system manufacturer for application.

12. Flashing Tape: 4-inch wide self-adhering butyl flashing tape.

13. Panel Attachment Clips: Concealed G-90 galvanized steel clip configured to prevent overdriving of fastener and crushing of foam core, with panel fasteners engaging both face and liner elements and mechanically attaching to panel supports. Clip configured also to be utilized without removing significant portions of the foam at each clip location.

G. Secondary Metal Framing:

1. Miscellaneous Framing Components, General: Cold-formed metallic-coated steel sheet, ASTM C 645, Grade 50, with ASTM A 653/A 653M, G90 (Z180) hot-dip galvanized zinc coating.
2. Subgirts: C- or Z-shaped sections, 0.054-inch (1.37-mm) minimum.
3. Sill Channels: 0.054-inch (1.37-mm) minimum.
4. Hat Channels: 0.054 (1.37mm) minimum.

H. Finish and Color:

1. For insulated wall panels the finishes shall be as follows for galvanized steel face sheets:
 - a. Manufacturer's Fluoropolymer finish, two-coat system.
 - b. Colors: Refer to Section 09 06 00.

2.2 COMPOSITE METAL PANEL

A. Performance Requirements

1. Structural Performance: Provide metal composite material panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E330:
 - a. Wind Loads: As indicated on Drawings.
 - b. Other Design Loads: As indicated on Drawings.
 - c. Deflection Limits: For wind loads, no greater than $[1/180]$ $[1/240]$ <Insert deflection> of the span.
2. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) when tested according to ASTM E 283 at the following test-pressure difference:
 - a. Test-Pressure Difference: $[1.57 \text{ lbf/sq. ft. (75 Pa)}]$ $[6.24 \text{ lbf/sq. ft. (300 Pa)}]$.
3. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference.
 - a. Test-Pressure Difference: $[2.86 \text{ lbf/sq. ft. (137 Pa)}]$ $[6.24 \text{ lbf/sq. ft. (300 Pa)}]$.
4. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

B. Metal Composite Material Wall Panels:

1. Metal Composite Material Wall Panel Systems: Provide factory-formed and -assembled, metal composite material wall panels fabricated from two metal facings that are bonded to a solid, extruded thermoplastic core; formed into profile for installation method indicated. Include attachment assembly components, panel stiffeners, and accessories required for weathertight system.
2. Aluminum-Faced Composite Wall Panels: Formed with 0.020-inch- (0.50-mm-) thick, coil-coated aluminum sheet facings.
 - a. Panel Thickness: $[0.118 \text{ inch (3 mm)}]$ $[0.157 \text{ inch (4 mm)}]$ $[0.197 \text{ inch (5 mm)}]$ $[0.236 \text{ inch (6 mm)}]$.
 - b. Core: Standard.
 - c. Exterior Finish: Two-coat fluoropolymer.

1) Color: As scheduled in Section 09 06 00.

3. Attachment Assembly Components: Formed from extruded aluminum.
4. Attachment Assembly: Clip.

C. Miscellaneous Materials:

1. Miscellaneous Metal Subframing and Furring: ASTM C 645, cold-formed, metallic-coated steel sheet ASTM A 653/A 653M, G90 (Z275 hot-dip galvanized) coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal composite material panel system.
2. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal composite material panels unless otherwise indicated.
3. Flashing and Trim: Provide flashing and trim formed from same material as metal composite material panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal composite material panels.
4. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal composite material panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.
5. Panel Sealants: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal composite material panels and remain weathertight; and as recommended in writing by metal composite material panel manufacturer.

D. Fabrication

1. General: Fabricate and finish metal composite material panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

2. Fabricate metal composite material panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
3. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
 - a. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 - b. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 - c. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
 - d. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 - e. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
 - 1) Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

E. Finishes:

1. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
2. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

3. Aluminum Panels and Accessories:

- a. Two-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

2.3 CORRUGATED METAL PANEL

- A. Materials: Galvanized steel.
- B. Profile: Shall match existing color.
- C. Finish shall match existing.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine metal wall panel system substrate with Installer present. Inspect for erection tolerances and other conditions that would adversely affect installation of metal wall panels.
- B. Framing: Inspect framing that will support metal wall panels to determine if support components are installed as indicated on approved shop drawings. Confirm presence of acceptable framing members at recommended spacing to match installation requirements of metal wall panels.
 1. Maximum deviations acceptable:
 - a. 1/4-inch in 20 feet vertically or horizontally from face plane of framing.
 - b. 1/2-inch maximum deviation from framing face plane on any building elevation.
 - c. 1/8-inch in 5 feet.
- C. Openings: Verify that window, door, louver and other penetrations match layout on shop drawings.
- D. Correct out-of-tolerance work and other deficient conditions prior to proceeding with metal wall panel system installation.

3.2 INSTALLATION - INSULATED METAL WALL PANEL

- A. General: Install panels in accordance with the manufacturer's approved erection instructions and diagrams, except as specified otherwise.
 1. Install metal wall panel system in accordance with approved shop drawings and manufacturer's recommendations. Install metal wall panels in orientation, sizes and locations indicated. Anchor metal wall panels and other components securely in place. Provide for thermal and structural movement.
- B. Attach panels to metal framing using recommended clips, screws, fasteners, sealants, and adhesives indicated on approved shop drawings.

1. Fasteners for Steel Wall Panels: Stainless-steel for exterior locations and locations exposed to moisture; carbon steel for interior use only.
 2. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated or, if not indicated, as approved by manufacturer.
 3. Fasten metal wall panels to supports with concealed clips at each joint at location, spacing, and with fasteners recommended by manufacturer. Install clips to supports with self-tapping fasteners.
 4. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.
 5. Horizontal Joinery: Working from base of installation to top connect upper panel to lower panel at dry seal joinery.
 6. Vertical Joinery: Provide reveal between vertical ends of panels as shown on shop drawings using hardware and gaskets furnished by manufacturer to form a weather tight seal between panels.
 7. Dissimilar Materials: Where elements of metal wall panel system will come into contact with dissimilar materials, treat faces and edges in contact with dissimilar materials as recommended by manufacturer.
- C. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal wall panel assemblies.
1. Seal panel end utilizing two beads of non-curing butyl aligning with factory-applied seal in adjacent panel pocket; apply continuously without gaps to complete panel system air barrier.
 2. Seal metal wall panel end laps to supports or back-up flashing sealant, full width of panel. Seal side joints where recommended by metal wall panel manufacturer. Do not install sealant in locations that will interfere with drainage of pressure-equalized panel chambers.
 3. Prepare joints and apply sealants in accordance with sealant manufacturer's written instructions for required installation.

D. Accessory Installation: Install metal wall panel accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal wall panel assembly, including trim, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
2. Comply with performance requirements and manufacturer's written installation instructions.
3. Provide concealed fasteners except where noted on approved shop drawings.
4. Set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

E. Integrated Unit Installation: Install window units in accordance with manufacturer's recommendations and approved shop drawings. Anchor supports to structure with approved anchors. Assemble wall components using gaskets, fasteners, and trim supplied by metal wall panel manufacturer. Separate dissimilar metals with bituminous coating.

3.3 METAL COMPOSITE MATERIAL PANEL INSTALLATION

A. General: Install metal composite material panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to supports unless otherwise indicated. Anchor metal composite material panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal composite material panels.
2. Flash and seal metal composite material panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal composite material panels are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal composite material panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.

7. Align bottoms of metal composite material panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
 8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
- B. Fasteners:
1. Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
- C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal composite material panel manufacturer.
- D. Attachment Assembly, General: Install attachment assembly required to support metal composite material wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.
1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.
- E. Clip Installation: Attach panel clips to supports at locations, spacings, and with fasteners recommended by manufacturer. Attach routed-and-turned flanges of wall panels to panel clips with manufacturer's standard fasteners.
1. Seal horizontal and vertical joints between adjacent panels with sealant backing and sealant. Install sealant backing and sealant according to Sealant Manufacturer's written requirements.
 2. Seal horizontal and vertical joints between adjacent metal composite material wall panels with manufacturer's standard gaskets.
- F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete metal composite material panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal composite material panel manufacturer; or, if not indicated, provide types recommended in writing by metal composite material panel manufacturer.
- G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set

units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

1. Install exposed flashing and trim that is without buckling and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (605 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

H. Installation Tolerances: Shim and align metal composite material wall panel units within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m), non-accumulative, on level, plumb, and location lines as indicated, and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.4 CORRUGATED PANEL INSTALLATION

- A. Install panels at locations shown on Drawings.
- B. Refer to details.

3.5 PROTECTION AND CLEANING

- A. Protect panels and other components from damage during and after erection, and until project is accepted by the Government.
- B. After completion of work, all exposed finished surfaces of panels shall be cleaned of soil, discoloration and disfiguration. Touch-up abraded surfaces of panels.
- C. Remove temporary protective films. Clean finished surfaces as recommended by metal wall panel manufacturer. Clear weep holes and drainage channels of obstructions, dirt, and sealant. Maintain in a clean condition during construction.
- D. Replace damaged panels and accessories that cannot be repaired by finish touch-up or minor repair.

- - - E N D - - -

SECTION 07 54 16
ETHYLENE INTERPOLYMER (KEE) ROOFING

PART 1 GENERAL

1.1 DESCRIPTION

- A. Ethylene Interpolymer (KEE)sheet roofing adhered to roof deck.

1.2 RELATED WORK

- A. General sustainable design documentation requirements: Section 01 81 13
SUSTAINABLE DESIGN REQUIREMENTS.
- B. Roof Insulation: Section 07 22 00, ROOF AND DECK INSULATION.
- C. Miscellaneous items: Section 07 72 00, ROOF ACCESSORIES.

1.3 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only. Editions of applicable publications current on date of issue of bidding documents apply unless otherwise indicated.
- B. American National Standards Institute/Single-Ply Roofing Institute (ANSI/SPRI):
ANSI/SPRI ES-1-03.....Wind Design Standards for Edge Systems Used with
Low Slope Roofing Systems
- C. American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI):
ASCE/SEI-7-10.....Minimum Design Loads for Buildings and Other
Structures
- D. ASTM International (ASTM):
C1371-04.....Standard Test Method for Determination of
Emittance of Materials Near Room Temperature
Using Portable Emissometers
C1549-04.....Standard Test Method for Determination of Solar
Reflectance Near Ambient Temperature Using a
Portable Solar Reflectometer
D4263-83(R2005).....Standard Test Method for Indicating Moisture in
Concrete by the Plastic Sheet Method
D4434-06.....Standard Specification for Poly (Vinyl Chloride)
Sheet Roofing
D6754-02.....Standard Specification for Ketone Ethylene Ester
Based Sheet Roofing

- E108-10.....Standard Test Methods for Fire Tests of Roof Coverings
- E408-71(R2008).....Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques
- E1918-06.....Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field
- E1980-01.....Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field
- E. American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE)
- ASHRAE 90.1-2007.....Energy Standard for Buildings Except Low-Rise Residential Buildings, Appendix f.
- F. Cool Roof Rating Council:
- CRRC-1.....Product Rating Program, www.coolroofs.org
- G. National Roofing Contractors Association: Roofing and Waterproofing Manual
- H. U.S. Department of Energy (DoE): Roof Products Qualified Product List, www.energystar.gov

1.4 PERFORMANCE REQUIREMENTS

- A. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.
- B. Roofing System Energy Performance Requirements: Provide a roofing system identical to components that that have been successfully tested by a qualified independent testing and inspecting agency to meet the following requirements:
1. Energy Performance, Energy Star: Provide roofing system that is listed on DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.
 2. Solar Reflectance Index: Not less than 78 when calculated according to ASTM E1980 based on testing identical products by a qualified testing agency.
 3. Energy Performance, Aged: Provide roofing system with minimum three-year aged solar reflectance not less than 0.55 when tested in accordance with ASTM C1549 or ASTM E1918, and in addition, a minimum

three-year-aged thermal emittance of 0.75 when tested in accordance with ASTM C1371 or ASTM E408.

- a. Where tested aged values are not available for proposed product, submit calculations to adjust initial solar reflectance to demonstrate compliance as indicated in ASHRAE 90.1-2007 Addendum f.
- b. Alternatively, provide roofing system with minimum three-year aged Solar Reflectance Index of not less than 64 when determined in accordance with the Solar Reflectance Index method in ASTM E1980 using a convection coefficient of 2.1 BTU/h-ft² (12 W/m²K).

1.5 QUALITY CONTROL

A. Installer Qualifications:

1. Licensed or approved in writing by manufacturer to perform work under warranty requirements of this Section.
2. Employ full-time supervisors knowledgeable and experienced in roofing of similar types and scopes, and able to communicate with owner and workers.

B. Inspector Qualifications: Inspection of work by third-party technical inspector or technical representative of manufacturer experienced in the installation and maintenance of the specified roofing system, qualified to perform roofing observation and inspection specified in Field Quality Control Article, to determine Installer's compliance with the requirements of this Project, and approved by the manufacturer to issue warranty certification. The Roofing Inspector shall be one of the following:

1. An authorized full-time technical employee of the manufacturer, not engaged in the sale of products.
2. An independent party certified as a Registered Roof Observer by the Roof Consultants Institute (RCI), retained by the Contractor or the Manufacturer and approved by the Manufacturer.

C. Product/Material Requirements:

1. Obtain products from single manufacturer or from sources recommended by manufacturer for use with roofing system and incorporated in manufacturer's warranty.

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 ANSI/SPRI ES-1 for roof edge design.

3. 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 Drawings for uplift requirements.

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.

1.6 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, SAMPLES.
- B. Product Data:
 1. Adhesive materials.
 2. Membrane sheet roofing and flashing membrane.
 3. Roofing cement.
 4. Roof walkway.
 5. Fastening requirements.
 6. Application instructions.
- C. Samples:
 1. Nails and fasteners, each type.
- D. Shop Drawings: Include plans, sections, details, and attachments.
 1. Base flashings and terminations.
- E. Certificates:
 1. Indicating compliance with energy performance requirement.
- F. Warranty: As specified.

- G. Documentation of supervisors' and inspectors' qualifications.
- H. Field reports of roofing inspector.
- I. Temporary protection plan. Include list of proposed temporary materials.
- J. Contract Close-out Submittals:
 - 1. Maintenance Manuals.
 - 2. Warranty signed by installer and manufacturer.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Comply with the recommendations of the NRCA "Roofing and Waterproofing Manual" applicable to single ply membrane roofing for storage, handling and installation.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.
- B. Environmental Controls: Refer to Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.
- C. Protection of interior spaces: Refer to Section 01 00 00, GENERAL REQUIREMENTS.

1.9 WARRANTY

- A. Roofing work subject to the terms of the Article "Warranty of Construction," FAR clause 52.246-21, except extend the warranty period to 20 years.
- B. Manufacturer's Warranty: "Total System Warranty", including roof membrane, base flashings, roofing accessories, roof insulation, fasteners, roof edge fascia, and other components of membrane roofing system.

PART 2 - PRODUCTS

2.1 KEE MEMBRANE ROOFING

- A. KEE Sheet: ASTM D6754, fabric reinforced, 60 mils with no backing.
 - 1. Color: White.

2.2 ACCESSORIES:

- A. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as KEE sheet membrane.
- B. Bonding Adhesive: Manufacturer's standard, water based.
- C. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 25 by 3 mm (1 by 1/8 inch) thick; with anchors.
- D. Fasteners: Factory-coated steel fasteners and metal plates, designed for fastening membrane to substrate.
- E. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads or rolls, approximately 5 mm (3/16 inch) thick, and acceptable to membrane roofing system manufacturer.
- F. Miscellaneous Accessories: Provide sealers, preformed flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories acceptable to manufacturer.

2.3 ADHESIVE AND SEALANT MATERIALS:

- A. General: Adhesive and sealant materials recommended by roofing system manufacturer for intended use, identical to materials utilized in approved listed roofing system, and compatible with roofing membrane.
 - 1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
 - 2. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. Plastic Foam Adhesives: 50 g/L.
 - b. Multipurpose Construction Adhesives: 70 g/L.
 - c. Single-Ply Roof Membrane Adhesives: 250 g/L.
 - d. Other Adhesives: 250 g/L.
 - e. Single-Ply Roof Membrane Sealants: 450 g/L.
 - f. Nonmembrane Roof Sealants: 300 g/L.
 - g. Sealant Primers for Nonporous Substrates: 250 g/L.
 - h. Sealant Primers for Porous Substrates: 775 g/L.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Examine substrates and conditions with roofing Installer and roofing inspector to verify compliance with project requirements and suitability to accept subsequent roofing work. Correct unsatisfactory conditions before proceeding with roofing work.
- B. Do not apply roofing if roof surface will be used for subsequent work platform, storage of materials, or staging or scaffolding will be erected thereon unless system is protected.

3.2 PREPARATION

- A. Complete roof deck construction prior to commencing roofing work:
 - 1. Install curbs, blocking, edge strips, nailers, and other components where insulation, roofing, and base flashing is attached to, in place ready to receive insulation and roofing.
 - 2. Complete deck and insulation to provide designed drainage to working roof drains.
 - 3. Document installation of related materials to be concealed prior to installing roofing work.
- B. Dry out surfaces, including the flutes of metal deck that become wet from any cause during progress of the work before roofing work is resumed. Apply materials to dry substrates.
- C. Sweep decks to broom clean condition. Remove all dust, dirt or debris.
- D. Remove projections that might damage materials.
- E. Concrete Decks:
 - 1. Test concrete decks for moisture prior to application of roofing materials. Test for capillary moisture by plastic sheet method according to ASTM D4263.
 - 2. Prime concrete decks, including precast units, with primer as specified. Keep primer back four inches from joints in precast units.
 - 3. Allow primer to dry before application of bitumen.
- F. Existing Membrane Roofs and Repair Areas:
 - 1. At areas to be altered or repaired, remove loose, damaged, or cut sheet that is not firmly adhered only where new penetrations occur or repairs are required.

3.3 TEMPORARY PROTECTION

- A. Install temporary protection at the end of day's work and when work is halted for an indefinite period or work is stopped when precipitation is imminent. Comply with approved temporary protection plan.
- B. Install temporary cap flashing over the top of base flashings where permanent flashings are not in place to provide protection against moisture entering the roof system through or behind the base flashing. Securely anchor in place to prevent blow off and damage by construction activities.
- C. Provide for removal of water or drainage of water away from the work.
- D. Provide temporary protection over installed roofing by means of duckboard walkways, plywood platforms, or other materials, as approved by COR, for roof areas that are to remain intact, and that are subject to foot traffic and damage. Provide notches in sleepers to permit free drainage.

3.4 INSTALLATION, GENERAL

- A. NRCA Installation Standard: Install roofing system in accordance with applicable NRCA Manual Plates and NRCA recommendations.
- B. Manufacturer Recommendations: Comply with roofing system manufacturer's written installation recommendations.
- C. Coordination with related work: Coordinate roof operations with roof insulation and sheet metal work so that insulation and flashings are installed concurrently to permit continuous roofing operations.
- D. Installation Conditions:
 - 1. Apply dry roofing materials. Apply roofing work over dry substrates and materials.
 - 2. Apply materials within temperature range and surface and ambient conditions recommended by manufacturer.
 - 3. Except for temporary protection, do not apply materials during damp or rainy weather, during excessive wind conditions, nor while moisture (dew, snow, ice, fog or frost) is present in any amount in or on the materials to be covered or installed:
 - a. Do not apply materials when the temperature is below 4 deg. C (40 deg. F).
 - b. Do not apply materials to substrate having temperature of 4 deg. C (40 deg. F) or less.

3.5 INSTALLATION OF KEE ROOFING

- A. Do not allow the membrane to come in contact with surfaces contaminated with asphalt, coal tar, oil, grease, or other substances which are not compatible with KEE.
- B. Install the membrane so the sheets run perpendicular to the long dimension of the insulation boards.
- C. Commence installation at the low point of the roof and work towards the high point. Lap the sheets so the flow of water is not against the edges of the sheet.
- D. Position the membrane so it is free of buckles and wrinkles.
- E. Roll sheet out on deck; inspect for defects as being rolled out and remove defective areas. Allow for relaxing before proceeding.
 - 1. Lap edges and ends of sheets 50 mm (two inches) or more as recommended by the manufacturer.
 - 2. Heat weld laps. Apply pressure as required. Seam strength of laps as required by ASTM D4434.
 - 3. Check seams to ensure continuous adhesion and correct defects.
 - 4. Finish edges of laps with a continuous beveled bead of sealant to sheet edges to provide smooth transition.
 - 5. Finish seams as the membrane is being installed (same day).
 - 6. Anchor perimeter to deck or wall as specified.
- F. Repair areas of welded seams where samples have been taken or marginal welds, bond voids, or skips occurs.
- G. Repair fishmouths and wrinkles by cutting to lay flat and installing patch over cut area extending 100 mm (four-inches) beyond cut.
- H. Membrane Perimeter Anchorage:
 - 1. Install metal fastening strip at the perimeter of each roof level, curb flashing, expansion joints and similar penetrations as indicated and in accordance with membrane manufacturer's instructions on top of roof membrane to deck or wall.
- I. Adhered System:
 - 1. Apply adhesive in quantities required by roof membrane manufacturer.
 - 2. Fold sheet back on itself after rolling out and coat the bottom side of the membrane and the top of the deck with adhesive. Do not coat the lap joint area.
 - 3. After adhesive has set according to adhesive manufacturers application instruction, roll the membrane into the adhesive in a manner that minimizes voids and wrinkles.
 - 4. Repeat for other half of sheet. Cut voids and wrinkles to lay flat and clean for repair patch over cut area.

3.6 INSTALLATION OF FLASHING

- A. Install flashings as the membrane is being installed. If the flashing can not be completely installed in one day, complete the installation until the flashing is in a watertight condition and provide temporary covers or seals.
- B. Flashing Roof Drains:
 - 1. Install roof drain flashing as recommended by the membrane manufacturer, generally as follows:
 - a. Coordinate to set the metal drain flashing in asphalt roof cement, holding cement back from the edge of the metal flange.
 - b. Do not allow the roof cement to come in contact with the KEE roof membrane.
 - c. Adhere the KEE roof membrane to the metal flashing with the membrane manufacturer's recommended adhesive.
 - 2. Turn down the metal drain flashing and KEE roof membrane into the drain body and install clamping ring and strainer.
- C. Installing KEE Base Flashing and Pipe Flashing:
 - 1. Install KEE flashing membranes to pipes, wall or curbs to a height not less than eight-inches above roof surfaces and 100 mm (four inches) on roof membrane.
 - a. Adhere flashing to pipe, wall or curb with adhesive.
 - b. Form inside and outside corners of KEE flashing membrane in accordance with NRCA manual. Form pipe flashing in accordance with NRCA manual use pipe boot.
 - c. Lap ends not less than 100 mm (four inches).
 - d. Heat weld flashing membranes together and flashing membranes to roof membranes. Finish exposed edges with sealant as specified.
 - e. Install flashing membranes in accordance with NRCA manual.
 - 2. Anchor top of flashing to walls or curbs with fasteners spaced not over 200 mm (eight inches) on centers. Use fastening strip on ducts. Use pipe clamps on pipes or other round penetrations.
 - 3. Apply sealant to top edge of flashing.
- D. Repairs to membrane and flashings:
 - 1. Remove sections of KEE sheet roofing or flashing that is creased wrinkled or fishmouthed.
 - 2. Cover removed areas, cuts and damaged areas with a patch extending 100 mm (four inches) beyond damaged, cut, or removed area. Heat weld to roof membrane or flashing. Finish edge of lap with sealant as specified.

3.7 FLEXIBLE WALKWAYS

- A. Use reinforced sheet not less than 900 mm (three feet) wide.
- B. Heat weld walkway sheet to roof sheet at edges. Weld area 50 mm (two inches) wide by the entire length of the walkway sheet.
- C. Finish edges of laps with sealants as specified.

3.8 FIELD QUALITY CONTROL:

- A. Roofing Inspector: Contractor shall engage a qualified roofing inspector for a minimum of 5 full-time days on site to perform roof tests and inspections and to prepare start up, interim, and final reports.
 - 1. Examine and probe seams in the membrane and flashing in the presence of COR and Membrane Manufacturer's Inspector.
 - 2. Probe edge of welded seams with a blunt tipped instrument. Use sufficient hand pressure to detect marginal welds, voids, skips, and fishmouths.
- B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
 - 1. Notify Architect and Owner 48 hours in advance of date and time of inspection.
- C. Repair or remove and replace components of roofing work where test results or inspections indicate that they do not comply with specified requirements.
 - 1. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.9 PROTECTING AND CLEANING

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

- - - E N D - - -

SECTION 07 54 23
THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

PART 1 GENERAL

1.1 DESCRIPTION

- A. Thermoplastic Polyolefin (TPO) sheet roofing adhered to roof deck.

1.2 RELATED WORK

- A. General sustainable design documentation requirements: Section 01 81 13
SUSTAINABLE DESIGN REQUIREMENTS.
- B. Roof Insulation: Section 07 22 00, ROOF AND DECK INSULATION.
- C. Miscellaneous items: Section 07 72 00, ROOF ACCESSORIES.

1.3 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only. Editions of applicable publications current on date of issue of bidding documents apply unless otherwise indicated.
- B. American National Standards Institute/Single-Ply Roofing Institute (ANSI/SPRI):
ANSI/SPRI ES-1-03.....Wind Design Standard for Edge Systems Used with
Low Slope Roofing Systems.
- C. American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI):
ASCE/SEI-7-10.....Minimum Design Loads for Buildings and Other
Structures
- D. ASTM International (ASTM):
C1549-04.....Standard Test Method for Determination of Solar
Reflectance Near Ambient Temperature Using a
Portable Solar Reflectometer
D4263.....Standard Test Method for Indicating Moisture in
Concrete by the Plastic Sheet Method
D4434-06.....Standard Specification for Poly (Vinyl Chloride)
Sheet Roofing
D6878-08.....Standard Specification for Thermoplastic
Polyolefin Based Sheet Roofing
E108-10.....Standard Test Methods for Fire Tests of Roof
Coverings
E408-71(R2008).....Standard Test Methods for Total Normal Emittance
of Surfaces Using Inspection-Meter Techniques

- E1918-06.....Standard Test Method for Measuring Solar
Reflectance of Horizontal and Low-Sloped
Surfaces in the Field
- E1980-01.....Standard Test Method for Measuring Solar
Reflectance of Horizontal and Low-Sloped
Surfaces in the Field
- E. American Society of Heating, Refrigeration, and Air Conditioning
Engineers (ASHRAE)
ASHRAE 90.1-2007.....Energy Standard for Buildings Except Low-Rise
Residential Buildings, Appendix f.
- F. Cool Roof Rating Council:
CRRC-1.....Product Rating Program, www.coolroofs.org
- G. National Roofing Contractors Association: Roofing and Waterproofing
Manual
- H. U.S. Department of Energy (DoE): Roof Products Qualified Product List,
www.energystar.gov

1.4 PERFORMANCE REQUIREMENTS

- A. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.
- B. Roofing System Energy Performance Requirements: Provide a roofing system identical to components that have been successfully tested by a qualified independent testing and inspecting agency to meet the following requirements:
1. Energy Performance, Energy Star: Provide roofing system that is listed on DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.
 2. Solar Reflectance Index: Not less than 78 when calculated according to ASTM E1980 based on testing identical products by a qualified testing agency.
 3. Energy Performance, Aged: Provide roofing system with minimum three-year aged solar reflectance not less than 0.55 when tested in accordance with ASTM C1549 or ASTM E1918, and in addition, a minimum three-year-aged thermal emittance of 0.75 when tested in accordance with ASTM C1371 or ASTM E408.
 - a. Where tested aged values are not available for proposed product, submit calculations to adjust initial solar reflectance to

demonstrate compliance as indicated in ASHRAE 90.1-2007
Addendum f.

- b. Alternatively, provide roofing system with minimum three-year aged Solar Reflectance Index of not less than 64 when determined in accordance with the Solar Reflectance Index method in ASTM E1980 using a convection coefficient of 2.1 BTU/h-ft² (12 W/m²K).

1.5 QUALITY CONTROL

A. Installer Qualifications:

1. Licensed or approved in writing by manufacturer to perform work under warranty requirements of this Section.
2. Employ full-time supervisors knowledgeable and experienced in roofing of similar types and scopes, and able to communicate with owner and workers.

B. Inspector Qualifications: Inspection of work by third-party technical inspector or technical representative of manufacturer experienced in the installation and maintenance of the specified roofing system, qualified to perform roofing observation and inspection specified in Field Quality Control Article, to determine Installer's compliance with the requirements of this Project, and approved by the manufacturer to issue warranty certification. The Roofing Inspector shall be one of the following:

1. An authorized full-time technical employee of the manufacturer, not engaged in the sale of products.
2. An independent party certified as a Registered Roof Observer by the Roof Consultants Institute (RCI), retained by the Contractor or the Manufacturer and approved by the Manufacturer.

C. Product/Material Requirements:

1. Obtain products from single manufacturer or from sources recommended by manufacturer for use with roofing system and incorporated in manufacturer's warranty.

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 ANSI/SPRI ES-1 for roof edge design.
3. 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 drawings for uplift requirements.
- 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.

1.6 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, SAMPLES.
- B. Product Data:
 - 1. Adhesive materials.
 - 2. Membrane sheet roofing and flashing membrane.
 - 3. Roofing cement.
 - 4. Roof walkway.
 - 5. Fastening requirements.
 - 6. Application instructions.
- C. Samples:
 - 1. Nails and fasteners, each type.
- D. Shop Drawings: Include plans, sections, details, and attachments.
 - 1. Base flashings and terminations.
- E. Certificates:
 - 1. Indicating compliance with energy performance requirement.
- F. Warranty: As specified.
- G. Documentation of supervisors' and inspectors' qualifications.
- H. Field reports of roofing inspector.
- I. Temporary protection plan. Include list of proposed temporary materials.

J. Contract Close-out Submittals:

1. Maintenance Manuals.
2. Warranty signed by installer and manufacturer.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Comply with the recommendations of the NRCA "Roofing and Waterproofing Manual" applicable to single ply membrane roofing for storage, handling and installation.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.
- B. Environmental Controls: Refer to Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.
- C. Protection of interior spaces: Refer to Section 01 00 00, GENERAL REQUIREMENTS.

1.9 WARRANTY

- A. Roofing work subject to the terms of the Article "Warranty of Construction," FAR clause 52.246-21, except extend the warranty period to 20 years.
- B. Manufacturer's Warranty: "Total System Warranty", including roof membrane, base flashings, roofing accessories, roof insulation, fasteners, roof edge fascia, and other components of membrane roofing system.

PART 2 - PRODUCTS

2.1 TPO MEMBRANE ROOFING

- A. TPO Sheet: ASTM D6878, internally fabric or scrim reinforced, 1.5 mm (60 mils) thick, with no backing.
1. Color: White.

2.2 ACCESSORIES:

- A. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as TPO sheet membrane.
- B. Bonding Adhesive: Manufacturer's standard, water based.

- C. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 25 by 3 mm (1 by 1/8 inch) thick; with anchors.
- D. Fasteners: Factory-coated steel fasteners and metal plates designed for fastening membrane to substrate.
- E. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads or rolls, approximately 5 mm (3/16 inch) thick, and acceptable to membrane roofing system manufacturer.
- F. Miscellaneous Accessories: Provide sealers, preformed flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories acceptable to manufacturer.

2.3 ADHESIVE AND SEALANT MATERIALS:

- A. General: Adhesive and sealant materials recommended by roofing system manufacturer for intended use, identical to materials utilized in approved listed roofing system, and compatible with roofing membrane.
 - 1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
 - 2. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. Plastic Foam Adhesives: 50 g/L.
 - b. Multipurpose Construction Adhesives: 70 g/L.
 - c. Single-Ply Roof Membrane Adhesives: 250 g/L.
 - d. Other Adhesives: 250 g/L.
 - e. Single-Ply Roof Membrane Sealants: 450 g/L.
 - f. Nonmembrane Roof Sealants: 300 g/L.
 - g. Sealant Primers for Nonporous Substrates: 250 g/L.
 - h. Sealant Primers for Porous Substrates: 775 g/L.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Examine substrates and conditions with roofing Installer and roofing inspector to verify compliance with project requirements and suitability to accept subsequent roofing work. Correct unsatisfactory conditions before proceeding with roofing work.

- B. Do not apply roofing if roof surface will be used for subsequent work platform, storage of materials, or staging or scaffolding will be erected thereon unless system is protected.

3.2 PREPARATION

- A. Complete roof deck construction prior to commencing roofing work:
 - 1. Install curbs, blocking, edge strips, nailers, and other components where insulation, roofing, and base flashing is attached to, in place ready to receive insulation and roofing.
 - 2. Complete deck and insulation to provide designed drainage to working roof drains.
 - 3. Document installation of related materials to be concealed prior to installing roofing work.
- B. Dry out surfaces, including the flutes of metal deck that become wet from any cause during progress of the work before roofing work is resumed. Apply materials to dry substrates.
- C. Sweep decks to broom clean condition. Remove all dust, dirt or debris.
- D. Remove projections that might damage materials.
- E. Concrete Decks:
 - 1. Test concrete decks for moisture prior to application of roofing materials. Test for capillary moisture by plastic sheet method according to ASTM D4263.
 - 2. Prime concrete decks, including precast units, with primer as specified. Keep primer back four inches from joints in precast units.
 - 3. Allow primer to dry before application of adhesive.

3.3 TEMPORARY PROTECTION

- A. Install temporary protection at the end of day's work and when work is halted for an indefinite period or work is stopped when precipitation is imminent. Comply with approved temporary protection plan.
- B. Install temporary cap flashing over the top of base flashings where permanent flashings are not in place to provide protection against moisture entering the roof system through or behind the base flashing. Securely anchor in place to prevent blow off and damage by construction activities.
- C. Provide for removal of water or drainage of water away from the work.
- D. Provide temporary protection over installed roofing by means of duckboard walkways, plywood platforms, or other materials, as approved by COR, for roof areas that are to remain intact, and that are subject

to foot traffic and damage. Provide notches in sleepers to permit free drainage.

3.4 INSTALLATION, GENERAL

- A. NRCA Installation Standard: Install roofing system in accordance with applicable NRCA Manual Plates and NRCA recommendations.
- B. Manufacturer Recommendations: Comply with roofing system manufacturer's written installation recommendations.
- C. Coordination with related work: Coordinate roof operations with roof insulation and sheet metal work so that insulation and flashings are installed concurrently to permit continuous roofing operations.
- D. Installation Conditions:
 - 1. Apply dry roofing materials. Apply roofing work over dry substrates and materials.
 - 2. Apply materials within temperature range and surface and ambient conditions recommended by manufacturer.
 - 3. Except for temporary protection, do not apply materials during damp or rainy weather, during excessive wind conditions, nor while moisture (dew, snow, ice, fog or frost) is present in any amount in or on the materials to be covered or installed:
 - a. Do not apply materials when the temperature is below 4 deg. C (40 deg. F).
 - b. Do not apply materials to substrate having temperature of 4 deg. C (40 deg. F) or less.

3.5 INSTALLATION OF TPO ROOFING

- A. Do not allow the membrane to come in contact with surfaces contaminated with asphalt, coal tar, oil, grease, or other substances which are not compatible with TPO.
- B. Install the membrane so the sheets run perpendicular to the long dimension of the insulation boards.
- C. Commence installation at the low point of the roof and work towards the high point. Lap the sheets so the flow of water is not against the edges of the sheet.
- D. Position the membrane so it is free of buckles and wrinkles.
- E. Roll sheet out on deck; inspect for defects as being rolled out and remove defective areas. Allow for relaxing before proceeding.
 - 1. Lap edges and ends of sheets 50 mm (two inches) or more as recommended by the manufacturer.

2. Heat weld laps. Apply pressure as required. Seam strength of laps as required by ASTM D4434.
 3. Check seams to ensure continuous adhesion and correct defects.
 4. Finish edges of laps with a continuous beveled bead of sealant to sheet edges to provide smooth transition.
 5. Finish seams as the membrane is being installed (same day).
 6. Anchor perimeter to deck or wall as specified.
- F. Repair areas of welded seams where samples have been taken or marginal welds, bond voids, or skips occurs.
- G. Repair fishmouths and wrinkles by cutting to lay flat and installing patch over cut area extending 100 mm (four-inches) beyond cut.
- H. Membrane Perimeter Anchorage:
1. Install metal fastening strip at the perimeter of each roof level, curb flashing, expansion joints and similar penetrations as indicated and in accordance with membrane manufacturer's instructions on top of roof membrane to deck or wall.
- I. Adhered System:
1. Apply adhesive in quantities required by roof membrane manufacturer.
 2. Fold sheet back on itself after rolling out and coat the bottom side of the membrane and the top of the deck with adhesive. Do not coat the lap joint area.
 3. After adhesive has set according to adhesive manufacturers application instruction, roll the membrane into the adhesive in a manner that minimizes voids and wrinkles.
 4. Repeat for other half of sheet. Cut voids and wrinkles to lay flat and clean for repair patch over cut area.

3.6 INSTALLATION OF FLASHING

- A. Install flashings as the membrane is being installed. If the flashing can not be completely installed in one day, complete the installation until the flashing is in a watertight condition and provide temporary covers or seals.
- B. Flashing Roof Drains:
1. Install roof drain flashing as recommended by the membrane manufacturer, generally as follows:
 - a. Coordinate to set the metal drain flashing in asphalt roof cement, holding cement back from the edge of the metal flange.
 - b. Do not allow the roof cement to come in contact with the TPO roof membrane.

- c. Adhere the TPO roof membrane to the metal flashing with the membrane manufacturer's recommended adhesive.
 2. Turn down the metal drain flashing and TPO roof membrane into the drain body and install clamping ring and strainer.
- C. Installing TPO Base Flashing and Pipe Flashing:
 1. Install TPO flashing membranes to pipes, wall or curbs to a height not less than eight-inches above roof surfaces and 100 mm (four inches) on roof membrane.
 - a. Adhere flashing to pipe, wall or curb with adhesive.
 - b. Form inside and outside corners of TPO flashing membrane in accordance with NRCA manual. Form pipe flashing in accordance with NRCA manual use pipe boot.
 - c. Lap ends not less than 100 mm (four inches).
 - d. Heat weld flashing membranes together and flashing membranes to roof membranes. Finish exposed edges with sealant as specified.
 - e. Install flashing membranes in accordance with NRCA manual.
 2. Anchor top of flashing to walls or curbs with fasteners spaced not over 200 mm (eight inches) on centers. Use fastening strip on ducts. Use pipe clamps on pipes or other round penetrations.
 3. Apply sealant to top edge of flashing.
- D. Repairs to membrane and flashings:
 1. Remove sections of TPO sheet roofing or flashing that is creased wrinkled or fishmouthed.
 2. Cover removed areas, cuts and damaged areas with a patch extending 100 mm (four inches) beyond damaged, cut, or removed area. Heat weld to roof membrane or flashing. Finish edge of lap with sealant as specified.

3.7 FLEXIBLE WALKWAYS

- A. Use reinforced sheet not less than 900 mm (three feet) wide.
- B. Heat weld walkway sheet to roof sheet at edges. Weld area 50 mm (two inches) wide by the entire length of the walkway sheet.
- C. Finish edges of laps with sealants as specified.

3.8 FIELD QUALITY CONTROL:

- A. Roofing Inspector: Contractor shall engage a qualified roofing inspector for a minimum of 5 full-time days on site to perform roof tests and inspections and to prepare start up, interim, and final reports.

1. Examine and probe seams in the membrane and flashing in the presence of COR and Membrane Manufacturer's Inspector.
 2. Probe edge of welded seams with a blunt tipped instrument. Use sufficient hand pressure to detect marginal welds, voids, skips, and fishmouths.
- B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
1. Notify Architect and Owner 48 hours in advance of date and time of inspection.
- C. Repair or remove and replace components of roofing work where test results or inspections indicate that they do not comply with specified requirements.
1. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.9 PROTECTING AND CLEANING

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

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SECTION 07 60 00
FLASHING AND SHEET METAL

PART 1 - GENERAL

1.1 DESCRIPTION

Formed sheet metal work for wall flashing is specified in this section.

1.2 RELATED WORK

- A. Manufactured flashing, and fasciae: Section 07 72 00 ROOF ACCESSORIES.
- B. Flashing components of factory finished roofing and wall systems:
Division 07 wall system sections.
- C. 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 Architectural Manufacturers Association (AAMA):
AAMA 620.....Voluntary Specification for High Performance
Organic Coatings on Coil Coated Architectural
Aluminum
- C. ASTM International (ASTM):
A653/A653M-09.....Steel Sheet Zinc-Coated (Galvanized) or Zinc
Alloy Coated (Galvanized) by the Hot- Dip
Process
B32-08.....Solder Metal
B209-07.....Aluminum and Aluminum-Alloy Sheet and Plate
D1187-97(R2002).....Asphalt Base Emulsions for Use as Protective
Coatings for Metal
- D. National Association of Architectural Metal Manufacturers (NAAMM):
AMP 500-06.....Metal Finishes Manual

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, including:
 - 1. Flashings

- C. Certificates: Indicating compliance with specified finishing requirements, from applicator and contractor.

PART 2 - PRODUCTS

2.1 FLASHING AND SHEET METAL MATERIALS

- A. Aluminum Sheet: ASTM B2009, alloy 3003-H14.
- B. Galvanized Sheet: ASTM, A653.

2.2 FLASHING ACCESSORIES

- A. Solder: ASTM B32; flux type and alloy composition as required for use with metals to be soldered.
- B. Bituminous Paint: ASTM D1187, Type I.
- C. Fasteners:
 - 1. Use stainless steel for aluminum alloy. Use galvanized steel or stainless steel for galvanized steel.
 - 2. Nails:
 - a. 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.
- D. Sealant: As specified in Section 07 92 00, JOINT SEALANTS for exterior locations.

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. Galvanized steel: 0.5 mm (0.021 inch) thick.
- C. Thickness of aluminum and galvanized steel is specified with each item.

2.4 FABRICATION, GENERAL

- A. Jointing:
 - 1. 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.
 - 2. Flat and lap joints shall be made in direction of flow.

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. Aluminum:
 - a. Fluorocarbon Finish: AAMA 620, high performance organic coating.
 - 2. Galvanized Steel:
 - a. Finish paint under Section 09 91 00, PAINTING unless specified as prefinished item.

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. 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.
 - 6. 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.

7. Install flashings in conjunction with other trades so that flashings are inserted in other materials and joined together to provide a water tight installation.
8. 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.
9. 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 coat of bituminous paint.
10. Paint aluminum in contact with or built into mortar, concrete, plaster, or other masonry materials with a coat of bituminous paint.
11. Paint aluminum in contact with absorptive materials that may become repeatedly wet with two coats of bituminous paint or two coats of aluminum paint.

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SECTION 07 72 00
ROOF ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies copings and fascia joints.

1.2 RELATED WORK

- A. Color and texture of finish: Section 09 06 00, SCHEDULE FOR FINISHES
- B. Sealant material and installation: Section 07 92 00, JOINT SEALANTS.

1.3 QUALITY CONTROL

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

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples: Representative sample of color not less than 100 mm X 100 mm (four by four inches). Sample shall show color and shall include manufacturer's identifying label.
- C. Shop Drawings: Each item specified showing design, details of construction, installation and fastenings.
- D. Manufacturer's Literature and Data: Each item specified.
- E. Certificates: Stating that aluminum has been given specified thickness of anodizing.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extend referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Material (ASTM):
 - B209/209M-07.....Aluminum and Aluminum Alloy-Sheet and Plate
 - B221/221M-08.....Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
 - D1187-97 (R2002).....Asphalt-Base Emulsions for Use as Protective Coatings for Metal
- C. National Association of Architectural Metal Manufacturers (NAAMM):
 - AMP 500-06.....Metal Finishes Manual

- D. American Architectural Manufacturers Association (AAMA):
2605-11.....High Performance Organic Coatings on
Architectural Extrusions and Panels.

1.6 WARRANTY

- A. Perimeter Edge Metal Warranty: Roof edge fascia and coping shall be included in roof membrane manufacturer's "Total System Warranty".

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum Sheet: ASTM B209/B209M.
B. Galvanized Sheet Steel: ASTM A526/A526M; G-90 coating.

2.2 COPINGS

- A. Fabricate of aluminum not less than 0.050 inch thick; formed aluminum.
B. Turn outer edges down each face of wall as shown.
C. Maximum lengths of 3000 mm (10 feet).
D. Shop fabricate external and internal corners as one piece assemblies with not less than 300 mm (12 inch) leg lengths.
E. Provide concealed guttered splice plate. Use galvanized steel anchor plate providing compression spring anchoring of coping cover.
F. Finish: Fluorocarbon.

2.3 FORMED ALUMINUM FASCIA SYSTEM

- A. Roof Edge Fascia: Manufactured, two-piece, roof-edge fascia consisting of snap-on metal fascia cover in section lengths not to exceed 12 feet and a continuous metal receiver to engage fascia cover and secure single-ply roof membrane. Provide matching corner units.
B. Internal and external corners:
1. Factory fabricate and fully weld mitered joints.
2. Furnish corner sections in manufacturers standard sizes with not less than 300 mm (12 inch) leg lengths.

2.4 FINISH

- A. In accordance with NAAMM Amp 500-505.
B. Fluorocarbon Finish: AAMA 2605.2 high performance organic coating.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install roof accessories where shown.
B. Secure with fasteners in accordance with manufacture's printed installation instructions and approved shop drawings unless shown otherwise.

- C. 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. Aluminum Coping:
 - 1. Install sections of coping with approximately 6 mm (1/4-inch) space between ends of sections.
 - 2. When snap-on system is used ensure front and back edges are locked in place.
- F. Fascia System:
 - 1. Install formed aluminum fascia; coordinate with roofing work.
 - 2. Install system to allow for expansion and contraction with 6 mm (1/4 inch) space between aluminum members as required by manufacturer of system.

3.2 PROTECTION OF ALUMINUM

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

3.3 ADJUSTING

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

3.4 PROTECTION

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

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SECTION 07 81 00
APPLIED FIREPROOFING

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies and cementitious coverings to provide fire resistance to interior structural steel members shown.

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.
- C. Certificates:
 - 1. Certificate from testing laboratory attesting fireproofing material and application method meet the specified fire ratings.
 - a. List thickness and density of material required to meet fire ratings.
 - b. Accompanied by complete test report and test record.
 - 2. Manufacturer's certificate indicating sprayed-on fireproofing material supplied under the Contract is same within manufacturing tolerance as fireproofing material tested.
- D. Miscellaneous:
 - 1. Manufacturer's written approval of surfaces to receive sprayed-on fireproofing.
 - 2. Manufacturer's written approval of completed installation.
 - 3. Manufacturer's written approval of the applicators of fireproofing material.

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(R2008).....Installation of Interior Lathing and Furring
 - C847-10.....Metal Lath
 - E84-10.....Surface Burning Characteristics of Building Materials
 - E119-10.....Fire Tests of Building Construction and Materials

E605-93(R2006).....Thickness and Density of Sprayed Fire-Resistive
Materials Applied to Structural Members
E736-00(R2006).....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(R2008).....Acoustically, Absorptive Materials Applied by
Trowel or Spray.
G21-09.....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

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.
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 48 kPa (1000psf).
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 WATER

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

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 fireproofing 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. 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, 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).
- D. 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 VA 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 on interior structural steel members.
- B. Type I:
 - 1. Three hour fire rating.

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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. Spray applied fireproofing: Section 07 81 00, APPLIED FIREPROOFING
- B. Sealants and application: Section 07 92 00, JOINT SEALANTS.
- C. Fire and smoke damper assemblies in ductwork: Section 23 31 00, HVAC DUCTS AND CASINGS and Section 23 37 00, AIR OUTLETS AND INLETS.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturers literature, data, and installation instructions for types of firestopping and smoke stopping used.
- C. List of UL or WH classification number of systems installed.
- D. Certified laboratory test reports for ASTM E814 tests for systems not listed by UL or WH proposed for use.

1.4 DELIVERY AND STORAGE

- A. Deliver materials in their original unopened containers with manufacturer's name and product identification.
- B. Store in a location providing protection from damage and exposure to the elements.

1.5 WARRANTY

Firestopping work subject to the terms of the Article "Warranty of Construction", FAR clause 52.246-21, except extend the warranty period to five years.

1.6 QUALITY ASSURANCE

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

1.7 APPLICABLE PUBLICATIONS

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

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

E84-10.....Surface Burning Characteristics of Building
Materials

E814-11.....Fire Tests of Through-Penetration Fire Stops

C. Underwriters Laboratories, Inc. (UL):

Annual Issue Building Materials Directory

Annual Issue Fire Resistance Directory

1479-10.....Fire Tests of Through-Penetration Firestops

D. 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 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. UL, or WH rated or tested by an approved laboratory in accordance with ASTM E814.
- H. Materials to be asbestos free.

2.2 SMOKE STOPPING IN SMOKE PARTITIONS

- A. Use silicone sealant in smoke partitions as specified in Section 07 92 00, JOINT SEALANTS.
- B. Use mineral fiber filler and bond breaker behind sealant.
- C. Sealants shall have a maximum flame spread of 25 and smoke developed of 50 when tested in accordance with E84.
- D. When used in exposed areas capable of being sanded and finished with similar surface treatments as used on the surrounding wall or floor surface.

PART 3 - EXECUTION

3.1 EXAMINATION

Submit product data and installation instructions, as required by article, submittals, after an on site examination of areas to receive firestopping.

3.2 PREPARATION

- A. Remove dirt, grease, oil, loose materials, or other substances that prevent adherence and bonding or application of the firestopping or smoke stopping materials.
- B. Remove insulation on insulated pipe for a distance of 150 mm (six inches) on either side of the fire rated assembly prior to applying the firestopping materials unless the firestopping materials are tested and approved for use on insulated pipes.

3.3 INSTALLATION

- A. Do not begin work until the specified material data and installation instructions of the proposed firestopping systems have been submitted and approved.
- B. Install firestopping systems with smoke stopping in accordance with UL WH, or other approved system details and installation instructions.
- C. Install smoke stopping seals in smoke partitions.

3.4 CLEAN-UP AND ACCEPTANCE OF WORK

- A. As work on each floor is completed, remove materials, litter, and debris.
- B. Do not move materials and equipment to the next-scheduled work area until completed work is inspected and accepted by the COR.
- C. Clean up spills of liquid type materials.

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SECTION 07 92 00
JOINT SEALANTS

PART 1 - GENERAL

1.1 DESCRIPTION:

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

1.2 RELATED WORK:

- A. Firestopping penetrations: Section 07 84 00, FIRESTOPPING.
- B. Glazing: Section 08 80 00, GLAZING.
- C. Sound rated gypsum partitions/sound sealants: Section 09 29 00, GYPSUM BOARD.
- D. Mechanical Work: Section 21 05 11, COMMON WORK RESULTS FOR FIRE SUPPRESSION, Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING and Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

1.3 QUALITY CONTROL:

- A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.
- C. Product Testing: Obtain test results from a qualified testing agency based on testing current sealant formulations within a 12-month period.
 - 1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021.
 - 2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C920, and where applicable, to other standard test methods.
 - 3. Test elastomeric joint sealants according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C920 for adhesion and cohesion under cyclic movement, adhesion-in peel, and indentation hardness.
 - 4. Test other joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.

D. 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 WARRANTY:

- A. Warranty exterior sealing against leaks, adhesion, and cohesive failure, and subject to terms of "Warranty of Construction", FAR clause 52.246-21, except that warranty period shall be extended to two years.
- B. General Warranty: Special warranty specified in this Article shall not deprive Government of other rights Government may have under other provisions of Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of Contract Documents.

1.9 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - C509-06.....Elastomeric Cellular Preformed Gasket and Sealing Material.
 - C612-10.....Mineral Fiber Block and Board Thermal Insulation.
 - C717-10.....Standard Terminology of Building Seals and Sealants.
 - C834-10.....Latex Sealants.
 - C919-08.....Use of Sealants in Acoustical Applications.

C920-10.....Elastomeric Joint Sealants.
C1021-08.....Laboratories Engaged in Testing of Building
Sealants.
C1193-09.....Standard Guide for Use of Joint Sealants.
C1330-02 (R2007).....Cylindrical Sealant Backing for Use with Cold
Liquid Applied Sealants.
D1056-07.....Specification for Flexible Cellular Materials—
Sponge or Expanded Rubber.
E84-09.....Surface Burning Characteristics of Building
Materials.

C. Sealant, Waterproofing and Restoration Institute (SWRI).
The Professionals' Guide

PART 2 - PRODUCTS

2.1 SEALANTS:

A. S-1:

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

B. S-2:

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

C. S-3:

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

D. S-4:

1. ASTM C920 polyurethane or polysulfide.
2. Type S.
3. Class 25.
4. Grade NS.

5. Shore A hardness of 25-40.

E. S-6:

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

F. S-9:

1. ASTM C920 silicone.
2. Type S.
3. Class 25.
4. Grade NS.
5. Shore A hardness of 25-30.
6. Non-yellowing, mildew resistant.

2.2 CAULKING COMPOUND:

- A. C-1: ASTM C834, acrylic latex.
- B. C-2: One component acoustical caulking, non drying, non hardening, synthetic rubber.

2.3 COLOR:

- A. Sealants used with exposed masonry shall match color of mortar joints.
- B. Sealants used with unpainted concrete shall match color of adjacent concrete.
- C. Color of sealants for other locations shall be light gray or aluminum, unless specified otherwise.
- D. Caulking shall be light gray or white, unless specified otherwise.

2.4 JOINT SEALANT BACKING:

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
 1. Type C: Closed-cell material with a surface skin.
- C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 32° C

(minus 26° F). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.

- D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.5 FILLER:

- A. Mineral fiber board: ASTM C612, Class 1.
- B. Thickness same as joint width.
- C. Depth to fill void completely behind back-up rod.

2.6 PRIMER:

- A. As recommended by manufacturer of caulking or sealant material.
- B. Stain free type.

2.7 CLEANERS-NON POUROUS SURFACES:

Chemical cleaners acceptable to manufacturer of sealants and sealant backing material, free of oily residues and other substances capable of staining or harming joint substrates and adjacent non-porous surfaces and formulated to promote adhesion of sealant and substrates.

PART 3 - EXECUTION

3.1 INSPECTION:

- A. Inspect substrate surface for bond breaker contamination and unsound materials at adherent faces of sealant.
- B. Coordinate for repair and resolution of unsound substrate materials.
- C. Inspect for uniform joint widths and that dimensions are within tolerance established by sealant manufacturer.

3.2 PREPARATIONS:

- A. Prepare joints in accordance with manufacturer's instructions and SWRI.
- B. Clean surfaces of joint to receive caulking or sealants leaving joint dry to the touch, free from frost, moisture, grease, oil, wax, lacquer paint, or other foreign matter that would tend to destroy or impair adhesion.
 - 1. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants.

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

3.3 BACKING INSTALLATION:

- A. Install back-up material, to form joints enclosed on three sides as required for specified depth of sealant.
- B. Where deep joints occur, install filler to fill space behind the back-up rod and position the rod at proper depth.
- C. Cut fillers installed by others to proper depth for installation of back-up rod and sealants.
- D. Install back-up rod, without puncturing the material, to a uniform depth, within plus or minus 3 mm (1/8 inch) for sealant depths specified.

E. Where space for back-up rod does not exist, install bond breaker tape strip at bottom (or back) of joint so sealant bonds only to two opposing surfaces.

F. Take all necessary steps to prevent three sided adhesion of sealants.

3.4 SEALANT DEPTHS AND GEOMETRY:

A. At widths up to 6 mm (1/4 inch), sealant depth equal to width.

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

3.5 INSTALLATION:

A. General:

1. Apply sealants and caulking only when ambient temperature is between 5° C and 38° C (40° and 100° F).
2. Do not use polysulfide base sealants where sealant may be exposed to fumes from bituminous materials, or where water vapor in continuous contact with cementitious materials may be present.
3. Do not use sealant type listed by manufacture as not suitable for use in locations specified.
4. Apply caulking and sealing compound in accordance with manufacturer's printed instructions.
5. Avoid dropping or smearing compound on adjacent surfaces.
6. Fill joints solidly with compound and finish compound smooth.
7. Tool joints to concave surface unless shown or specified otherwise.
8. Finish paving or floor joints flush unless joint is otherwise detailed.
9. Apply compounds with nozzle size to fit joint width.
10. Test sealants for compatibility with each other and substrate. Use only compatible sealant.

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

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

1. Apply a 6 mm (1/4 inch) minimum bead of sealant each side of runners (tracks), including those used at partition intersections with dissimilar wall construction.

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

3.6 FIELD QUALITY CONTROL:

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

- E. Repair sealants pulled from test area by applying new sealants following same procedures used to originally seal joints. Ensure that original sealant surfaces are clean and new sealant contacts original sealant.
- F. Evaluation of Field-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements, will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.7 CLEANING:

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

3.8 LOCATIONS:

- A. Exterior Building Joints, Horizontal and Vertical:
 - 1. Metal to Metal: Type S-1, S-2
 - 2. Threshold Setting Bed: Type S-1, S-3, S-4
- 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. Interior Caulking:
 - 1. Typical Narrow Joint 6 mm, (1/4 inch) or less at Walls and Adjacent Components: Types C-1 and C-2.
 - 2. Perimeter of Doors, Access Panels which Adjoin Concrete or Masonry Surfaces: Types C-1 and C-2.
 - 3. Joints at Masonry Walls and Columns, Piers, Concrete Walls or Exterior Walls: Types C-1 and C-2.
 - 4. Perimeter of Gypsum Wallboard Walls: Types C-1 and C-2.
 - 5. Exposed Isolation Joints at Top of Full Height Walls: Types C-1 and C-2.
 - 6. Exposed Acoustical Joint at Sound Rated Partitions Type C-2.

7. Concealed Acoustic Sealant Types S-4, C-1 and C-2.

- - - E N D - - -

SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies steel doors, steel frames and related components.
- B. Terms relating to steel doors and frames as defined in ANSI A123.1 and as specified.

1.2 RELATED WORK

- A. Frames fabricated of structural steel: Section 05 50 00, METAL FABRICATIONS.
- B. Aluminum frames entrance work: Section 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS.
- C. Door Hardware: Section 08 71 00, DOOR HARDWARE.
- D. Glazing: Section 08 80 00, GLAZING.
- E. Card readers and biometric devices: Section 28 13 00, ACCESS CONTROL.
- F. Security Monitors: Section 28 51 00, SECURITY CONTROL CENTER.

1.3 TESTING

An independent testing laboratory shall perform testing.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturers Literature and Data:
 - 1. Fire rated doors and frames, showing conformance with NFPA 80 and Underwriters Laboratory, Inc., or Intertek Testing Services.

1.5 SHIPMENT

- A. Prior to shipment label each door and frame to show location, size, door swing and other pertinent information.
- B. Fasten temporary steel spreaders across the bottom of each door frame.

1.6 STORAGE AND HANDLING

- A. Store doors and frames at the site under cover.
- B. Protect from rust and damage during storage and erection until completion.

1.7 APPLICABLE PUBLICATIONS

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

- B. 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 (R2006).....Thermal Transmittance of Steel Door and Frame
Assemblies
128-09.....Acoustical Performance for Steel Door and Frame
Assemblies
- D. American National Standard Institute:
A250.8-2003 (R2008).....Specifications for Standard Steel Doors and
Frames
- E. American Society for Testing and Materials (ASTM):
A167-99(R2009).....Stainless and Heat-Resisting Chromium-Nickel
Steel Plate, Sheet, and Strip
A568/568-M-11.....Steel, Sheet, Carbon, and High-Strength, Low-
alloy, Hot-Rolled and Cold-Rolled
A1008-10.....Steel, sheet, Cold-Rolled, Carbon, Structural,
High Strength Low Alloy and High Strength Low
Alloy with Improved Formability
- F. The National Association Architectural Metal Manufacturers (NAAMM):
Metal Finishes Manual (AMP 500-06)
- G. National Fire Protection Association (NFPA):
80-13.....Fire Doors and Fire Windows
- H. Underwriters Laboratories, Inc. (UL):
Fire Resistance Directory
- I. Intertek Testing Services (ITS):
Certifications Listings...Latest Edition

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 FABRICATION GENERAL

- A. GENERAL:
1. Follow ANSI A250.8 for fabrication of standard steel doors, except
as specified otherwise. Doors to receive hardware specified in

- Section 08 71 00, DOOR HARDWARE. Tolerances as per ANSI A250.8.
Thickness, 44 mm (1-3/4 inches), unless otherwise shown.
2. When vertical steel stiffeners are used for core construction, fill spaces between stiffeners with mineral fiber insulation.
- B. Standard Duty Doors: ANSI A250.8, Level 1, Full flush seamless design of size and design shown. Use for interior locations only.

Core Construction Type	Door Core Description
a	Kraft honeycomb

- C. 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.
- D. Fire Rated Doors (Labeled):
1. Conform to NFPA 80 when tested by Underwriters Laboratories, Inc., Inchcape Testing Services 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.

2.3 METAL FRAMES

- A. General:
1. ANSI A250.8, 1.3 mm (0.053 inch) thick sheet steel, types and styles as shown or scheduled.
 2. Frames for labeled fire rated doors.
 - a. Comply with NFPA 80. Test by Underwriters Laboratories, Inc., Inchcape Testing Services.
 - 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.

3. Frames for doors specified to have automatic door operators, minimum 1.7 mm (0.067 inch) thick.
4. Knocked-down frames are not acceptable.

B. Reinforcement and Covers:

1. ANSI A250.8 for, minimum thickness of steel reinforcement welded to back of frames.
2. Provide mortar guards securely fastened to back of hardware reinforcements.
3. Where concealed door closers are installed within the head of the door frames, prepare frames for closers and provide 1 mm (0.042 inch) thick steel removable stop sections for access to concealed face plates and control valves, except when cover plates are furnished with closer.

C. Glazed Openings:

1. Integral stop on exterior, corridor, or secure side of door.
2. Design rabbet width and depth to receive glazing material.

D. Frame Anchors:

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

- a. Locate anchors on jambs near top and bottom of each frame, and at intermediate points not over 600 mm (24 inches) apart, except for fire rated frames space anchors as required by labeling authority.
- b. Form jamb anchors of not less than 1 mm (0.042 inch) thick steel unless otherwise specified.
- c. Anchors set in masonry: Use adjustable anchors designed for friction fit against the frame and for extension into the masonry not less than 250 mm (10 inches). Use one of following type:
 - 1) Wire loop type of 5 mm (3/16 inch) diameter wire.
 - 2) T-shape or strap and stirrup type of corrugated or perforated sheet steel.
- d. Anchors for stud partitions: Either weld to frame or use lock-in snap-in type. Provide tabs for securing anchor to the sides of the studs.
- e. Anchors for frames set in prepared openings:
 - 1) Steel pipe spacers with 6 mm (1/4 inch) inside diameter welded to plate reinforcing at jamb stops or hat shaped formed strap spacers, 50 mm (2 inches) wide, welded to jamb near stop.
 - 2) Drill jamb stop and strap spacers for 6 mm (1/4 inch) flat head bolts to pass thru frame and spacers.
 - 3) Two piece frames: Subframe or rough buck drilled for 6 mm (1/4 inch) bolts.
- f. Modify frame anchors to fit special frame and wall construction and provide special anchors where shown or required.

2.6 SHOP PAINTING

- A. ANSI A250.8.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Plumb, align and brace frames securely until permanent anchors are set.
 1. Use triangular bracing near each corner on both sides of frames with temporary wood spreaders at midpoint.
 2. Use wood spreaders at bottom of frame if the shipping spreader is removed.
 3. Protect frame from accidental abuse.
 4. Where construction will permit concealment, leave the shipping spreaders in place after installation, otherwise remove the spreaders after the frames are set and anchored.

5. Remove wood spreaders and braces only after the walls are built and jamb anchors are secured.

B. Floor Anchors:

1. Anchor the bottom of door frames to floor with two 6 mm (1/4 inch) diameter expansion bolts.
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.

3.2 INSTALLATION OF DOORS AND APPLICATION OF HARDWARE

Install doors and hardware as specified in Sections, Section 08 11 13, HOLLOW METAL DOORS AND FRAMES, Section 08 14 00, WOOD DOORS, Section 08 71 00, DOOR HARDWARE.

- - - E N D - - -

SECTION 08 14 00
INTERIOR WOOD DOORS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies interior flush doors with prefinish, prefit .
- B. Section includes fire rated doors and smoke doors.

1.2 RELATED WORK

- A. Metal door frames: Section 08 11 13, HOLLOW METAL DOORS AND FRAMES.
- B. Door hardware including hardware location (height): Section 08 71 00, DOOR HARDWARE.
- C. Installation of doors and hardware: Section 08 11 13, HOLLOW METAL DOORS AND FRAMES, Section 08 14 00, WOOD DOORS, or Section 08 71 00, DOOR HARDWARE.
- D. Glazing: Section 08 80 00, GLAZING.
- E. Finish: Section 09 06 00, SCHEDULE FOR FINISHES.
- F. Card readers and biometric devices: Section 28 13 00, ACCESS CONTROL
- G. Security monitors: Section 28 51 00, SECURITY CONTROL CENTER

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples:
 - 1. Corner section of flush veneered door 300 mm (12 inches) square, showing details of construction, labeled to show grade and type number and conformance to specified standard.
 - 2. Veneer sample 200 mm (8 inch) by 275 mm (11 inch) by 6 mm (1/4 inch) showing specified wood species sanded to receive a transparent finish. Factory finish veneer sample.
- C. Shop Drawings:
 - 1. Show every door in project and schedule location in building.
 - 2. Indicate type, grade, finish and size; include detail of glazing sound gasketing 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.
- E. Laboratory Test Reports:

1. Screw holding capacity test report in accordance with WDMA T.M.10.
2. Split resistance test report in accordance with WDMA T.M.5.
3. Cycle/Slam test report in accordance with WDMA T.M.7.
4. Hinge-Loading test report in accordance with WDMA T.M.8.

1.4 WARRANTY

- A. Doors are subject to terms of Article titled "Warranty of Construction", FAR clause 52.246-21, except that warranty shall be as follows:
1. For interior doors, manufacturer's warranty for lifetime of original installation.

1.5 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, Job Site Information.
- C. Label package for door opening where used.

1.6 APPLICABLE PUBLICATIONS

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.1A-11.....Architectural Wood Flush Doors
 - I.S.4-09.....Water-Repellent Preservative Non-Pressure
Treatment for Millwork
 - I.S.6A-11.....Architectural Wood Stile and Rail Doors
 - 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):
- 80-10.....Protection of Buildings from Exterior Fire
 - 252-08.....Fire Tests of Door Assemblies
- D. ASTM International (ASTM):
- E90-09.....Laboratory 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.
- B. Face Veneer:
1. In accordance with WDMA I.S.1-A.
 2. One species throughout the project unless scheduled or otherwise shown.
 3. For transparent finishes: Premium Grade. quarter sliced white maple.
 - a. AA grade face veneer
 - b. Match face veneers for doors for uniform effect of color and grain at joints.
 - c. Door edges shall be same species as door face veneer.
- C. Wood for stops, muntins and moldings of flush doors required to have transparent finish:
1. Solid Wood of same species as face 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.
- D. Fire rated wood doors:
1. Fire Performance Rating: As indicated on Drawings.
 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.

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.

2.3 PREFINISH, PREFIT

- A. Flush doors may 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.
- C. Flush doors to receive transparent finish (in addition to being prefit) shall be factory finished as follows:
 1. WDMA I.S.1-A Section F-3 specification for System TR-6, catalyzed polyurethane.
 2. Use stain when required to produce the finish specified in Section 09 06 00 SCHEDULE FOR FINISHES.

2.4 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.

2.5 SEALING:

Give top and bottom edge of doors two coats of catalyzed polyurethane or water resistant sealer before sealing in shipping containers.

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.
- 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, undercut where shown.
- F. Immediately after fitting and cutting of doors for hardware, seal cut edges of doors with two coats of water resistant sealer.
- G. Finish surfaces, including both faces, top and bottom and edges of the doors smooth to touch.
- H. Apply a steel astragal on the opposite side of active door on pairs of fire rated doors.
- I. 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

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.

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SECTION 08 31 13
ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 DESCRIPTION:

Section specifies access doors.

1.2 RELATED WORK

A. Section 09 06 00, SCHEDULE FOR FINISHES.

1.3 SUBMITTALS:

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

B. Shop Drawings: 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):
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. The National Association of Architectural Metal Manufacturers (NAAMM):
AMP 500 Series.....Metal Finishes Manual

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.
- 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.

2.2 ACCESS DOORS, FLUSH PANEL:

- A. Door Panel:
 - 1. Form of 14 gage thick steel sheet.
 - 2. Reinforce to maintain flat surface.
- B. Frame:
 - 1. Form of 16 gage thick steel sheet of depth and configuration to suit material and type of construction where installed.
 - 2. Provide surface mounted units having frame flange at perimeter where installed in concrete, masonry, or gypsum board construction.
 - 3. Weld exposed joints in flange and grind smooth.
- C. Hinge:
 - 1. Concealed piano hinge.
- D. Lock:
 - 1. Flush, screwdriver operated cam lock.

2.3 FINISH:

- A. Provide in accordance with NAAMM AMP 500 series on exposed surfaces.
- B. Steel Surfaces: Baked-on prime coat.

2.4 SIZE:

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 or plaster.
- B. Use flush panels in partitions and gypsum board or plaster ceilings, except lay-in acoustical panel ceilings or upward access acoustical tile ceilings.

3.2 INSTALLATION, GENERAL:

- A. Install access doors in openings to have sides vertical in wall installations, and parallel to ceiling suspension grid or side walls when installed in ceiling.
- B. Set frames so that edge of frames without flanges will finish flush with surrounding finish surfaces.
- C. Set frames with flanges to overlap opening and so that face will be uniformly spaced from the finish surface.

3.3 ANCHORAGE:

- A. Secure frames to adjacent construction using anchors attached to frames or by use of bolts or screws through the frame members.
- B. Type, size and number of anchoring device suitable for the material surrounding the opening, maintain alignment, and resist displacement during normal use of access door.

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.

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**SECTION 08 33 00
COILING DOORS AND GRILLES**

PART 1 - GENERAL

1.1 DESCRIPTION

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

1.2 RELATED WORK

- A. Section 09 06 00, SCHEDULE FOR FINISHES.
- B. 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 FIRE DOOR REQUIREMENTS

Where fire doors exceed the size for which testing and labeling is available, submit certificates stating that the doors and hardware is identical in design, materials, and construction to a door that has been tested and meets the requirements for the class indicated.

1.5 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 or grille.
 - 2. Manufacturer's installation procedures and instructions.
 - 3. Maintenance instructions, parts lists.
- D. Certificates:
 - 1. Attesting doors, anchors and hardware will withstand the horizontal loads specified.

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):
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 (R1997).....Dry-Type Transformers for General Applications
- D. National Fire Protection Association (NFPA):
70-11.....National Electrical Code 1999 Edition
80-10.....Fire Doors and Fire Windows
- E. National Association of Architectural Metal Manufacturers (NAAMM):
AMP 500 Series.....Metal Finishes Manual
- F. Underwriters Laboratories, Inc. (UL):
2010.....Fire Resistance Directory

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, mounted between jambs.
- B. All motor operators shall have manual emergency mechanical operators.
- C. Fire rated doors shall conform to the requirements specified herein and to NFPA 80 for the class indicated. Doors shall bear Underwriters Laboratories, Inc. label indicating the applicable fire rating.

2.3 FABRICATION

- A. Curtains:

1. Form of interlocking slats of galvanized steel of shapes standard with the manufacturer.
 2. Thickness of slats shall be as required to resist loads specified except not less than the following:
 - a. For doors less than 4500 mm (15 feet) wide: 0.75 mm (0.0299 inch).
 - b. For doors from 4530 mm (15 feet 1 inch) to 6300 mm (21 feet wide): 0.90 mm (0.0359 inch).
 - c. For doors wider than 6330 mm (21 feet 1 inch): 1.20 mm (0.0478 inch).
- B. Endlocks and Windlocks:
1. Manufacturer's stock design of galvanized malleable iron or galvanized steel or stamped cadmium steel for doors.
 2. The ends of each slat for interior doors shall have endlocks.
- C. Bottom Bar:
1. Two angles of equal weight, one on each side, standard steel members not less than 3 mm (0.125 inch) thick.
 2. Bottom bar designed to receive smoke seal safety device, and be securely fastened to bottom of curtain.
- D. 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.
- E. Brackets:
1. Steel plate designed to form end closure.

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.

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.
5. Provide manufacturer's smoke shield.

G. Guides:

1. Manufacturer's standard formed sections or angles of steel.
 - a. Steel sections 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.

H. Perimeter Seals:

1. Motor Operated Doors: Bottom bar safety device shall be a combination compressible seal and safety device as specified in paragraph, ELECTRIC MOTOR OPERATORS.
3. Provide manufacturer's standard brush-type smoke seals.

I. Locking:

1. Cylinder locks shall receive standard screw in cylinders furnished under Section, 08 71 00 DOOR HARDWARE.
2. For motor operated doors provide manufacturer's standard cylinder dead lock type locking device on the inside, key operated from both sides, interlocked with motor to prevent motor from operating when locks are activated.

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. 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. The control equipment shall conform to NEMA ICS 1 and 2.
2. Control enclosures shall be NEMA ICS 6, Type 12 or Type 4, except that contractor enclosures may be Type 1.
3. 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.
4. 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.

5. Use three-button type, push button switch on interior, 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.
6. Provide limit switches to automatically stop the doors at their fully open and closed positions. Positions of the limit switches shall be readily adjustable.
7. 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.
8. 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.
9. Electrical components shall conform to NFPA 70.

2.5 FIRE DOORS

- A. Fire rated doors shall be complete with hardware, accessories, and automatic closing device as required by NFPA 80. See Drawings for rating.
- B. Equip fire doors with an automatic closing mechanism actuated by fusible links to release at 54 °C (130 °F).

- C. Doors shall be forced into a closed position by an auxiliary spring in the barrel which is inoperative during normal operation and when activated will not affect the adjustment of the counterbalance spring. The auxiliary spring shall exert pressure on the curtain until the release device is reset. Door shall come to rest on the floor without impact.
- D. Control descent of curtain by an oscillating governor.
- E. Provide handles for push up operation.

2.6 FINISHES

- A. Steel:
 - 1. Clean surfaces of steel free from scale, rust, oil and grease, and then apply a light colored shop prime paint after fabrication.
 - 2. Non-galvanized steel: Treat to assure maximum paint adherence, and apply corrosion inhibitive primer.
 - 3. Galvanized steel: Apply a phosphate treatment and a corrosion inhibitive primer.
 - 4. Provide manufacturer's standard powder coat finish; color as scheduled in Section 09 06 00.

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.
- 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.

3.4 INSPECTION

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

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**SECTION 08 33 13
COILING COUNTER DOORS**

PART 1 -GENERAL

1.1 DESCRIPTION

- A. Section specifies overhead roll up coiling shutters over counter in walls.
- B. Motor operation.

1.2 RELATED WORK

- A. Lock cylinder and keying: Section 08 71 00, DOOR HARDWARE.
- B. Color of shutter; Section 09 06 00, SCHEDULE FOR FINISHES.
- C. Electrical Devices and Wiring: Division 26, ELECTRICAL.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - Shutter, each type.
 - Installation procedures and instructions.
- C. Shop Drawings:
 - Shutter, each type, showing details of construction and 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):
 - A47-99(R2009).....Malleable Iron Castings
 - A48-03(R2008).....Gray Iron Castings
 - A53-10.....Pipe, Steel, Black and Hot-Dipped, Zinc-Coated
Welded and Seamless
 - A653-10.....Steel Sheet Zinc-Coated (Galvanized) or Zinc-
Iron Alloy Coated (Galvannealed) by the Hot Dip
Process
 - F468-10.....Nonferrous Bolts, Hex Cap Screws, and Studs for
General Use
 - F593-02(R2008).....Stainless Steel Bolts, Hex Cap Screws, and
Studs
- C. American Welding Society (AWS):
 - D1.1-10.....Structural Welding Code Steel
 - D1.3-08.....Structural Welding Code Sheet Steel

- D. National Association of Architectural Metal Manufacturers (NAAMM)
AMP 500 Series-2006.....Metal Finishes Manual
- E. Federal Specifications (Fed. Spec):
TT-P-645B.....Primer, Paint, Zinc-Molybdates, Alkyd Type
- F. National Fire Protection Association (NFPA):
80-10.....Fire Doors and Fire Windows

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Galvanized Repair Compound: Mil. Spec MIL-P-21035.
- B. Primer: Fed. Spec. TT-P-645.
- C. Galvanized Steel: ASTM A653.
- D. Steel Pipe: ASTM A53.
- E. Casting: ASTM A47 or A48.

2.2 FABRICATION

- A. Weld in accordance with AWS applicable code.
- B. Fire Rated Shutter:
 - 1. Comply with NFPA 80. The counter shall have Underwriters Laboratories Inc., or other nationally recognized laboratory label for opening as shown on Drawings.
 - 2. Construct for recessed installation.
 - 3. Construct of galvanized steel.
 - 4. Curtain:
 - a. Flat type slats, approximately 32 mm (1 1/4-inches) wide.
 - b. Bottom bar equipped with recessed flush handles, recessed slide bolt on one end, key operated cylinder lock on other end and a continuous flexible seal to make contact with counter. Lock cylinder specified in Section 08 71 00, DOOR HARDWARE.
 - 5. Hood: Steel Sheet, formed with beads or flanges to prevent deflection. Sloping top exposed ends, hood, and flush closures fastened as recommended by manufacturer.
 - 6. Frame: Frame jamb sections to include guide slots for curtain with receiver for bolts and locks and continuous closure angles.
 - 7. Counterbalance Assembly:
 - a. Spring barrel or shaft of steel pipe of sufficient strength to ensure deflection not exceeding 1 mm (0.03-inch) per 300 mm (1 foot) of span.
 - b. Barrel or shaft house oil-tempered, helically wound steel spring, and rotate on grease-sealed ball or roller-bearing units.
 - c. Spring adjustable from outside.

- d. Brackets not less than 3 mm (0.125-inch) thick steel designed to form end closure support for head.

8. Operation:

- a. Manual operated.
- b. Equip shutter with an automatic closing device actuated by fusible link to release at 130 degrees F. located exposed below the ceiling on both sides of opening in accordance with NFPA No. 80.

9. Perimeter Seals: Provide manufacturer's standard bursh-type smoke seals.

C. Locking:

- 1. Cylinder locks shall receive standard screw-in cylinders furnished under Section 08 71 00, DOOR HARDWARE.

2.3 FINISH

A. Galvanized Steel:

- 1. Manufacturer's standard powder coat.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with approved shop drawings and manufacturer's instructions.
- B. Locate anchors and inserts for guides, brackets, supports, hardware, and other accessories and components accurately.
- C. Securely attach guides to adjoining construction with not less than 10 mm (3/8-inch) diameter bolts, spaced near each end and not over 600 mm (24 inches) apart.
 - 1. Use fasteners conforming to ASTM F468 and F593.
 - 2. Use toggle bolts to frame walls or hollow masonry.
 - 3. Use expansion bolts in solid masonry or concrete.

3.2 REPAIR

Repair damaged zinc-coated surfaces by applying galvanized repair compound in accordance with the manufacturer's directions.

3.3 ADJUSTING AND CLEANING

- A. Lubricate properly, adjust and demonstrate, to operate freely and as specified.
- B. Clean upon completion.

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SECTION 08 41 13
ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies aluminum entrance work including storefront construction, hung doors, and *other* components to make a complete assembly.

1.2 RELATED WORK:

- A. Glass and Glazing: Section 08 80 00, GLAZING.
- B. Hardware: Section 08 71 00, DOOR HARDWARE.
- C. Automatic Door Operators: Section 08 71 13, AUTOMATIC DOOR OPERATORS.
- D. Texture and color of finish: Section 09 06 00, SCHEDULE FOR FINISHES.

1.3 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: (1/2 full scale) showing construction, anchorage, reinforcement, and installation details.
- C. Manufacturer's Literature and Data:
 - 1. Doors, each type.
 - 2. Entrance and Storefront construction.
- D. Samples:
 - 1. Door corner section, 450 mm x 450 mm (18 x 18 inches), of each door type specified, showing vertical and top hinge edges, door closer reinforcement and internal reinforcement
 - 2. Two samples of organic finish of each color specified.
- E. Manufacturer's Certificates:
 - 1. Stating that aluminum has been given specified thickness of anodizing.
 - 2. Indicating manufacturer's qualifications specified.

1.4 QUALITY ASSURANCE:

- A. Approval by Contracting Officer is required of products of proposed manufacturer, or supplier, and will be based upon submission by Contractor certification.
- B. Certify manufacturer regularly and presently manufactures aluminum entrances and storefronts as one of their principal products.

1.5 DELIVERY, STORAGE AND HANDLING:

- A. Deliver aluminum entrance and storefront material to the site in packages or containers; labeled for identification with the manufacturer's name, brand and contents.
- B. Store aluminum entrance and storefront material in weather-tight and dry storage facility.
- C. Protect from damage from handling, weather and construction operations before, during and after installation.

1.6 APPLICABLE PUBLICATIONS:

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - B209-07.....Aluminum and Aluminum-Alloy Sheet and Plate
 - B221-08.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
 - E283-04.....Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
 - E331-00(R2009).....Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference
 - F468-10.....Nonferrous Bolts, Hex Cap Screws, and Studs for General Use
 - F593-02(R2008).....Stainless Steel Bolts, Hex Cap Screws, and Studs
- C. National Association of Architectural Metal Manufacturers (NAAMM):
 - AMP 500 Series.....Metal Finishes Manual
- D. American Architectural Manufacturer's Association (AAMA):
 - 2604-10.....High Performance Organic Coatings on Architectural Aluminum Extrusions and Panels
- E. American Welding Society (AWS):
 - D1.2-08.....Structural Welding Code Aluminum

1.7 PERFORMANCE REQUIREMENTS:

- A. Shapes and thickness of framing members shall be sufficient to withstand a design wind load of not less than [1.4] kilopascals ([30] pounds per square foot) of supported area with a deflection of not more than 1/175 times the length of the member and a safety factor of not

less than 1.65 (applied to overall load failure of the unit). Provide glazing beads, moldings, and trim of not less than 1.25 mm (0.050 inch) nominal thickness.

- B. Air Infiltration: When tested in accordance with ASTM E 283, air infiltration shall not exceed 2.63×10^{-5} cm per square meter (0.06 cubic feet per minute per square foot) of fixed area at a test pressure of 0.30 kPa (6.24 pounds per square foot) 80 kilometers (50 mile) per hour wind.
- C. Water Penetration: When tested in accordance with ASTM E 331, there shall be no water penetration at a pressure of 0.38 kPa (8 pounds per square foot) of fixed area.

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. Aluminum, ASTM B209 and B221:
 - 1. Alloy 6063 temper T5 for doors, door frames, and storefronts.
- B. Thermal Break: Manufacturer standard low conductive material retarding heat flow in the framework where insulating glass is scheduled and entrance doors.
- C. Fasteners:
 - 1. Aluminum: ASTM F468, Alloy 2024.
 - 2. Stainless Steel: ASTM F593, Alloy Groups 1, 2 and 3.

2.2 FABRICATION:

- A. Fabricate doors, of extruded aluminum sections not less than 3 mm (0.125 inch) thick. Fabricate glazing beads of aluminum not less than 1.0 mm (0.050 inch) thick.
- B. Accurately form metal parts and accurately fit and rigidly assemble joints, except those joints designed to accommodate movement. Seal joints to prevent leakage of both air and water.
- C. Make welds in aluminum in accordance with the recommended practice AWA D1.2. Use electrodes and methods recommended by the manufacturers of the metals and alloys being welded. Make welds behind finished surfaces so as to cause no distortion or discoloration of the exposed side. Clean welded joints of welding flux and dress exposed and contact surfaces.
- D. Make provisions in doors and frames to receive the specified hardware and accessories. Coordinate schedule and template for hardware specified under Section 08 71 00, DOOR HARDWARE. Where concealed

closers or other mechanisms are required, provide the necessary space, cutouts, and reinforcement for secure fastening.

- E. Fit and assemble the work at the manufacturer's plant. Mark work that cannot be permanently plant-assembled to assure proper assembly in the field.

2.3 PROTECTION OF ALUMINUM:

- A. Isolate aluminum from contact with dissimilar metals other than stainless steel, white bronze, or zinc by any of the following:
 - 1. Coat the dissimilar metal with two coats of heavy-bodied alkali resistant bituminous paint.
 - 2. Place caulking compound, or non-absorptive tape, or gasket between the aluminum and the dissimilar metal.
 - 3. Paint aluminum in contact with mortar, concrete and plaster, with a coat of aluminum paint primer.

2.4 FRAMES:

- A. Fabricate doors, frames and similar members from extruded aluminum not less than 3 mm (0.125 inch) thick.
- B. Provide integral stops and glass rebates and applied snap-on type trim.
- C. Use concealed screws, bolts and other fasteners. Secure cover boxes to frames in back of all lock strike cutouts.
- D. Fabricate framework with thermal breaks in frames where thermally broken exterior door is scheduled.

2.5 STILE AND RAIL DOORS:

- A. Nominal 2-inch thick, wide stile, head rail 5-inches wide, and bottom rail 250 mm (10 inches) wide, unless otherwise indicated.
- B. Bevel single-acting doors 3 mm (1/8 inch) at lock, hinge and meeting stile edges. Provide clearances of 2 mm (1/16 inch) at hinge stiles, 3 mm (1/8 inch) at lock stiles and top rails, and 5 mm (3/16 inch) at floors and thresholds. Form glass rebates integrally with stiles and rails. Glazing beads may be formed integrally with stiles and rails or applied type secured with fasteners at 150 mm (six inches) on centers.
- C. Construct doors with a system of welded joints or interlocking dovetail joints between stiles and rails. Clamp door together through top and bottom rails with 9 mm (3/8 inch) primed steel rod extending into the stiles, and having a self-locking nut and washer at each end. Reinforce stiles and rails to prevent door distortion when tie rods are tightened. Provide a compensating spring-type washer under each nut to

take up any stresses that may develop. Construct joints between rails and stiles to remain rigid and tight when door is operated.

- D. Weather-stripping: Provide removable, woven pile type (silicone-treated) weather-stripping attached to aluminum or vinyl holder. Make slots for applying weather-stripping integral with doors and door frame stops. Apply continuous weather-stripping to heads, jambs, bottom, and meeting stiles of doors and frames. Install weather-stripping so doors can swing freely and close positively.

2.6 REINFORCEMENT FOR BUILDERS HARDWARE:

- A. Fabricate from stainless steel plates.
- B. Hinge and pivot reinforcing: 4.55 mm (0.1793 inch) thick.
- C. Reinforcing for lock face, flush bolts, concealed holders, concealed or surface mounted closers: 2.66 mm (0.1046 inch) thick.
- D. Reinforcing for all other surface mounted hardware: 1.5 mm (0.0598 inch) thick.

2.7 FINISH

- A. In accordance with NAAMM AMP 500 series.
- B. Fluorocarbon Finish: AAMA 2605, high performance coating. (70% resin)

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Allowable Installation Tolerances: Install work plumb and true, in alignment and in relation to lines and grades shown. Variation of 3 mm (1/8 inch) in 2400 mm (eight feet), non-accumulative, is maximum permissible for plumb, level, warp, bow and alignment.
- B. Anchor aluminum frames to adjoining construction at heads, jambs and bottom and to steel supports, and bracing. Anchor frames with stainless steel or aluminum countersunk flathead, expansion bolts or machine screws, as applicable. Use aluminum clips for internal connections of adjoining frame sections.
- C. Where work is installed within masonry or concrete openings, place no parts other than built-in anchors and provision for operating devices located in the floor, until after the masonry or concrete work is completed.
- D. Install hardware specified under Section 08 71 00, DOOR HARDWARE.
- E. Install hung door operators specified under Section 08 71 13, AUTOMATIC DOOR OPERATORS.

3.2 ADJUSTING:

After installation of entrance and storefront work is completed, adjust and lubricate operating mechanisms to insure proper performance.

3.3 PROTECTION, CLEANING AND REPAIRING:

Remove all mastic smears and other unsightly marks, and repair any damaged or disfiguration of the work. Protect the installed work against damage or abuse.

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SECTION 08 42 29.23
SLIDING AUTOMATIC ENTRANCES

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies aluminum exterior and interior sliding, power operated automatic entrances.

1.2 RELATED WORK:

- A. Glass and Glazing: Section 08 80 00, GLAZING.
- B. Texture and color of finish: Section 09 06 00, SCHEDULE FOR FINISHES.
- C. Card Reader: Work of Division 26.

1.3 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: (1/2 full scale) showing construction, anchorage, reinforcement, and installation details.
- C. Manufacturer's Literature and Data:
 - 1. Doors, each type.

1.4 QUALITY ASSURANCE:

- A. Approval by Contracting Officer is required of products of proposed manufacturer, or supplier, and will be based upon submission by Contractor certification.
- B. Certify manufacturer regularly and presently manufactures aluminum entrances as one of their principal products.

1.5 DELIVERY, STORAGE AND HANDLING:

- A. Deliver aluminum entrance material to the site in packages or containers; labeled for identification with the manufacturer's name, brand and contents.
- B. Store aluminum entrance material in weather-tight and dry storage facility.
- C. Protect from damage from handling, weather and construction operations before, during and after installation.

1.6 APPLICABLE PUBLICATIONS:

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - B209-07.....Aluminum and Aluminum-Alloy Sheet and Plate

B221-08.....Aluminum and Aluminum-Alloy Extruded Bars,
Rods, Wire, Shapes, and Tubes
E283.....Standard Test Method for Determining Rate of
Air Leakage
F468-10.....Nonferrous Bolts, Hex Cap Screws, and Studs for
General Use
F593-02(R2008).....Stainless Steel Bolts, Hex Cap Screws, and
Studs

C. Builders Hardware Manufacturers Association: BHMA

D. National Association of Architectural Metal Manufacturers (NAAMM):
AMP 500 Series.....Metal Finishes Manual

E. American Welding Society (AWS):

D1.2-08.....Structural Welding Code Aluminum

1.7 DESCRIPTION OF OPERATION

A. Regular Hours:

1. Exterior entrance door and interior vestibule door are opened thru activation of motion sensors mounted on both sides of header for each door.
2. In the event of a power failure, entrance door will fail secure; exit is accomplished by activation of panic exit device.
3. In the event of a power failure, vestibule door will fail safe; exit is accomplished thru break away feature.

B. After Hours:

1. Exterior door is manually locked thru wall-mounted function control panel or key switch.
2. Exterior entrance door is opened from the exterior thru activation of card reader, exterior motion sensor is disabled.
3. Exit thru entrance door is accomplished by either activation of/or panic exit device sensor. Exit control panel shall be programmable for each exit option.
4. Interior vestibule door is opened thru activation of motion sensor.
5. In the event of a power failure, entrance door will fail secure; exit is accomplished by activation of panic exit device.
6. In the event of a power failure, vestibule door will fail safe; exit is accomplished thru break away feature.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Automatic entrances shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to ASCE/SEI7.
 - 1. Wind Loads: As indicated on Drawings.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- C. Operating Temperature Range: Automatic entrances shall operate within minus 20 to plus 122 deg F (minus 29 to plus 50 deg C).
- D. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 1.25 cfm/sq. ft. (6.4 L/s x sq. m) of fixed entrance-system area when tested according to ASTM E283 at a minimum static-air-pressure difference of 6.24 lbf/sq.ft.(300 Pa).
- E. Opening Force:
 - 1. Power-Operated Doors: Not more than 50 lbf (222 N) required to manually set door in motion if power fails, and not more than 15 lbf (67 N) required to open door to minimum require width.
 - 2. Breakaway Device for Power-Operated Doors: Not more than 50 lbf (222 N) required for a breakaway door or panel to open.
- F. Entrapment-Prevention Force:
 - 1. Power-Operated Sliding Doors: Not more than 30 lbf (133 N) required to prevent stopped door from closing.

2.2 MATERIALS:

- A. Aluminum, Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - 1. Extrusions: ASTM B 221 (ASTM B 221M).
 - 2. Sheet: ASTM B 209 (ASTM B 209M).
- B. Steel Reinforcement: Reinforcement with corrosion-resistant primer complying with SSPC-PS Guide No. 12.00 applied immediately after surface preparation and pretreatment. Use surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.
- C. Glazing: As specified in Section 08 80 00 GLAZING.
- D. Sealants and Joint Fillers: As specified in Section 07 92 00 JOINT SEALANTS.

- E. Nonmetallic, Shrinkage-Resistant Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout; complying with ASTM C 1107/C 1107M; of consistency suitable for application.
- F. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.3 SLIDING AUTOMATIC ENTRANCES

- A. General: Provide manufacturer's standard automatic entrances including doors, sidelites, framing, headers, carrier assemblies, roller tracks, door operators, controls, and accessories required for a complete installation.
- B. Sliding Automatic Entrance:
 - 1. Configuration: Biparting-sliding doors with two sliding leaves, and sidelites on each side.
 - a. Traffic Pattern: Two way.
 - b. Emergency Breakaway Capability: Operable panels.
 - c. Mounting: Between jambs.
 - 2. Operator Features:
 - a. Power opening and closing.
 - b. Adjustable opening and closing speeds.
 - c. Adjustable hold-open time between zero and 30 seconds.
 - d. Obstruction recycle.
 - e. On/off hold-open switch to control electric power to operator, key operated.
 - 3. Sliding-Door Carrier Assemblies and Overhead Roller Tracks: 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 wheels operating on a continuous roller track.
 - a. Rollers: Minimum of two ball-bearing roller wheels and two antirise rollers for each active leaf.
 - 4. Controls: Activation and safety devices according to BHMA standards.
 - a. Activation Device: Motion sensor mounted on each side of door header to detect pedestrians in activating zone and to open door.
 - b. Safety Device: Two photoelectric beams mounted in sidelite jambs on each side of door to detect pedestrians in presence zone and to prevent door from closing.

- c. Sidelite Safety Device: Presence sensor mounted above each sidelite on side of door opening through which door travel, to detect obstructions and to prevent door from opening.

5. Finish: As scheduled in Section 09 06 00.

2.4 FABRICATION:

- A. General: Factory fabricate automatic entrance components to designs, sizes, and thicknesses indicated and to comply with indicated standards.
 - 1. Form aluminum shapes before finishing.
 - 2. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
 - 3. Use concealed fasteners to greatest extent possible. Where exposed fasteners are required, use countersunk Phillips flat-head machine screws, finished to match framing.
 - a. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
 - b. Reinforce members as required to receive fastener threads.
 - 4. 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.
- B. Framing: Provide automatic entrances as prefabricated assemblies. Complete fabrication, assembly, finishing, hardware application, and other work before shipment to Project site.
 - 1. Fabricate tubular and channel frame assemblies with welded or mechanical joints. Provide subframes and reinforcement as required for a complete system to support required loads.
 - 2. Perform fabrication operations in manner that prevents damage to exposed finish surfaces.
 - 3. Form profiles that are sharp, straight, and free of defects or deformations.
 - 4. Provide components with concealed fasteners and anchor and connection devices.
 - 5. Fabricate components with accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion.

6. Fabricate exterior components to drain condensation and water passing joints within system to the exterior.
7. Provide anchorage and alignment brackets for concealed support of assembly from building structure.
8. Allow for thermal expansion of exterior units.
- 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. Controls:
 1. General: Factory install activation and safety devices in doors and headers as required by BHMA A156.10 for type of door and direction of travel.
 2. Install photoelectric beams in vertical jambs of sidelites, with dimension above finished floor as follows:
 - a. Top Beam: 48 inches (1219 mm).
 - b. Bottom Beam: 24 inches (610 mm).

2.5 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Apply organic finishes to formed metal after fabrication unless otherwise indicated.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 DOOR OPERATORS AND CONTROLS

- A. General: Provide operators and controls, which include activation and safety devices, according to BHMA standards, for condition of exposure, and for long-term, maintenance-free operation under normal traffic load for type of occupancy indicated.
- B. Door Operators: Provide door operators of size recommended by manufacturer for door size, weight, and movement.
 - 1. Door Operator Performance: Door operators shall 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 solid-state microprocessor controller; UL 325; and with manual operation with power off.
- C. Motion Sensors: Self-contained, K-band-frequency, microwave-scanner units; fully enclosed by its plastic housing; adjustable to provide detection-field sizes and functions required by BHMA A156.10.
 - 1. Provide capability for switching between bidirectional and unidirectional detection.
- D. Presence Sensors: Self-contained, active-infrared scanner units; adjustable to provide detection-field sizes and functions required by BHMA A156.10. Sensors shall remain active at all times.
- E. Photoelectric Beams: Pulsed infrared, sender-receiver assembly for recessed mounting. Beams shall not be active when doors are fully closed.
- F. Function Control Panel or Key Switch: Provide faceplate engraved with letters indicating functions.
 - 1. Face-Plate Material: Stainless steel.
 - 2. Functions: Two-way automatic, exit and off.
- G. 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.

2.7 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 unless otherwise indicated.
- B. Breakaway Device for Power-Operated Doors: 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 as stipulated in "Performance Requirements" Article. Interrupt powered operation of door operator while in breakaway mode.

C. Weather Stripping: Replaceable components.

1. Sliding Type: AAMA 701, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

D. Exit Device: Shall be integral with exterior door.

2.8 FINISH

A. In accordance with NAAMM AMP 500 series.

B. Finish and Color: As scheduled in Section 09 06 00. AAMA 2605 (70% resin)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances, header support, and other conditions affecting performance of automatic entrances.
- B. Examine roughing-in for electrical systems to verify actual locations of power connections before automatic entrance installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install automatic entrances according to manufacturer's written instructions and cited BHMA standard for direction of pedestrian travel, including signage, controls, wiring, and connection to the building's power supply.
 - 1. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight.
 - 2. 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.
 - 3. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous coating.
- 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.
- C. Door Operators: Connect door operators to electrical power distribution system.
- D. Controls: Install and adjust activation and safety devices according to manufacturer's written instructions and cited BHMA standard for direction of pedestrian travel. Connect control wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- E. Glazing: Install glazing as specified in Section 08 80 00 "GLAZING."
- F. Sealants: Comply with requirements specified in Section 079200 "Joint Sealants" to provide weathertight installation.
- G. Signage: Apply signage on both sides of each door and breakaway sidelite as required by cited BHMA standard for direction of pedestrian travel.
- H. 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.

3.3 FIELD QUALITY CONTROL

- A. Certified Inspector: Engage a Certified Inspector to test and inspect components, assemblies, and installations, including connections.
- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
1. Test and inspect each automatic entrance, using AAADM inspection forms, to determine compliance of installed systems with applicable BHMA standards.
- C. Automatic entrances will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.4 ADJUSTING

- A. Adjust hardware, moving parts, door operators, and controls to function smoothly, and lubricate as recommended by manufacturer; comply with requirements of applicable BHMA standards.
 - 1. Adjust exterior doors for weathertight closure.
- B. Readjust door operators and controls after repeated operation of completed installation equivalent to three days' use by normal traffic (100 to 300 cycles).
- C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.5 CLEANING

- A. Clean glass and metal surfaces promptly after installation. Remove excess glazing and sealant compounds, dirt, and other substances. Repair damaged finish to match original finish.
 - 1. Comply with requirements in Section 08 80 00 GLAZING for cleaning and maintaining glass.

3.6 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Acceptance, maintenance service shall include 12 months' full maintenance by skilled employees of automatic entrance Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper automatic entrance operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
 - 1. Engage a Certified Inspector to perform safety inspection after each adjustment or repair and at end of maintenance period. Furnish completed inspection reports to Owner.
 - 2. Perform maintenance, including emergency callback service, during normal working hours.
 - 3. Include 24-hour-per-day, 7-day-per-week, emergency callback service.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain automatic entrances.

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SECTION 08 44 13
GLAZED ALUMINUM CURTAIN WALLS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Section specifies new glazed aluminum curtain wall system.
 - 1. Thermally isolated, pressure equalized on interior.
 - 2. Type: Stick system to include following:
 - a. Integral reinforcing.
 - b. Closures, trim, subsills and flashings.
 - c. Fasteners, anchors, and related reinforcement.
- B. Refer to Drawings for modification work to existing curtainwall.

1.2 RELATED WORK

- A. Joint sealants: Section 07 92 00, JOINT SEALANTS.
- B. Aluminum and glass hinged entry doors and storefront construction:
Section 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS.
- C. Glazing: Section 08 80 00, GLAZING.
- D. Finish Color: Section 09 06 00, SCHEDULE FOR FINISHES.

1.3 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Approval is required of products or service of proposed manufacturer, suppliers and installers, and will be based upon submission by Contractor of certification that:
 - a. Manufacturers Qualifications: Manufacturer with five (5) years continuous documented experience in design, fabrication, and installation of glazed aluminum curtain wall systems of type and size required for that project.
 - b. Installer: Manufacturer approved in writing. Continuously installed glazed aluminum curtain walls systems for previous ten (10) years.
 - c. Manufacturer shall provide technical field representation at project site, as a minimum, at start of project, during middle, and towards end of project.
 - d. Existing Curtainwall Modification Work: Contractor must be approved by manufacturer of existing curtainwall system (Vistawall/Oldcastle).
 - e. Product Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of glazed aluminum curtain wall system. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, one

another, and adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, or in-service performance.

- 1) Do not modify intended aesthetic effects. If modifications are proposed, submit comprehensive explanatory data for review.

f. Qualification of Welders:

- 1) Welding shall be performed by certified welders qualified in accordance with AWS D1.2, using procedures, materials, and equipment of the type required for this work.

B. Pre-Installation Conference

1. Prior to starting installation of glazed curtain wall system schedule conference with Contracting Officer to ensure following:
 - a. Clear understanding of drawings and specifications.
 - b. Onsite inspection and acceptance of structural and pertinent structural details relating to curtain wall system.
 - c. Coordination of work of various trades involved in providing system. Conference shall be attended by Contractor; personnel directly responsible for installation of curtain wall system, flashing and sheet metal work, firestopping system and curtain wall manufacturer and their Technical Field Representatives. Conflicts shall be resolved and confirmed in writing.

1.4 SUBMITTALS

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Product Data:
 1. Manufacturer's standard details and fabrication methods.
 2. Data on finishing, components, and accessories.
 3. Instructions: Submit descriptive literature, detail specifications, available performance test data and instructions for installation, and adjustments.
 4. Recommendations for maintenance and cleaning of exterior surfaces.
- C. Shop Drawings:
 1. Show elevations of glazed curtain wall system at 1:50 (1/4 inch) scale, metal gages, details of construction, methods of anchorage, glazing details, and details of installation.
 2. Submit for curtain wall system and accessories.
 3. Operation and Maintenance Manuals
 - a. Submit cleaning and maintenance instructions.
- D. Samples:

1. Submit pairs of samples of each specified color and finish on 300 mm (12-inch) long section by width of each tubular, or extruded shape section or 300 mm by 300 mm (12-inch by 12-inch) wide sections of sheet shapes.
2. Submit corner section of framing members showing fasteners, panels, glazing methods, glazing materials, and weather-stripping. Submit one sample minimum 300 mm by 300 mm (12 inches by 12 inches). In lieu of submitting separate samples for corner section, intermediate section, and panel, one composite sample incorporating all components and features listed may be submitted.
3. Where normal color variations are anticipated, include 2 or more units in set indicating extreme limits of color variations.

E. Glass:

1. Specified in Section 08 80 00, GLAZING.

F. Quality Control Submittals:

1. Design Data:

- a. Submit structural and thermal calculations for complete wall assembly. Structural calculations and design shop drawings shall be signed and sealed by a structural engineer registered in state in which project is to be located.

2. Factory Test Reports:

- a. Test Reports: Provide certified test reports, for each of following listed tests, from a qualified independent testing laboratory showing that glazed aluminum curtain wall system assembly has been tested in accordance with specified test procedures and complies with performance characteristics as indicated by manufacturer's testing procedures. Manufacturer shall submit appropriate testing numbers for specific tests indicated below.

- 1) Deflection and structural tests.
- 2) Water penetration tests.
- 3) Air infiltration tests.
- 4) Thermal conductance tests.
- 5) Submit factory tests required except that where a curtain wall system or component of similar type, size, and design as specified for this project has been previously tested within last year, under conditions specified herein, resulting test reports may be submitted in lieu of listed testing.

G. Manufacturer's Certificates:

1. Submit Certificates of Compliance, with specification requirements, for the following:

- a. Metal extrusions.
 - b. Metal accessories.
 - c. Indicating manufacturer's and installer's meet qualifications as specified.
 - d. Submit list of equivalent size installations, for both manufacturer and installer, which have had satisfactory and efficient operation.
- H. Manufacturer's Field Reports:
- 1. Submit field reports of manufacturer's field representative observations of curtain wall installation indicating observations made during inspection at beginning of project, during middle of installation and at conclusion of project.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Refer to AAMA CW 10 for care and handling of architectural aluminum from shop to site.
- B. Prior to packaging for shipment from factory, mark wall components to correspond with shop and erection drawings and their placement location and erection.
- C. Prior to shipment from factory, place knocked-down lineal members in cardboard containers and cover finished surfaces of members with protective covering of adhesive paper, waterproof tape, or strippable plastic. Do not cover metal surfaces that will be in contact with sealants after installation.
- D. Inspect materials delivered to site for damage; unload and store with ventilation, free from heavy dust, not subject to combustion products or sources of water, and shall permit easy access for inspection and handling. Sealing and caulking compounds, including handling, shall be in accordance with requirements of Section 07 92 00 JOINT SEALANTS.

1.6 PROJECT CONDITIONS

Field Measurements: Where glazed aluminum curtain wall systems are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying Work.

1.7 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referred to in text by basic designation only.
- B. American Architectural Manufacturers Association (AAMA):
MCWM-1-89.....Metal Curtain Wall Manual

- CW 10-04.....Care and Handling of Architectural Aluminum from
Shop to Site
- CW 11-85.....Design Windloads for Buildings and Boundary
Layer Wind Tunnel Testing
- CWG 1-89.....Installation of Aluminum Curtain Walls
- TIR A9-91.....Metal Curtain Wall Fasteners
- TIR A11-04.....Maximum Allowable Deflection of Framing Systems
for Building Cladding Components of Design Wind
Loads
- 101/I.S.2/A440-08.....Windows, Doors and Unit Skylights
- 501-05.....Methods of Test for Exterior Walls
- 2605-98.....High Performance Organic Coatings on
Architectural Extrusions and Panels
- 1503-09.....Thermal Transmission and Condensation Resistance
of Windows, Doors and Glazed Wall Sections
- C. American Society of Civil Engineers (ASCE):
- ASCE 7-10.....Minimum Design Loads for Buildings and Other
Structures
- D. American Society for Testing and Materials (ASTM):
- A36/A36M-08.....Structural Steel
- A123-09.....Zinc (Hot-Dip Galvanized) Coatings on Iron and
Steel Products
- A193-10.....Alloy-Steel and Stainless Steel Bolting
Materials for High Temperature Service
- A307-10.....Carbon Steel Bolts and Studs, 60,000 PSI Tensile
Strength
- B209-10.....Aluminum and Aluminum Alloy Sheet and Plate
- B211-03.....Aluminum and Aluminum Alloy Bar, Rod, Wire
- B221/B221M-08.....Aluminum and Aluminum Alloy Extruded Bars, Rods,
Wire, Shapes and Tubes
- B316/B316M-10.....Aluminum and Aluminum Alloy Rivet and Cold-
Heading, Wire, and Rods
- C920-11.....Elastomeric Joint Sealants
- E283-04.....Determining Rate of Air Leakage Through Exterior
Windows, Curtain Walls, and Doors under
Specified Pressure Difference Across this
Specification
- E330-02(R2010).....Structural Performance of Exterior Windows,
Curtain Walls, and Doors by Uniform Static Air
Pressure Difference

- E331-00(R2009).....Water Penetration of Exterior Windows, Curtain Walls, and Doors By Uniform Static Air Pressure Difference
- E413-10.....Classification for Rating Sound Insulation
- E783-02(R2010).....Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.
- E1105-00(R2008).....Field Determination of Water Penetration of Installed Exterior Windows, Curtain Walls, and Doors By Uniform or Cyclic Static Air Pressure Differences
- E. American Welding Society, Inc. (AWS):
- D1.2-08.....Structural Welding Code-Aluminum
- F. Federal Specifications (FS):
- TT-P-645B-90.....Primer, Paint, Zinc-Molybdate, Alkyd Type
- G. Military Specifications (MIL):
- MIL-C-18480.....(Rev. B) Coating Compound, Bituminous Solvent, Coal Tar Base
- H. National Association of Architectural Metal Manufacturers (NAAMM):
- 500 Series (2006).....Metal Finishes Manual.
- I. Steel Structures Painting Council (SSPC)
- Paint 25-97 (2004).....Red Iron Oxide Raw Linseed Oil and Alkyd Primer (Without Lead and Chromate Pigments)

1.8 WARRANTY

- A. Submit manufacturer's written warranty for materials, installation and weathertightness, and subject to terms of "Warranty of Construction", FAR clause 52.246-21, except that warranty period shall be extended to five (5) years from date of final acceptance of project by Government.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Design Requirements:
1. Curtain Wall System: Tubular aluminum sections, Tubular aluminum sections with thermal break condition framing, factory prefinished, vision glass, glass related flashings, anchorage and attachment devices.
 2. System Assembly: Site assembled.
 3. No curtain wall framing member shall deflect, in a direction normal to plane of wall, more than 1/175 of its clear span or 20 mm (3/4 inch), whichever is less, when designed in accordance with requirements of TIR A11 and tested in accordance with ASTM E330, except that when a gypsum wallboard surface will be affected, deflection shall not exceed 1/360 of span. No framing member shall

have a permanent deformation in excess of 0.2 percent of its clear span when tested in accordance with ASTM E330 for a minimum test period of 10 seconds at 1.5 times design wind pressures indicated as part of structural drawing wind load requirements. No glass breakage, damage to fasteners, hardware or accessories shall be permitted due to deformation stated above:

- a. Provide system complete with framing, mullions, trim, fasteners, anchors, accessories, concealed auxiliary members, and attachment devices for securing wall to structure as specified or indicated. Unless noted otherwise, comply with MCWM-1.
 - b. Curtain wall system components shall be furnished by one manufacturer or fabricator; however, all components need not be products of same manufacturer.
 - c. Fully coordinate system accessories directly incorporated, and adjacent to contiguous related work and ensure materials compatibility, deflection limitations, thermal movements, and clearances and tolerances as indicated or specified.
 - d. Provide system with adequate allowances for expansion and contraction of components and fastenings to prevent buckling damage, joint seal failure, glass breakage, undue stress on fastenings or other detrimental effects. For design purposes, base provisions for thermal movement on assumed ambient temperature range of from -18 degrees C to 49 degrees C (0 degrees F to 120 degrees F).
 - e. Provide wall system to accommodate tolerances in building frame and other contiguous work as indicated or specified.
- B. Manufacturer's Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of kind indicated. Engineering services are defined as those performed for installations of curtain walls that are similar to those indicated for this Project in material, design, and extent.
- C. Performance Requirements:
1. System shall meet or exceed all performance requirements specified.
 2. Curtain wall components shall have been tested in accordance with requirements below and shall meet performance requirements specified:
 3. System Design: Design and size components to withstand dead loads and live loads caused by positive and negative wind loads acting normal to plane of wall as calculated in accordance with ASCE 7-Minimum Design Loads for Buildings and Other Structures and as measured in accordance with ASTM E330.

4. Water Penetration:
 - a. No water penetration shall occur when wall is tested in accordance with ASTM E331 at a differential static test pressure of 20 percent of inward acting design wind pressure as indicated on structural drawings, but not less than 479 Pa (10 psf).
 - b. Make provision in wall construction for adequate drainage to outside of water leakage or condensation that occurs within outer face of wall. Leave drainage and weep openings in members and wall open during test.
5. Air Infiltration: Test glazed aluminum curtain wall system according to AAMA 503, which requires testing according to ASTM E783
 - a. Static-Air-Differential: 75 Pa (1.57 lbf/sq. ft.) minimum.
 - b. Air Leakage: 0.03 L/s per sq. m (0.06 cfm/sq ft) of surface maximum.
6. Deflections Test: ASTM E330, Procedure B:
 - a. No member shall deflect in a direction parallel to plane of wall, when carrying its full design load, more than an amount which will reduce edge cover or glass bite below 75 percent of design dimension. No member after deflection under full design load, shall have a clearance between itself and top of panel, glass, sash, or other part immediately below it less than 3 mm (1/8 inch); clearance between member and an operable window or door shall be minimum 1.5 mm (1/16 inch).

2.2 MATERIALS

- A. Extruded Aluminum Framing Members: ASTM B221M; 6063-T5 extruded aluminum for non-structural components or 6063-T6 extruded aluminum for structural members; temper and alloy as recommended by manufacturer.
- B. Sheet Aluminum: ASTM B209M; 6065-T5 temper and alloy as recommended by manufacturer.
 1. Formed flashing and closures: Minimum 1.58 mm (0.062 inch) thick aluminum, in finish as selected.
 2. Extruded sill members: Minimum 1.58 mm (0.062 inch) thick aluminum, in finish as selected.
- C. Steel Sections: ASTM A36M.
- D. Primer: TS TT-P-645; red, for shop application and field touch-up.
- E. Fasteners:
 1. For Exterior Cap Retainers: ASTM A193 B8 300 series, stainless steel screws.
 2. For Framework Connections: ASTM B211M 2024-T4 aluminum, ASTM A193 B8 300 series, stainless steel, and ASTM B316 aluminum rivets, as required by connection.

3. For Anchoring Glazed Aluminum Curtain Wall to Support Structure: ASTM A307 zinc plated steel fasteners.
- F. Shims: Metal or plastic.
- G. Joint Sealants and Accessories:
 1. In accordance with requirements specified in Section 07 92 00, JOINT SEALANTS.
 2. Comply with recommendations of sealant manufacturer for specific sealant selections.
 3. Exposed metal to metal joints: Silicone sealant selected from manufacturer's standard colors.
- H. Glazing Materials:
 1. As specified under Section 08 80 00, GLAZING.
 2. Glass Sizes and Clearances:
 - a. Accommodate up to 25 mm (1 inch) glazing.
 - b. Sizes indicated are nominal. Verify actual sizes required by measuring frames. Coordinate dimensions for glass and glass holding members to meet applicable minimum clearances as recommended by glass manufacturer. Do not nip glass to remove flares or to reduce oversized dimensions. All cutting shall occur in factory.
 3. Glass Setting Materials:
 - a. Provide accessories required for glass installation to suit curtain wall system in accordance with manufacture's recommendations.

2.3 FABRICATION

- A. Curtain wall components shall be of materials and thickness indicated or specified. Details indicated are representative of required design and profiles. Maintain sightlines indicated on drawings. Unless specifically indicated or specified otherwise, methods of fabrication and assembly shall be at discretion of curtain wall manufacturer. Perform fitting and assembling of components in shop to maximum extent practicable. Anchorage devices shall permit adjustment in three directions. There shall be no exposed fasteners.
- B. Joints: Joints exceeding +1.5 mm (+1/16") shall be mechanically fastened.
- C. Ventilation and Drainage: Direct water leakage to exterior by means of concealed drainage system and weeps. Flashings and other materials used internally shall be nonstaining, noncorrosive, and nonbleeding.
- D. Protection and Treatment of Metals:
 1. Remove from metal surfaces lubricants used in fabrication and clean off other extraneous material before leaving shop.

2. Provide protection against galvanic action wherever dissimilar metals are in contact, except in case of aluminum in permanent contact with galvanized steel, zinc, stainless steel, or relatively small areas of white bronze. Paint contact surfaces with one coat bituminous paint conforming to MIL-C-18480 or apply appropriate caulking material or nonabsorptive, noncorrosive, and nonstaining tape or gasket between contact surfaces.

E. Metal sills and Closures: Fabricate accessories, spandrel panels, trim closures of sizes and shapes indicated from similar materials and finish as specified for wall system.

F. Concealed Interior Mullion Reinforcing: ASTM A36M steel shapes as required for strength and mullion size limitations, hot dip galvanized after fabrication in accordance with ASTM A123.

2.4 PROTECTION

A. Provide protection for aluminum against galvanic action, wherever dissimilar materials are in contact, by painting contact surfaces of dissimilar material with a heavy coat of bituminous paint (complete coverage), or by separating contact surfaces with a preformed neoprene tape having pressure sensitive adhesive coating on one side.

2.5 METAL FINISHES

A. In accordance with NAAMM AMP500 series.

B. Fluorocarbon Finish: AAMA 2605. (70% resin)
1. Color as selected.

C. Concealed Steel Items: Galvanized in accordance with ASTM A123 to 610 gm/sq m. Primed with iron oxide paint.

G. Apply one coat of bituminous paint to concealed aluminum and steel surfaces in contact with cementitious or dissimilar materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to installation of glazed curtain wall system, arrange for representative(s) of manufacturer to examine structure and substrate to determine that they are properly prepared, and ready to receive glazed curtain wall work included herein.

B. Verifying Conditions and Adjacent Surfaces: After establishment of lines and grades and prior to system installation examine supporting structural elements. Verify governing dimensions, including floor elevations, floor to floor heights, minimum clearances between curtain wall and structural frames, and other permissible dimensional tolerances in building frame.

3.2 PREPARATION

- A. Take field dimensions and examine condition of substrates, supports, and other conditions under which work of this section is to be performed to verify that work may properly commence. Do not proceed with installation until unsatisfactory conditions have been corrected.
- B. Contact between aluminum and dissimilar metals shall receive a protective coating of asphaltic paint for prevention of electrolytic action and corrosion.

3.3 INSTALLATION

- A. Installation and erection of glazed curtain wall system and all components shall be in accordance with written directions of curtain wall manufacturer. Match profiles, sizes, and spacing indicated on approved shop drawings.
- B. Bench Marks and Reference Points: Establish and permanently mark bench marks for elevations and building line offsets for alignment at convenient points on each floor level. Should any error or discrepancy be discovered in location of marks, stop erection work in that area until discrepancies have been corrected.
- C. Ensure that drainage system operates properly in accord with AAMA 501 procedures.
- D. Do not proceed with structural silicone work when metal temperature is below 0 degrees C (32 degrees F).
- E. Isolate between aluminum and dissimilar metals with protective coating or plastic strip to prevent electrolytic corrosion.
- F. Install glazed aluminum curtain wall system so as to maintain a virtually flat face cap, with no visible bowing.
- G. Install entire system so that fasteners are not visible.
- H. Tolerances:
 - 1. Maximum variation from plane or location shown on approved shop drawings: 3 mm per 3600 mm (1/8 inch per 12 feet) of length up to not more than 13 mm (1/2 inch) in any total length.
 - 2. Maximum offset from true alignment between two identical members abutting end to end in line: 0.8 mm (1/32 inch).
 - 3. Sealant Space Between Curtain Wall Mullion and Adjacent Construction: Maximum of 19 mm (3/4 inch) and minimum of 6 mm (1/4 inch).
- I. Joint Sealants:
 - 1. Joint Sealants: Shall be in accordance with requirements of Section 07 92 00, JOINT SEALANTS.
 - 2. Surfaces to be primed and sealed shall be clean, dry to touch, free from frost, moisture, grease, oil, wax, lacquer, paint, or other foreign matter. Enclose joints on three sides. Clean out grooves to

- proper depth. Joint dimensions shall conform to approved detail drawings with a tolerance of plus 3 mm (1/8 inch). Do not apply compound unless ambient temperature is between 5 and 35 degrees C (40 and 90 degrees F). Clean out loose particles and mortar just before sealing. Remove protective coatings or coverings from surfaces in contact with sealants before applying sealants or tapes. Solvents used to remove coatings shall be of type that leave no residue on metals.
3. Match approved sample. Force compound into grooves with sufficient pressure to fill grooves solidly. Sealing compound shall be uniformly smooth and free of wrinkles and, unless indicated otherwise, shall be tooled and left sufficiently convex to result in a flush joint when dry. Do not trim edges of sealing material after joints are tooled. Mix only amount of multi-component sealant which can be installed within four hours, but at no time shall this amount exceed 19 liters (5 gallons).
 4. Apply primer to masonry, concrete, and other surfaces as recommended by sealant manufacturer. Do not apply primer to surfaces which will be exposed after caulking is completed.
 5. Tightly pack backing in bottom of joints which are over 13 mm (1/2 inch) in depth with specified backing material to depth indicated or specified. Roll backing material of hose or rod stock into joints to prevent lengthwise stretching.
 6. Install bond preventive material at back or bottom of joint cavities in which no backstop material is required, covering full width and length of joint cavities.
 7. Remove compound smears from surfaces of materials adjacent to sealed joints as work progresses. Use masking tape on each side of joint where texture of adjacent material will be difficult to clean. Remove masking tape immediately after filling joint. Scrape off fresh compound from adjacent surfaces immediately and rub clean with approved solvent. Upon completion of caulking and sealing, remove remaining smears, stains, and other soiling, and leave work in clean neat condition.

3.4 CLEANING

- A. Install curtain wall frame and associated metal to avoid soiling or smudging finish.
- B. Clean metal surfaces promptly after installation, exercising care to avoid damage to coatings.
- C. Remove excess glazing and sealant compounds, dirt, and other substances.

- D. Follow recommendations of manufacturer in selection of cleaning agents. Do not use cleaning agents containing ammonia or other compounds that might damage finished metal surfaces.
- E. Replace cracked, broken, and defective glass with new glass at no additional cost to Government. Just prior to final acceptance of curtain wall system clean glass surfaces on both sides, remove labels, paint spots, compounds, and other defacements, and clean metal fixed panels. Remove and replace components that cannot be cleaned successfully.

3.5 PROTECTION

- A. After installation, protect exposed surfaces from disfiguration, contamination, contact with harmful materials, and from other construction hazards that will interfere with their operation, or damage their appearance or finish. Protection methods shall be in accordance with recommendations of product manufacturers or of respective trade association. Remove paper or tape factory applied protection immediately after installation. Clean surfaces of mortar, paint, smears of sealants, and other foreign matter to present neat appearance and prevent fouling of operation. In addition, wash with a stiff fiber brush, soap and water, and thoroughly rinse. Where surfaces become stained or discolored, clean or restore finish in accordance with recommendations of product manufacturer or respective trade association.

- - - END - - -

SECTION 08 56 19
PASS WINDOWS

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies sliding glass counter mounted pass windows.

1.2 RELATED WORK

- A. Color of factory finish: Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Glass and Glazing: Section 08 80 00, GLAZING.

1.3 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extend referenced. Publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - B221/221M-08.....Aluminum and Aluminum- Alloy Extruded Bars, Rods, Wire, Shapes and Tubes (Metric)
 - C509-06.....Elastomeric Cellular Preformed Gasket and Sealing Material
- C. American Society of Mechanical Engineers (ASME):
 - B18.6.4-98(R2005).....Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws
- D. National Association of Architectural Metal Manufacturers (NAAMM):
 - AMP 500 Series.....Metal Finishes Manual
 - AMP 500.....Introduction to Metal Finishing
 - AMP 501.....Finishes for Aluminum

PART 2 - PRODUCTS

2.1 MATERIAL

- A. Aluminum Extrusions:
 - 1. ASTM B 221 M.
 - 2. Alloy and temper recommended by window manufacturer for strength, corrosion resistance, and application of required finish, but not less than 150 MPa (22,000 psi) ultimate tensile strength, and yield of 110 MPa (16,000 psi).
 - 3. Aluminum alloy used for colored anodic coating as required to produce specified color.
- B. Glazing Gaskets: ASTM C 509.

2.1 SLIDING GLASS PASS WINDOWS, COUNTER MOUNTED

- A. Fabricate sliding glass sash and frames of extruded aluminum with corners mitered.
- B. Fabricate sash to receive 6 mm (1/4 inch) thick glass.
- C. Fabricate sliding sash of "H" channel molding at bottom edges including concealed nylon rollers at bottom set on track and guides at top set into track.
- D. Provide sash with pin tumbler lock and two keys.
- E. Provide sash with finger slot on vertical edge.
- F. Fabricate frame with channel sash slot, bottom roller track, and top guides.
- G. Sash shall be field glazed using glazing gaskets.
- H. Use concealed screws in assembly.
- I. Finish:
 - 1. Comply with NAAMM AMP 500 Series.
 - 2. Clear anodic coating, Class II Architectural 0.4 mills thick, AA-C22A41.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in pass window opening level and plumb.
- B. Secure with screws to opening; ASME B18.6.4.
 - 1. Screw within 100 mm (4 inches) of ends.
 - 2. Space screws not over 600 mm (24 inches) between end screws.
- C. Coat aluminum in contact with steel with one coat of MPI No. 18.
- D. Clean unit of dust and markings.

3.2 OPERATION

- A. Adjust to roll smoothly and stay in position where stopped.
- B. Demonstrate to COTR operation and locking.
- C. Turn keys with key tags over to COTRs.

- - E N D - - -

SECTION 08 71 00
DOOR HARDWARE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Door hardware and related items necessary for complete installation and operation of doors.

1.2 RELATED WORK

- A. Caulking: Section 07 92 00 JOINT SEALANTS.
- B. Application of Hardware: -Section 08 14 00, WOOD DOORS, Section 08 11 13, HOLLOW METAL DOORS AND FRAMES, Section 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS, Section 08 34 53, SECURITY DOORS AND FRAMES Section 08 71 13, AUTOMATIC DOOR OPERATORS, and Section 08 71 13.11, LOW ENERGY DOOR OPERATORS C. Finishes: Section 09 06 00, SCHEDULE FOR FINISHES.
- D. Painting: Section 09 91 00, PAINTING.
- E. Card Readers: Section 28 13 11, PHYSICAL ACCESS CONTROL SYSTEMS.
- F. Electrical: Division 26, ELECTRICAL.
- G. Fire Detection: Section 28 31 00, FIRE DETECTION AND ALARM.

1.3 GENERAL

- A. All hardware shall comply with UFAS, (Uniform Federal Accessible Standards) unless specified otherwise.
- B. Provide rated door hardware assemblies where required by most current version of the International Building Code (IBC).
- C. Hardware for Labeled Fire Doors and Exit Doors: Conform to requirements of NFPA 80 for labeled fire doors and to NFPA 101 for exit doors, as well as to other requirements specified. Provide hardware listed by UL, except where heavier materials, large size, or better grades are specified herein under paragraph HARDWARE SETS. In lieu of UL labeling and listing, test reports from a nationally recognized testing agency may be submitted showing that hardware has been tested in accordance with UL test methods and that it conforms to NFPA requirements.
- D. Hardware for application on metal and wood doors and frames shall be made to standard templates. Furnish templates to the fabricator of these items in sufficient time so as not to delay the construction.
- E. The following items shall be of the same manufacturer, except as otherwise specified:
 - 1. Mortise locksets.
 - 2. Hinges for hollow metal and wood doors.

3. Surface applied overhead door closers.
4. Exit devices.
5. Floor closers.

1.4 WARRANTY

A. Automatic door operators shall be subject to the terms of FAR Clause 52.246-21, except that the Warranty period shall be two years in lieu of one year for all items except as noted below:

1. Locks, latchsets, and panic hardware: 5 years.
2. Door closers and continuous hinges: 10 years.

1.5 MAINTENANCE MANUALS

A. In accordance with Section 01 00 00, GENERAL REQUIREMENTS Article titled "INSTRUCTIONS", furnish maintenance manuals and instructions on all door hardware. Provide installation instructions with the submittal documentation.

1.6 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. Submit 6 copies of the schedule per Section 01 33 23. Submit 2 final copies of the final approved schedules to VAACC Locksmith as record copies (VISN Locksmith if the VAACC 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.

B. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.8 PREINSTALLATION MEETING

A. Convene a preinstallation meeting not less than 30 days before start of installation of door hardware. Require attendance of parties directly affecting work of this section, including Contractor and Installer, Architect, Project Engineer and VA Locksmith, Hardware Consultant, and Hardware Manufacturer's Representative. Review the following:

1. Inspection of door hardware.
2. Job and surface readiness.
3. Coordination with other work.
4. Protection of hardware surfaces.
5. Substrate surface protection.
6. Installation.
7. Adjusting.
8. Repair.
9. Field quality control.
10. Cleaning.

1.9 INSTRUCTIONS

- A. Hardware Set Symbols on Drawings: Except for protective plates, door stops, mutes, thresholds and the like specified herein, hardware requirements for each door are indicated on drawings by symbols. Symbols for hardware sets consist of letters (e.g., "HW") followed by a number. Each number designates a set of hardware items applicable to a door type.
- B. Keying: All cylinders shall be keyed into existing Grand Master Key System. Provide removable core cylinders that are removable only with a special key or tool without disassembly of knob or lockset. Cylinders shall be 7 pin type. Keying information shall be furnished at a later date by the COR.
- C. Keying: A new Great Grandmaster key shall be established for this project. The key system shall be small format (Best size and profile) removable core type as previously described. The key blanks shall be protected by a utility patent with a minimum seven years remaining on the patent from the start of construction, and protected by contract-controlled distribution. The manufacturer shall furnish code pattern listings in both paper and electronic formats so keys may be reproduced by code.; provide electronic format in file type required by project's key control software. The manufacturer shall design the new key system with the capacity to rekey the existing system and also provide for 25 percent expansion capability beyond this requirement. Submit a keying chart for approval showing proposed keying layout and listing expansion capacity.
1. Keying information will be furnished to the Contractor by the COR.
 2. Supply information regarding key control of cylinder locks to manufacturers of equipment having cylinder type locks. Notify COR immediately when and to whom keys or keying information is supplied. Return all such keys to the COR.

1.10 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. In text, hardware items are referred to by series, types, etc., listed in such specifications and standards, except as otherwise specified.

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

F883-04.....Padlocks

E2180-07.....Standard Test Method for Determining the
Activity of Incorporated Antimicrobial Agent(s)
In Polymeric or Hydrophobic Materials

C. American National Standards Institute/Builders Hardware Manufacturers
Association (ANSI/BHMA):

A156.1-06.....Butts and Hinges

A156.2-03.....Bored and Pre-assembled Locks and Latches

A156.3-08.....Exit Devices, Coordinators, and Auto Flush
Bolts

A156.4-08.....Door Controls (Closers)

A156.5-01.....Auxiliary Locks and Associated Products

A156.6-05.....Architectural Door Trim

A156.8-05.....Door Controls-Overhead Stops and Holders

A156.12-05Interconnected Locks and Latches

A156.13-05.....Mortise Locks and Latches Series 1000

A156.14-07Sliding and Folding Door Hardware

A156.15-06.....Release Devices-Closer Holder, Electromagnetic
and Electromechanical

A156.16-08.....Auxiliary Hardware

A156.17-04Self-Closing Hinges and Pivots

A156.18-06.....Materials and Finishes

A156.20-06Strap and Tee Hinges, and Hasps

A156.21-09.....Thresholds

A156.22-05.....Door Gasketing and Edge Seal Systems

A156.23-04.....Electromagnetic Locks

A156.24-03.....Delayed Egress Locking Systems

A156.25-07Electrified Locking Devices

A156.26-06.....Continuous Hinges

A156.28-07Master Keying Systems

A156.29-07Exit Locks and Alarms

A156.30-03High Security Cylinders

A156.31-07Electric Strikes and Frame Mounted Actuators

A250.8-03.....Standard Steel Doors and Frames

D. National Fire Protection Association (NFPA):

80-10.....Fire Doors and Fire Windows

101-09.....Life Safety Code

E. Underwriters Laboratories, Inc. (UL):
Building Materials Directory (2008)

PART 2 - PRODUCTS

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. Exterior Doors: Type A2112/A5112 for doors 900 mm (3 feet) wide or less and Type A2111/A5111 for doors over 900 mm (3 feet) wide. Hinges for exterior outswing doors shall have non-removable pins. Hinges for exterior fire-rated doors shall be of stainless steel material.
 2. Interior Doors: Type A8112/A5112 for doors 900 mm (3 feet) wide or less and Type A8111/A5111 for doors over 900 mm (3 feet) wide. Hinges for doors exposed to high humidity areas (shower rooms, toilet rooms, kitchens, janitor rooms, etc. shall be of stainless steel material.
- B. Provide quantity and size of hinges per door leaf as follows:
1. Doors up to 1210 mm (4 feet) high: 2 hinges.
 2. Doors 1210 mm (4 feet) to 2260 mm (7 feet 5 inches) high: 3 hinges minimum.
 3. Doors greater than 2260 mm (7 feet 5 inches) high: 4 hinges.
 4. Doors up to 900 mm (3 feet) wide, standard weight: 114 mm x 114 mm (4-1/2 inches x 4-1/2 inches) hinges.
 5. Doors over 900 mm (3 feet) to 1065 mm (3 feet 6 inches) wide, standard weight: 127 mm x 114 mm (5 inches x 4-1/2 inches).
 6. Doors over 1065 mm (3 feet 6 inches) to 1210 mm (4 feet), heavy weight: 127 mm x 114 mm (5 inches x 4-1/2 inches).
 7. Provide heavy-weight hinges where specified.
 8. At doors weighing 330 kg (150 lbs.) or more, furnish 127 mm (5 inch) high hinges.
- C. See Articles "MISCELLANEOUS HARDWARE" and "HARDWARE SETS" for pivots and hinges other than butts specified above and continuous hinges specified below.

2.2 CONTINUOUS HINGES

- A. ANSI/BHMA A156.26, Grade 1-600.
1. Listed under Category N in BHMA's "Certified Product Directory."

- B. General: Minimum 0.120-inch- (3.0-mm-) thick, hinge leaves with minimum overall width of 4 inches (102 mm); fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete
- C. Continuous, Barrel-Type Hinges: Hinge with knuckles formed around a Teflon-coated 6.35mm (0.25-inch) minimum diameter pin that extends entire length of hinge.
 - 1. Base Metal for Exterior Hinges: Stainless steel.
 - 2. Where required to clear adjacent casing, trim, and wall conditions and allow full door swing, provide wide throw hinges of minimum width required.
 - 3. Provide with manufacturer's cut-outs for separate mortised power transfers and/or mortised automatic door bottoms where they occur.
 - 4. Where thru-wire power transfers are integral to the hinge, provide hinge with easily removable portion to allow easy access to wiring connections.
 - 5. Where models are specified that provide an integral wrap-around edge guard for the hinge edge of the door, provide manufacturer's adjustable threaded stud and machine screw mechanism to allow the door to be adjusted within the wrap-around edge guard.

2.3 DOOR CLOSING DEVICES

- A. Closing devices shall be products of one manufacturer for each type specified.

2.4 OVERHEAD CLOSERS

- A. Conform to ANSI A156.4, Grade 1.
- B. Closers shall conform to the following:
 - 1. The closer shall have minimum 50 percent adjustable closing force over minimum value for that closer and have adjustable hydraulic back check effective between 60 degrees and 85 degrees of door opening.
 - 2. Where specified, closer shall have hold-open feature.
 - 3. Size Requirements: Provide multi-size closers, sizes 1 through 6, except where multi-size closer is not available for the required application.
 - 4. Material of closer body shall be forged or cast.
 - 5. Arm and brackets for closers shall be steel, malleable iron or high strength ductile cast iron.

6. Where closers are exposed to the exterior or are mounted in rooms that experience high humidity, provide closer body and arm assembly of stainless steel material.
7. Closers shall have full size metal cover; plastic covers will not be accepted.
8. Closers shall have adjustable hydraulic back-check, separate valves for closing and latching speed, adjustable back-check positioning valve, and adjustable delayed action valve.
9. Provide closers with any accessories required for the mounting application, including (but not limited to) drop plates, special soffit plates, spacers for heavy-duty parallel arm fifth screws, bull-nose or other regular arm brackets, longer or shorter arm assemblies, and special factory templating. Provide special arms, drop plates, and templating as needed to allow mounting at doors with overhead stops and/or holders.
10. Closer arms or backcheck valve shall not be used to stop the door from overswing, except in applications where a separate wall, floor, or overhead stop cannot be used.
11. Provide parallel arm closers with heavy duty rigid arm.
12. Where closers are to be installed on the push side of the door, provide parallel arm type except where conditions require use of top jamb arm.
13. Provide all surface closers with the same body attachment screw pattern for ease of replacement and maintenance.
14. All closers shall have a 1-1/2" (38mm) minimum piston diameter.

2.5 DOOR STOPS

- A. Conform to ANSI A156.16.
- B. Provide door stops wherever an opened door or any item of hardware thereon would strike a wall, column, equipment or other parts of building construction. For concrete, masonry or quarry tile construction, use lead expansion shields for mounting door stops.
- C. Where cylindrical locks with turn pieces or pushbuttons occur, equip wall bumpers Type L02251 (rubber pads having concave face) to receive turn piece or button.
- D. Provide floor stops (Type L02141 or L02161 in office areas; Type L02121 x 3 screws into floor elsewhere. Wall bumpers, where used, must be installed to impact the trim or the door within the leading half of its

- width. Floor stops, where used, must be installed within 4-inches of the wall face and impact the door within the leading half of its width.
- E. Where drywall partitions occur, use floor stops, Type L02141 or L02161 in office areas, Type L02121 elsewhere.
 - F. Provide stop Type L02011, as applicable for exterior doors. At outswing doors where stop can be installed in concrete, provide stop mated to concrete anchor set in 76mm (3-inch) core-drilled hole and filled with quick-setting cement.
 - G. Omit stops where floor mounted door holders are required and where automatic operated doors occur.
 - H. Provide appropriate roller bumper for each set of doors (except where closet doors occur) where two doors would interfere with each other in swinging.
 - I. Provide appropriate door mounted stop on doors in individual toilets where floor or wall mounted stops cannot be used.
 - J. Provide overhead surface applied stop Type C02541, ANSI A156.8 on patient toilet doors in bedrooms where toilet door could come in contact with the bedroom door.
 - K. Provide door stops on doors where combination closer magnetic holders are specified, except where wall stops cannot be used or where floor stops cannot be installed within 4-inches of the wall.
 - L. Where the specified wall or floor stop cannot be used, provide concealed overhead stops (surface-mounted where concealed cannot be used).

2.6 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.

2.7 FLOOR DOOR HOLDERS

- A. Conform to ANSI Standard A156.16. Provide extension strikes for Types L01301 and L01311 holders where necessary.

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. 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 1. 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 Yale Augusta. No substitute lever material shall be accepted. All locks and latchsets shall be furnished with 122.55 mm (4-7/8-inch) curved lip strike and wrought box. At outswing pairs with overlapping astragals, provide flat lip strip with 21mm (7/8-inch) lip-to-center dimension. Lock function F02 shall be furnished with emergency tools/keys for emergency entrance. All lock cases installed on lead lined doors shall be lead lined before applying final hardware finish. Furnish armored fronts for all mortise locks. Where mortise locks are installed in high-humidity locations or where exposed to the exterior on bothsides of the opening, provide non-ferrous mortise lock case.
2. Cylindrical Lock and Latch Sets: levers shall meet ADA (Americans with Disabilities Act) requirements. Cylindrical locksets shall be series 4000 Grade 1. All locks and latchsets shall be furnished with 122.55 mm (4-7/8-inch) curved lip strike and wrought box. At outswing pairs with overlapping astragals, provide flat lip strip with 21mm (7/8-inch) lip-to-center dimension. Provide lever design to match design selected by Architect or to match existing lever design. Where two turn pieces are specified for lock F76, turn piece on inside knob shall lock and unlock inside knob, and turn

piece on outside knob shall unlock outside knob when inside knob is in the locked position. (This function is intended to allow emergency entry into these rooms without an emergency key or any special tool.)

3. Auxiliary locks shall be as specified under hardware sets and conform to ANSI A156.5.
4. 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 ELECTROMAGNETIC LOCKS

A. ANSI/BHMA A156.23; electrically powered, of strength and configuration indicated; with electromagnet attached to frame and armature plate attached to door. Listed under Category E in BHMA's "Certified Product Directory."

1. Type: Full exterior or full interior, as required by application indicated.
2. Strength Ranking: 1500 lbf (6672 N).
3. Inductive Kickback Peak Voltage: Not more than 53V.
4. Residual Magnetism: Not more than 4 lbf (18 N) to separate door from magnet.

2.10 ELECTRIC STRIKES

- A. ANSI/ BHMA A156.31 Grade 1.
- B. General: Use fail-secure electric strikes at fire-rated doors.

2.11 KEYS

- A. Stamp all keys with change number and key set symbol. Furnish keys in quantities as follows:

Locks/Keys	Quantity
Cylinder locks	2 keys each
Cylinder lock change key blanks	100 each different key way
Master-keyed sets	6 keys each
Grand Master sets	6 keys each
Great Grand Master set	5 keys
Control key	2 keys

2.12 KEY CABINET

- A. ANSI Standard A156.5. Provide key cabinet made of cold rolled, 1.2 mm (0.0478 inch) thick furniture steel electro-welded. Doors shall have "no sag" continuous brass-pin piano type hinge and be equipped with chrome plated locking door handles, hook cam and mechanical pushbutton door lock. Key Cabinet and Key Control System shall accommodate all keys for this project plus 25 percent. Provide minimum number of multiple cabinets where a single cabinet of largest size will not accommodate the required number of keys.
- B. Key tags shall consist of two sets: Permanent self-locking and loan key snaphook type with tag colors as follows: Red fiber marker of the permanent self-locking type approximately 32 mm (1-1/4 inch) in diameter engraved with the legend "FILE KEY MUST NOT BE LOANED." Also furnish for each hook a white cloverleaf key marker with snap-hooks engraved with the legend "LOAN KEY."
- C. The manufacturer of the lock cylinders and locks shall attach a key tag to keys of each lock cylinder and shall mark thereon the respective item number and key change number. Provide each group of keys in a key gathering envelope (supplied by Key Cabinet Manufacturer) in which the lock manufacturer shall include the following information: Item number, key change number and door number. The contractor shall furnish the Key Cabinet Manufacturer the hardware and keying schedules and change keys.

2.13 ARMOR PLATES, KICK PLATES, MOP PLATES AND DOOR EDGING

- A. Conform to ANSI Standard A156.6.
- B. Provide protective plates and door edging as specified below:
 - 1. Kick plates, mop plates and armor plates of metal, Type J100 series.
 - 2. Provide kick plates and mop plates where specified. Kick plates shall be 254 mm (10 inches) high. Mop plates shall be 152 mm (8 inches) high. Both kick and mop plates shall be minimum 1.27 mm (0.050 inches) thick. Provide kick and mop plates beveled on all 4 edges (B4E). On push side of doors where jamb stop extends to floor, make kick plates 38 mm (1-1/2 inches) less than width of door, except pairs of metal doors which shall have plates 25 mm (1 inch) less than width of each door. Extend all other kick and mop plates to within 6 mm (1/4 inch) of each edge of doors. Kick and mop plates shall butt astragals. For jamb stop requirements, see specification sections pertaining to door frames.

3. Kick plates and/or mop plates are not required on following door sides:
 - a. Armor plate side of doors;
 - b. Exterior side of exterior doors;
 - c. Closet side of closet doors;
 - d. Both sides of aluminum entrance doors.
4. Armor plates for doors are listed under Article "Hardware Sets".

Armor plates shall be thickness as noted in the hardware set, 875 mm (36 inches) high and 38 mm (1-1/2 inches) less than width of doors, except on pairs of metal doors. Provide armor plates beveled on all 4 edges (B4E). Plates on pairs of metal doors shall be 25 mm (1 inch) less than width of each door. Where top of intermediate rail of door is less than 875 mm (35 inches) from door bottom, extend armor plates to within 13 mm (1/2 inch) of top of intermediate rail. On doors equipped with panic devices, extend armor plates to within 13 mm (1/2 inch) of panic bolt push bar.
5. Where louver or grille occurs in lower portion of doors, substitute stretcher plate and kick plate in place of armor plate. Size of stretcher plate and kick plate shall be 254 mm (10 inches) high.
6. Provide stainless steel edge guards where so specified at wood doors. Provide mortised type instead of surface type except where door construction and/or ratings will not allow. Provide edge guards of bevel and thickness to match wood door. Provide edge guards with factory cut-outs for door hardware that must be installed through or extend through the edge guard. Provide full-height edge guards except where door rating does not allow; in such cases, provide edge guards to height of bottom of typical lockset armor front. Forward edge guards to wood door manufacturer for factory installation on doors.

2.14 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 (LEVER EXTENSION)

- A. Conform to ANSI A156.16. Flush bolts shall be Type L24081 unless otherwise specified. Furnish proper dustproof strikes conforming to ANSI A156.16, for flush bolts required on lower part of doors.
- B. Lever extension manual flush bolts shall only be used at non-fire-rated pairs for rooms only accessed by maintenance personnel.
- C. Face plates for cylindrical strikes shall be rectangular and not less than 25 mm by 63 mm (1 inch by 2-1/2 inches).
- D. Friction-fit cylindrical dustproof strikes with circular face plate may be used only where metal thresholds occur.
- E. Provide extension rods for top bolt where door height exceeds 2184 mm (7 feet 2 inches).

2.16 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.

2.17 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.

2.18 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 $\frac{1}{4}$ -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.

2.19 AUTOMATIC DOOR BOTTOM SEAL AND RUBBER GASKET FOR LIGHT PROOF OR SOUND CONTROL DOORS

- A. Conform to ANSI A156.22. Provide mortise or under-door type, except where not practical. For mortise automatic door bottoms, provide type specific for door construction (wood or metal).

2.20 WEATHERSTRIPS (FOR EXTERIOR DOORS)

- A. Conform to ANSI A156.22. Air leakage shall not to exceed 0.50 CFM per foot of crack length ($0.000774\text{m}^3/\text{s/m}$).

2.21 MISCELLANEOUS HARDWARE

- A. 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.

2.22 FINISHES

- A. Exposed surfaces of hardware shall have ANSI A156.18, finishes as specified below. Finishes on all hinges, pivots, closers, thresholds, etc., shall be as specified below under "Miscellaneous Finishes." For field painting (final coat) of ferrous hardware, see Section 09 91 00, PAINTING.
- B. 626 or 630: All surfaces on exterior and interior of buildings, except where other finishes are specified.
- C. Miscellaneous Finishes:
 - 1. Hinges --exterior doors: 626 or 630.
 - 2. Hinges --interior doors: 652 or 630.
 - 3. Pivots: Match door trim.
 - 4. Door Closers: Factory applied paint finish. Dull or Satin Aluminum color.
 - 5. Thresholds: Mill finish aluminum.
 - 6. Cover plates for floor hinges and pivots: 630.
 - 7. Other primed steel hardware: 600.
- D. Hardware Finishes for Existing Buildings: U.S. Standard finishes shall match finishes of hardware in (similar) existing spaces.
- F. 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.

2.23 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. 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.

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 Ambulatory Care 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 VA Resident/Project Engineer that upon completion, installer has visited the Project and has accomplished the following:

1. Re-adjust hardware.
2. Evaluate maintenance procedures and recommend changes or additions, and instruct VA personnel.
3. Identify items that have deteriorated or failed.
4. Submit written report identifying problems.

3.4 DEMONSTRATION

A. Demonstrate efficacy of mechanical hardware and electrical, and electronic hardware systems, including adjustment and maintenance procedures, to satisfaction of Resident/Project Engineer and VA Locksmith.

3.5 HARDWARE SETS

A. Following sets of hardware correspond to hardware symbols shown on drawings. Only those hardware sets that are shown on drawings will be required. Disregard hardware sets listed in specifications but not shown on drawings.

B. Hardware Consultant working on a project will be responsible for providing additional information regarding these hardware sets. The numbers shown in the following sets come from BHMA standards.

C. Abbreviations used in hardware sets:

1. 4BE - Bevel all four edges.
2. CSK - counter sunk screws with undercut heads
3. LDW - Less Door width
4. MA - Markar
5. MK - McKinney
6. PE - Pemko
7. RF - Rixson
8. RO - Rockwood
9. SA - Self adhesive
10. SA - Sargent
11. SU - Securitron
12. YA - Yale

Set: 1

Doors: 1B601A

Description: Exterior aluminum slider set of doors

1 Mortise Cylinder	K625xCT7SL	626	YA
1 Permanent core	E09241 - A600 7-Pin	626	YA
Remainder of hardware by aluminum door supplier			

Set: 2

Doors: 2B104A

Description: Exterior wide stile aluminum door, to roof. Four sided frame, Storeroom lockset.

Hinges	Provided with door/frame		
1 Cylindrical Lock (storeroom)	Function F86 - B-AU5405LN A600	626	YA
1 Permanent core	E09241 - A600 7-Pin	626	YA
1 Closer (top jamb)	C02041 (PT-4C, 4D, 4H) J7500	689	YA
1 Concealed overhead stop	C01541 #6 low profile	630	RF
1 Weather strip	By aluminum door supplier		
1 Rain drip cap	R3Y976		PE

Notes: Hinges provided with door and frame. Locate cylinder on room side and thumb turn on exterior side.

Set: 3

Doors: 2B174A

Description: Pair of doors with store room lockset, Surgery Supply

6 Hinge (std wt)	A8112 - TA2714	US26D	MK
1 Self latch top flush bolt	Type 27 - 2805 self latch flush bolt	US26D	RO
1 Bottom flush bolt	555	US26D	RO
1 Dust proof strike	570	US26D	RO
1 Cylindrical Lock (storeroom)	Function F86 - B-AU5405LN A600	626	YA
1 Permanent core	E09241 - A600 7-Pin	626	YA
1 Coordinator	2600 series with filler bar	Blk	RO
2 Closer (parallel arm)	C02021 (PT-4C, 4D, 4H) - PR7500	689	NO
2 Kick plate	J102 10" x 2" LDW 4BE CSK - K1050	US32D	RO
2 Mop plate	J103 8" x 1" LDW 4BE CSK - K1050	US32D	RO
2 Wall stop	L02251 - 401	US26D	RO
1 Smoke seal / gasketing	R0E154 - S88D		PE
1 Astragal seal	S772D		PE

Set: E4

Doors: 1B115A

Description: Receiving Dock Alcove pair of doors.

6 Hinge (std wt)	A8112 - TA2714	US26D	MK
1 Self latch top flush bolt	Type 27 - 2805 self latch flush bolt	US26D	RO
1 Bottom flush bolt	555	US26D	RO
1 Dust proof strike	570	US26D	RO
1 Cylindrical Lock (entry)	Function F109 - B-AU5407LN A600	626	YA
1 Permanent core	E09241 - A600 7-Pin	626	YA
1 Coordinator	2600 series with filler bar	Blk	RO
2 Closer (Regular arm)	C02011 (PT-4C, 4D, 4H) - 7500	689	NO
2 Electromagnetic holder	C00011 - 998	689	RF
2 Kick plate	J102 10" x 2" LDW 4BE CSK - K1050	US32D	RO
2 Mop plate	J103 8" x 1" LDW 4BE CSK - K1050	US32D	RO
1 Smoke seal/gasketing	R0E154 - S88D		PE
1 Astragal	S772D		PE

Note: Lockable lever on dock side.

Set: 5

Doors: 1B656A, 1B658A, 1B676A

Description: Storeroom lockset, rated door, Soiled Utility, Equipment storage, clean hold.

3 Hinge (std wt)	A8112 - TA2714	US26D	MK
1 Cylindrical Lock (storeroom)	Function F86 - B-AU5405LN A600	626	YA
1 Permanent core	E09241 - A600 7-Pin	626	YA
1 Closer (Regular arm)	C02011 (PT-4C, 4D, 4H) - 7500	689	NO
1 Armor plate	J101 36" x 2" LDW 4BE SA -K1050F SA	US32D	RO
1 Mop plate	J103 8" x 1" LDW 4BE CSK - K1050	US32D	RO
1 Edge guard (lock stile)	306B-UL	US32D	RO
1 Edge guard (hinge stile)	305-UL	US32D	RO
1 Wall stop	L02251 - 401	US26D	RO
1 Smoke seal/gasketing	R0E154 - S88D		PE

Set: 6

Doors: 1B691B

Description: Pair of doors, with storeroom lockset, Med supply

6 Hinge (std wt)	A8112 - TA2714	US26D	MK
1 Self latch top flush bolt	Type 27 - 2805 self latch flush bolt	US26D	RO
1 Bottom flush bolt	555	US26D	RO
1 Dust proof strike	570	US26D	RO
1 Cylindrical Lock (storeroom)	Function F86 - B-AU5405LN A600	626	YA
1 Permanent core	E09241 - A600 7-Pin	626	YA
1 Closer (parallel arm w/stop)	C02021 (PT-4C, 4D, 4H, 4G) - CLP7500	689	NO
1 Surface overhead stop	C05542 #10	652	RF
2 Kick plate	J102 10" x 2" LDW 4BE CSK - K1050	US32D	RO
2 Mop plate	J103 8" x 1" LDW 4BE CSK - K1050	US32D	RO
2 Silencer	608		RO

Set: 7

Doors: 1B616A, 1B618A, 1B620A, 1B622A, 1B624A, 1B625A, 1B653A, 1B655A, 1B657A, 1B660A. 1B672A, 1B674A, 1B678A, 1B680A

Description: Passage, Fit Lab, Exam, Posturag, Sleep, PFT lab, Staff break.

3 Hinge (std wt)	A8112 - TA2714	US26D	MK
1 Cylindrical Latchset (passage)	Function F75 - AU5401LN	626	YA
1 Kick plate	J102 10" x 2" LDW 4BE CSK - K1050	US32D	RO
1 Mop plate	J103 8" x 1" LDW 4BE CSK - K1050	US32D	RO
1 Wall stop	L02251 - 401	US26D	RO
3 Silencer	608		RO

Set: 8

Doors: 1B673A, 1B675A

Description: Toilet

3 Hinge (std wt)	A2112 - TA2314	US26D	MK
1 Mortise Latchset (privacy)	Function 19 w/indicator-AUR 8802FL	IND 626	YA
1 Kick plate	J102 10" x 2" LDW 4BE CSK - K1050	US32D	RO
1 Mop plate	J103 8" x 1" LDW 4BE CSK - K1050	US32D	RO
1 Wall stop	L02251 - 401	US26D	RO
3 Silencer	608		RO

Set: 9

Doors: 1B626A, 1B681A

Description: Toilet

1 Jamb Mount Pivot Set	C07042 EP-5J	US26D	MK
1 Mortise Latchset (privacy)	Function 19 w/indicator-AUR 8802FL	IND 626	YA
1 Combination Strike and Stop	K81111 CSS-9	US26D	MK
1 Kick plate	J102 10" x 1" LDW 4BE CSK - K1050	US32D	RO
1 Mop plate	J103 8" x 1" LDW 4BE CSK - K1050	US32D	RO
1 Concealed overhead stop	C04542 #2	652	RF

Set: 10

Doors: 1B677A

Description: Entry lockset with door closer, Physiology Lab.

3 Hinge (std wt)	A8112 - TA2714	US26D	MK
1 Cylindrical Lock (classroom)	Function F84 - B-AU5408LN A600	626	YA
1 Permanent core	E09241 - A600 7-Pin	626	YA
1 Closer (Regular arm)	C02011 (PT-4C, 4D, 4H) - 7500	689	NO
1 Kick plate	J102 10" x 2" LDW 4BE CSK - K1050	US32D	RO
1 Mop plate	J103 8" x 1" LDW 4BE CSK - K1050	US32D	RO
1 Wall stop	L02251 - 401	US26D	RO
3 Silencer	608		RO

Set: 11

Doors: 1B117A, 1B612A, 1B613A, 1B614A, 1B640A, 1B641A, 1B642A, 1B643A, 1B644A, 1B645A, 1B646A, 1B647A, 1B648A, 1B652A, 1B654A, 1B661A, 1B662A, 1B663A, 1B671A, 1B695A, 1B697A, 1B698A

Description: Office lockset, Offices, store keeper, Nurse, RESP, Physician, Director, Monitor, Health Tech, PSA, Home O2, C-PAP, Speech Special Procedure, Reception, Group

3 Hinge (std wt)	A8112 - TA2714	US26D	MK
1 Cylindrical Lock (entry)	Function F109 - B-AU5407LN A600	626	YA
1 Permanent core	E09241 - A600 7-Pin	626	YA
1 Kick plate	J102 10" x 2" LDW 4BE CSK - K1050	US32D	RO
1 Mop plate	J103 8" x 1" LDW 4BE CSK - K1050	US32D	RO
1 Wall stop	L02251 - 404	US26D	RO
3 Silencer	608		RO

Set: 12

Doors: 1B631A, 1B632A, 1B633A, 1B634A, 1B635A

Description: Entry lockset, Audio Lab

3 Hinge (std wt)	A8112 - TA2714	US26D	MK
1 Cylindrical Lock (entry)	Function F109 - B-AU5407LN A600	626	YA
1 Permanent core	E09241 - A600 7-Pin	626	YA
1 Kick plate	J102 10" x 2" LDW 4BE CSK - K1050	US32D	RO
1 Mop plate	J103 8" x 1" LDW 4BE CSK - K1050	US32D	RO
1 Wall stop	L02251 - 404	US26D	RO
1 Rabbet Sound Seal	S88D head and jambs		PE
1 Soffit Sound Seal	379 CR head and jambs		PE
1 Automatic door bottom	430 CMRL semi-mortise		PE

Note: Door bottom to be mortised for the semi-mortise mounting of the automatic door bottom

Set: 13

Doors: 1B607A, 1B610A, 1B610B

Description: Entry lockset with door closer, Reception

3 Hinge (std wt)	A8112 - TA2714	US26D	MK
1 Cylindrical Lock (entry)	Function F109 - B-AU5407LN A600	626	YA
1 Permanent core	E09241 - A600 7-Pin	626	YA
1 Closer (Regular arm)	C02011 (PT-4C, 4D, 4H) - 7500	689	NO
1 Kick plate	J102 10" x 2" LDW 4BE CSK - K1050	US32D	RO
1 Mop plate	J103 8" x 1" LDW 4BE CSK - K1050	US32D	RO
1 Wall stop	L02251 - 404	US26D	RO
3 Silencer	608		RO

Set: 14

Doors: 1B619A

Description: Storeroom lockset, Clean Hold.

3 Hinge (std wt)	A8112 - TA2714	US26D	MK
1 Cylindrical Lock (storeroom)	Function F86 - B-AU5405LN A600	626	YA
1 Permanent core	E09241 - A600 7-Pin	626	YA
1 Closer (parallel arm w/stop)	C02021 (PT-4C, 4D, 4H, 4G) - CLP7500	689	NO
1 Armor plate	J101 36" x 2" LDW 4BE CSK - K1050	US32D	RO
1 Mop plate	J103 8" x 1" LDW 4BE CSK - K1050	US32D	RO
1 Edge guard (lock stile)	302B	US32D	RO
1 Edge guard (hinge stile)	301	US32D	RO
3 Silencer	608		RO

Set: 15

Doors: 1B636A, 1B651A

Description: Storeroom lockset with door closer, soiled utility, housekeeping.

3 Hinge (std wt)	A8112 - TA2714	US26D	MK
1 Cylindrical Lock (storeroom)	Function F86 - B-AU5405LN A600	626	YA
1 Permanent core	E09241 - A600 7-Pin	626	YA
1 Closer (parallel arm)	C02021 (PT-4C, 4D, 4H) - PR7500	689	NO
1 Armor plate	J101 36" x 2" LDW 4BE CSK - K1050	US32D	RO
1 Mop plate	J103 8" x 1" LDW 4BE CSK - K1050	US32D	RO
1 Edge guard (lock stile)	302B	US32D	RO
1 Edge guard (hinge stile)	301	US32D	RO
1 Wall stop	L02251 - 401	US26D	RO
3 Silencer	608		RO

Set: E16

Doors: 1B690A

Description: Exterior pair or aluminum wide stile doors with automatic operator, card reader and exit devices.

6 Continuous Hinge	FM300	630	MA
1 Exit Device(CVR LBR, NL elec)	7160 B P LBR 632F K645xCT7SL Type funct 03	630	YA
1 Exit Device(CVR LBR, DT elec)	7160 B P LBR 634F Type funct 02	630	YA
1 Permanent core	E09241 - A600 7-Pin	626	YA
1 Automatic Operator (pair of doors)	By automatic door operator supplier		
2 Wall actuator	By automatic door operator supplier		
2 Kick plate	J102 10" x 2" LDW 4BE CSK - K1050	US32D	RO
2 Mop plate	J103 8" x 1" LDW 4BE CSK - K1050	US32D	RO
1 Threshold	J32130 171A Pemkote		PE
1 Rain drip cap	R3Y976		PE
1 Head weather strip	2891APK		PE
2 Jamb weather strip	45041CNB TEK		PE
2 Door sweep	R3A535 345ANB		PE
2 Astragal	R3A735 - 29324CNB		PE
2 Power Transfers	EL-CEPT		SU
1 Card Reader	By Card Reader supplier		
2 Door position switches	DPS-M-BK		SU

1 Power supply 782 YA

Notes: Operation - Inside wall actuator will signal automatic operator to open. Automatic operator will signal exit devices to unlatch first, then open. Outside card reader will unlock one exit device and enable the outside wall actuator. When enabled depressing the outside wall actuator will signal the automatic operator to open.

Set: E17

Doors: 1B600A

Description: Cross corridor double egress doors

6 Hinge (hvy wt)	A8111 - HT T4A3786	US26D	MK
2 Fire Exit Device (SVR LBR, EO) Type 2 funct. 01 - 7170F LBR EO		630	YA
2 Closer (pull side track - double egress) 7500ST DE		689	NO
	C02211 (PT-4C, 4D, 4H) -		
2 Kick plate	J102 10" x 2" LDW 4BE CSK - K1050	US32D	RO
2 Mop plate	J103 8" x 1" LDW 4BE CSK - K1050	US32D	RO
2 Electromagnetic holder	C00011 - 998	689	RF
1 Smoke seal / gasketing	R0E154 - S88D		PE
1 Astragal	S772D		PE

Notes: Apply kickplate to both sides of both doors. On the pull side kickplate is to be 1 inch less door width. Fire alarm system to power electromagnetic holders.

Set: E18

Doors: 1B696A

Description: Card reader lockset, Med Supply

2 Hinge (std wt)	A8112 - TA2714	US26D	MK
1 Electric Hinge (std wt)	A8112 12 conductor - HT TA2714 QC12	US26D	MK
1 Mortise Lock (Card Reader)	70 M1 82271	26D	SA
1 Permanent core	E09241 - A600 7-Pin	626	YA
1 Closer (parallel arm)	C02021 (PT-4C, 4D, 4H) - PR7500	689	NO
1 Kick plate	J102 10" x 2" LDW 4BE CSK - K1050	US32D	RO
1 Mop plate	J103 8" x 1" LDW 4BE CSK - K1050	US32D	RO
1 Wall stop	L02251 - 401	US26D	RO
1 Smoke seal / gasketing	R0E154 - S88D		PE
1 Quick connect door cable	QC-CXXXXP		MK
1 Quick connect frame cable	QC-C1500		MK

Notes: Operation - Valid card read unlocks outside lever allowing entrance.

Set: E19

Doors: 1B623A, 1B650B

Description: Card reader lockset, Corridor.

2 Hinge (std wt)	A8112 - TA2714	US26D	MK
1 Electric Hinge (std wt)	A8112 12 conductor - HT TA2714 QC12	US26D	MK
1 Mortise Lock (Card Reader)	70 M1 82271	26D	SA
1 Permanent core	E09241 - A600 7-Pin	626	YA
1 Closer (parallel arm)	C02021 (PT-4C, 4D, 4H) - PR7500	689	NO
1 Armor plate US32D	J101 36" x 2" LDW 4BE SA - K1050F SA RO		
1 Mop plate	J103 8" x 1" LDW 4BE CSK - K1050	US32D	RO
1 Edge guard (lock stile)	306B-UL	US32D	RO
1 Edge guard (hinge stile)	305-UL	US32D	RO
1 Wall stop	L02251 - 401	US26D	RO
1 Smoke seal / gasketing	R0E154 - S88D		PE
1 Quick connect door cable	QC-CXXXP		MK
1 Quick connect frame cable	QC-C1500		MK

Notes: Operation - Valid card read unlocks outside lever allowing entrance.

Set: E20

Doors: 1B691A

Description: Storeroom lockset with electric strike, card reader and automatic operator, Med supply

3 Hinge (std wt)	A8112 - TA2714	US26D	MK
1 Cylindrical Lock (storeroom)	Function F86 - B-AU5405LN A600	626	YA
1 Permanent core	E09241 - A600 7-Pin	626	YA
1 Electric strike	1006 J faceplate 24VDC	630	HS
1 Automatic Operator (single door)	By automatic door operator supplier		
1 Wall actuator	By automatic door operator supplier		
1 Armor plate US32D	J101 36" x 2" LDW 4BE SA - K1050F SA RO		
1 Mop plate	J103 8" x 1" LDW 4BE CSK - K1050	US32D	RO
1 Edge guard (lock stile)	306B-UL	US32D	RO
1 Edge guard (hinge stile)	305-UL	US32D	RO
1 Wall stop	L02251 - 401	US26D	RO
1 Smoke seal / gasketing	R0E154 - S88D		PE
1 Card Reader	By Card Reader supplier		
1 Door position switch	DPS-M-BK		SU

Notes: Operation - Inside wall actuator or outside card reader will signal automatic operator to open. Automatic operator will signal electric strike to unlatch first, then open. Fire alarm to signal automatic operator to close door during alarm, and disable electric strike for positive latching requirements during fire alarm.

Set: E21

Doors: 1B606A

Description: Passage latchset with electric strike and automatic operator, Radiology sub waiting.

3 Hinge (std wt)	A8112 - TA2714	US26D	MK
1 Cylindrical Latchset (passage) Function F75 - AU5401LN		626	YA
1 Electric strike	1006 J faceplate 24VDC	630	HS
1 Automatic Operator (single door)	By automatic door operator supplier		
2 Wall actuators	By automatic door operator supplier		
1 Armor plate	J101 36" x 2" LDW 4BE CSK - K1050	US32D	RO
1 Mop plate	J103 8" x 1" LDW 4BE CSK - K1050	US32D	RO
1 Edge guard (lock stile)	302B	US32D	RO
1 Edge guard (hinge stile)	301	US32D	RO
1 Wall stop	L02251 - 401	US26D	RO
3 Silencer	608		RO

Notes: Operation - Either wall actuator will signal automatic operator to open. Automatic operator will signal electric strike to unlatch first, then open. Fire alarm to signal automatic operator to close door during alarm, and disable electric strike for positive latching requirements during fire alarm.

Set: E22

Doors: 1B692A

Description: Pair of doors, Storeroom lockset with electric strike, card reader and automatic operator, Break out

6 Hinge (hvy wt)	A8111 - T4A3786	US26D	MK
1 Automatic flush bolts	Type 27 - 2842 set	US26D	RO
1 Dust proof strike	570	US26D	RO
1 Cylindrical Lock (storeroom) Function F86 - B-AU5405LN A600		626	YA
1 Permanent core	E09241 - A600 7-Pin	626	YA
1 Electric strike	1006 KM faceplate 24VDC	630	HS
1 Automatic Operator (single door)		By	
automatic door operator supplier (main door leaf)			
2 Wall actuators	By automatic door operator supplier		
1 Armor plate	J101 36" x 2" LDW 4BE CSK - K1050	US32D	RO

1	Mop plate	J103 8" x 1" LDW 4BE CSK - K1050	US32D	RO
1	Edge guard (lock stile)	302B	US32D	RO
1	Edge guard (hinge stile)	301	US32D	RO
2	Wall stop	L02251 - 401	US26D	RO
2	Silencer	608		RO
1	Card Reader	By Card Reader supplier		
1	Quick connect door cable	QC-CXXXXP		MK
1	Quick connect frame cable	QC-C1500		MK
1	Power Transfers	EL-CEPT		SU
2	Door position switch	DPS-M-BK		SU

Notes: Operation - Inside wall actuator will signal automatic operator to open. Automatic operator will signal electric strike to unlatch first, then open. Card reader will unlatch electric strike allowing door to be pulled open. During this unlock time the breakout room side wall actuator will be enabled, depressing it will signal the automatic operator to open, similar to the inside wall actuator. Without valid card breakout room side wall actuator is disabled.

Set: E23

Doors: 1B030A

Description: Existing door add card reader, and locking hardware.

	Door hardware	Re-use existing door hardware		
1	Magnetic Lock (double door)	DM62D		SU
1	Exit Sensor	XMS	WHT	SU
1	Emergency exit button	EEB2		SU
1	Card Reader	By Card Reader supplier		

Note: Fire alarm to signal magnetic lock during alarm. Lock to de-energize during alarm.

Set: E24

Doors: 1B605A, 1B693A

Description: Card reader lockset, Staff break, Dispatch.

2	Hinge (std wt)	A8112 - TA2714	US26D	MK
1	Electric Hinge (std wt)	A8112 12 conductor - HT TA2714 QC12	US26D	MK
1	Mortise Lock (Card Reader)	70 M1 82271	26D	SA
1	Permanent core	E09241 - A600 7-Pin	626	YA
1	Closer (parallel arm for 1B693A)		C02021	
	(PT-4C, 4D, 4H) - PR7500	689	NO	
1	Closer (Regular arm for 1B505A)		C02011	
	(PT-4C, 4D, 4H) - 7500	689	NO	

1 Kick plate	J102 10" x 2" LDW 4BE CSK - K1050	US32D	RO
1 Mop plate	J103 8" x 1" LDW 4BE CSK - K1050	US32D	RO
1 Wall stop	L02251 - 401	US26D	RO
3 Silencer	608		RO
1 Quick connect door cable	QC-CXXXXP		MK
1 Quick connect frame cable	QC-C1500		MK

Notes: Operation - Valid card read unlocks outside lever allowing entrance.
For 1B693A, lockable lever on 1B694 side.

Set: E25

Doors: 1B608A

Description: Card reader lockset, Electric

2 Hinge (std wt)	A8112 - TA2714	US26D	MK
1 Electric Hinge (std wt)	A8112 12 conductor - HT TA2714 QC12	US26D	MK
1 Mortise Lock (Card Reader)	70 M1 82271	26D	SA
1 Permanent core	E09241 - A600 7-Pin	626	YA
1 Closer (Regular arm)	C02011 (PT-4C, 4D, 4H) - 7500	689	NO
1 Kick plate	J102 10" x 2" LDW 4BE CSK - K1050	US32D	RO
1 Mop plate	J103 8" x 1" LDW 4BE CSK - K1050	US32D	RO
1 Wall stop	L02251 - 401	US26D	RO
3 Silencer	608		RO
1 Quick connect door cable	QC-CXXXXP		MK
1 Quick connect frame cable	QC-C1500		MK

Notes: Operation - Valid card read unlocks outside lever allowing entrance.

Set: E26

Doors: 1B611B

Description: Card reader lockset, Suite entrance

2 Hinge (std wt)	A8112 - TA2714	US26D	MK
1 Electric Hinge (std wt)	A8112 12 conductor - HT TA2714 QC12	US26D	MK
1 Mortise Lock (Card Reader)	70 M1 82271	26D	SA
1 Permanent core	E09241 - A600 7-Pin	626	YA
1 Closer (parallel arm)	C02021 (PT-4C, 4D, 4H) - PR7500	689	NO
1 Kick plate	J102 10" x 2" LDW 4BE CSK - K1050	US32D	RO
1 Mop plate	J103 8" x 1" LDW 4BE CSK - K1050	US32D	RO
1 Wall stop	L02251 - 401	US26D	RO
3 Silencer	608		RO
1 Quick connect door cable	QC-CXXXXP		MK

1 Quick connect frame cable QC-C1500 MK

Notes: Operation - Valid card read unlocks outside lever allowing entrance.

Set: E27

Doors: 1B032A

Description: Electric lockset for card reader with keypad on wall, Security

2 Hinge (std wt)	A8112 - TA2714	US26D	MK
1 Electric Hinge (std wt)	A8112 12 conductor - HT TA2714 QC12	US26D	MK
1 Electric Mortise Lock	AUR 8897FL REX A620	626	YA
1 Permanent core	E09241 - A600 7-Pin	626	YA
1 Closer (parallel arm w/stop)	CLP7500	689	NO
	C02021 (PT-4C, 4D, 4H, 4G)		
1 Kick plate	J102 10" x 2" LDW 4BE CSK - K1050	US32D	RO
1 Mop plate	J103 8" x 1" LDW 4BE CSK - K1050	US32D	RO
1 Wall stop	L02251 - 401	US26D	RO
3 Silencer	608		RO
1 Card Reader with keypad	By Card Reader supplier		
1 Door position switch	DPS-M-BK	BLK	SU
1 Quick connect door cable	QC-CXXXXP		MK
1 Quick connect frame cable	QC-C1500		MK

Notes: Operation - Valid card read unlocks outside lever allowing entrance.

Set: E28

Doors: 1B609A

Description: Electric lockset for card reader with keypad on wall, Data

2 Hinge (std wt)	A8112 - TA2714	US26D	MK
1 Electric Hinge (std wt)	A8112 12 conductor - HT TA2714 QC12	US26D	MK
1 Electric Mortise Lock	AUR 8897FL REX A620	626	YA
1 Permanent core	E09241 - A600 7-Pin	626	YA
1 Closer (Regular arm)	C02011 (PT-4C, 4D, 4H) - 7500	689	NO
1 Kick plate	J102 10" x 2" LDW 4BE CSK - K1050	US32D	RO
1 Mop plate	J103 8" x 1" LDW 4BE CSK - K1050	US32D	RO
1 Wall stop	L02251 - 401	US26D	RO
3 Silencer	608		RO
1 Card Reader with keypad	By Card Reader supplier		
1 Door position switch	DPS-M-BK	BLK	SU
1 Quick connect door cable	QC-CXXXXP		MK

1 Quick connect frame cable QC-C1500 MK

Notes: Operation - Valid card read unlocks outside lever allowing entrance.

Set: E29

Doors: 1B603A, 1B604A

Description: Toilet

3 Hinge (std wt)	A2112 - TA2314	US26D	MK
1 Mortise Latchset (privacy)	Function 19 w/indicator-AUR 8802FL	IND 626	YA
1 Automatic Operator	by automatic operator supplier	689	NO
1 Concealed overhead stop	C04542 #2	652	RF
1 Kick plate	J102 10" x 2" LDW 4BE CSK - K1050	US32D	RO
1 Mop plate	J103 8" x 1" LDW 4BE CSK - K1050	US32D	RO
3 Silencer	608		RO

Set: E30

Doors: 1B611A, 1B650A

Description: Holdback lockset with monitor strike and automatic operator, Suite entrance, waiting

3 Hinge (std wt)	A8112 - TA2714	US26D	MK
1 Mortise Lock (holdback)	Function F06-AUR 8824FL K625 CT7SD	626	YA
1 Permanent core	E09241 - A600 7-Pin	626	YA
1 Monitor strike	LML-1		SU
1 Automatic Operator (single door)	By automatic door operator supplier		
2 Wall actuators	By automatic door operator supplier		
1 Armor plate	J101 36" x 2" LDW 4BE CSK - K1050	US32D	RO
1 Mop plate	J103 8" x 1" LDW 4BE CSK - K1050	US32D	RO
1 Edge guard (lock stile)	302B	US32D	RO
1 Edge guard (hinge stile)	301	US32D	RO
1 Wall stop	L02251 - 401	US26D	RO
3 Silencer	608		RO

Notes: Operation - When lockset is set to latchbolt holdback, the monitor strike will enable both wall actuators. Either wall actuator will open the door. When the lockset is locked, the latchbolt will trip the monitor strike which will disable the wall actuators.

Set: E31

Provide the following:

Description: Shared power supplies

2 Power supplies AQM20-8F SU

Notes: One power supply for doors in the logistics area and the other one is
for doors in the Pulmonary and Audio area.

- - - E N D - - -

SECTION 08 71 13.11
LOW ENERGY POWER ASSIST DOOR OPERATORS

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies low energy power assisted automatic operation of swing doors. The door operator system shall be complete including operator, controls, door arm and operator enclosure (header and cover).

1.2 RELATED WORK

- A. Sealants; Section 07 92 00, JOINT SEALANTS.
- B. Steel doors; Section 08 11 13, HOLLOW METAL DOORS AND FRAMES.
- C. Wood doors; Section 08 14 00, INTERIOR WOOD DOORS.
- D. Aluminum frames entrance work; Section 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS.
- E. Door hardware; Section 08 71 00, DOOR HARDWARE.
- F. Glass and glazing of doors and frames; Section 08 80 00, GLAZING.
- G. Finish Color, Section 09 06 00, SCHEDULE FOR FINISHES.
- H. Smoke detectors for control of fire/smoke doors to be wired per Section 28 31 00, FIRE DETECTION AND ALARM.
- I. Electric general wiring, connections and equipment requirements; Division 26, ELECTRICAL.

1.3 MANUFACTURER'S QUALIFICATIONS

- A. Power assisted 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 manufacturer of automatic door equipment shall be used throughout the project.

1.4 WARRANTY

Power assisted door operators, controls and other related equipment shall be subject to the terms of the "Warranty of Construction", FAR clause 52.246-21, except that the warranty period shall be two years in lieu of one year.

1.5 MAINTENANCE MANUALS

In accordance with Section 01 00 00, GENERAL REQUIREMENTS Article titled "INSTRUCTIONS," furnish three copies of maintenance manuals and instructions on automatic door operators.

1.6 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's literature and data describing operators, power units, controls, door hardware and safety devices.
- C. Shop Drawings:
Showing location of controls and safety devices in relationship to each automatically operated door. This includes templates, wiring diagrams, fabrication details, anchorage and other information to providers of related work to coordinate the proper installation of the door operators.

1.7 DESIGN CRITERIA

- A. Power assisted automatic door equipment shall accommodate normal traffic as well as the weight of the doors.
- B. Equipment: UL approved and comply with applicable codes. Motors shall be rated minimum one-quarter horsepower and shall be single phase and 115 volts.
- C. Electrical Wiring; Provide wiring so that only a single power supply is required. Equipment and wiring shall be as specified in Division 26, ELECTRICAL.

1.8 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American National Standards Institute (ANSI):
ICC/ANSI A117.1-03.....Guideline for Accessible and Usable Buildings and Facilities-Providing Accessibility and Usability for Physically Handicapped People
- B. Builders Hardware Manufacturers Association, Inc. (BHMA):
156.19-07.....Power Assist and Low Energy Power Operated Doors

PART 2 - PRODUCTS

2.1 OPERATORS

- A. Automatic door operators shall be for commercial doors and shall be electromechanical and surface mounted above the door to the header or transom bar. The opening force shall be generated by a permanent magnet DC motor driving a combination spiral bevel/spur gear reducer and transmitted to the door through an arm linkage. Opening speed shall be

adjustable and feature dual backcheck control allowing adjustment of backcheck speed and position. Closing shall be by spring force generated by a metal compression spring. The spring shall reduce manual opening force to not more than 67 N (15 lbf). The minimum diameter of spring wire shall be .007mm (172 in.). Under the specified design load of the door, the spring shall be capable of performing 2,000,000 cycles before fracture. Adjustable closing speed and fixed latch speed shall control the door in the closing cycle. The doors shall be operated manually at any time without damage to the operator or components.

B. All operators shall have checking mechanism providing cushioning action at last part of door travel, in both opening and closing cycle. Operators shall recycle doors instantaneously to full open position from any point in closing cycle when control switch is reactivated.

C. Operator shall be swinging type enclosed in housing. Operator 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. System shall operate as manual door control in event of power failure. Opening and closing speeds shall be adjustable:

1. Swing Operator Housing: Housing shall be 140 mm (5-1/2 inches) wide by 150 mm (6 inches) high aluminum extrusions with enclosed end caps for application to 100 mm (4 inch) and larger frame systems. All structural sections shall have a minimum thickness of 3.7 mm (0.146 inch) and be fabricated of 6063-T5 aluminum alloy.
2. Swing Power Operator: Completely assembled and sealed unit which shall include helical gear drive transmission, mechanical spring and bearings, all located in cast aluminum case and filled with special lubricant for extreme temperature conditions. A "DC" shunt-wound permanent magnet motor with sealed ball bearings shall be attached to transmission system. Complete unit shall be rubber mounted with provisions for easy maintenance and replacement, without removing door from pivots or frame.
3. Connecting hardware for swing overhead concealed type power operator shall have drive arm attached to door with a pin linkage rotating in a self-lubricating bearing and adjustable slide block, traveling in an interconnected track and top pivot assembly. Top track and pivot

assembly shall be fabricated of steel. 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. Relays shall be plug-in type for individual replacement and all connecting harnesses shall have interlocking plugs. Control shall also include time delay for normal cycle. Swing door control shall include safe-swing circuit with optional switching which automatically limits power and slows door when approached from the doors swing area.
5. On pairs of doors, operators shall allow either door to be opened manually without the other door opening or as noted in the Hardware Schedule.

2.2 MICROPROCESSOR CONTROLS

- A. The system shall include a multi-function microprocessor control providing adjustable hold open time (1 - 30 sec.), LED indications for actual position unknown, system status, open obstruction shutdown, activation signal, safety mat/sensor signal, Stop-and-Hold signal, and mode selector switches providing a means for easy field selection of the following functions: push-to-operate, latch assist and stack pressure. Control shall be capable of receiving activation signals from any device with normally open dry contact output.
 1. With push-to-operate function enabled, the control shall provide a means of initiating a self-start activation circuit by slightly pushing the door open at any point in the door swing.
 2. Latch Assist shall provide a two second impulse in the close direction to overcome restrictions with locking devices of pressure differentials, allowing the unit to operate in standard time delay mode, and permitting the door to close from the full open position after the hold time is satisfied. 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 shuts the motor off if an open obstruction is sensed. The control shall include a recycle feature the reopens the door if an obstruction is sensed at any point during its closing cycle.

The control shall include a standard three position toggle switch with functions for ON, OFF, and HOLD OPEN.

2.3 ENCLOSURE

Operator shall be completely self-contained within an extruded aluminum housing (alloy 6063-T6) to conceal operator mechanism and mounting brackets and with removable access cover with an overall maximum size of 140 mm (5-1/2 inches) wide by 150 mm (6 inches) deep. Header color shall be integral color anodized/painted to match adjacent storefront/frame finish.

2.4 ACTIVATION DEVICES

- A. Automatic: Opening cycle shall be activated by pressing switches with international symbol of accessibility and "PRESS TO OPERATE DOOR" engraved on the faceplate. Switches shall be installed in a standard 2-gang electrical wall box and placed in a location in compliance with ANSI A117.1. Switches may be wall mounted or mounted on a free standing post or guard rail. Push button for operation shall also be located at Reception desks. Coordinate with Electrical Drawings.
- B. Manual: Push-to-operate; manually pushing the door shall activate the automatic opening cycle. Door shall automatically close after timer delay expires.
- C. Opening and closing force, measured 25 mm (1 inch) out from the lock stile of the door, shall not exceed 67 N (15 lbf) to stop the door when operating in either direction or cycle.
- D. Opening Time: Doors shall be field adjusted so that opening time to back check or 80 degrees, whichever occurs first, shall be 3 seconds or longer as required in Table 1. Backcheck shall not occur before 60 degrees opening.
Total opening time to fully open shall be as in Table II.
- E. Closing Time:
Doors shall be field adjusted to close from 90 degrees to 10 degrees in 3 seconds or longer as required in Table 1.
 - 1. Doors shall be field adjusted to close from 10 degrees to fully close position in not less than 1.5 seconds.
 - 2. Doors shall be field adjusted to remain fully open for not less than 5 seconds.
 - 3. Table 1 provides speed settings for various widths and weights of doors for obtaining results complying with this paragraph.
- F. Cycle Tests:

1. Low Energy Power Operated, Low Energy Power Open and Power Assist Operators shall be cycle tested for 300,000 cycles.
2. Use the widest and heaviest door specified as a test specimen. Narrower or lighter doors of the same configurations shall then be considered to meet the cycle test requirements.

Table 1

Minimum Opening Time to Backcheck or 80 degrees, which ever occurs first and the Minimum Closing Time from 90 degrees to Latch Check or 10 degrees.

"D" Door Leaf Width- mm (inches)	"W" Door Weight in kg (pounds) Matrix Values are in seconds				
	(100) 45.4	(56.7) 125	(68.0) 150	(79.4) 175	(90.7) 200
(762) 30	3.0	3.0	3.0	3.0	3.5
(914) 36	3.0	3.5	3.5	4.0	4.0
(1067) 42	3.5	4.0	4.0	4.5	4.5

Doors of other weights and widths can be calculated using the formula;

$T = DvW/133$ in US units $T = DvW/2260$ in SI (metric) units

Where: T= Time, seconds

D= Door width, mm (inches)

W= Door weight, kg (lbs)

The values for "T" time have been rounded up to the nearest half second.

These values are based on a kinetic energy of (1.25 lbf-ft).

Table II

Total Opening Time to Full Open Position

Backcheck at 60 degrees	Backcheck at 70 degrees	Backcheck at 80 degrees
Table 1 plus 2 seconds	Table 1 plus 1.5 seconds	Table 1 plus 1 second

Note: To determine maximum times from close to full open, the operator shall be adjusted as shown in the chart. Backcheck occurring at a point between positions in Table II shall use the lowest setting. For example, if the backcheck occurs at 75 degrees, the full open shall be the time shown in Table 1 plus 1.5 seconds.

2.5 POWER UNITS

Provide separate self-contained electric circuits for automatic operators located on each floor of the building. Interruption or failure of power circuits for operators located on one floor of the building shall not interfere with continuous performance of automatic operated doors located on other floors. Capacity and size of power circuits shall be in accordance with automatic operator manufacturer's specifications.

2.6 SAFETY DEVICES

- A. Time delay switches shall be adjustable between 5 to 60 seconds and shall control closing cycle of doors.
- B. Decals with sign "In" or "Do Not Enter" shall be installed on both faces of each door where shown and shall conform to the requirements of ANSI/BHMA A156.19.
- C. Each swing door shall have installed a motion sensor to detect any person standing in the door swing path and prevent the door from opening.
- D. Motion sensors shall consist of detection modules, factory prepared to be attached to each side of the lock/strike stile, an armored flex link power cable and bracket assembly, factory prepared for attachment to the pivot stile; a logic board and a position encoder which shall mount to the operator. The detection modules shall contain transmitting and receiving diodes and sense multidimensional zones for detection of people and/or objects in the door area. Detection modules shall be high impact, shock resistant zinc castings with tinted lenses. The swing door sensor system shall provide complete operate and safety zone coverage. These zones shall be fully adjusted to meet specific jobsite conditions (sidewalls, adjacent panels, etc.) The system shall not be affected by ultrasonic, ambient light or radios frequencies within the vicinity of the swing door.
- E. Each swing door shall have installed a re-activation sensor mounted on the push-side door face near the top detect any person standing in the door swing path and prevent the door from closing. Wiring for the re-activation sensor between the door and frame shall be concealed in a power transfer device, hinge or pivot provided under Section 08 71 00; wire chase in door provided under door section.

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) 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.

----- END -----

SECTION 08 80 00
GLAZING

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies glass, plastic, related glazing materials and accessories. Glazing products specified apply to factory or field glazed items.

1.2 RELATED WORK

- A. Section 08 11 13 HOLLOW METAL DOORS AND FRAMES
- B. Section 08 14 00 INTERIOR WOOD DOORS
- C. Section 08 41 13 ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS
- D. Section 08 40 29.23 SLIDING AUTOMATIC ENTRANCES
- E. Section 08 44 13 GLAZED ALUMINUM CURTAIN WALLS

1.3 LABELS

- A. Temporary labels:
 - 1. Provide temporary label on each light of glass identifying manufacturer or brand and glass type, quality and nominal thickness.
 - 2. Label in accordance with NFRC (National Fenestration Rating Council) label requirements.
 - 3. Temporary labels shall remain intact until glass is approved by 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.
 - c. Organic coated glass.

1.4 PERFORMANCE REQUIREMENTS

- A. Building Enclosure Vapor Retarder and Air Barrier:
 - 1. Utilize the inner pane of multiple pane sealed units for the continuity of the air barrier and vapor retarder seal.
 - 2. Maintain a continuous air barrier and vapor retarder throughout the glazed assembly from glass pane to heel bead of glazing sealant.

B. Glass Thickness:

1. Select thickness of exterior glass to withstand dead loads and wind loads acting normal to plane of glass at design pressures calculated in accordance with applicable code.
2. Test in accordance with ASTM E 1300.
3. Thicknesses listed are minimum. Coordinate thicknesses with framing system manufacturers.

1.5 SUBMITTALS

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

B. Manufacturer's Certificates:

1. Certificates stating that wire glass, meets requirements for safety glazing material as specified in ANSI Z97.1.
2. Certificate on shading coefficient.
3. Certificate on "R" value when value is specified.
4. Certificate test reports confirming compliance's with specified bullet resistive rating.
5. Certificate that blast resistant glass meets the requirements of UFC4-010-01.

C. Warranty: Submit written guaranty, conforming to General Condition requirements, and to "Warranty of Construction" Article in this Section.

D. Manufacturer's Literature and Data:

1. Glass, each kind required.
2. Insulating glass units.
6. Glazing cushion.
7. Sealing compound.

E. Samples:

1. Size: 150 mm by 150 mm (6 inches by 6 inches).
2. Tinted glass.
3. Reflective glass.

F. Preconstruction Adhesion and Compatibility Test Report: Submit glazing sealant manufacturer's test report indicating glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Delivery: Schedule delivery to coincide with glazing schedules so minimum handling of crates is required. Do not open crates except as required for inspection for shipping damage.
- B. Storage: Store cases according to printed instructions on case, in areas least subject to traffic or falling objects. Keep storage area clean and dry.
- C. Handling: Unpack cases following printed instructions on case. Stack individual windows on edge leaned slightly against upright supports with separators between each.
- D. Protect laminated security glazing units against face and edge damage during entire sequence of fabrication, handling, and delivery to installation location. Provide protective covering on exposed faces of glazing plastics, and mark inside as "INTERIOR FACE" or "PROTECTED FACE":
 - 1. Treat security glazing as fragile merchandise, and packaged and shipped in export wood cases with width end in upright position and blocked together in a mass. Storage and handling shall comply with Manufacturer's directions and as required to prevent edge damage or other damage to glazing resulting from effects of moisture, condensation, temperature changes, direct exposure to sun, other environmental conditions, and contact with chemical solvents.
 - 2. Protect sealed-air-space insulating glazing units from exposure to abnormal pressure changes, as could result from substantial changes in altitude during delivery by air freight. Provide temporary breather tubes which do not nullify applicable warranties on hermetic seals.
 - 3. Temporary protections: The glass front and polycarbonate back of glazing shall be temporarily protected with compatible, peelable, heat-resistant film which will be peeled for inspections and re-applied and finally removed after doors and windows are installed at destination. Since many adhesives will attack polycarbonate, the film used on exposed polycarbonate surfaces shall be approved and applied by manufacturer.
 - 4. Edge protection: To cushion and protect glass clad, polycarbonate, and Noviflex edges from contamination or foreign matter, the four edges shall be sealed the depth of glazing with continuous standard-thickness Santoprene tape. Alternatively, continuous channel shaped

extrusion of Santoprene shall be used, with flanges extending into face sides of glazing.

5. Protect "Constant Temperature" units including every unit where glass sheet is directly laminated to or directly sealed with metal-tube type spacer bar to polycarbonate sheet, from exposures to ambient temperatures outside the range of 16 to 24 C, during the fabricating, handling, shipping, storing, installation, and subsequent protection of glazing.

1.7 PROJECT CONDITIONS

Field Measurements: Field measure openings before ordering tempered glass products. Be responsible for proper fit of field measured products.

1.8 WARRANTY

- A. Warranty: Conform to terms of "Warranty of Construction", FAR clause 52.246-21, except extend warranty period for the following:
 1. Bullet resistive plastic material to remain visibly clear without discoloration for 10 years.
 2. Insulating glass units to remain sealed for 10 years.
 3. Laminated glass units to remain laminated for 5 years.
 4. Polycarbonate to remain clear and ultraviolet light stabilized for 5 years.
 5. Insulating plastic to not have more than 6 percent decrease in light transmission and be ultraviolet light stabilized for 10 years.

1.9 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American National Standards Institute (ANSI):
Z97.1-09.....Safety Glazing Material Used in Building -
Safety Performance Specifications and Methods
of Test.
- C. American Society for Testing and Materials (ASTM):
C542-05.....Lock-Strip Gaskets
C716-06.....Installing Lock-Strip Gaskets and Infill
Glazing Materials.
C794-10.....Adhesion-in-Peel of Elastomeric Joint Sealants
C864-05.....Dense Elastomeric Compression Seal Gaskets,
Setting Blocks, and Spacers

- C920-11.....Elastomeric Joint Sealants
- C964-07.....Standard Guide for Lock-Strip Gasket Glazing
- C1036-06.....Flat Glass
- C1048-12.....Heat-Treated Flat Glass-Kind HS, Kind FT Coated
and Uncoated Glass.
- C1376-10.....Pyrolytic and Vacuum Deposition Coatings on
Flat Glass
- D635-10.....Rate of Burning and/or Extent and Time of
Burning of Self-Supporting Plastic in a
Horizontal Position
- D4802-10.....Poly (Methyl Methacrylate) Acrylic Plastic
Sheet
- E84-10.....Surface Burning Characteristics of Building
Materials
- E119-10.....Standard Test Methods for Fire Test of Building
Construction and Material
- E2190-10.....Insulating Glass Unit
- D. Commercial Item Description (CID):
- A-A-59502.....Plastic Sheet, Polycarbonate
- E. Code of Federal Regulations (CFR):
- 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; 2010
- F. National Fire Protection Association (NFPA):
- 80-13.....Fire Doors and Windows.
- 252-12.....Standard Method of Fire Test of Door Assemblies
- 257-12.....Standard on Fire Test for Window and Glass
Block Assemblies
- G. National Fenestration Rating Council (NFRC)
- H. Safety Glazing Certification Council (SGCC) 2012:
Certified Products Directory (Issued Semi-Annually).
- I. Underwriters Laboratories, Inc. (UL):
- 752-11.....Bullet-Resisting Equipment.
- J. Unified Facilities Criteria (UFC):
- 4-010-01-2012.....DOD Minimum Antiterrorism Standards for
Buildings
- K. Glass Association of North America (GANA):
Glazing Manual (Latest Edition)
Sealant Manual (2009)
- L. American Society of Civil Engineers (ASCE):

ASCE 7-10.....Wind Load Provisions

PART 2 - PRODUCT

2.1 GLASS

- A. Use thickness stated unless specified otherwise in assemblies.
- B. Clear Glass:
 - 1. ASTM C1036, Type I, Class 1, Quality q3
 - 2. Thickness as indicated

2.2 HEAT-TREATED GLASS

- A. Clear Heat Strengthened Glass (HS-1):
 - 1. ASTM C1048, Kind HS, Condition A, Type I, Class 1, Quality q3.
 - 2. Thickness as indicated.
- B. Clear Tempered Glass (TG-1):
 - 1. ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality q3.
 - 2. Thickness as indicated.

2.3 COATED GLASS

- A. Coated Spandrel Glass (SG-1):
 - 1. ASTM C1048, Kind HS, Condition B, Type I, quality q3 clear (HS-1)
 - 2. Opacifier: V175 high opacity white.
 - 3. Apply coating to second surface.
 - 4. Thickness as indicated.

2.4 LAMINATED GLASS

- A. Two or more lites of glass bonded with an interlayer material for use in building glazing.
- B. Interlayer: Clear
- C. Use min. 1.5 mm (0.060 inch) thick interlayer for:
 - 1. Heat strengthened or fully tempered glass assemblies.
- D. Clear Heat Strengthened Glazing (LG-1):
 - 1. Both panes, ASTM C1048, Kind HS, Condition A, Type I, Glass 1, Quality q3.
 - 2. Thickness: Each pane as indicted.
 - 3. Interlayer: 0.060-inch.
- E. Clear Tempered Glazing (LG-2):
 - 1. Both panes ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality q3.
 - 2. Thickness: Each pane as indicated.
 - 3. Interlayer: 0.060-inch.

2.5 INSULATING GLASS UNITS

A. Provide factory fabricated, hermetically sealed glass unit consisting of two panes of glass separated by a dehydrated air space and comply with ASTM E2190.

B. Assemble units using glass types specified.

C. Sealed Edge Units (SEU): IG-1, 1-inch thick

1. Insulating Glass Unit Makeup:

a. Outboard Light:

- 1) Glass type: Heat strengthened (HS-1)
- 2) Glass: Clear
- 3) Nominal Thickness: 1/4-inch
- 4) Coating Orientation: VE1-2M Low-E coating, Surface #2

b. Air Space:

- 1) Nominal Thickness: 1/2-inch
- 2) Gas Fill: (Air or 90% Argon)

c. Inboard Light:

- 1) Glass type: Heat strengthened (HS-1)
- 2) Glass: Clear
- 3) Nominal Thickness: 1/4-inch

2. Performance Characteristics:

- a. Visible Transmittance: 70%
- b. Visible Reflectance: 11%
- c. Winter U-factor (U-value): 0.29
- d. Shading Coefficient (SC): 0.44
- e. Solar Heat Gain Coefficient (SHGC): 0.38

3. Glass shall be annealed, heat strengthened or tempered as required by codes, or as required to meet thermal stress and wind loads.

4. Glass heat-treated by horizontal (roller hearth) process with inherent roller wave distortion parallel to the bottom edge of the glass as installed when specified.

D. Sealed Edge Units (SEU): IG-2, 1-3/16-inch thick

1. Insulating Glass Unit Makeup:

a. Outboard Light:

- 1) Glass type: Heat strengthened (HS-1)
- 2) Glass: Clear
- 3) Nominal Thickness: 1/4-inch
- 4) Coating Orientation: VE1-2M Low-E coating, Surface #2

b. Air Space:

- 1) Nominal Thickness: 1/2-inch
- 2) Gas Fill: (Air or 90% Argon)
- c. Inboard Light:
 - 1) Glass type: Laminated (LG-1)
 - 2) Glass: Clear
 - 3) Nominal Thickness: 7/16-inch
 - 4) Interlayer: 0.060 inch
2. Performance Characteristics (Center of Glass):
 - a. Visible Transmittance: 70%
 - b. Visible Reflectance: 11%
 - c. Winter U-factor (U-value): 0.29
 - d. Shading Coefficient (SC): 0.44
 - e. Solar Heat Gain Coefficient (SHGC): 0.38
3. Glass shall be annealed, heat strengthened or tempered as required by codes, or as required to meet thermal stress and wind loads.
4. Glass heat-treated by horizontal (roller hearth) process with inherent roller wave distortion parallel to the bottom edge of the glass as installed when specified.
- E. Sealed Edge Units (SEU): IG-3, 1-inch thick
 1. Insulating Glass Unit Makeup:
 - a. Outboard Light:
 - 1) Glass type: Heat strengthened (HS-1) with silk screen #3058 (V1086 simulated sand blast Viraspan)
 - 2) Glass: Clear
 - 3) Nominal Thickness: 1/4-inch
 - 4) Coating Orientation: Surface #2
 - b. Air Space:
 - 1) Nominal Thickness: 1/2-inch
 - 2) Gas Fill: (Air or 90% Argon)
 - c. Inboard Light:
 - 1) Glass type: Spandrel (SG-1)
 - 2) Nominal Thickness: 1/4-inch
 - 3) Opacifier Orientation: Surface #4
 2. Performance Characteristics (Center of Glass):
 - a. Visible Transmittance: 0
 - b. Visible Reflectance: 0
 - c. Winter U-factor (U-value): 0.47
 - d. Shading Coefficient (SC): 0

- e. Solar Heat Gain Coefficient (SHGC): 0
- 3. Glass shall be annealed, heat strengthened or tempered as required by codes, or as required to meet thermal stress and wind loads.
- 4. Glass heat-treated by horizontal (roller hearth) process with inherent roller wave distortion parallel to the bottom edge of the glass as installed when specified.
- F. Sealed Edge Units (SEU): IG-4, 1-inch thick
 - 1. Insulating Glass Unit Makeup:
 - a. Outboard Light:
 - 1) Glass type: Heat strengthened (HS-1)
 - 2) Glass: Clear
 - 3) Nominal Thickness: 1/4-inch
 - 4) Coating Orientation: VRE1-59 Low-E coating on Surface #2
 - b. Air Space:
 - 1) Nominal Thickness: 1/2-inch
 - 2) Gas Fill: (Air or 90% Argon)
 - c. Inboard Light:
 - 1) Glass type: Heat Strengthened (HS-1)
 - 2) Glass: Clear
 - 3) Nominal Thickness: 1/4-inch
 - 2. Performance Characteristics (Center of Glass):
 - a. Visible Transmittance: 53%
 - b. Visible Reflectance: 30%
 - c. Winter U-factor (U-value): 0.30
 - d. Shading Coefficient (SC): 0.39
 - e. Solar Heat Gain Coefficient (SHGC): 0.33
 - 3. Glass shall be annealed, heat strengthened or tempered as required by codes, or as required to meet thermal stress and wind loads.
 - 4. Glass heat-treated by horizontal (roller hearth) process with inherent roller wave distortion parallel to the bottom edge of the glass as installed when specified.
- G. Sealed Edge Units (SEU): IG-5, 1-inch thick
 - 1. Insulating Glass Unit Makeup:
 - a. Outboard Light:
 - 1) Glass type: Tempered (TG-1)
 - 2) Glass: Clear
 - 3) Nominal Thickness: 1/4-inch
 - 4) Coating Orientation: VE1-2M Low-E coating on Surface #2

- b. Air Space:
 - 1) Nominal Thickness: 1/2-inch
 - 2) Gas Fill: (Air or 90% Argon)
- c. Inboard Light:
 - 1) Glass type: Tempered (TG-1)
 - 2) Glass: Clear
 - 3) Nominal Thickness: 1/4-inch
- 2. Performance Characteristics (Center of Glass):
 - a. Visible Transmittance: 70%
 - b. Visible Reflectance: 11%
 - c. Winter U-factor (U-value): 0.29
 - d. Shading Coefficient (SC): 0.44
 - e. Solar Heat Gain Coefficient (SHGC): 0.38
- 3. Glass shall be annealed, heat strengthened or tempered as required by codes, or as required to meet thermal stress and wind loads.
- 4. Glass heat-treated by horizontal (roller hearth) process with inherent roller wave distortion parallel to the bottom edge of the glass as installed when specified.
- H. Sealed Edge Units (SEU): IG-6, 1-3/16-inch thick
 - 1. Insulating Glass Unit Makeup:
 - a. Outboard Light:
 - 1) Glass type: Tempered (TG-1)
 - 2) Glass: Clear
 - 3) Nominal Thickness: 1/4-inch
 - 4) Coating Orientation: VE1-2M Low-E coating on Surface #2
 - b. Air Space:
 - 1) Nominal Thickness: 1/2-inch
 - 2) Gas Fill: (Air or 90% Argon)
 - c. Inboard Light:
 - 1) Glass type: Laminated (LG-2)
 - 2) Glass: Clear
 - 3) Nominal Thickness: 7/16-inch
 - 4) Interlayer: 0.060 inch
 - 2. Performance Characteristics (Center of Glass):
 - a. Visible Transmittance: 68%
 - b. Visible Reflectance: 11%
 - c. Winter U-factor (U-value): 0.29
 - d. Shading Coefficient (SC): 0.43

- e. Solar Heat Gain Coefficient (SHGC): 0.37
- 3. Glass shall be annealed, heat strengthened or tempered as required by codes, or as required to meet thermal stress and wind loads.
- 4. Glass heat-treated by horizontal (roller hearth) process with inherent roller wave distortion parallel to the bottom edge of the glass as installed when specified.
- I. Sealed Edge Units (SEU): IG-7, 1-inch thick
 - 1. Insulating Glass Unit Makeup:
 - a. Outboard Light:
 - 1) Glass type: Tempered (TG-1)
 - 2) Glass: Clear
 - 3) Nominal Thickness: 1/4-inch
 - 4) Coating Orientation: VRE1-59 Low-E coating on Surface #2
 - b. Air Space:
 - 1) Nominal Thickness: 1/2-inch
 - 2) Gas Fill: (Air or 90% Argon)
 - c. Inboard Light:
 - 1) Glass type: Tempered (TG-1)
 - 2) Glass: Clear
 - 3) Nominal Thickness: 1/4-inch
 - 2. Performance Characteristics (Center of Glass):
 - a. Visible Transmittance: 70%
 - b. Visible Reflectance: 11%
 - c. Winter U-factor (U-value): 0.29
 - d. Shading Coefficient (SC): 0.44
 - e. Solar Heat Gain Coefficient (SHGC): 0.38
 - 3. Glass shall be annealed, heat strengthened or tempered as required by codes, or as required to meet thermal stress and wind loads.
 - 4. Glass heat-treated by horizontal (roller hearth) process with inherent roller wave distortion parallel to the bottom edge of the glass as installed when specified.

2.6 FIRE RESISTANT GLASS WITHOUT WIRE MESH FG-1

- A. Type 1 (Transparent float glass), Class 1 (Clear).
- B. Fire-protective glass products used to protect against smoke and flames only shall be rated for 45 minutes as required by local building code and shall be tested in accordance with NFPA 252 (Standard Methods of Fire Tests of Door Assemblies) and NFPA 257 (Standard on Fire Test for Window and Glass Block Assemblies)

- C. Fire-resistive products used to protect against smoke, flame, and the transmission of radiant heat shall be rated for 90 minutes and shall be tested in accordance with NFPA 252, NFPA 257, and ASTM E119 (Standard Test Methods for Fire Tests of Building Construction and Materials).
- D. Fire-rated glass or glass assembly shall be classified by Underwriters Laboratory (UL), Intertek Testing Services- Warnock Hersey (ITS-WHI) or any other OSHA certified testing laboratory. All glass shall bear a permanent mark of classification in accordance with local building code.
- E. Maximum size is per the manufacturer's test agency listing for doors, transoms, side lights, borrowed lights, and windows.
- F. Where safety glazing is required by local building code, fire-rated glass shall be tested in accordance with CPSC 16 CFR 1201 Category I or II and bear a permanent mark of classification.
 - 1. Category I products are limited to 0.84 m² - 9 ft² and tested to no less than 203 Nm-150 ft-lbs impact loading.
 - 2. Category II products are greater than 0.84 m² - 9 ft² and tested to no less than 542 Nm-400 ft-lbs impact loading. Category II products can be used in lieu of Category I products.

2.7 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. Spring Steel Spacer: Galvanized steel wire or strip designed to position glazing in channel or rabbeted sash with stops.

F. Glazing Clips: Galvanized steel spring wire designed to hold glass in position in rabbeted sash without stops.

G. Glazing Points (Sprigs): Pure zinc stock, thin, flat, triangular or diamond shaped pieces, 6 mm (1/4 inch) minimum size.

H. 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.

J. 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.

K. Structural Sealant: ASTM C920, silicone acetoxo cure:

1. Type S.
2. Class 25.
3. Grade NS.
4. Shore a hardness of 25 to 30 Durometer.

L. 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.

M. 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. Patterned Glass:
 - 1. Install units with one patterned surface with smooth surface on the weather side.
 - 2. Install units in interior partitions with pattern in same direction in all openings.
- G. Tempered Glass: Install with roller distortions in horizontal position unless otherwise directed.
- H. Insulating Glass Units:
 - 1. Glaze in compliance with glass manufacturer's written instructions.
 - 2. When glazing gaskets are used, they shall be of sufficient size and depth to cover glass seal or metal channel frame completely.
 - 3. Do not use putty or glazing compounds.
 - 4. Do not grind, nip, cut, or otherwise alter edges and corners of fused glass units after shipping from factory.
 - 5. Install with tape or gunnable sealant in wood sash.
- I. Fire Resistant Glass:
 - 1. Other fire resistant glass: Glaze in accordance with UL design requirements.

3.4 INSTALLATION - WET/DRY METHOD (PREFORMED TAPE AND SEALANT)

- A. Cut glazing tape to length and set against permanent stops, 5 mm (3/16 inch) below sight line. Seal corners by butting tape and dabbing with butyl sealant.
- B. Apply heel bead of butyl sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete the continuity of the air and vapor seal.
- C. Place setting blocks at 1/4 points with edge block no more than 150 mm (6 inches) from corners.
- D. Rest glazing on setting blocks and push against tape and heel bead of sealant with sufficient pressure to achieve full contact at perimeter of pane or glass unit.
- E. Install removable stops, with spacer strips inserted between glazing and applied stops, 6 mm (1/4 inch) below sight line. Place glazing tape on glazing pane or unit with tape flush with sight line.
- F. Fill gap between glazing and stop with approved type sealant to depth equal to bite of frame on glazing, but not more than 9 mm (3/8 inch) below sight line.

- G. Apply cap bead of approved type sealant along void between the stop and the glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.5 INSTALLATION - EXTERIOR BUTT GLAZED METHOD (SEALANT ONLY)

- A. Temporarily brace glass in position for duration of glazing process. Mask edges of glass at adjoining glass edges and between glass edges and framing members.
- B. Temporarily secure a small diameter non-adhering foamed rod on back side of joint.
- C. Apply sealant to open side of joint in continuous operation; thoroughly fill the joint without displacing the foam rod. Tool the sealant surface smooth to concave profile.
- D. Permit sealant to cure then remove foam backer rod. Apply sealant to opposite side, tool smooth to concave profile.
- E. Remove masking tape.

3.6 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.

3.7 PROTECTION

Protect finished surfaces from damage during erection, and after completion of work. Strippable plastic coatings on colored anodized finish are not acceptable.

- - - E N D - - -

SECTION 09 06 00
SCHEDULE FOR FINISHES

SECTION 09 06 00-SCHEDULE FOR FINISHES

VAACC: 757-200

Location: Columbus, Ohio

Project no. 757-200 and Name: CHALMERS P. WYLIE ACC - BUILD SPECIALTY CARE CENTER

Submission: BID AND CONSTRUCTION

Date: April 25, 2014

**SECTION 09 06 00
SCHEDULE FOR FINISHES**

PART I - GENERAL

1.1 DESCRIPTION

This section contains a coordinated system in which requirements for materials specified in other sections shown are identified by abbreviated material names and finish codes in the room finish schedule or shown for other locations.

1.2 MANUFACTURERS

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

1.3 SUBMITALS

Submit in accordance with SECTION 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES—provide quadruplicate samples for color approval of materials and finishes specified in this section.

PART 2- PRODUCTS

2.1 DIVISION 06 WOOD, PLASTICS AND COMPOSITES

A. SECTION 06 20 00, FINISH CARPENTRY

1. RECEPTION COUNTER PUBLIC OR PATIENT SIDE, SHARED WAITING ROOM 1B602				
Finish Code	Component	Material	Manufacturer	Finish/Color
SSM1	Countertop	Solid Surface	Dupont "Corian"	Linen
DG-1	Decorative Glass Divider	Glass	Carvart	04-07-T-4851

2. RECEPTION COUNTER STAFF SIDE, SHARED RECEPTION ROOM 1B610				
Finish Code	Component	Material	Manufacturer	Finish/Color
SSM1	Task Surface	Solid Surface	Dupont "Corian"	Linen
DG-1	Decorative Glass Divider	Glass	Carvart	04-07-T-4851

3. RECEPTION COUNTER PUBLIC OR PATIENT SIDE, RADIOLOGY WAITING ROOM 1B606				
Finish Code	Component	Material	Manufacturer	Finish/Color
SSM1	Countertop	Solid Surface	Dupont "Corian"	Linen
DG-1	Decorative Glass Divider	Glass	Carvart	04-07-T-4851

4. RECEPTION COUNTER STAFF SIDE - RECEPTION ROOM 1B607				
Finish Code	Component	Material	Manufacturer	Finish/Color
SSM1	Task Surface	Solid Surface	DuPont "Corian"	Linen
DG-1	Decorative Glass Divider	Glass	Carvart	04-07-T-4851

5. NOURISHMENT ROOM 1B670 AND STAFF BREAKROOM 1B605				
Finish Code	Component	Material	Manufacturer	Finish/Color
SSM1	Countertop Surface	Solid Surface	Dupont "Corian"	Linen
PLAM-4	Vertical Surfaces	Plastic Laminate	Nevamar	Siren Maple, WM0005T

6. WINDOW SILLS AND DISPATCH COUNTER				
Finish Code	Component	Material	Manufacturer	Finish/Color
SSM1	Counter & Sills	Solid Surface	Dupont "Corian"	Linen

B. CABINET AND HARDWARE SCHEDULE

Reference No. & Code	Component	Manufacturer	Finish/Color
1	Door and Drawer Pull, 6"	Hafele	117.95.630 Stainless Steel
2	Self-closing hinges; flush overlay with synthetic dowels	Blum	71T6580 - Nickel plated (170 degree)
3	Cabinet Locks - Disc Tumbler, cam type lock for flush overlay construction	National Cabinet Lock	C8053 - Brite Nickel
4	Box Drawer Slide	Accuride	3832, 100 # capacity, full extension
5	Cabinet Shelf Support Pine	Knape and Vogt	346 ANO (Anochrome)
6	Support Bracket	A&M Hardware	Field Finish paint - color selected by Architect to match adjacent wall
7	Grommet, "G" Series	Doug Mockett	Plastic Color: Metallic Silver

2.2 Division 07 - THERMAL AND MOISTURE PROTECTION

A. SECTION 07 24 00, EXTERIOR INSULATION AND FINISH SYSTEMS

Product	Finish	Manufacturer	Mfg. Color Name/No.
Outsulation Plus MD	Sandblast Medium Texture	Dryvit	130 Gull Grey

B. SECTION 07 40 00, ROOFING AND SIDING PANELS

Type	Series	Ext. Finish	Manufacturer	Mfg. Color Name/No.
Wall Panel*	Formawall Dimension 3T	Match Existing	Centria	Valspar Fluropon Classic: Dark Fine Copper, 439Z1342M
Composite Metal Panel	Reynobond	Match Curtainwall	Alcoa	Valspar Fluropon Classic II: Platinum Ice 399B756
Integrated Insulated Window System	Formavue FV600	Match Existing	Centria	Valspar Fluropon Premier: Med. Bronze, 437C1921

*Insulated

C. SECTION 07 54 16, ETHYLENE INTERPOLYMER ROOFING (KEE)

Product	Manufacturer	Mfg. Color Name/No.
Sure Weld	Carlisle	White

D. SECTION 07 54 23, THERMOPLASTIC POLYOLEFIN ROOFING (TPO)

Product	Manufacturer	Mfg. Color Name/No.
Sure Weld	Carlisle	White

E. SECTION 07 72 00, ROOF AND ACCESSORIES

Code/Item	Material	Finish	Manufacturer	Manufacturer/Color Name/Number.
FS-1/Fascia Systems	0.040	Kynar	Metal Era*	Valspar Fluropon Classic: Dark Fine Copper, 439Z1342M
FS-2/Fascia Systems	0.040 Formed Aluminum	Kynar	Metal Era*	Valspar Fluropon Classic II: Platinum Ice 399B756
Coping	0.050 Formed Aluminum	Kynar	Metal Era**	Valspar Fluropon Classic: Dark Fine Copper, 439Z1342M

* Anchor Tite Standard Fascia AF Series

** Permatite Series Tapered Version

F. SECTION 07 92 00, JOINT SEALANTS

Location	Color	Manufacturer	Manufacturer Color
Masonry Expansion Joints	As selected by Architect	-	As listed in Section 07 92 00
CMU Control Joints	As selected by Architect	-	As listed in Section 07 92 00
New to Existing Walls	As selected by Architect	-	As listed in Section 07 92 00
Building Expansion Joints	As selected by Architect	-	As listed in Section 07 92 00
Masonry Sealed Joints	As selected by Architect	-	As listed in Section 07 92 00
Other joints as indicated on Drawings	As selected by Architect	-	As listed in Section 07 92 00

2.3 DIVISION 08 - OPENINGS

A. SECTION 08 11 13, HOLLOW METAL DOORS AND FRAMES

Paint both sides of door and frames same color including ferrous metal louvers, and hardware attached to door	
Component	Color/Paint System and Gloss
Door	P8/C, Semi-Gloss
Frame	P8/C, Semi-Gloss
Window frame	P8/C, Semi-Gloss

B. SECTION 08 14 00, WOOD DOORS

Component	Species	Manufacturer	Finish/Veneer Cut
Doors	White Maple	Algoma	RA-1050/quartered

C. SECTION 08 31 13, ACCESS DOORS AND FRAMES

Material	Manufacturer	Finish/Color
Steel	Babcock-Davis	Paint System: C*

* Factory primer for field painting; color to mach ceiling paint color P19/A

D. SECTION 08 33 00, COILING DOORS AND GRILLES

Location	Item	Material	Model	Manufacturer	Manufacturer Color Name/No.
Dispatch	Door*	Steel	ERD-11	Cornell	20-1012 (Powder Coat)

*Motor Operated - Model #M100

E. SECTION 08 33 13, COILING COUNTER DOORS

Location	Item	Model	Material	Manufacturer	Manufacturer Color Name/No.
Radiology/Reception	Shutter*	ERC-11	Steel	Cornell	20-1012 (Powder Coat)

*Motor Operated - Model #M100

F. SECTION 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

Component	Material/Finish	Manufacturer	Manufacturer Color Name/No.
Interior Store Front FG2000*	Aluminum/Kynar (2 coats)	Oldcastle	Valspar Platinum Ice, SL9A871
Exterior Thermal Entrance Door "Wide Stile"***	Aluminum/Kynar (2 coats)	Oldcastle	Valspar Platinum Ice, SL9A871
Frame for Exterior Thermal Entrance Door***	Aluminum/Kynar (2 coats)	Oldcastle	Valspar Platinum Ice, SL9A871
Single Door: Terrace Door Terra Swing 62E** ****	Aluminum/Kynar (2 coats)	Oldcastle	Valspar Platinum Ice, SL9A871

* Interior Glass: 1/4-inch clear tempered

** Exterior Door Glass: 1" insulating glass

*** Series 3000 Thermal Multiplane

**** Project Door Number 2B104A

G. SECTION 08 42 29.23, SLIDING AUTOMATIC ENTRANCES

Model	Manufacturer	Material	Color
TX9200AC	Tormax	Kynar (2 coats)	Valspar Platinum Ice, SL9A871

H. SECTION 08 44 13, GLAZED ALUMINUM CURTAIN WALLS

Component	Material	Finish	Manufacturer	Mfg. Color Name/No.
Frame*	Aluminum	Kynar	Old Castle	Valspar Fluoropon Classic II: Platinum Ice 399B756
Glazing	1" Insulating			

*Product: Reliance Curtainwall System

I. SECTION 08 71 13.11, LOW ENERGY POWER ASSIST DOOR OPERATORS

Model	Manufacturer	Material	Color
GT8500	Gyro Tech	Push Plate SS #4	N/A

2.4 DIVISION 09 - FINISHES

A. SECTION 09 30 13, CERAMIC TILING

1. MORTAR AND CRACK ISOLATION MEMBRANE FOR TILING				
Finish Code	Product	Tile Used With	Manufacturer	Mfg. Color Name/No.
-	Ultimate	All Tile	TEC	Gray
-	317	Floor Tile	TEC	-

2. SECTION 09 30 13, CERAMIC TILING				
Finish Code	Size/Use	Pattern	Manufacturer	Mfg. Color Name/No.
CT-7	12" X 12" - Walls	Main Street	Crossville	Cinema Champagne, AV211
CT-8	4" x 12" - Bullnose*	Main Street	Crossville	Cinema Champagne, AV211
CT-9	2" x 2" - Shower Floor	Main Street	Crossville	Cinema Champagne, AV211
CT-10	12" x 24" - Walls/Floor	Now	Crossville	Rust
CT-11	6" x 12" - Cove Base	Now	Crossville	Rust

* Wainscot Cap. Note: CT 1 - 6 Not used

3. SECTION 09 30 13, CERAMIC TILE GROUT		
Finish Code	Manufacturer/Type	Mfg. Color Name/No.
GR-1	TEC, Power Grout	Pearl, 988 (Walls)
GR-2	TEC, Power Grout	Light Pewter, 927 (Floors)

4. SECTION 09 30 13, SOLID SURFACE THRESHOLDS		
Type	Manufacturer	Mfg. Color Name/No.
SSM-2	Dupont "Corian"	Maui

5. SECTION 09 30 13, TRANSITION STRIPS - TS		
Profile	Material	Manufacturer
Schiene-E	Stainless Steel	Schluter
Reducer: SSR-281-B	Vinyl	Johnsonite, Color: Grizzly 281

*VCT to painted concrete floor

B. SECTION 09 51 00, ACOUSTICAL CEILINGS

Finish Code	Component	Color/Type	Manufacturer	Mfg Name/No.
ESS-1	Exposed Suspension System	White, 9/16"	Armstrong	Suprafine XL
AT-1	Type IV	White, Tegular	Armstrong	Ultima, 1912, 2x2
AT-2	Type IV	White, Square	Armstrong	Ultima, 1910, 2x2
AT-3	Type IV	White, Square	Armstrong	Ultima, 1913, 2x4
AT-4	Type IV	White, Square	Armstrong	Clean Room, Mylar, 1716, 2x4
ESS-2	Exposed Suspension System	White, 15/16"	Armstrong	Prelude XL
SST-1	Special Suspension Trim	White, Classic Series	Armstrong	Axiom, 6"*

*Aluminum

C. SECTION 09 65 19, RESILIENT TILE FLOORING

Finish Code	Size/Style	Material/Component	Manufacturer	Mfg Name/No.
VCT1	12" x 12" Excelon	Vinyl Composition Tile	Armstrong	Antique White, 51811
VP2	4" x 36" Arbor Art	Vinyl Plank	Armstrong	Cerisier Heirloom, TP049
VT1	12" x 24" Earthcuts	Cinyl Tile	Armstrong	Delicato Ochre, TP530
RF2	24" x 24" Inertia	SP.Edge Rubber Tile*	Johnsonite	Mohavi, 745
VCT6	12" x 12" SDT	Static Dissipative Tile	Armstrong	Marble Beige, 51950

*Note: VP1 and RF1 not used; *Hammered Finish

D. SECTION 09 65 43, LINOLEUM SHEET FLOORING (RSF) WITH HEAT WELD SEAMS

Finish Code	Pattern name	Manufacturer	Mfg. Color Name/No.
RSF1	Real	Forbo	Rosato 3120

E. SECTION 09 65 16, VINYL SHEET FLOORING, HEAT WELDED SEAMS (RSF)

Finish Code	Pattern name	Manufacturer	Mfg. Color Name/No.
RSF-9	Biospec MD	Mannington	Bedrock 15169

1. SECTION 09 65 16, WELDING RODS (WR)

Finish code	Manufacturer	Mfg. Color Name/No.
WR1 (with RSF1)	Forbo	Dual Heat Weld Rod: R3120 MC
WR2 (with RSF9)	Mannington	Camouflage Heat Weld Rod: 415169

2. SECTION 09 65 16, CAP STRIPS (RSF)

Finish Code	Manufacturer/Material	Mfg. Color Name/No.
	Metal	Silver

F. SECTION 09 65 13, RESILIENT BASE STAIR TREADS AND ACCESSORIES

Finish Code	Item	Height/Type	Manufacturer	Mfg Name/No.
RB1 (coved)	Rubber Base (RB)	4 3/8" Tightlock	Johnsonite	Canvas, 11
RB2 (Straight)	Rubber Base (RB)	4 3/8" Tightlock	Johnsonite	Canvas, 11

G. SECTION 09 68 00, CARPET MODULES (CPT)

Finish Code	Size	Pattern direction	Manufacturer/Pattern	Mfg. Color Name/No.
CPT2	24" x 24"	Monolithic	Shaw/Veil	Canopy, 33327
CPT3	24" x 24"	Monolithic	Shaw/Technique	Coffee, 22755

1. SECTION 09 68 00, CARPET EDGE STRIP (TRANSITION STRIP)

Finish Code	Profile	Material	Manufacturer	Mfg. Color Name/No.
TS1	Schiene-E	Metal	Schluter	Stainless Steel
TS2*	Reducer: CRS	Vinyl	Johnsonite	Grizzly, CRS-281-A

*Carpet tile to P18 pointed concrete floor

H. SECTION 09 77 10 FRAMED DECORATIVE PANEL SYSTEMS (FDPS)

System	Reveal Size/Color	Panel Material	Manufacturer/System	Mfg. Color Name/No.
FDPS1	CP4: 3/4" **	Metal Laminate*	Marlite/Flamesafe	Fine Hammered Copper, C471
Trim	CP280, CP90, CP270**	-	Marlite/Flamesafe	**

* Manufacturer: Advanced Technology, Inc.

**Clear Satin Anodized Aluminum

I. SECTION 09 91 00, PAINT AND COATINGS

1. Paint Systems and Paint Colors

- a. "Paint Systems" are listed below. Each Paint System includes primers and finishes for specific substrates indicated.

- b. "Paint Colors" are listed in the "Paint Code: Color/System". Each Paint Color Code includes the paint color, paint system, finish and manufacturer.
- c. Provide "Paint Systems" in the Paint Colors scheduled in the "Paint Code".
- d. For Paint System E, refer to Section PAINTING for colors.

2. Paint Systems

- a. Interior A:
 - 1. Substrate: Gypsum Board Walls, Soffits and Ceilings
 - 2. Primer: 1 Coat Premium Wall & Wood Primer, B28W08111 @ 1.8 mils dft
 - 3. Finish: 2 Coats Emerald Interior Satin Latex K37 Series @ 1.7 mils dft
 - 4. Manufacturer: Sherwin-Williams
- b. Interior B:
 - 1. Substrate: Gypsum Board Walls, Soffits and Ceilings
 - 2. Primer: 1 Coat Promar 200 Interior Latex Primer (B28W8200) @ 1.1 mils dft
 - 3. Finish: 2 Coats Water Based Catalyzed Epoxy Semi-gloss (B 70 Series) @ 2.5-3.0 mils dft
 - 4. Manufacturer: Sherwin-Williams
- c. Interior C:
 - 1. Substrate: Ferrous Metal (doors, door frames, and elsewhere indicated) and galvanized metal
 - 2. Primer: 1 Coat Industrial Pro-Cryl Universal Primer, (B66-310), @ 2.0-4.0 mils dft
 - 3. Finish: 2 Coats DTM Acrylic Coating semi-gloss, B66-211 @ 2.5 - 4.0 dft
 - 4. Manufacturer: Sherwin-Williams
- d. Interior D:
 - 1. Substrate: Concrete masonry units.
 - 2. Primer: 1 Coat Loxon Block Surfacers, A24W00200 @ 8 mils dft
 - 3. Finish: 2 Coats Emerald Interior Latex Satin, K37 Series @ 1.7 mils dft
 - 4. Manufacturer: Sherwin-Williams
- e. Interior E:
 - 1. Substrate: Insulation Jackets
 - 2. Primer: 1 Coat Promar 200 Interior Latex Primer (B28W8200) @ 1.1 mils dft

3. Finish: 2 Coats Metalatex Acrylic Emulsion (Semi-Gloss), B42-100, @1.5-4.0 mils dft
 4. Colors: Field verify color coding for each pipe system and obtain written approval from the Owner
 5. Type of Finish: Semi-gloss (SG)
 6. Manufacturer: Sherwin-Williams
- f. Interior Floors F:
1. Substrate: Concrete (Floors)
 2. Primer: 1 Coat Armorseal, 1000HS, B67-2000 Series, and Hardener B67V2002
 3. Finish: 1-2 Coats Armorseal 1000HS @2.5-4.0 mils dft, B67-2000 Series and Hardener B67V2002 @3.0 - 5.0 mils dft
 4. Manufacturer: Sherwin-Williams
 5. Type of Finish: Gloss
- g. Exterior G:
1. Substrate: Ferrous Metal (architectural exposed structural steel- AESS)
 2. Preparation: Refer to Section 05 12 00 "Structural Steel Framing".
 3. Primer: Refer to Section 05 12 00 "Structural Steel Framing."
 4. Finish: 2 coats Sher-Cryl High Performance Acrylic Semi-Gloss (B66-350 Series @ 2.5-4.0 mils dft
 5. Manufacturer: Sherwin Williams
 6. Type of Finish: Semi-gloss
 7. Color: P24/G as selected by Architect

Paint Code:Color/System	Finish	Manufacturer	Mfg. Color Name/No.
P1/A	Satin	Sherwin-Williams	Match B. Moore 2154-70, Vanilla Ice Cream
P8/C	Semi-gloss	Sherwin-Williams	Match B. Moore HC-45 Shaker Beige
P5/A	Satin	Sherwin-Williams	Match B. Moore 2143-40 Camouflage
P12/B	Semi-gloss	Sherwin-Williams	SW1900, Luminous White
P13/A	Satin	Sherwin-Williams	SW7572, Lotus Pod
P14/A	Satin	Sherwin-Williams	SW7736, Garden Sage
P15/A	Satin	Sherwin-Williams	SW7718, Oak Creek
P16/A	Satin	Sherwin-Williams	SW6221, Moody Blue
P17/D	Satin	Sherwin-Williams	Match B. Moore 2154-70 Vanilla Ice Cream
P18/F	Gloss	Sherwin-Williams	SW6108, Latte
P19/A	Satin	Sherwin-Williams	SW1900, Luminous White
P20/A	Satin	Sherwin-Williams	Match B. Moore HC-45 Shaker Beige
P21/B	Semi-Gloss	Sherwin-Williams	Match B. Moore HC-45 Shaker Beige
P22/D	Satin	Sherwin-Williams	SW7588, Show Stopper
P23/C	Semi-Gloss	Sherwin-Williams	SW7572, Lotus Pod
P24/G	Semi-Gloss	Sherwin-Williams	As selected by Architect

2.5 DIVISION 10 - SPECIALTIES

A. SECTION 10 26 00, WALL GUARDS AND CORNER GUARDS

Item	Material/Model	Manufacturer	Mfg. Color Name/No.
90° Corner Guards (CG-1)	Stainless Steel, CO-8	Construction Specialties	-
Handrail (HR-1)	Wood & Metal, HRWS-6C	Construction Specialties	Maple w/061 Light Oak Finish
90° Corner Guards (CG-2)	Acrovyn FS-20N	Construction Specialties	Parchment 253 (Shadow Grain)
Wall Panel (WP-1)	Acrovyn, .040 Sheet	Construction Specialties	Parchment 253 (Suede)
End Corner Guards (CG-3)	Acrovyn, FSC-25N	Construction Specialties	Parchment 253 (Shadow Grain)
Odd Corner Guards (CG-4)	Acrovyn, FS-10NM	Construction Specialties	Parchment 253 (Shadow Grain)

B. SECTION 10 44 13, FIRE EXTINGUISHER CABINETS

Component	Manufacturer/Series	Model/Style/Finish
Fire Extinguisher Cabinet	JL Industries/Ambassador*	2015 Flat Trim/Fire-Rated Steel/White

*With full glass front

C. SECTION 10 28 00, TOILET AND BATH ACCESSORIES

Code	Item	Material, Manufacturer, Color Name/No.
FM-1	Framed Mirror	Bobrick; Model B-290 24x36; Stainless Steel
PTD-1	Paper Towel Dispenser	Owner Furnished, Contractor Installed
TTD-1	Toilet Tissue Dispenser	Owner Furnished, Contractor Installed
GB-1	Grab Bar*	Bobrick; Model B-6806 x 48"; Stainless Steel, Satin Finish
GB-2	Grab Bar*	Bobrick; Model B-6806 x 42"; Stainless Steel, Satin Finish
GB-3	Grab Bar*	Bobrick; Model B-6806 x 36"; Stainless Steel, Satin Finish
GB-4	Grab Bar*	Bobrick; Model B-6806 x 18"; Stainless Steel, Satin Finish
TCD-1	Toilet Seat Cover Dispenser	Bobrick; Model B-221, Stainless Steel, Satin Finish
CH-1	Coat Hook	Bobrick; Model B-6827; Stainless Steel, Satin Finish
BCS	Baby Changing Station	Bobrick: Model KB100-00, Polyethylene, Cream
SNDU-1	Sanitary Napkin Dispenser Unit	Bobrick; B-254; Stainless Steel
SD-1	Soap Dispenser	Owner Furnished, Contractor Installed
AF-1	Air Freshner	Owner Furnished, Contractor Installed
EHD-1	Electric Hand Dryer	World Dryer; Model- Air Force Series; J-971, Finish Brushed Aluminum
WR-1	Recessed Waste Receptacle	Bobrick, Model B-43644; Stainless Steel
FSS-1	Folding Shower Seat	Bobrick; Model B-5181; Frame: Stainless steel, Seat: Phenolic plastic
SCR-1	Shower Curtain Rod	Bobrick, Model B-207x72; Stainless Steel, Satin Finish

*Provide manufacturer's concealed anchor devices and fasteners for a complete installation

2.6 DIVISION 12- FURNISHINGS

A. SECTION 12 24 13, ROLLER SHADES - MOTORIZED

Component	Material	Manufacturer	Mfg. Color Name/No.
Shade Cloth (RSIA)	Thermoveil 1300 series	Mechoshade	1302 Beige (5% O.F.)
Brackets	Electro 1	Mechoshade	w/recessed pocket 4124
Motor	Whispershade IQ System	Mechoshade	-
Automated Shade System	Solartrac	Mechoshade	-
Shade Cloth (RS1B)	Thermoveil 1500 Series	Mechoshade	1502, Beige (3% O.F.)

*With white closure mount and closure

B. SECTION 12 24 13, ROLLER SHADES - MANUAL

Component	Material	Manufacturer	Mfg. Color Name/No.
Shade Cloth (RS2 and 3)	Thermoveil 1500 Series	Mechoshade	1502 Beige (3% O.F.)
Blackout Shade Cloth (RS2)	Opaque Vinyl, 0700 Series	Mechoshade	0706, Oyster
Bracket (RS3)	Mecho #5	Mechoshade	w/recessed pocket 5113*
Double Bracket (RS2)	Mecho #15	Mechoshade	w/recessed pocket 4124*

*With white closure mount and closure

C. SECTION 12 48 13, FLOOR MATS AND FRAMES

Code	Series	Tread Material	Manufacturer	Tread Insert Color
RUFM-1	Peditred LP*	Recycled Rubber	Construction Specialties	Chunky Monkey

* With rail and frame finish anodized aluminum

D. SECTION 12 59 00, SYSTEMS FURNITURE (BASED ON HAMILTON SORTER MODULAR FURNITURE) AUDIOLOGY

PART NUMBER OR NAME	PART DESCRIPTION
MCWJ361430	Cabinet with doors and eight open vertical slots below
MCWF361430	Overhead cabinet with doors and two columns of open horizontal shelves
6 Drawer Base Cabinet	With plastic insert drawer dividers (Configuration to be confirmed)
5 Drawer Base Cabinet	With plastic insert drawer dividers
Slope Tops	For overhead cabinets, front and side
All Cabinetry	Plastic Laminate: Wilsonart, Monticello Maple, 7925-38
Countertop	Solid surface material, DuPont's Corian, color: Linen
Cabinet Pulls	Style 101A - Flared crescent, color: silver
Hinges	Flush overlay, self closing
Task Light	Standard color: Black, plug-in
5 Drawer Dividers	Plastic, slotted inserts glued to side

PART III EXECUTION

3.1 FINISH SCHEDULES & MISCELLANEOUS ABBREVIATIONS

FINISH SCHEDULE & MISCELLANEOUS ABBREVIATIONS	
Term	Abbreviation
Acoustical Ceiling	AT
Anodized Aluminum Natural Finish	AA
Carpet Module Tile	CPT
Cementitious Backer Board	CBB
Ceramic Tile	CT
Concrete	C
Corner Guard	CG
Decorative Glass	DG
Existing	E
Exposed Suspension System	ESS
Framed Decorative Panel System	FDPS
Grout	GR
Gypsum Wallboard	GWB
Handrail	HR
High Pressure Decorative	PLAM

Laminate	
Impact Resistant Wallcovering Wall Panel	WP
Linoleum	RSF
Material	MAT
Mortar	M
Paint	P
Roll Up Floor Mat	RUFM
Roller Shade	RS
Rubber Base	RB
Rubber Flooring	RF
Solid Surface Material	SSM
Special Suspension Trim	SST
Transition Strip	TS
Vinyl Composition Tile	VCT
Vinyl Plank	VP
Vinyl Tile	VT
Vinyl Sheet Flooring (Welded Seams)	RSF
Weld Rod	WR

3.2 FINISH SCHEDULE SYMBOLS

Symbol Definition

** Same finish as adjoining walls
 - No color required
 E Existing
 XX To match existing
 EFTR Existing finish to remain
 RM Remove

--- E N D---

SECTION 09 22 16
NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 DESCRIPTION

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

1.2 RELATED WORK

- A. Load bearing framing: Section 05 40 00, COLD-FORMED METAL FRAMING.
- B. Support for wall mounted items: Section 05 50 00, METAL FABRICATIONS.

1.3 TERMINOLOGY

- A. Description of terms shall be in accordance with ASTM C754, ASTM C11, ASTM C841 and as specified.
- B. Underside of Structure Overhead: In spaces where steel trusses or bar joists are shown, the underside of structure overhead shall be the underside of the floor or roof construction supported by beams, trusses, or bar joists. In interstitial spaces with walk-on floors the underside of the walk-on floor is the underside of structure overhead.
- C. Thickness of steel specified is the minimum bare (uncoated) steel thickness.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Studs, runners and accessories.
 - 2. Hanger inserts.
 - 3. Channels (Rolled steel).
 - 4. Furring channels.
 - 5. Screws, clips and other fasteners.
- C. Shop Drawings:
 - 1. Typical ceiling suspension system.
 - 2. Typical metal stud and furring construction system including details around openings and corner details.
 - 3. Typical shaft wall assembly
 - 4. Typical fire rated assembly and column fireproofing showing details of construction same as that used in fire rating test.
- D. Test Results: Fire rating test designation, each fire rating required for each assembly.

1.5 DELIVERY, IDENTIFICATION, HANDLING AND STORAGE

In accordance with the requirements of ASTM C754.

1.6 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society For Testing And Materials (ASTM)
- 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

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

2.2 STEEL STUDS AND RUNNERS (TRACK)

- A. ASTM C645, modified for thickness specified and sizes as shown.
 - 1. Use ASTM A525 steel, 0.8 mm (0.0329-inch) thick bare metal (33 mil).
 - 2. Runners same thickness as studs.
- B. Provide not less than two cutouts in web of each stud, approximately 300 mm (12 inches) from each end, and intermediate cutouts on approximately 600 mm (24-inch) centers.
- C. Doubled studs for openings and studs for supporting concrete backer-board.
- D. Studs 3600 mm (12 feet) or less in length shall be in one piece.
- E. Shaft Wall Framing:
 - 1. Conform to rated wall construction.
 - 2. C-H Studs.
 - 3. E Studs.
 - 4. J Runners.
 - 5. Steel Jamb-Strut.

2.3 FURRING CHANNELS

- A. Rigid furring channels (hat shape): ASTM C645.
- B. Resilient furring channels:
 - 1. Not less than 0.45 mm (0.0179-inch) thick bare metal.
 - 2. Semi-hat shape, only one flange for anchorage with channel web leg slotted on anchorage side, channel web leg on other side stiffens fastener surface but shall not contact anchorage surface other channel leg is attached to.
- C. "Z" Furring Channels:
 - 1. Not less than 0.45 mm (0.0179-inch)-thick bare metal, with 32 mm (1-1/4 inch) and 19 mm (3/4-inch) flanges.
 - 2. Web furring depth to suit thickness of insulation with slotted perforations.
- D. Rolled Steel Channels: ASTM C754, cold rolled; or, ASTM C841, cold rolled.

2.4 FASTENERS, CLIPS, AND OTHER METAL ACCESSORIES

- A. ASTM C754, except as otherwise specified.
- B. For fire rated construction: Type and size same as used in fire rating test.
- C. Fasteners for steel studs thicker than 0.84 mm (0.033-inch) thick. Use ASTM C954 steel drill screws of size and type recommended by the manufacturer of the material being fastened.

- D. Clips: ASTM C841 (paragraph 6.11), manufacturer's standard items. Clips used in lieu of tie wire shall have holding power equivalent to that provided by the tie wire for the specific application.
- E. Concrete ceiling hanger inserts (anchorage for hanger wire and hanger straps): Steel, zinc-coated (galvanized), manufacturers standard items, designed to support twice the hanger loads imposed and the type of hanger used.
- F. Tie Wire and Hanger Wire:
 - 1. ASTM A641, soft temper, Class 1 coating.
 - 2. Gage (diameter) as specified in ASTM C754 or ASTM C841.
- G. Attachments for Wall Furring:
 - 1. Manufacturers standard items fabricated from zinc-coated (galvanized) steel sheet.
 - 2. For concrete or masonry walls: Metal slots with adjustable inserts or adjustable wall furring brackets. Spacers may be fabricated from 1 mm (0.0396-inch) thick galvanized steel with corrugated edges.
- H. Power Actuated Fasteners: Type and size as recommended by the manufacturer of the material being fastened.

2.5 SUSPENDED CEILING SYSTEM FOR GYPSUM BOARD

- A. Conform to ASTM C635, heavy duty, with not less than 35 mm (1-3/8 inch) wide knurled capped flange face designed for screw attachment of gypsum board.
- B. Wall track channel with 35 mm (1-3/8 inch) wide flange.

PART 3 - EXECUTION

3.1 INSTALLATION CRITERIA

- A. Where fire rated construction is required for walls, partitions, columns, beams and floor-ceiling assemblies, the construction shall be same as that used in fire rating test.
- B. Construction requirements for fire rated assemblies and materials shall be as shown and specified, the provisions of the Scope paragraph (1.2) of ASTM C754 and ASTM C841 regarding details of construction shall not apply.

3.2 INSTALLING STUDS

- A. Install studs in accordance with ASTM C754, except as otherwise shown or specified.
- B. Space studs not more than 610 mm (24 inches) on center.
- C. Cut studs 6 mm to 9 mm (1/4 to 3/8-inch) less than floor to underside of structure overhead when extended to underside of structure overhead.
- D. Where studs are shown to terminate above suspended ceilings, provide bracing as shown or extend studs to underside of structure overhead.

- E. Extend studs to underside of structure overhead for fire, rated partitions, smoke partitions, shafts, and sound rated partitions and insulated exterior wall furring.
- F. Openings:
 - 1. Frame jambs of openings in stud partitions and furring with two studs placed back to back or as shown.
 - 2. Fasten back to back studs together with 9 mm (3/8-inch) long Type S pan head screws at not less than 600 mm (two feet) on center, staggered along webs.
 - 3. Studs fastened flange to flange shall have splice plates on both sides approximately 50 X 75 mm (2 by 3 inches) screwed to each stud with two screws in each stud. Locate splice plates at 600 mm (24 inches) on center between runner tracks.
- G. Fastening Studs:
 - 1. Fasten studs located adjacent to partition intersections, corners and studs at jambs of openings to flange of runner tracks with two screws through each end of each stud and flange of runner.
 - 2. Do not fasten studs to top runner track when studs extend to underside of structure overhead.
- H. Chase Wall Partitions:
 - 1. Locate cross braces for chase wall partitions to permit the installation of pipes, conduits, carriers and similar items.
 - 2. Use studs or runners as cross bracing not less than 63 mm (2-1/2 inches wide).
- I. Form building seismic or expansion joints with double studs back to back spaced 75 mm (three inches) apart plus the width of the seismic or expansion joint.
- J. Form control joint, with double studs spaced 13 mm (1/2-inch) apart.

3.3 INSTALLING WALL FURRING FOR FINISH APPLIED TO ONE SIDE ONLY

- A. In accordance with ASTM C754, or ASTM C841 except as otherwise specified or shown.
- B. Wall furring-Stud System:
 - 1. Framed with 63 mm (2-1/2 inch) or narrower studs, 600 mm (24 inches) on center.
 - 2. Brace as specified in ASTM C754 for Wall Furring-Stud System or brace with sections or runners or studs placed horizontally at not less than three foot vertical intervals on side without finish.
 - 3. Securely fasten braces to each stud with two Type S pan head screws at each bearing.

C. Direct attachment to masonry or concrete; rigid channels or "Z" channels:

1. Install rigid (hat section) furring channels at 600 mm (24 inches) on center, horizontally or vertically.
2. Install "Z" furring channels vertically spaced not more than 600 mm (24 inches) on center.
3. At corners where rigid furring channels are positioned horizontally, provide mitered joints in furring channels.
4. Ends of spliced furring channels shall be nested not less than 200 mm (8 inches).
5. Fasten furring channels to walls with power-actuated drive pins or hardened steel concrete nails. Where channels are spliced, provide two fasteners in each flange.
6. Locate furring channels at interior and exterior corners in accordance with wall finish material manufacturers printed erection instructions. Locate "Z" channels within 100 mm (4 inches) of corner.

D. Installing Wall Furring-Bracket System: Space furring channels not more than 400 mm (16 inches) on center.

3.4 INSTALLING SUPPORTS REQUIRED BY OTHER TRADES

- A. Provide for attachment and support of electrical outlets, plumbing, laboratory or heating fixtures, recessed type plumbing fixture accessories, access panel frames, wall bumpers, wood seats, toilet stall partitions, dressing booth partitions, urinal screens, chalkboards, tackboards, wall-hung casework, handrail brackets, recessed fire extinguisher cabinets and other items like auto door buttons and auto door operators supported by stud construction.
- B. Provide additional studs where required. Install metal backing plates, or special metal shapes as required, securely fastened to metal studs.

3.5 INSTALLING SHAFT WALL SYSTEM

- A. Conform to UL Design for fire rating.
- B. Position J runners at floor and ceiling with the short leg toward finish side of wall. Securely attach runners to structural supports with power driven fasteners at both ends and 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 400 mm (16-inch) centers for metal lath anchorage.
 2. Space framing at 600 mm (24-inch) centers for gypsum board anchorage.
- B. New exposed concrete slabs:
 1. Use metal inserts required for attachment and support of hangers or hanger wires with tied wire loops for embedding in concrete.
 2. Furnish for installation under Division 03, CONCRETE.
 3. Suspended ceilings under concrete rib construction shall have runner channels at right angles to ribs and be supported from ribs with hangers at ends and at 1200 mm (48-inch) maximum intervals along channels. Stagger hangers at alternate channels.
- C. Concrete slabs on steel decking composite construction:
 1. Use pull down tabs when available.
 2. Use power activated fasteners when direct attachment to structural framing can not be accomplished.
- D. Where bar joists or beams are more than 1200 mm (48 inches) apart, provide intermediate hangers so that spacing between supports does not exceed 1200 mm (48 inches). Use clips, bolts, or wire ties for direct attachment to steel framing.
- E. 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.
- F. 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.
- G. 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.
- H. 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.

3.7 TOLERANCES

- A. Fastening surface for application of subsequent materials shall not vary more than 3 mm (1/8-inch) from the layout line.
- B. Plumb and align vertical members within 3 mm (1/8-inch.)
- C. Level or align ceilings within 3 mm (1/8-inch.)

- - - E N D - - -

SECTION 09 29 00
GYPSUM BOARD

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies installation and finishing of gypsum board.

1.2 RELATED WORK

- A. Section 09 22 16, NON-STRUCTURAL METAL FRAMING.
- B. Acoustical Sealants: Section 07 92 00, JOINT SEALANTS.
- C. Lay in gypsum board ceiling panels: Section 09 51 00, ACOUSTICAL CEILING.

1.3 TERMINOLOGY

- A. Definitions and description of terms shall be in accordance with ASTM C11, C840, and as specified.
- B. Underside of Structure Overhead: In spaces where steel trusses or bar joists are shown, the underside of structure overhead shall be the underside of the floor or roof construction supported by the trusses or bar joists.
- C. "Yoked": Gypsum board cut out for opening with no joint at the opening (along door jamb or above the door).

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Cornerbead and edge trim.
 - 2. Finishing materials.
 - 3. Gypsum board, each type.
- C. Shop Drawings:
 - 1. Typical gypsum board installation, showing corner details, edge trim details and the like.
 - 2. Typical sound rated assembly, showing treatment at perimeter of partitions and penetrations at gypsum board.
 - 3. Typical shaft wall assembly.
 - 4. Typical fire rated assembly and column fireproofing, indicating details of construction same as that used in fire rating test.
- D. Samples:
 - 1. Cornerbead.
 - 2. Edge trim.
 - 3. Control joints.
- E. Test Results:

1. Fire rating test, each fire rating required for each assembly.
2. Sound rating test.

1.5 DELIVERY, IDENTIFICATION, HANDLING AND STORAGE

In accordance with the requirements of ASTM C840.

1.6 ENVIRONMENTAL CONDITIONS

In accordance with the requirements of ASTM C840.

1.7 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing And Materials (ASTM):
 - C11-08.....Terminology Relating to Gypsum and Related Building Materials and Systems
 - C475-02.....Joint Compound and Joint Tape for Finishing Gypsum Board
 - C840-08.....Application and Finishing of Gypsum Board
 - C919-08.....Sealants in Acoustical Applications
 - C954-07.....Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Stud from 0.033 in. (0.84mm) to 0.112 in. (2.84mm) in thickness
 - C1002-07.....Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
 - C1047-05.....Accessories for Gypsum Wallboard and Gypsum Veneer Base
 - C1177-06.....Glass Mat Gypsum Substrate for Use as Sheathing
 - C1658-06.....Glass Mat Gypsum Panels
 - C1396-06.....Gypsum Board
 - E84-08.....Surface Burning Characteristics of Building Materials
- C. Underwriters Laboratories Inc. (UL):
 - Latest Edition.....Fire Resistance Directory
- D. Inchcape Testing Services (ITS):
 - Latest Editions.....Certification Listings

PART 2 - PRODUCTS

2.1 GYPSUM BOARD

- A. Gypsum Board: ASTM C1396, Type X, 16 mm (5/8 inch) thick unless shown otherwise. Shall contain a minimum of 20 percent recycled gypsum.
- B. Coreboard or Shaft Wall Liner Panels.

1. ASTM C1396, Type X.

2. ASTM C1658: Glass Mat Gypsum Panels,

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

C. Gypsum cores shall contain maximum percentage of post industrial recycled gypsum content available in the area (a minimum of 95 percent post industrial recycled gypsum content). Paper facings shall contain 100 percent post-consumer recycled paper content.

2.2 GYPSUM SHEATHING BOARD

A. ASTM C1177, Type X.

2.3 ACCESSORIES

A. ASTM C1047, except form of 0.39 mm (0.015 inch) thick zinc coated steel sheet or rigid PVC plastic.

B. Flanges not less than 22 mm (7/8 inch) wide with punchouts or deformations as required to provide compound bond.

2.4 FASTENERS

A. ASTM C1002 and ASTM C840, except as otherwise specified.

B. ASTM C954, for steel studs thicker than 0.04 mm (0.33 inch).

C. Select screws of size and type recommended by the manufacturer of the material being fastened.

D. For fire rated construction, type and size same as used in fire rating test.

E. Clips: Zinc-coated (galvanized) steel; gypsum board manufacturer's standard items.

2.5 FINISHING MATERIALS AND LAMINATING ADHESIVE

ASTM C475 and ASTM C840. Free of antifreeze, vinyl adhesives, preservatives, biocides and other VOC. Adhesive shall contain a maximum VOC content of 50 g/l.

PART 3 - EXECUTION

3.1 GYPSUM BOARD HEIGHTS

A. Extend all layers of gypsum board from floor to underside of structure overhead on following partitions and furring:

1. Two sides of partitions:

a. Fire rated partitions.

b. Smoke partitions.

c. Sound rated partitions.

d. Full height partitions shown (FHP).

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.
- 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. For three-ply gypsum board assemblies, apply plies in same manner as for two-ply assemblies, except that heads of fasteners need only be driven flush with surface for first and second plies. Apply third ply of wallboard in same manner as second ply of two-ply assembly, except use fasteners of sufficient length enough to have the same penetration into framing members as required for two-ply assemblies.
 7. No offset in exposed face of walls and partitions will be permitted because of single-ply and two-ply or three-ply application requirements.
 8. Control Joints ASTM C840 and as follows:
 - a. Locate at both side jambs of openings if gypsum board is not "yoked". Use one system throughout.
 - b. Not required for wall lengths less than 9000 mm (30 feet).
 - c. Extend control joints the full height of the wall or length of soffit/ceiling membrane.
- H. Acoustical or Sound Rated Partitions, Fire and Smoke Partitions:
1. Cut gypsum board for a space approximately 3 mm to 6 mm (1/8 to 1/4 inch) wide around partition perimeter.
 2. Coordinate for application of caulking or sealants to space prior to taping and finishing.
 3. For sound rated partitions, use sealing compound (ASTM C919) to fill the annular spaces between all receptacle boxes and the partition finish material through which the boxes protrude to seal all holes and/or openings on the back and sides of the boxes. STC minimum values as shown.
- I. Electrical and Telecommunications Boxes:
1. Seal annular spaces between electrical and telecommunications receptacle boxes and gypsum board partitions.
- J. Accessories:
1. Set accessories plumb, level and true to line, neatly mitered at corners and intersections, and securely attach to supporting surfaces as specified.
 2. Install in one piece, without the limits of the longest commercially available lengths.

3. Corner Beads:

- a. Install at all vertical and horizontal external corners and where shown.
- b. Use screws only. Do not use crimping tool.

4. Edge Trim (casings Beads):

- a. At both sides of expansion and control joints unless shown otherwise.
- b. Where gypsum board terminates against dissimilar materials and at perimeter of openings, except where covered by flanges, casings or permanently built-in equipment.
- c. Where gypsum board surfaces of non-load bearing assemblies abut load bearing members.
- d. Where shown.

3.3 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. on Drawings.
- C. Cut coreboard (liner) panels 25 mm (one inch) less than floor-to-ceiling height, and erect vertically between J-runners on shaft side.
 1. Where shaft walls exceed 4300 mm (14 feet) in height, position panel end joints within upper and lower third points of wall.
 2. Stagger joints top and bottom in adjacent panels.
 3. After erection of J-struts of opening frames, fasten panels to J-struts with screws of sufficient length to secure to framing staggered from those in base, spaced 300 mm (12 inches) on center.
- D. Gypsum Board:
 1. Two hour wall:
 - a. Erect base layer (backing board) vertically on finish side of wall with end joints staggered. Fasten base layer panels to studs with 25 mm (one inch) long screws, spaced 600 mm (24 inches) on center.
 - b. Use laminating adhesive between plies in accordance with UL or FM if required by fire test.
 - c. Apply face layer of gypsum board required by fire test vertically over base layer with joints staggered and attach with screws of sufficient length to secure to framing staggered from those in base, spaced 300 mm (12 inches) on center.
 2. One hour wall with one layer on finish side of wall: Apply face layer of gypsum board vertically. Attach to studs with screws of sufficient length to secure to framing, spaced 300 mm (12 inches) on center in field and along edges.

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

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

3.4 FINISHING OF GYPSUM BOARD

A. Finish joints, edges, corners, and fastener heads in accordance with ASTM C840. Use Level 4 finish for all finished areas open to public view.

B. Before proceeding with installation of finishing materials, assure the following:

1. Gypsum board is fastened and held close to framing or furring.
2. Fastening heads in gypsum board are slightly below surface in dimple formed by driving tool.

C. Finish joints, fasteners, and all openings, including openings around penetrations, on that part of the gypsum board extending above suspended ceilings to seal surface of non decorated smoke barrier, fire rated 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.

3.5 REPAIRS

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

B. Patch holes or openings 13 mm (1/2 inch) or less in diameter, or equivalent size, with a setting type finishing compound or patching plaster.

C. Repair holes or openings over 13 mm (1/2 inch) diameter, or equivalent size, with 16 mm (5/8 inch) thick gypsum board secured in such a manner as to provide solid substrate equivalent to undamaged surface.

D. Tape and refinish scratched, abraded or damaged finish surfaces including cracks and joints in non decorated surface to provide smoke tight construction, fire protection equivalent to the fire rated construction.

- - - E N D - - -

SECTION 09 30 13
CERAMIC/PORCELAIN TILING

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies ceramic (porcelain) tile, thresholds, membranes for thin-set applications, crack isolation membranes, tile backer board, and floor transition strips.

1.2 RELATED WORK

- A. Sealing of joints where specified: Section 07 92 00, JOINT SEALANTS.
- B. Color, texture and pattern of field tile and trim shapes, size of field tile, trim shapes, crack isolation, mortar, and color of grout specified: Section 09 06 00, SCHEDULE FOR FINISHES.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples:
 - 1. Base tile, each type, each color, each size.
 - 2. Mosaic floor tile panels, 225 mm by 225 mm (9 inches by 9 inches), each type, color, size and pattern.
 - 3. Floor and wall (or wainscot) tile, each color, size and pattern.
 - 4. Trim shapes, bullnose cap and cove including base pieces at internal corners of vertical surfaces, each type, color, and size.
- C. Product Data:
 - 1. Ceramic tile, marked to show each type, size, and shape required.
 - 2. Cementitious backer unit.
 - 3. Leveling compound.
 - 4. Latex-Portland cement mortar and grout.
 - 5. Slip resistant tile.
 - 6. Crack isolation membrane.
 - 7. Fasteners.
- D. Certification:
 - 1. Master grade, ANSI A137.1.
 - 2. Manufacturer's certificates indicating that the following materials comply with specification requirements:
 - a. Cementitious backer unit.
 - b. Latex-Portland cement mortar and grout.
 - c. Leveling compound.
 - d. Crack isolation membrane.

- e. Factory mounted tile suitability for application in wet area specified under 2.1, A, 3 with list of successful in-service performance locations.

1.4 DELIVERY AND STORAGE

- A. Deliver materials in containers with labels legible and intact and grade-seals unbroken.
- B. Store material to prevent damage or contamination.

1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in text by basic designation only.
- B. American National Standards Institute (ANSI):
 - A108.1A-11.....Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar
 - A137.1-08.....Ceramic Tile
- C. American Society For Testing And Materials (ASTM):
 - C109/C109M-11.....Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 inch. or [50-mm] Cube Specimens)
 - C241-09.....Abrasion Resistance of Stone Subjected to Foot Traffic
 - C348-08.....Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars
 - C954-11.....Steel Drill Screws for the Application of Gypsum Board on Metal Plaster Base to Steel Studs from 0.033 in (0.84 mm) to 0.112 in (2.84 mm) in thickness
 - C979-10.....Pigments for Integrally Colored Concrete
 - C1002-07.....Steel Self-Piercing Tapping Screws for the Application of Panel Products
 - C1027-09.....Determining "Visible Abrasion Resistance on Glazed Ceramic Tile"
 - C1028-07.....Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull Meter Method
 - C1325-08.....Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units
 - D4397-10.....Standard Specification for Polyethylene Sheeting for Construction, Industrial and Agricultural Applications

D5109-99(R2004).....Standard Test Methods for Copper-Clad
Thermosetting Laminates for Printed Wiring
Boards

D. Tile Council of America, Inc. (TCA):

2007.....Handbook for Ceramic Tile Installation

PART 2 - PRODUCTS

2.1 TILE

A. Comply with ANSI A137.1, Standard Grade, except as modified:

1. Inspection procedures listed under the Appendix of ANSI A137.1.
2. Abrasion Resistance Classification:
 - a. Tested in accordance with values listed in Table 1, ASTM C 1027.
 - b. Class V, 12000 revolutions for floors in Corridors, Kitchens, Storage including Refrigerated Rooms
 - c. Class IV, 6000 revolutions for remaining areas.
3. Slip Resistant Tile for Floors:
 - a. Coefficient of friction, when tested in accordance with ASTM C1028, required for level of performance:
 - 1) Not less than 0.7 (wet condition) for bathing areas.
 - 2) Not less than 0.8 on ramps for wet and dry conditions.
 - 3) Not less than 0.6, except 0.8 on ramps as stated above, for wet and dry conditions for other areas.
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.
7. Factory-Applied Temporary Protective Coating:
 - a. Protect exposed face surfaces (top surface) of tile against adherence of mortar and grout by pre-coating with a continuous film of petroleum paraffin wax, applied hot.
 - b. Do not coat unexposed tile surfaces.
 - c. Pre-wax tiles set or grouted with latex modified mortars.

B. Tile: As specified in Section 09 06 00, SCHEDULE FOR FINISHES.

C. Trim Shapes:

1. Conform to applicable requirements of adjoining floor and wall tile.
2. Use trim shapes sizes conforming to size of adjoining field wall tile unless detailed or specified otherwise in Section 09 06 00, SCHEDULE FOR FINISHES.
3. Internal and External Corners:

- a. Provide cove and bullnose shapes where shown and as listed in Section 09 06 00, and required to complete tile work.

2.2 CEMENTITIOUS BACKER UNITS

- A. Use in showers or wet areas.
- B. ASTM C1325.
- C. Use Cementitious backer units in maximum available lengths.

2.3 JOINT MATERIALS FOR CEMENTITIOUS BACKER UNITS

- A. Reinforcing Tape: Vinyl coated woven glass fiber mesh tape, open weave, 50 mm (2 inches) wide. Tape with pressure sensitive adhesive backing will not be permitted.
- B. Tape Embedding Material: Latex-Portland cement mortar complying with ANSI A108.1.
- C. Joint material, including reinforcing tape, and tape embedding material, shall be as specifically recommended by the backer unit manufacturer.

2.4 FASTENERS

- A. Screws for Cementitious Backer Units.
 - 1. Standard screws for gypsum board are not acceptable.
 - 2. Minimum 11 mm (7/16 inch) diameter head, corrosion resistant coated, with washers.
 - 3. ASTM C954 for steel 1 mm (0.033 inch) thick.
 - 4. ASTM C1002 for steel framing less than 0.0329 inch thick.
- B. Washers: Galvanized steel, 13 mm (1/2 inch) minimum diameter.

2.5 SETTING MATERIALS OR BOND COATS

- A. Conform to TCA Handbook for Ceramic Tile Installation.
- B. Latex-Portland Cement Mortar: ANSI A108.1.
 - 1. For wall applications, provide non-sagging, latex-Portland cement mortar complying with ANSI A108.1.
 - 2. Prepackaged Dry-Mortar Mix: Factory-prepared mixture of Portland cement; dry, redispersible, ethylene vinyl acetate additive; and other ingredients to which only water needs to be added at Project site.
- C. Crack Isolation Membrane:
 - 1. Roll-on crack isolation membrane.

2.6 GROUTING MATERIALS

- A. Coloring Pigments:
 - 1. Pure mineral pigments, limeproof and nonfading, complying with ASTM C979.
 - 2. Add coloring pigments to grout by the manufacturer.
 - 3. Job colored grout is not acceptable.

- B. Latex-Portland Cement Grout Polymer Modified: ANSI 118.7, color as specified.

- 1. Sanded grout mixture for joints 3.2 mm (1/8 inch) and wider.

2.7 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.

2.8 WATER

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

2.9 CLEANING COMPOUNDS

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

2.10 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:
 - 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.
 - c. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.

C. Walls:

1. In showers or other wet areas cover studs with polyethylene sheet.
2. 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.

3.4 CEMENTITIOUS BACKER UNITS

- A. Remove polyethylene wrapping from cementitious backer units and separate to allow for air circulation. Allow moisture content of backer units to dry down to a maximum of 35 percent before applying joint treatment and tile.
- B. Install in accordance with ANSI A108.1 except as specified otherwise.
- C. Install units 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 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 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. Set wall tile over cementitious backer board in latex-Portland cement mortar, ANSI A108.1B.
- D. 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. Align new tile work scheduled for existing spaces to the existing tile work unless specified otherwise.
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. Align finish surface of new tile work flush with other and existing adjoining floor finish where shown.
 - b. In areas where floor drains occur, slope to drains where shown.
 - c. Shove and vibrate tiles over 200 mm (8 inches) square to achieve full support of bond coat.
9. Walls:
 - a. Cover walls and partitions from floor to ceiling, or from floor to nominal wainscot heights shown with tile.
10. Joints:
 - a. Keep all joints in line, straight, level, perpendicular and of even width unless shown otherwise.
 - b. Make joints 3/16 inch wide for floor and wall tile. Mosaic Tile: Mesh-mounted.
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.
 - b. Tile wall installations composed of tiles 200 by 200 mm (8 by 8 inches or larger).

3.6 THIN SET CERAMIC TILE INSTALLED WITH LATEX-PORTLAND CEMENT MORTAR

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

3.7 GROUTING

- A. Grout Type and Location:
 - 1. Grout for wall and base tile, floor and unglazed mosaic tile polymer-modified cement grout.
- B. Workmanship:
 - 1. Install and cure grout in accordance with the applicable standard.
 - 2. Polymer-Modified Cement Grout: ANSI A118.3.

3.8 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. Rake out grout at joints between tile, at toe of base, and where shown, not less than 6 mm (1/4 inch) deep.

3.9 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.

3.10 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.

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SECTION 09 51 00
ACOUSTICAL CEILINGS

PART 1- GENERAL

1.1 DESCRIPTION

- A. Metal ceiling suspension system for acoustical ceilings.
- B. Acoustical units.

1.2 RELATED WORK

- A. Color, pattern, and location of each type of acoustical unit:
Section 09 06 00, SCHEDULE FOR FINISHES.

1.3 SUBMITTAL

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples:
 - 1. Acoustical units, each type, with label indicating conformance to specification requirements.
 - 2. Colored markers for units providing access.
- C. Manufacturer's Literature and Data:
 - 1. Ceiling suspension system, each type, showing complete details of installation.
 - 2. Acoustical units, each type
- D. Manufacturer's Certificates: Acoustical units, each type, in accordance with specification requirements.

1.4 DEFINITIONS

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

1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in the text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - A641/A641M-03.....Zinc-coated (Galvanized) Carbon Steel Wire
 - A653/A653M-07.....Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-coated (Galvannealed) by the Hot-Dip Process
 - C423-07.....Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
 - C634-02 (E2007).....Standard Terminology Relating to Environmental Acoustics
 - C635-04 Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings

C636-06.....	Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels
E84-07.....	Surface Burning Characteristics of Building Materials
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 (ESS-1, ESS-2, SST-1)

- A. ASTM C635, heavy-duty system, except as otherwise specified.
 - 1. Ceiling suspension system members may be fabricated from the following unless specified otherwise.
 - a. Galvanized cold-rolled steel, bonderized (ESS-1).
 - b. Extruded aluminum (ESS-2).
 - 2. Use same construction for cross runners as main runners. Use of lighter-duty sections for cross runners is not acceptable.
- B. Exposed grid suspension system for support of lay-in panels:
 - 1. AT-1: Exposed grid width not less than 9/16-inch (galvanized steel).
 - 2. AT-2, AT-3: Exposed grid width not less than 15/16-inch (galvanized steel)
 - 3. AT-4: Exposed grid width not less than 15/16-inch (aluminum).
 - 4. Fabricate wall molding and other special molding from the same material with same exposed width and finish as the exposed grid members.
 - 5. On exposed metal surfaces apply baked-on enamel flat texture finish in color to match adjacent acoustical units unless specified otherwise in Section 09 06 00, SCHEDULE FOR FINISHES.
- C. Special Suspension Trim (SST-1): As scheduled in Section 09 06 00.

2.2 PERIMETER SEAL

- A. Vinyl, polyethylene or polyurethane open cell sponge material having density of 1.3 plus or minus 10 percent, compression set less than 10 percent with pressure sensitive adhesive coating on one side.
- B. Thickness as required to fill voids between back of wall molding and finish wall.
- C. Not less than 9 mm (3/8 inch) wide strip.

2.3 WIRE

- A. ASTM A641.

B. For wire hangers: Minimum diameter 2.68 mm (0.1055 inch).

C. For bracing wires: Minimum diameter 3.43 mm (0.1350 inch).

2.4 ANCHORS AND INSERTS

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

B. Hanger Inserts:

1. Fabricate inserts from steel, zinc-coated (galvanized after fabrication).

2. Nailing type option for wood forms:

a. Upper portion designed for anchorage in concrete and positioning lower portion below surface of concrete approximately 25 mm (one inch).

b. Lower portion provided with not less than 8 mm (5/16 inch) hole to permit attachment of hangers.

3. Flush ceiling insert type:

a. Designed to provide a shell covered opening over a wire loop to permit attachment of hangers and keep concrete out of insert recess.

b. Insert opening inside shell approximately 16 mm (5/8 inch) wide by 9 mm (3/8 inch) high over top of wire.

c. Wire 5 mm (3/16 inch) diameter with length to provide positive hooked anchorage in concrete.

C. Clips:

1. Galvanized steel.

2. Designed to clamp to steel beam or bar joists, or secure framing member together.

3. Designed to rigidly secure framing members together.

4. Designed to sustain twice the loads imposed by hangers or items supported.

D. Tile Splines: ASTM C635.

2.5 CARRYING CHANNELS FOR SECONDARY FRAMING

A. Fabricate from cold-rolled or hot-rolled steel, black asphaltic paint finish, free of rust.

B. Weighing not less than the following, per 300 m (per thousand linear feet):

Size mm	Size Inches	Cold-rolled		Hot-rolled	
		Kg	Pound	Kg	Pound
38	1 1/2	215.4	475	508	1120
50	2	267.6	590	571.5	1260

2.6 ACOUSTICAL UNITS (AT-1, AT-2, AT-3, AT-4)

A. General:

1. Ceiling Tile 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): 0.70 (AT-1, AT-2, AT-3), 0.55 (AT-4): ASTM C423.
5. Minimum CAC (Ceiling Attenuation Class): 35-40 range unless specified otherwise: ASTM E413.
6. Manufacturers standard finish, minimum Light Reflectance (LR) coefficient of 0.90 on the exposed surfaces (AT-2, AT-2, AT-3), 0.79 (AT-4); refer to Section 09 06 00, SCHEDULE FOR FINISHES.
7. Lay-in panels: Sizes as shown, with square edges and beveled tegular edges.

B. Type IV Units - Mineral base with membrane-faced overlay, Form 2 - Water felted, minimum 3/4-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.

1. AT-1, AT-2, AT-3: Pattern "E".
2. AT-4: Pattern "G, H".

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. Treatment of ceilings shall include sides and soffits of ceiling beams, furred work 600 mm (24 inches) wide and over, and vertical surfaces at changes in ceiling heights unless otherwise shown. Install acoustic tiles after wet finishes have been installed and solvents have cured.
- B. Lay out acoustical units symmetrically about center lines of each room or space unless shown otherwise on reflected ceiling plan.
- C. Moldings:
 - 1. Install metal wall molding at perimeter of room, column, or edge at vertical surfaces.
 - 2. Install special shaped molding at changes in ceiling heights and at other breaks in ceiling construction to support acoustical units and to conceal their edges.
- D. Perimeter Seal:
 - 1. Install perimeter seal between vertical leg of wall molding and finish wall, partition, and other vertical surfaces.
 - 2. Install perimeter seal to finish flush with exposed faces of horizontal legs of wall molding.
- E. Existing ceiling:
 - 1. Comply with specifications for new acoustical units for new units required to match appearance of existing units.

3.2 CEILING SUSPENSION SYSTEM INSTALLATION

- A. General:
 - 1. Install metal suspension system for acoustical tile and lay-in panels in accordance with ASTM C636, except as specified otherwise.
 - 2. Use direct or indirect hung suspension system or combination thereof as defined in ASTM C635.
 - 3. Support a maximum area of 1.48 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.

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) on 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 UNIT INSTALLATION

- A. Cut acoustic units for perimeter borders and penetrations to fit tight against penetration for joint not concealed by molding.
- B. Install lay-in acoustic panels in exposed grid with not less than 6 mm (1/4 inch) bearing at edges on supports.
 - 1. Install tile to lay level and in full contact with exposed grid.
 - 2. Replace cracked, broken, stained, dirty, or tile not cut for minimum bearing.
- E. 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.

3.5 CLEAN-UP AND COMPLETION

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

- - - E N D - - -

**SECTION 09 65 13
RESILIENT BASE AND ACCESSORIES**

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the installation of rubber base.

1.2 RELATED WORK

- A. Color and texture: Section 09 06 00, SCHEDULE FOR FINISHES.
- 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. Base material manufacturer's recommendations for adhesives.
 - 3. Application and installation instructions.
- C. Samples:
 - 1. Base: 150 mm (6 inches) long, each type and color.
 - 2. Adhesive: Literature indicating each type.

1.4 DELIVERY

- A. Deliver materials to the site in original sealed packages or containers, clearly marked with the manufacturer's name or brand, type and color, production run number and date of manufacture.
- B. Materials from containers which have been distorted, damaged or opened prior to installation will be rejected.

1.5 STORAGE

- A. Store materials in weather tight and dry storage facility.
- B. Protect material from damage by handling and construction operations before, during, and after installation.

1.6 APPLICABLE PUBLICATIONS

- A. The publication listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - F1861-08.....Resilient Wall Base

PART 2 - PRODUCTS

2.1 GENERAL

Use only products by the same manufacturer and from the same production run.

2.2 RESILIENT BASE - RUBBER (RB)

- A. ASTM F1861, nominal 4-1/2-inch.
- B. Coved Base (RB-1): Type TP rubber.
- C. Straight Base (RB-2): Type TP rubber.

2.3 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 architectural woodwork and elsewhere indicated.
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.

3.7 CLEANING AND PROTECTION

A. Clean all exposed surfaces of base and adjoining areas of adhesive spatter before it sets.

B. 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.

C. 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.

- - - E N D - - -

SECTION 09 65 16
RESILIENT SHEET FLOORING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section specifies the installation of sheet flooring without backing and integral cove base.
- B. Installation of sheet flooring including following:
 - 1. Heat welded seams.
 - 2. Integral cove base: Installed at intersection of floor and vertical surfaces.

1.2 RELATED WORK

- A. Concrete floors: Section 03 30 00, CAST-IN-PLACE CONCRETE.
- B. Color, pattern and texture: Section 09 06 00, SCHEDULE FOR FINISHES.
- C. Resilient Base: Section 09 65 13, RESILIENT BASE AND ACCESSORIES.
- D. Linoleum Flooring: Section 09 65 43.

1.3 QUALITY CONTROL-QUALIFICATIONS:

- A. The Contracting Officer shall approve products or service of proposed manufacturer, suppliers, and installers, and the Contractor shall submit certification that:
 - 1. Heat welded seaming is manufacturer's prescribed method of installation.
 - 2. Installer is approved by manufacturer of materials and has technical qualifications, experience, trained personnel, and facilities to install specified items.
 - 3. 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 material and accessories to be provided.
 - 2. Resilient material manufacturer's recommendations for adhesives, weld rods, sealants, and underlayment.
 - 3. Application and installation instructions.
- C. Samples:
 - 1. Sheet material, 38 mm by 300 mm (1-1/2 inch by 12 inch), of each color and pattern with a welded seam using proposed welding rod 300 mm (12 inches) square for each type, pattern and color.
 - 2. Cap strip and fillet strip, 300 mm (12 inches) for integral base.
 - 3. Shop Drawings and Certificates: Layout of joints showing patterns where joints are expressed, and type and location of obscure type joints. Indicate orientation of directional patterns.
 - 4. Certificates: Quality Control Certificate Submittals and lists specified in paragraph, QUALIFICATIONS.
 - 5. Edge strips: 150 mm (6 inches) long each type.
 - 6. Adhesive, underlayment and primer: Pint container, each type.

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.
 - F1303-04.....Sheet Vinyl Floor Covering with Backing.
 - 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

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.

1.9 WARRANTY:

Submit written warranty, in accordance with FAR clause 52.246-21, Warranty of Construction requirements except that warranty period shall be extended to include two (2) years.

PART 2 - PRODUCTS

2.1 SHEET VINYL FLOOR COVERINGS (RSF)

- A. Sheet Vinyl Floor Coverings: Smooth face, minimum thickness nominal 2 mm (0.08 inch). Sheet flooring shall conform to ASTM F1913 and material requirements specified in ASTM F1303, Type II, Grade 1, backing classification not applicable. Foam backed sheet flooring is not acceptable.
- B. Size: Provide maximum size sheet vinyl material produced by manufacturer to provide minimum number of joints. Minimum size width acceptable - 1200 mm (48 inches).
- C. Each color and pattern of sheet flooring shall be of same production run.

2.2 WELDING ROD:

Product of floor covering manufacturer in color shall match field color of sheet vinyl covering.

2.3 APPLICATION MATERIALS AND ACCESSORIES

- A. Floor and Base Adhesive: Type recommended by sheet flooring material manufacturer for conditions of use.
- B. Mastic Underlayment (for concrete floors): Provide products with latex or polyvinyl acetate resins in mix. Condition to be corrected shall determine type of underlayment selected for use.
- C. Base Accessories:
 - 1. Fillet Strip: 19 mm (3/4 inch) radius fillet strip compatible with resilient sheet material.
 - 2. Cap Strip: Extruded flanged zero edge vinyl reducer strip approximately 25 mm (one inch) exposed height with 13 mm (1/2 inch) flange.

2.4 SHEET FLOORING

- A. ASTM F1303, Type II, Grade 1, except for backing requirements. Foam backed sheet flooring is not acceptable.
- B. Minimum nominal thickness 2 mm (0.08 inch); 1800 mm (6 ft) minimum width.
- C. Critical Radiant Flux: 0.45 watts per sq.cm or more, Class I, per ASTM E648.
- D. Smoke density: less than 450 per ASTM E662.
- E. Color and pattern of sheet flooring of the same production run.

2.5 ADHESIVES

Water resistant type recommended by the sheet flooring manufacturer for the conditions of use. VOC not to exceed 50g/L

2.6 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.

2.7 LEVELING COMPOUND (FOR CONCRETE FLOORS)

Provide cementitious products with latex or polyvinyl acetate resins in the mix.

2.8 PRIMER (FOR CONCRETE SUBFLOORS)

As recommended by the adhesive or sheet flooring manufacturer.

2.9 EDGE STRIPS

- A. Refer to Section 09 06 00, SCHEDULE FOR FINISHES.

2.10 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. Building is permanently enclosed.
- E. 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.
 - 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. 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.
- M. Integral Cove Base Installation:
 - 1. Set preformed fillet strip to receive base.
 - 2. Install the base with adhesive, terminate expose edge with the cap strip.
 - 3. Form internal and external corners to the geometric shape generated by the cove at either straight or radius corners.

4. Solvent weld joints as specified for the flooring. Seal cap strip to wall with an adhesive type sealant.
5. 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 INSTALLATION OF INTEGRAL COVED BASE

- A. Set preformed cove to receive base. Install base material with adhesive and terminate exposed edge with cap strip. Integral base shall be 150 mm (6 inches) high.
- B. Internal and external corners shall be formed to geometric shape generated by cove at either square or radius corners.

3.5 WELDING

- A. Heat weld all joints of flooring and base using equipment and procedures recommended by flooring manufacturer.
- B. Welding shall consist of routing joint, inserting a welding rod into routed space, and terminally fusing into a homogeneous joint.
- C. Upon completion of welding, surface across joint shall finish flush, free from voids, and recessed or raised areas.
- D. Fusion of Material: Joint shall be fused a minimum of 65 percent through thickness of material, and after welding shall meet specified characteristics for flooring.

3.6 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. Vacuum floor thoroughly.
- E. Do not wash floor until after period recommended by floor covering manufacturer and then prepare in accordance with manufacturer's recommendations.
- F. Upon completion, COR shall inspect floor and base to ascertain that work was done in accordance with manufacturer's printed instructions.
- G. Perform initial maintenance according to flooring manufacturer's written recommendations.

3.7 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.
- D. Where protective materials are removed and immediately prior to acceptance, repair any damage, re-clean sheet flooring, lightly re-apply polish and buff floor.

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SECTION 09 65 19
RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the installation of solid vinyl tile flooring, vinyl composition tile flooring, rubber tile flooring, and accessories.

1.2 RELATED WORK

- A. Color and pattern and location in room finish schedule: Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Resilient Base: Section 09 65 13, RESILIENT BASE AND ACCESSORIES.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Description of each product.
 - 2. Resilient material manufacturers' recommendations for adhesives, underlayment, primers and polish.
 - 3. Application and installation instructions.
- C. Samples:
 - 1. Tile: 3-inch by 3-inch minimum for each type, pattern and color.
 - 2. Edge Strips: 150 mm (6 inches) long, each type.
- D. Shop Drawings:
 - 1. Layout of patterns shown on the drawings and in Section 09 06 00, SCHEDULE FOR FINISHES.
 - 2. Edge strip locations showing types and detail cross sections.
- E. Test Reports:
 - 1. Abrasion resistance: Depth of wear for each tile type and color and volume loss of tile, certified by independent laboratory.
 - 2. Tested per ASTM F510.

1.4 DELIVERY

- A. Deliver materials to the site in original sealed packages or containers, clearly marked with the manufacturer's name or brand, type and color, production run number and date of manufacture.
- B. Materials from containers which have been distorted, damaged or opened prior to installation will be rejected.

1.5 STORAGE

- A. Store materials in weathertight and dry storage facility.
- B. Protect from damage from handling, water, and temperature.

1.6 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - D4078-02 (2008).....Water Emulsion Floor Finish
 - E648-10.....Critical Radiant Flux of Floor Covering Systems
Using a Radiant Energy Source
 - E662-09.....Specific Optical Density of Smoke Generated by
Solid Materials
 - E1155-96 (R2008).....Determining Floor Flatness and Floor Levelness
Numbers
 - F510-93 (R 2008).....Resistance to Abrasion of Resilient Floor
Coverings Using an Abrader with a Grit Feed
Method
 - F710-08.....Preparing Concrete Floors to Receive Resilient
Flooring
 - F1066-04 (R2010).....Vinyl Composition Floor Tile
 - F1344-10.....Rubber Floor Tile
 - F1700-04 (R2010).....Solid Vinyl Floor Tile
- C. Resilient Floor Covering Institute (RFCI):
 - IP #2.....Installation Practice for Vinyl Composition Tile
(VCT)
- D. Federal Specifications (Fed. Spec.):
 - SS-T-312.....Tile Floor: Asphalt, Rubber, Vinyl and Vinyl
Composition

PART 2 - PRODUCTS

2.1 GENERAL

- A. Furnish product type, materials of the same production run and meeting following criteria.
- B. Use adhesives, underlayment, primers and polish recommended by the floor resilient material manufacturer.
- C. Critical Radiant Flux: 0.45 watts per sq. cm or more, Class I, per ASTM E 648.
- D. Smoke density: Less than 450 per ASTM E662.

2.2 VINYL COMPOSITION TILE (VCT)

- A. ASTM F1066, Composition 1, Class 2 (through pattern), 300 mm (12 inches) square, 3 mm (1/8 inch) thick.
- B. Color and pattern uniformly distributed throughout thickness.

2.3 SOLID VINYL-TILE

- A. ASTM F1700, homogenous throughout:
 - 1. Vinyl Plank (VP)
 - 2. Vinyl Tile (VT)
- B. Color and Pattern uniformly distributed throughout thickness.

2.4 RUBBER TILE (RF-2)

- A. ASTM F1344, Class 1, homogenous rubber tile, 24 inch square, 1/4-inch thick.
- B. Color and pattern uniformly distributed throughout tile.

2.5 ADHESIVES

- A. Use low-VOC adhesive during installation. Water based is preferred over solvent based adhesives.

2.6 PRIMER (FOR CONCRETE SUBFLOORS)

As recommended by the adhesive and tile manufacturer.

2.7 LEVELING COMPOUND (FOR CONCRETE FLOORS)

- A. Provide cementitious products with latex or polyvinyl acetate resins in the mix.
- B. Determine the type of underlayment selected for use by the condition to be corrected.

2.8 POLISH AND CLEANERS

- A. Cleaners RFCI CL-1.
- B. Polish: ASTM D4078.

2.9 EDGE STRIPS

- A. Refer to Section 09 06 00, SCHEDULE FOR FINISHES.

2.10 SCREWS

- A. Stainless steel flat head screw.

PART 3 - EXECUTION

3.1 PROJECT CONDITIONS

- A. Maintain temperature of materials a minimum of 22 °C (70 °F,) for 48 hours before installation.
- B. Maintain temperature of rooms where work occurs between 21 °C and 27 °C (70 °F and 80 °F), for at least 48 hours, before, during and after installation.
- C. Do not install flooring until building is permanently enclosed and wet construction in or near areas to receive tile materials is complete, dry and cured.

3.2 SUBFLOOR PREPARATION

- A. Verify that concrete slabs comply with ASTM F710. At existing slabs, determine levelness by F-number method in accordance with ASTM E1155. Overall value shall not exceed as follows:
FF30/FL20
- B. Correct conditions which will impair proper installation.
- C. Fill cracks, joints and other irregularities in concrete with leveling compound:
 - 1. Do not use adhesive for filling or leveling purposes.
 - 2. Do not use leveling compound to correct imperfections which can be corrected by spot grinding.
 - 3. Trowel to smooth surface free of trowel marks, pits, dents, protrusions, cracks or joints.
- D. Clean floor of oil, paint, dust, and deleterious substances: Leave floor dry and cured free of residue from existing curing or cleaning agents.
- E. Concrete Subfloor Testing:
Determine Adhesion and dryness of the floor by bond and moisture tests as recommended by RFCI manual MRP.
- F. Perform additional subfloor preparation to obtain satisfactory adherence of flooring if subfloor test patches allows easy removal of tile.
- G. Prime the concrete subfloor if the primer will seal slab conditions that would inhibit bonding, or if priming is recommended by the tile or adhesive manufacturers.
- H. Preparation of existing installation shall include the removal of existing resilient floor and existing adhesive. Do not use solvents to remove adhesives.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions for application and installation unless specified otherwise.
- B. Mix tile from at least two containers. An apparent line either of shades or pattern variance will not be accepted.
- C. Tile Layout:
 - 1. If layout is not shown on drawings, lay tile symmetrically about center of room or space with joints aligned.
 - 2. No tile shall be less than 150 mm (6 inches) and of equal width at walls.
 - 3. Place tile pattern in the same direction; do not alternate tiles.
- D. Trim tiles to touch for the length of intersections at pipes and vertical projections, seal joints at pipes with waterproof cement.
- E. Application:

1. Apply adhesive uniformly with no bare spots.
 - a. Conform to RFC1-TM-6 for joint tightness and for corner intersection unless layout pattern shows random corner intersection.
 - b. More than 5 percent of the joints not touching will not be accepted.
2. Roll tile floor with a minimum 45 kg (100 pound) roller, or as recommended by manufacturer.
3. The COR may have test tiles removed to check for non-uniform adhesion, spotty adhesive coverage, and ease of removal. Install new tile for broken removed tile.

F. Installation of Edge Strips:

1. Locate edge strips under center line of doors unless otherwise shown.
2. Set resilient edge strips in adhesive. Anchor metal edge strips with anchors and screws specified.
3. Where tile edge is exposed, butt edge strip to touch along tile edge.
4. Where thin set ceramic tile abuts resilient tile, set edge strip against floor file and against the ceramic tile edge.

3.4 CLEANING AND PROTECTION

- A. Clean adhesive marks on exposed surfaces during the application of resilient materials before the adhesive sets. Exposed adhesive is not acceptable.
- B. Keep traffic off resilient material for a minimum 72 hours after installation.
- C. Clean and polish materials as recommended by manufacturer.
- D. When construction traffic occurs over tile, cover resilient materials with reinforced kraft paper properly secured and maintained until removal is directed by COR. At entrances and where wheeled vehicles or carts are used, cover tile with plywood, hardboard, or particle board over paper, secured and maintained until removal is directed by COR.
- E. When protective materials are removed and immediately prior to acceptance, replace any damaged tile and re-clean resilient materials according to manufacturer's written instructions.

3.6 LOCATION

- A. Unless otherwise specified or shown, install tile flooring, on floor under areas where casework, laboratory and pharmacy furniture and other equipment occurs, except where mounted in wall recesses.
- B. Extend tile flooring for room into adjacent closets and alcoves.

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SECTION 09 65 43
LINOLEUM FLOORING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section specifies the installation of linoleum flooring with heat welded seams and integral cove base.
- B. Installation of flooring including following:
 - 1. Heat welded seams.
 - 2. Integral cove base: Installed at intersection of floor and vertical surfaces.

1.2 RELATED WORK

- A. Color, pattern and texture: Section 09 06 00, SCHEDULE FOR FINISHES.

1.3 QUALITY CONTROL-QUALIFICATIONS:

- A. The Contracting Officer shall approve products or service of proposed manufacturer, suppliers, and installers, and the Contractor shall submit certification that:
 - 1. Heat welded seaming is manufacturer's prescribed method of installation.
 - 2. Installer is approved by manufacturer of materials and has technical qualifications, experience, trained personnel, and facilities to install specified items.
 - 3. 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 linoleum 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. Slip Resistance: Minimum COF 0.60 for flat surfaces.

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 material and accessories to be provided.

2. Resilient material manufacturer's recommendations for adhesives, weld rods, sealants, and underlayment.
3. Application and installation instructions.

C. Samples:

1. Sheet material, 38 mm by 300 mm (1-1/2 inch by 12 inch), of each color and pattern with a welded seam using proposed welding rod 300 mm (12 inches) square for each type, pattern and color.
2. Cap strip and fillet strip, 300 mm (12 inches) for integral base.
3. Shop Drawings and Certificates: Layout of joints showing patterns where joints are expressed, and type and location of obscure type joints. Indicate orientation of directional patterns.
4. Certificates: Quality Control Certificate Submittals and lists specified in paragraph, QUALIFICATIONS.
5. Transition strips: 150 mm (6 inches) long each type.
6. Adhesive, underlayment and primer: Pint container, each type.

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 linoleum 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
 - 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

Interior finish work such as drywall finishing, concrete, 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.

1.9 WARRANTY:

Submit written warranty, in accordance with FAR clause 52.246-21, Warranty of Construction requirements except that warranty period shall be extended to include two (2) years.

PART 2 - PRODUCTS

2.1 LINOLEUM FLOOR COVERINGS (RSF)

- A. Linoleum Floor Coverings: Smooth face, minimum thickness nominal 2 mm (0.08 inch). Sheet flooring shall conform to ASTM F2034.
- B. Size: Provide maximum size sheet material produced by manufacturer to provide minimum number of joints. Minimum size width acceptable - 1200 mm (48 inches).
- C. Each color and pattern of flooring shall be of same production run.

2.2 WELDING ROD:

Product of floor covering manufacturer. See Section 09 06 00 for colors.

2.3 APPLICATION MATERIALS AND ACCESSORIES

- A. Floor and Base Adhesive: Type recommended by sheet flooring material manufacturer for conditions of use.
- B. Mastic Underlayment (for concrete floors): Provide products with latex or polyvinyl acetate resins in mix. Condition to be corrected shall determine type of underlayment selected for use.

2.4 SHEET FLOORING

- A. ASTM F2034, Type 1.
- B. Minimum nominal thickness 1/10-inch; 79-inches wide.
- C. Critical Radiant Flux: 0.45 watts per sq.cm or more, Class I, per ASTM E648.
- D. Smoke density: less than 450 per ASTM E662.
- E. Color and pattern of sheet flooring of the same production run.

2.5 ADHESIVES

Water resistant type recommended by the sheet flooring manufacturer for the conditions of use. VOC not to exceed 50g/L

2.6 BASE CAP STRIP AND COVE STRIP

- A. Metal 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.

2.7 LEVELING COMPOUND (FOR CONCRETE FLOORS)

Provide cementitious products with latex or polyvinyl acetate resins in the mix.

2.8 PRIMER (FOR CONCRETE SUBFLOORS)

As recommended by the adhesive or sheet flooring manufacturer.

2.9 EDGE STRIPS

- A. See Section 09 06 00.

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. Building is permanently enclosed.
- E. 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 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. 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 and floor patterns.
- B. Maintain uniformity of sheet 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 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 regarding pattern match, if applicable.
- K. Installation of Transition Strips:
 1. Locate strips under center lines of doors unless otherwise indicated.

2. Set strips in adhesive.

L. Integral Cove Base Installation:

1. Set preformed fillet strip to receive 6-inch integral cove base.
2. Install the base with adhesive, terminate expose edge with the cap strip.
3. Form internal and external corners to the geometric shape generated by the cove at either straight or radius corners.
4. Solvent weld joints as specified for the flooring. Seal cap strip to wall with an adhesive type sealant.
5. 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 WELDING

- A. Heat weld all joints of flooring and base using equipment and procedures recommended by flooring manufacturer.
- B. Welding shall consist of routing joint, inserting a welding rod into routed space, and terminally fusing into a homogeneous joint.
- C. Upon completion of welding, surface across joint shall finish flush, free from voids, and recessed or raised areas.
- D. Fusion of Material: Joint shall be fused a minimum of 65 percent through thickness of material, and after welding shall meet specified characteristics for flooring.

3.5 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. Vacuum floor thoroughly.
- E. Do not wash floor until after period recommended by floor covering manufacturer and then prepare in accordance with manufacturer's recommendations.
- F. Upon completion, COR shall inspect floor and base to ascertain that work was done in accordance with manufacturer's printed instructions.
- G. Perform initial maintenance according to flooring manufacturer's written recommendations.

3.6 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.
- D. Where protective materials are removed and immediately prior to acceptance, repair any damage, re-clean sheet flooring, lightly re-apply polish and buff floor.

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SECTION 09 68 00
CARPETING

PART 1 - GENERAL

1.1 DESCRIPTION

Section specifies carpet, edge strips, adhesives, and other items required for complete installation.

1.2 RELATED WORK

- A. Color and texture of carpet and edge strip: Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Resilient wall base: Section 09 65 13, RESILIENT BASE AND ACCESSORIES.

1.3 QUALITY ASSURANCE

- A. Carpet installed by mechanics certified by the Floor Covering Installation Board.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Product 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 and recommended adhesives.
 - 3. Manufacturer's certificate verifying carpet containing recycled materials include percentage of recycled materials as specified.
- C. Samples:
 - 1. Carpet: "Production Quality", one full-size tile showing quality, pattern and color specified in Section 09 06 00, SCHEDULE FOR FINISHES.
 - 2. Floor Edge Strip (Molding): 150 mm (6 inches) long of each color and type specified.
- D. Shop Drawings: Installers layout plan for carpet modules.
- E. 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

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 WARRANTY

Carpet and installation subject to terms of "Warranty of Construction" FAR clause 52.246-21, except that warranty period is extended to two years.

1.8 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
- D. American Society for Testing and Materials (ASTM):
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 (CPT)

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: 660 mm (24 inches) square tile.
3. Provide static control to permanently control static build upto less than 3.5 kV when tested at 20 percent relative humidity and 21 degrees C (70 degrees F) in accordance with AATCC 134.
4. Pile Type: Multi Level Loop.
5. Appearance Retention Rating (ARR): Carpet shall be tested and have the minimum 3.5-4.0 Severe ARR when tested in accordance with either the ASTM D 5252 (Hexapod) or ASTM D 5417 (Vettermann) test methods using the number of cycles for short and long term tests as specified.
6. Soil Protection: Manufacturer's standard.
7. Colorfastness to Ozone: Comply with AATCC 129, minimum rating of 4 on the AATCC color transfer chart.
8. Flammability and Critical Radiant Flux Requirements:
 - a. Test Carpet in accordance with ASTM E 648.
 - b. Class I: Not less than 0.45 watts per square centimeter.
9. Density: Average Pile Yarn Density (APYD):
 - a. Corridors, lobbies, entrances, common areas or multipurpose rooms, open offices, waiting areas and dining areas: Minimum APYD 6000.
 - b. Other areas: Minimum APYD 4000.
10. VOC Limits: Use carpet and carpet adhesive that comply with ASTM D 5116:
11. CPT-1: Not Used
12. CPT-2: Refer to Section 09 06 00, SCHEDULE FOR FINISHES.
 - a. Dye Method: 100% solution dyed.
 - b. Repeat: None
 - c. Tufted Weight: 26.0
 - d. Gauge: 1/12
 - e. Stitches Per Inch: 10.0
 - f. Finished Pile Thickness: 0.128
 - g. Total Thickness: 0.267

- h. Average Density: 7313
- i. Primary Backing: Synthetic
- j. Secondary Backing: Manufacturer's standard
- 13. CPT-3: Refer to Section 09 06 00, SCHEDULE FOR FINISHES
 - a. Dye Method: 65% solution/35% yarn dyed
 - b. Pattern Repeat: None
 - c. Tufted Weight: 34.0
 - d. Gauge: 1/12
 - e. Stitches Per Inch: 11.0
 - f. Finished Pile Thickness: 0.162
 - g. Total Thickness: 0.300
 - h. Average Density: 7556
 - i. Primary Backing: Synthetic
 - j. Secondary Backing: Manufacturer's standard

B. Color, Texture, and Pattern: As specified in Section 09 06 00, SCHEDULE FOR FINISHES.

2.2 ADHESIVE AND CONCRETE PRIMER

- A. 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.
- B. Seam Adhesives: Waterproof, non-flammable and non-staining.

2.3 EDGE STRIPS (MOLDING)

- A. Refer to Section 09 06 00, SCHEDULE FOR FINISHES

2.4 LEVELING COMPOUND (FOR CONCRETE FLOORS)

- A. 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.
- B. Determine the type of underlayment selected for use by condition to be corrected.

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. Cut openings in carpet where required for installing equipment, pipes, outlets, and penetrations.
1. Use additional adhesive to secure carpets around pipes and other vertical projections.
- E. Carpet Modules:
1. Install per CRI 104, Section 13, Adhesive Application.
 2. Lay carpet modules with pile in direction specified in Section 09 06 00, SCHEDULE FOR FINISHES.
 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 edge strips to floor with suitable fasteners. Apply adhesive to edge strips.

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.

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SECTION 09 77 10
FRAMED DECORATIVE PANEL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies decorative prefinished panels and trim system.

1.2 RELATED WORK

A. Color of finish: Section 09 06 00, SCHEDULE FOR FINISHES.

1.3 SUBMITTALS

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

B. Shop Drawings:

1. Half full size scale for sections and details 1:50 (1/4-inch) for elevations and plans. Include mounting devices and details at panel head, base, joints and corners. Indicate panel edge and core materials.
2. Show construction and installation.

C. Samples:

1. Panel and finish materials.
2. Panel Edge: 12-inch long sample showing each edge profile, corner and finish.
3. Mounting Devices: Full-size samples.
4. Assembled Panels: Nominal 18-inches square, including joints and mounting methods.

D. Product Data: For each type of panel, panel edge, core material, and mounting indicated.

E. Coordination Drawings: Elevations and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Electrical outlets, switches, and thermostats.
2. Penetrating wall units.

1.4 DELIVERY, STORAGE AND HANDLING

A. Comply with wall panel manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage and handling.

B. Deliver materials in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Testing and Materials (ASTM):
 - E84-09.....Surface Burning Characteristics of Building Materials
- C. National Particleboard Association (NPA):
 - A208.1-99.....Wood Particleboard
- E. Architectural Woodwork Institute (AWI):
 - AWI.....Architectural Woodwork Quality Standards and Quality Certification Program
- F. National Electrical Manufacturers Association (NEMA):
 - LD 3-05.....High-Pressure Decorative Laminates

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install wall units until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for the project when occupied for its intended use.

PART 2 - PRODUCTS

2.1 PREFINISHED PANEL SYSTEM (FDPS-1 - DIVIDER SYSTEM)

- A. Refer to Section 09 06 00 for panel system, adhesive and trim.
- B. Metal Laminate: Copper, nominal 0.050-inch thick.
 - 1. Finish: As scheduled in Section 09 06 00.
- C. Adhesive: As recommended in writing by panel manufacturer.
- D. Panel Trim: As scheduled in Section 09 06 00.
- E. Panel Trim and Size: As detailed on Drawings.
- F. Panel Substrate: Wood Fiber Substrate; Class A and as recommended by panel manufacturer.
- G. Balancing Backer Material: Manufacturer's standard.

2.2 FABRICATION

- A. Framing, panels, hardware and accessories shall be factory finished. Field fabrication may be required by jobsite and perimeter conditions.
 - 1. Refinish field cut panel edges in accordance with manufacturer's instructions before installation.
 - 2. For all cut-outs, drill corners for a minimum 1/8-inch radius.

PART 3 - EXECUTION

3.1 ENVIRONMENTAL REQUIREMENTS

- A. Maintain work areas and storage areas to a minimum temperature of 60° - 80° and humidity range of 35 - 55% during storage and installation..
- B. Do not install finish lumber or millwork in any room or space where wet process systems such as concrete, masonry, or plaster work is not complete and dry.
- C. Panels shall be acclimatized to a balanced environment in location of installation 72 hours prior to installation.

3.2 EXAMINATION

- A. Examine fabricated units, substrates, areas, and conditions, for compliance with requirements, installation tolerances, and other conditions.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

- A. Install wall panels in locations indicated with vertical surfaces and edges plumb, top edges level and in alignment with other units, faces flush, and scribed to fit adjoining work accurately.
- B. Comply with wall panel manufacturer's written instructions for installation of units using type of mounting devices indicated. Mount units securely to supporting substrate.
- C. Fasten supports and trim using #6 trim-head screws anchored into a stud or other solid substrate at 16 inches o.c. Where screws do not hit studs, fasten with adhesive in accordance with manufacturers' written recommendations. Pre-drill holes thru members and fasten screw flush with flange on aluminum profile. Where necessary, countersink screw head to seat flush with flange.

3.4 CLEANING

- A. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

- - - E N D - - -

SECTION 09 91 00
PAINTING

PART 1-GENERAL

1.1 DESCRIPTION

- A. Section specifies field painting.
- B. Section specifies prime coats which may be applied in shop under other sections.
- C. Painting includes shellacs, stains, varnishes, coatings specified, and striping or markers and identity markings.

1.2 RELATED WORK

- A. Shop prime painting of steel and ferrous metals: Division 05 - METALS, Division 08 - OPENINGS, and where indicated elsewhere.
- B. Type of Finish, Color, and Gloss Level of Finish Coat: Section 09 06 00, SCHEDULE FOR FINISHES.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
Before work is started, submit manufacturer's literature indicating brand label, product name and product code as of the date of contract award, will be used to determine compliance with the submittal requirements of this specification. All coats on a particular substrate must be from a single manufacturer.
- C. Samples:
 - 1. Submit samples for verification showing each color specified.
 - 2. Sample size shall be 8-1/2 x 11 inches.
 - 3. Label each sample stating the following:
 - a. Federal Specification Number or manufacturers name and product number of paints used.
 - b. Specification code number specified in Section 09 06 00, SCHEDULE FOR FINISHES.
 - c. Product type and color.
 - d. Name of project.
 - 4. Strips showing not less than 50 mm (2 inch) wide strips of undercoats and 100 mm (4 inch) wide strip of finish coat.
- D. Sample of identity markers if used.
- E. Manufacturers' Certificates indicating compliance with specified requirements:

1. Manufacturer's paint substituted for Federal Specification paints meets or exceeds performance of paint specified.
2. High temperature aluminum paint.
3. Epoxy coating.

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-2012.....Threshold Limit Values (TLV) for Chemical Substances and Physical Agents and Biological Exposure Indices (BEIs)
ACGIH TLV-DOC-2012.....Documentation of Threshold Limit Values and Biological Exposure Indices, (Seventh Edition)
- C. American National Standards Institute (ANSI):
A13.1-07.....Scheme for the Identification of Piping Systems
- D. Steel Structures Painting Council (SSPC):
SSPC SP 1-04 (R2004)....Solvent Cleaning
SSPC SP 2-04 (R2004)....Hand Tool Cleaning
SSPC SP 3-04 (R2004)....Power Tool Cleaning

PART 2 - PRODUCTS

2.1 MATERIALS

A. Plastic Tape:

1. Pigmented vinyl plastic film in colors as specified in Section 09 06 00, SCHEDULE FOR FINISHES or specified.
2. Pressure sensitive adhesive back.
3. Widths as shown.

B. Identity markers options:

1. Pressure sensitive vinyl markers.
2. Snap-on coil plastic markers.

C. Paint:

1. Specified in Part 3 of this section.
2. Specified in Section Schedule for Finishes

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 not paint in direct sunlight or on surfaces that the sun will soon warm.
 4. Apply only on clean, dry and frost free surfaces except as follows:
 - a. Apply water thinned acrylic and cementitious paints to damp (not wet) surfaces where allowed by manufacturer's printed instructions.
 - b. Dampened with a fine mist of water on hot dry days concrete and masonry surfaces to which water thinned acrylic and cementitious paints are applied to prevent excessive suction and to cool surface.

3.2 SURFACE PREPARATION

- A. Method of surface preparation is optional, provided results of finish painting produce solid even color and texture specified with no overlays.
- B. General:
 1. Remove prefinished items not to be painted such as lighting fixtures, escutcheon plates, hardware, trim, and similar items for reinstallation after paint is dried.

2. Remove items for reinstallation and complete painting of such items and adjacent areas when item or adjacent surface is not accessible or finish is different.
3. See other sections of specifications for specified surface conditions and prime coat.
4. Clean surfaces for painting with materials and methods compatible with substrate and specified finish. Remove any residue remaining from cleaning agents used. Do not use solvents, acid, or steam on concrete and masonry.

C. Ferrous Metals:

1. Remove oil, grease, soil, drawing and cutting compounds, flux and other detrimental foreign matter in accordance with SSPC-SP 1 (Solvent Cleaning).
2. Remove loose mill scale, rust, and paint, by hand or power tool cleaning, as defined in SSPC-SP 2 (Hand Tool Cleaning) and SSPC-SP 3 (Power Tool Cleaning). Exception: where high temperature aluminum paint is used, prepare surface in accordance with paint manufacturer's instructions.
3. Fill dents, holes and similar voids and depressions in flat exposed surfaces of hollow steel doors and frames, access panels, roll-up steel doors and similar items specified to have semi-gloss or gloss finish with TT-F-322D (Filler, Two-Component Type, For Dents, Small Holes and Blow-Holes). Finish flush with adjacent surfaces.
 - a. This includes flat head countersunk screws used for permanent anchors.
 - b. Do not fill screws of item intended for removal such as glazing beads.
4. Spot prime abraded and damaged areas in shop prime coat which expose bare metal with same type of paint used for prime coat. Feather edge of spot prime to produce smooth finish coat.
5. Spot prime abraded and damaged areas which expose bare metal of factory finished items with paint as recommended by manufacturer of item.

D. Zinc-Coated (Galvanized) Metal 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 Organic Zinc Rich Coating. Prime or spot prime with Waterborne Galvanized Primer or Non-Cementitious Galvanized Primer depending on finish coat compatibility.

E. Gypsum Board:

1. Remove efflorescence 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.

F. New Interior Masonry and Concrete:

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 stem 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.
5. Repair broken and spalled concrete edges with concrete patching compound. Remove projections to level of adjacent surface by grinding or similar methods.

3.3 PAINT PREPARATION

- A. Thoroughly mix painting materials to ensure uniformity of color, complete dispersion of pigment and uniform composition.
- B. Do not thin unless necessary for application and when finish paint is used for body and prime coats. Use materials and quantities for thinning as specified in manufacturer's printed instructions.
- C. Remove paint skins, then strain paint through commercial paint strainer to remove lumps and other particles.
- D. Mix two component and two part paint and those requiring additives in such a manner as to uniformly blend as specified in manufacturer's printed instructions unless specified otherwise.
- E. For tinting required to produce exact shades specified, use color pigment recommended by the paint manufacturer.

3.4 APPLICATION

- A. Start of surface preparation or painting will be construed as acceptance of the surface as satisfactory for the application of materials.
- B. Unless otherwise specified, apply paint in three coats; prime, body, and finish. When two coats applied to prime coat are the same, first coat applied over primer is body coat and second coat is finish coat.
- C. Apply each coat evenly and cover substrate completely.

- D. Allow not less than 48 hours between applications of succeeding coats, except as allowed by manufacturer's printed instructions, and approved by 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.

3.5 PRIME PAINTING

- A. After surface preparation prime surfaces before application of body and finish coats, except as otherwise specified.
- B. Spot prime and apply body coat to damaged and abraded painted surfaces before applying succeeding coats.
- C. Additional field applied prime coats over shop or factory applied prime coats are not required except for exterior exposed steel apply an additional prime coat.
- D. Prime rebates for stop and face glazing of wood, and for face glazing of steel.
- E. Metals except boilers, incinerator stacks, and engine exhaust pipes:
 - 1. Steel and iron: Ferrous metal primer. Use epoxy coating where finish of epoxy coating is specified.
 - 2. Zinc-coated steel and iron: Zinc dust primer.
 - 3. Aluminum scheduled to be painted: Zinc molybdate primer.
 - 4. Machinery not factory finished: Exterior alkyd enamel.
 - 5. Asphalt coated metal: Aluminum Paint (AP).
 - 6. Metal over 94 degrees C. (200 degrees F), Boilers, Incinerator Stacks, and Engine Exhaust Pipes: (High Heat Resistant Coating (HR)).
- F. Gypsum Board: Comply with paint manufacturer's written instructions for each paint system.
 - 1. Refer to Section 09 06 00.
- G. Concrete Masonry Units:

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.
5. Repair broken and spalled concrete edges with concrete patching compound. Remove projections to level of adjacent surface by grinding or similar methods.

3.6 INTERIOR FINISHES

- A. Apply following finish coats over prime coats in spaces or on surfaces specified in Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Metal Work:
 1. Apply to exposed surfaces
 2. Omit body and finish coats on surfaces concealed after installation except electrical conduit containing conductors over 600 volts.
 3. Ferrous Metal. Galvanized Metal, and other Metals Scheduled: Refer to Section 09 06 00.
- C. Gypsum Board: Refer to Section 09 06 00.
- D. Concrete Masonry Units: 09 06 00, SCHEDULE FOR FINISHES.
- E. Miscellaneous:
 1. Apply where specified in Section 09 06 00, SCHEDULE FOR FINISHES.

3.7 REFINISHING EXISTING PAINTED SURFACES

- A. Clean, patch and repair existing surfaces as specified under surface preparation.
- B. Sand or dull glossy surfaces prior to painting.

3.8 PAINT COLOR

- A. Color and gloss of finish coats is specified in Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Coat Colors:
 1. Color of priming coat: Lighter than body coat.
 2. Color of body coat: Lighter than finish coat.
 3. Color prime and body coats to not show through the finish coat and to mask surface imperfections or contrasts.

3.9 MECHANICAL AND ELECTRICAL WORK FIELD PAINTING SCHEDULE

- A. Field painting of mechanical and electrical consists of cleaning, touching-up abraded shop prime coats, and applying prime, body and finish coats to materials and equipment if not factory finished in space scheduled to be finished.

- B. In spaces not scheduled to be finish painted in Section 09 06 00, SCHEDULE FOR FINISHES paint as specified under paragraph H, colors.
- C. Paint various systems specified in Division 02 - EXISTING CONDITIONS, Division 21 - FIRE SUPPRESSION, Division 22 - PLUMBING, Division 23 - HEATING, VENTILATION AND AIR-CONDITIONING, Division 26 - ELECTRICAL, Division 27 - COMMUNICATIONS, and Division 28 - ELECTRONIC SAFETY AND SECURITY.
- D. Paint after tests have been completed.
- E. Omit prime coat from factory prime-coated items.
- F. Finish painting of mechanical and electrical equipment is not required when located in interstitial spaces, above suspended ceilings, in concealed areas such as pipe and electric closets, pipe basements, pipe tunnels, trenches, attics, roof spaces, shafts and furred spaces except on electrical conduit containing feeders 600 volts or more.
- G. Omit field painting of items specified in paragraph, Building and Structural WORK NOT PAINTED.
- H. Color:
 - 1. Paint items having no color specified in Section 09 06 00, SCHEDULE FOR FINISHES to match surrounding surfaces.
 - 2. Paint colors as specified in Section 09 06 00, SCHEDULE FOR FINISHES except for following:
 - a. WhiteExterior unfinished surfaces of enameled plumbing fixtures. Insulation coverings on breeching and uptake inside boiler house, drums and drum-heads, oil heaters, condensate tanks and condensate piping.
 - b. Gray:Heating, ventilating, air conditioning and refrigeration equipment (except as required to match surrounding surfaces), and water and sewage treatment equipment and sewage ejection equipment.
 - c. Aluminum Color: Ferrous metal on outside of boilers and in connection with boiler settings including supporting doors and door frames and fuel oil burning equipment, and steam generation system (bare piping, fittings, hangers, supports, valves, traps and miscellaneous iron work in contact with pipe).
 - d. Federal Safety Red: Exposed fire protection piping hydrants, post indicators, electrical conducts containing fire alarm control wiring, and fire alarm equipment.
 - e. Federal Safety Orange: .Entire lengths of electrical conduits containing feeders 600 volts or more.

I. Apply paint systems on properly prepared and primed surface as follows:

1. Interior Locations:

a. Apply two coats of Interior Alkyd, Semi-Gloss) 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 High Heat Resistant Coating)to ferrous metal surface over 94 degrees K (200 degrees F) of following items:

- 1) Steam line flanges, bare pipe, fittings, valves, hangers and supports over 94 degrees K (200 degrees F). Refer to Section 09 06 00.

2. Other exposed locations:

- a. Metal surfaces, except aluminum, of cooling towers exposed to view, including connected pipes, rails, and ladders: Two coats of Aluminum Paint(AP). Refer to Section 09 06 00.
- b. Cloth jackets of insulation of ducts and pipes in connection with plumbing, air conditioning, ventilating, refrigeration and heating systems. Refer to Section 09 06 00.

3.10 BUILDING AND STRUCTURAL WORK FIELD PAINTING

A. Painting and finishing of interior work except as specified under paragraph 3.11 B.

1. Painting and finishing of new and existing work including colors and gloss of finish selected is specified in Finish Schedule, Section 09 06 00, SCHEDULE FOR FINISHES.
2. Painting of disturbed, damaged and repaired or patched surfaces when entire space is not scheduled for complete repainting or refinishing.
3. Painting of ferrous metal and galvanized metal.
4. Identity painting and safety painting.

B. Building and Structural Work not Painted:

1. Prefinished items:

- a. Casework, doors, elevator entrances and cabs, metal panels, wall covering, and similar items specified factory finished under other sections.
- b. Factory finished equipment and pre-engineered metal building components such as metal roof and wall panels.

2. Finished surfaces:

- a. Hardware except ferrous metal.
- b. Anodized aluminum, stainless steel, chromium plating, copper, and brass, except as otherwise specified.
- c. Signs, fixtures, and other similar items integrally finished.
- 3. Concealed surfaces:
 - a. Inside duct shafts, interstitial spaces, pipe basements, pipe tunnels, above ceilings, attics, except as otherwise specified.
 - b. Inside walls or other spaces behind access doors or panels.
 - c. Surfaces concealed behind permanently installed casework and equipment.
- 4. Moving and operating parts:
 - a. Shafts, chains, gears, mechanical and electrical operators, linkages, and sprinkler heads, and sensing devices.
- 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. Except where specifically specified to be painted.
- 7. Metal safety treads and nosings.
- 8. Gaskets.

3.11 IDENTITY PAINTING SCHEDULE

- A. Identify designated service in accordance with ANSI A13.1, unless specified otherwise, on exposed piping, piping above removable ceilings, piping in accessible pipe spaces, interstitial spaces, and piping behind access panels.
 - 1. Legend may be identified using 2.1 options or by stencil applications.
 - 2. Apply legends adjacent to changes in direction, on branches, where pipes pass through walls or floors, adjacent to operating accessories such as valves, regulators, strainers and cleanouts a minimum of 12,000 mm (40 feet) apart on straight runs of piping. Identification next to plumbing fixtures is not required.
 - 3. Locate Legends clearly visible from operating position.
 - 4. Use arrow to indicate direction of flow.
 - 5. Identify pipe contents with sufficient additional details such as temperature, pressure, and contents to identify possible hazard. Insert

working pressure shown on drawings where asterisk (*) appears for High, Medium, and Low Pressure designations as follows:

- a. High Pressure - 414 kPa (60 psig) and above.
 - b. Medium Pressure - 104 to 413 kPa (15 to 59 psig).
 - c. Low Pressure - 103 kPa (14 psig) and below.
 - d. Add Fuel oil grade numbers.
6. Legend name in full or in abbreviated form as follows:

PIPING	COLOR OF EXPOSED PIPING	COLOR OF BACKGROUND	COLOR OF LETTERS	LEGEND BBREVIATIONS
Blow-off		Yellow	Black	Blow-off
Boiler Feedwater		Yellow	Black	Blr Feed
A/C Condenser Water Supply		Green	White	A/C Cond Wtr Sup
A/C Condenser Water Return		Green	White	A/C Cond Wtr Ret
Chilled Water Supply		Green	White	Ch. Wtr Sup
Chilled Water Return		Green	White	Ch. Wtr Ret
Shop Compressed Air		Yellow	Black	Shop Air
Air-Instrument Controls		Green	White	Air-Inst Cont
Drain Line		Green	White	Drain
Emergency Shower		Green	White	Emg Shower
High Pressure Steam		Yellow	Black	H.P. _____*
High Pressure Condensate Return		Yellow	Black	H.P. Ret _____*
Medium Pressure Steam		Yellow	Black	M. P. Stm _____*
Medium Pressure Condensate Return		Yellow	Black	M.P. Ret _____*
Low Pressure Steam		Yellow	Black	L.P. Stm _____*
Low Pressure Condensate Return		Yellow	Black	L.P. Ret _____*
High Temperature Water Supply		Yellow	Black	H. Temp Wtr Sup
High Temperature Water Return		Yellow	Black	H. Temp Wtr Ret
Hot Water Heating Supply		Yellow	Black	H. W. Htg Sup
Hot Water Heating Return		Yellow	Black	H. W. Htg Ret
Gravity Condensate Return		Yellow	Black	Gravity Cond Ret
Pumped Condensate Return		Yellow	Black	Pumped Cond Ret
Vacuum Condensate Return		Yellow	Black	Vac Cond Ret
Fuel Oil - Grade		Green	White	Fuel Oil-Grade ____*
Boiler Water Sampling		Yellow	Black	Sample
Chemical Feed		Yellow	Black	Chem Feed

Continuous Blow-Down		Yellow	Black	Cont. B D
Pumped Condensate		Black		Pump Cond
Pump Recirculating		Yellow	Black	Pump-Recirc.
Vent Line		Yellow	Black	Vent
Alkali		Yellow	Black	Alk
Bleach		Yellow	Black	Bleach
Detergent		Yellow	Black	Det
Liquid Supply		Yellow	Black	Liq Sup
Reuse Water		Yellow	Black	Reuse Wtr
Cold Water (Domestic)	White	Green	White	C.W. Dom
Hot Water (Domestic)				
Supply	White	Yellow	Black	H.W. Dom
Return	White	Yellow	Black	H.W. Dom Ret
Tempered Water	White	Yellow	Black	Temp. Wtr
Ice Water				
Supply	White	Green	White	Ice Wtr
Return	White	Green	White	Ice Wtr Ret
Reagent Grade Water		Green	White	RG
Reverse Osmosis		Green	White	RO
Sanitary Waste		Green	White	San Waste
Sanitary Vent		Green	White	San Vent
Storm Drainage		Green	White	St Drain
Pump Drainage		Green	White	Pump Disch
Chemical Resistant Pipe				
Waste		Yellow	Black	Acid Waste
Vent		Yellow	Black	Acid Vent
Atmospheric Vent		Green	White	ATV
Silver Recovery		Green	White	Silver Rec
Oral Evacuation		Green	White	Oral Evac
Fuel Gas		Yellow	Black	Gas
Fire Protection Water				
Sprinkler		Red	White	Auto Spr
Standpipe		Red	White	Stand
Sprinkler		Red	White	Drain
Hot Water Supply Domestic/Solar Water			H.W. Sup Dom/SW	
Hot Water Return Domestic/Solar Water			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, 5000, 15000, and 25000.
8. See Sections for methods of identification, legends, and abbreviations of the following:
 - a. Laboratory gas and vacuum lines: Section 22 62 00, VACUUM SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES and Section 22 63 00, GAS SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES.
 - b. Medical Gases and vacuum lines: Section 22 62 00, VACUUM SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES and Section 22 63 00, GAS SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES.
 - c. Conduits containing high voltage feeders over 600 volts: Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS, Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS, and Section 28 05 33, RACEWAYS AND BOXES FOR ELECTRONIC SAFETY AND SECURITY.
- B. Fire and Smoke Partitions:
 1. Identify partitions above ceilings on both sides of partitions except within shafts in letters not less than 64 mm (2 1/2 inches) high.
 2. Stenciled message: "SMOKE BARRIER" or, "FIRE BARRIER" as applicable.
 3. Locate not more than 6100 mm (20 feet) on center on corridor sides of partitions, and with a least one message per room on room side of partition.
 4. Use semigloss paint of color that contrasts with color of substrate.
- C. Identify columns in pipe basements and interstitial space:
 1. Apply stenciled number and letters to correspond with grid numbering and lettering shown.
 2. Paint numbers and letters 100 mm (4 inches) high, locate 450 mm (18 inches) below overhead structural slab.
 3. Apply on four sides of interior columns and on inside face only of exterior wall columns.
 4. Color:
 - a. Use black on concrete columns.
 - b. Use white or contrasting color on steel columns.

3.12 PROTECTION CLEAN UP, AND TOUCH-UP

- A. Protect work from paint droppings and spattering by use of masking, drop cloths, removal of items or by other approved methods.

- B. Upon completion, clean paint from hardware, glass and other surfaces and items not required to be painted of paint drops or smears.
- C. Before final inspection, touch-up or refinished in a manner to produce solid even color and finish texture, free from defects in work which was damaged or discolored.

- - - E N D - - -

SECTION 10 26 00
WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies hand rails, corner guards and high impact wall covering.

1.2 RELATED WORK

- A. Armor plates and kick plates not specified in this section: Section 08 71 00, DOOR HARDWARE.
- B. Color and texture of stainless steel and resilient material: Section 09 06 00, SCHEDULE FOR FINISHES.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: Show design and installation details.
- C. Manufacturer's Literature and Data:
 - 1. Handrail.
 - 2. Corner Guards.
 - 3. High Impact Wall covering.
- D. Test Report: Showing that resilient material complies with specified fire and safety code requirements.

1.4 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.

1.5 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 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 (CG)

- A. Surface-Mounted, Stainless Steel Corner Guards (CG-1): Fabricate from 16 gage stainless steel. Provide 3-1/2-inch legs. Surface mount.
- B. Flush-Mounted, Resilient, Shock-Absorbing Corner Guards:
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. Design retainer used for flush mounted type to act as a stop for adjacent wall finish material.

- Provide appropriate mounting hardware, cushions and base plates as required.
2. Provide factory fabricated end closure caps at top and bottom of surface mounted corner guards.
 3. Flush mounted corner guards installed on any fire rated wall shall maintain the fire rating of the wall. Provide fire test of proposed corner guard system to verify compliance.
 - a. Where insulating materials are an integral part of the corner guard system, the insulating materials shall be provided by the manufacturer of the corner guard system.
 - b. All exposed metal in fire rated assemblies shall have a paintable finish.
- C. Resilient, Shock-Absorbing Corner Guards (CG-2): Flush mounted.
1. Profile: Nominal 3-inch leg and 6 mm 1/4-inch radius corner, 90 degrees.
- D. Flush-Mounted, Resilient, Plastic End-Wall Guard (CG-3):
1. Profile: Nominal 3-inch long leg and 1/4-inch (6-mm) corner radius; 90 degree.
- E. Flush-Mounted, Resilient, Plastic Variable Angle Wall Guard (CG-4):
1. Profile: Nominal 2-inch (50-mm) long leg and variable corner radius as indicated on Drawings.

2.3 HANDRAILS (HR)

- A. Solid-Wood Handrail (HR-1): Assembly consisting of continuous sculpted, solid-wood handrail.
1. Handrail: 5-1/4-inches high by 3-inch offset with 1-1/2-inch diameter gripping surface.
 - a. Returns and Mounting Brackets: Stainless Steel.
 - b. Wood Species, Finish and Color: Refer to Section 09 06 00.

2.4 HIGH IMPACT WALL COVERING (WP-1)

- A. Fabricate from vinyl acrylic or polyvinyl chloride resilient material minimum 0.040 inch thick designed especially for interior use.
- B. Provide adhesive as recommended by the wall covering manufacturer.
- C. Provide batten strips and include corner trim. Provide j-mold trim for wainscot.

2.5 FASTENERS AND ANCHORS

- A. Provide fasteners and anchors as required for each specific type of installation.
- B. Where type, size, spacing or method of fastening is not shown or specified, submit shop drawings showing proposed installation details.

2.6 FINISH

- A. In accordance with NAAMM AMP 500 series.
- B. Stainless Steel: NAAMM finish Number 4.
- C. Resilient Material: Embossed texture and color in accordance with SAE J 1545 and as specified in Section 09 06 00, SCHEDULE FOR FINISHES.

PART 3 - INSTALLATION

3.1 RESILIENT CORNER GUARDS

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.
 - 1. Where corner guards are installed on gypsum board, clean surface and anchor guards with a neoprene solvent-type contact adhesive specifically manufactured for use on gypsum board construction. Remove excess adhesive from around edge of guard and allow to cure undisturbed for 24 hours.

3.3 HANDRAILS

- A. Secure handrail to walls with brackets and fasteners in accordance with manufacturer's details and instructions.

3.6 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.

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SECTION 10 28 00
TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies manufactured items usually used in dressing rooms, toilets, baths, locker rooms and at sinks in related spaces.
- B. Items Specified:
 - 1. Paper towel dispenser (OFCI)
 - 2. Toilet tissue dispenser (OFCI).
 - 3. Grab Bars (GB).
 - 4. Coat Hook(CH).
 - 5. Air Freshner (OFCI)
 - 6. Metal framed mirror (FM).
 - 7. Baby Changing Station(BCS).
 - 8. Soap Dispenser (OFCI)
 - 9. Toilet Seat Cover Dispenser (TCD)
 - 10. Sanitary Napkin Disposal Unit (SNDU)
 - 11. Electric Hand Dryer (EHD)
 - 12. Waste Receptacle (WR)
 - 13. Shower Curtain Rod (SCR)
 - 14. Folding Shower Seat (FSS)

1.2 RELATED WORK

- A. Color of finishes: Section 09 06 00, SCHEDULE FOR FINISHES

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings:
 - 1. Each product specified.
 - 2. Metal framed mirrors, fillers, and design and installation of units when installed on ceramic tile wainscots and offset surfaces.
 - 3. Grab bars, showing design and each different type of anchorage.
- C. Samples:
 - 1. One of each type of accessory specified.
- D. Manufacturer's Literature and Data:
 - 1. All accessories specified.
 - 2. Show type of material, gages or metal thickness in inches, finishes, and when required, capacity of accessories.
 - 3. Show working operations for toilet tissue dispensers.

E. Manufacturer's Certificates:

1. Attesting that soap dispensers are fabricated of material that will not be affected by liquid soap or aseptic detergents, PhisoHex and solutions containing hexachlorophene.

1.4 QUALITY ASSURANCE

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

1.5 PACKAGING AND DELIVERY

- A. Pack accessories individually to protect finish.
- B. Deliver accessories to the project only when installation work in rooms is ready to receive them.
- C. Deliver inserts and rough-in frames to site at appropriate time for building-in.
- D. Deliver products to site in sealed packages of containers; labeled for identification with manufacturer's name, brand, and contents.

1.6 STORAGE

- A. Store products in weathertight and dry storage facility.
- B. Protect from damage from handling, weather and construction operations before, during and after installation in accordance with manufacturer's instructions.

1.7 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - A167-99(R2009).....Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
 - A176-99(R2009).....Stainless and Heat-Resisting Chromium Steel Plate, Sheet, and Strip
 - A269-10.....Seamless and Welded Austenitic Stainless Steel Tubing for General Service

- A312/A312M-09.....Seamless and Welded Austenitic Stainless Steel Pipes
- A653/A653M-10.....Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
- B456-03(R2009).....Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium
- C1036-06.....Flat Glass
- D635-10.....Rate of Burning and/or Extent and Time of Burning of Self Supporting Plastics in a Horizontal Position
- F446-85(R2009).....Consumer Safety Specification for Grab Bars and Accessories Installed in the Bathing Area.
- C. The National Association of Architectural Metal Manufacturers (NAAMM):
AMP 500 Series.....Metal Finishes Manual
- D. American Welding Society (AWS):
D10.4-86 (R2000).....Welding Austenitic Chromium-Nickel Stainless Steel Piping and Tubing
- E. Federal Specifications (Fed. Specs.):
A-A-3002.....Mirrors, Glass
FF-S-107C (2).....Screw, Tapping and Drive
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. 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.
- B. Stainless Steel Tubing: ASTM A269, Grade 304 or 304L, seamless or welded.
- C. Stainless Steel Pipe: ASTM A312; Grade TP 304 or TP 304L.
- D. Steel Sheet: ASTM A653, zinc-coated (galvanized) coating designation G90.
- E. Glass:
1. ASTM C1036, Type 1, Class 1, Quality q2, for mirrors.

2.2 FASTENERS

- A. Exposed Fasteners: Stainless steel or chromium plated brass, finish to match adjacent surface.
- B. Concealed Fasteners: Steel, hot-dip galvanized (except in high moisture areas such as showers or bath tubs use stainless steel).
- C. Toggle Bolts: For use in hollow masonry or frame construction.
- D. Hex bolts: For through bolting on thin panels.
- E. Expansion Shields: Lead or plastic as recommended by accessory manufacturer for component and substrate for use in solid masonry or concrete.
- 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. 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.

2.4 FABRICATION - GENERAL

- A. Welding, AWS D10.4.
- B. Grind dress, and finish welded joints to match finish of adjacent surface.
- C. Form exposed surfaces from one sheet of stock, free of joints.
- D. Provide steel anchors and components required for secure installation.
- E. Form flat surfaces without distortion. Keep exposed surfaces free from scratches and dents. Reinforce doors to prevent warp or twist.
- F. Isolate aluminum from dissimilar metals and from contact with building materials as required to prevent electrolysis and corrosion.
- G. Hot-dip galvanized steel, except stainless steel, anchors and fastening devices.
- H. Shop assemble accessories and package with all components, anchors, fittings, fasteners and keys.
- I. Key items alike.
- J. Provide templates and rough-in measurements as required.
- K. Round and deburr edges of sheets to remove sharp edges.

2.5 PAPER TOWEL DISPENSERS (OFCI)

2.6 TOILET TISSUE DISPENSERS (OFCI)

2.7 GRAB BARS (GB)

- A. Fed. Spec WW-P-541/8B, Type IV, bars, surface mounted, Class 2, grab bars and ASTM F446.
- B. Fabricate of stainless steel.
 - 1. Stainless steel: Grab bars, flanges, mounting plates, supports, screws, bolts, and exposed nuts and washers.
- C. Concealed mount, except grab bars mounted at floor.
- D. Bars:
 - 1. Fabricate from 38 mm (1-1/2 inch) outside diameter tubing.
 - a. Stainless steel, minimum 1.2 mm (0.0478 inch) thick.
 - 2. Fabricate in one continuous piece with ends turned toward walls.
 - 3. Continuous weld intermediate support to the grab bar.
- E. Flange for Concealed Mounting:
 - 1. Minimum of 2.65 mm (0.1046 inch) thick, approximately 75 mm (3 inch) diameter by 13 mm (1/2 inch) deep, with provisions for not less than three set screws for securing flange to back plate.
 - 2. Insert grab bar through center of the flange and continuously weld perimeter of grab bar flush to back side of flange.
- F. Back Plates:
 - 1. Minimum 2.65 mm (0.1046 inch) thick metal.
 - 2. Fabricate in one piece, approximately 6 mm (1/4 inch) deep, with diameter sized to fit flange. Provide slotted holes to accommodate anchor bolts.
 - 3. Furnish spreaders, through bolt fasteners, and cap nuts, where grab bars are mounted on metal partitions.

2.8 COAT HOOK (CH-1)

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

2.9 AIR FRESHNER (OFCI)

2.10 METAL FRAMED MIRRORS (FM-1)

- A. Fed. Spec. A-A-3002 metal frame; stainless steel, type 304.
- B. Mirror Glass:
 - 1. Minimum 6 mm (1/4 inch) thick.
 - 2. Set mirror in a protective vinyl glazing tape.
- C. Frames:

1. Angle shaped section with face of frame not less than 9 mm (3/8 inch) wide. Fabricate with square corners.
2. Use 0.9 mm (0.0359 inch) thick stainless steel.
3. Filler:
 - a. Where mirrors are mounted on walls having ceramic tile wainscots not flush with wall above, provide fillers at void between back of mirror and wall surface.
 - b. Fabricate fillers from same material and finish as the mirror frame, contoured to conceal the void behind the mirror at sides and top.

D. Back Plate:

1. Fabricate backplate for concealed wall hanging of zinc-coated, 0.9 mm (0.036 inch) thick sheet steel, die cut to fit face of mirror frame, and furnish with theft resistant concealed wall fastenings.
2. Use set screw type theft resistant concealed fastening system for mounting mirrors.

E. Mounting Bracket:

1. Designed to support mirror tight to wall.
2. Designed to retain mirror with concealed set screw fastenings.

2.11 BABY CHANGING STATION (BCS-1)

- A. Horizontal, wall mounted.

2.12 SOAP DISPENSER (OFCI)

2.13 TOILET SEAT COVER DISPENSER (TCD-1)

- A. Fabricate of stainless steel.
- B. Surface mount.

2.14 SANITARY NAPKIN DISPOSAL UNIT (SNDU-1)

- A. Fabricate from stainless steel.
- B. Surface mount.

2.15 ELECTRIC HAND DRYER (EHD-1)

- A. High Speed

2.16 WASTE RECEPTACLE (WR-1)

- A. 12.8 Gal. Capacity

2.17 SHOWER CURTAIN ROD (SCR-1)

- A. Heavy Duty
- B. Concealed Mounting

2.18 FIKDUNG SHIWER SEAT (FSS-1)

- A. Stainless steel frame, solid phenolic seat
- B. Reversible type

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. Toggle bolt to steel anchorage plates in frame partitions or hollow masonry. Expansion bolt to concrete or solid masonry.
- C. Install accessories in accordance with the manufacturer's printed instructions and ASTM F446.
- D. Install accessories plumb and level and securely anchor to substrate.
- E. Install accessories in a manner that will permit the accessory to function as designed and allow for servicing as required without hampering or hindering the performance of other devices.
- F. Align mirrors, dispensers and other accessories even and level.
- G. Install accessories to prevent striking by other moving, items or interference with accessibility.

3.3 SCHEDULE OF ACCESSORIES - REFER TO SECTION 09 06 00

3.4 CLEANING

After installation, clean as recommended by the manufacturer and protect from damage until completion of the project.

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SECTION 10 44 13
FIRE EXTINGUISHER CABINETS

PART 1 - GENERAL

1.1 DESCRIPTION

This section covers recessed fire extinguisher cabinets and fire extinguishers.

1.2 RELATED WORK

A. Section 09 06 00, SCHEDULE FOR FINISHES.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data: Fire extinguisher cabinet including installation instruction and rough opening required, fire extinguisher rating and classification.

1.4 APPLICATION PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Testing and Materials (ASTM):
 - D4802-10.....Poly (Methyl Methacrylate) Acrylic Plastic Sheet

PART 2 - PRODUCTS

2.1 FIRE EXTINGUISHER CABINET (FEC-1)

- A. Recessed type with flat trim of size and design shown; fire-rated.

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 white powder coat finish.
- B. Finish door, frame with manufacturer's standard white powder coat finish.

2.4 FIRE EXTINGUISHER

- A. Provide multipurpose dry chemical type in steel container, UL-rated

2-A:10-B:C, 5-lb. nominal capacity with monoammonium phosphate-based dry chemical in enameled steel container.

PART 3 - EXECUTION

3.1 INSTALLATION

- 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 36 inches above finished floor, unless otherwise indicated.

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SECTION 12 24 13
ROLLER SHADES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Manual roller shades (RS-2 and RS-3) are specified in this section. Shades shall be furnished complete, including brackets, fittings and hardware.
- B. Motor operated roller shades (RS-1A and RS-1B) are specified in this section. Shades shall be furnished complete, including brackets, fittings, hardware, and local group and master control system for shade operation.
- C. Solar Shade Control System - Roof mounted.

1.2 RELATED WORK

- A. Wood Blocking and Grounds: Section 06 10 00, ROUGH CARPENTRY.
- B. Color of Shades and Solar Shade Control System Components: Section 09 06 00, SCHEDULE FOR FINISHES.
- C. Acoustical Ceilings: Section 09 51 00.
- D. Electrical Work: Division 26.

1.3 QUALITY CONTROL

Manufacturer's Qualification: Roller Shade manufacturer shall provide evidence that the manufacture of shades are a major product, and that the shades have performed satisfactorily on similar installations.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples:
 - 1. Shade cloth, each type, 300 mm (12 inch) square, showing color, finish and texture.
 - 2. For Motor Operated Shades: One complete set of shade components, unassembled, demonstrating compliance with specified requirements.
- C. Manufacturer's literature and data; showing details of construction and hardware for: Roller shades and typical wiring diagrams, including integration of motor controllers.
- D. Solar and Sky Monitoring systems: Functionality of solar monitoring and sky monitoring systems. Provide detailed description of science and logic employed in automated solar tracking control system and a schedule of solar data provided.

- E. Warranty for Manual Operated Shades: Lifetime limited warranty with 100% replacement on manual bracket and no depreciation over life of the warranty. Fabric: 25 year non-depreciating warranty.
- F. Warranty for Motor Operated Shades: Twenty-five year limited warranty for roller shade hardware and shade cloth with no depreciation over life of the warranty. Roller shade motors, and motor control systems: Non-depreciating, five year warranty. Installation: One year from Date of Acceptance.
- G. Warranty For Solar Shade Control System: Provide manufacturer's standard warranty.
- H. Shop Drawings: Plans, elevations, sections, product details, installation details, operational clearances, wiring diagrams and relationship to adjacent work.
- I. Window Treatment Schedule.

1.5 APPLICABLE PUBLICATIONS

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

ANSI/WCMA.....A100.1

ASTM G21.....Standard practice for determining resistance of synthetic polymeric materials to fungi.

NFPA 70 National Electrical Code

NFPA 701 Flame Resistance Ratings

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install roller shades until construction and wet and dirty finish work in spaces, including painting, is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operable glazed units' operation hardware throughout the entire operating range. Notify A/E of discrepancies. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1.7 QUALITY ASSURANCE - SOLAR SHADE CONTROL SYSTEM

- A. Manufacturer Qualifications: Obtain automated window shade control system from a manufacturer, which will assume responsibility for all system components.
1. Manufacturer of roller shades shall have a minimum of ten years experience and minimum of five projects of similar scope and size in manufacturing products comparable to those specified in this section.
 2. Manufacturer of automated solar tracking shall have a minimum of five current operating projects of similar scope, functionality and size in Automated Solar-Ray tracking, motor controls; and microclimatic Sky analysis capability, comparable to those specified in this section.
- B. Installer Qualifications: Engage an installer, which will assume responsibility for installation of all system components, with the following qualifications.
1. Installer for automatic solar shade control system shall be a certified electrical engineer or controls specialist to set up the automated control system to assure communication continuity and operational functionality between the central control system and the individual operating motors and groups of motors. Installer shall have a minimum of 5 years experience in installing similar systems.
- C. Electrical Components: NFPA Article 100 listed and labeled by either UL or ETL or other testing agency acceptable to authorities having jurisdiction, marked for intended use, and tested as a system. Individual testing of components will not be acceptable in lieu of system testing. Where applicable, system components shall be FCC compliant.
- D. Internet Connection: A connection to the WWW Internet shall be provided as work of Division 26. An IP Interface shall be provided by the Contractor. Full 24/7 access to the Internet is required for the set up and operation of the system. Lack of IP access will substantially delay or totally inhibit implementation. Lack of IP access and connection shall negate all service warranties on the system.
- E. Requirements for Controls and Tracking System Switches:
1. Shade fabric, motor, and all related controls shall be furnished and installed as a complete two-way communicating system and assembly.
 2. Electrical and electronic motor controls and accessories required for a complete automated solar tracking motorized shade control

system including a two-way appropriate interface to communicate with a stand-alone Automated Solar Tracking and sky modeling system; which in turn shall have two-way communication with the buildings BMS, and or Day Lighting, AV systems.

3. Automated solar tracking system shall maintain a historical data base for one complete year, plus 3 months for conversion or a total of 15 months of historical data on each full days solar condition, from sunrise to sunset and shall log all shade moves i.e. Automatic; Manual Switch; Shadow Mode; Reflectance Mode.
4. Local switches shall be wired back to and integrated with the Solar Tracking system. Shade movements by a local switch shall be recorded by the Solar Tracking system and integrated into the database.
5. Automated solar tracking system shall provide standard reports on shade movement, solar condition at the time of each shade movement, and the control or switching system that moved the shades.

F. Single-Source Responsibility for Automated Solar Tracking Control System to control the Motorized Interior Roller Shades; To control the responsibility for performance of the automated solar tracking control systems, assign the design, engineering, and installation of the solar tracking head end system and related controls for the shade riser/backbone wiring specified in this Section to a single manufacturer of the automated solar tracking control system (Shade Control System).

1. Contractor shall provide IT risers of sufficient size, with appropriate fire rating necessary at each floor level. Containment provided within the IT risers by the contractor is for future use by others, including the automated shade control network.
2. Contractor shall provide sufficient space within the IT riser for the automated shade control communications cabling.
3. Contractor shall provide an access point to connect the riser shade control cable to the shade control network.
4. Contractor shall be responsible for all related fire proofing from the IT Riser closet to the shade control network.
5. Installer shall make connections to the floor controllers via a modular connection at each floor riser where floor controllers are located.

6. Installer shall coordinate and install IQ Communication Gateways, analog modules, Ethernet switches, within the same closet as the electrical IT riser.

1.8 WARRANTY

- A. Warranty: Provide manufacturer's standard warranties, including the following:
 1. Roller Shade Motor Control Systems: Manufacturer's standard non-depreciating five-year warranty.
 2. Roller Shade Control Systems Installation: One year from Date of Acceptance.
 3. Automated Systems Warranty: One year from Date of Acceptance.
 4. Electronics Warranty: One year from Date of Acceptance.

1.9 DELIVERY, STORAGE AND HANDLING

- A. Deliver components in factory-labeled packages, marked with manufacturer and product name, fire-test-response characteristics, and location of installation using same room designations indicated on Drawings and in the Window Treatment Schedule.

PART 2 - PRODUCTS

2.1 MOTOR OPERATED ROLLER SHADES (RS-1)

- A. Motor Operated Rollers: Motorized interior solar roller shades, operating together within groups (RS1A and RS1B Groups) with separate motor control systems. Extruded-aluminum tube of diameter and wall thickness required to support and fit internal components of operating system and the weight and width of shade band material without sagging; designed to be easily removable from support brackets; with removable spline fitting integral channel in tube for attaching shade material. Provide capacity for roller shade band(s) per roller, as indicated in the Roller Shade Schedule.
- B. Direction of Roll: Regular, from back of roller. Verify with A/E.
- C. Mounting Brackets: Minimum 1/8-inch thick plated steel, or heavier/thicker as required.
- D. Bottom Bar: Steel or extruded aluminum, with RF welded seams. Provide concealed, by pocket of shade material, internal-type bottom bar with concealed weight bar as required for smooth, properly balanced shade operation.
- E. Provide shade hardware system that allows for field adjustment of motor or replacement of any operable hardware component without removal of brackets.
- F. Shade Operation: Motor operated.
- G. Mounting: Top mount.

H. Shade Band:

1. Shade Bands: Construction of shade band includes the fabric, the hem weight, hem-pocket, shade roller tube, and attachment of the shade band to the roller tube. Sewn hems and open hem pockets are not acceptable.
 - a. Hem Pockets and Hem Weights: Fabric hem pocket with RF-welded seams (including welded ends) and concealed hem weights. Hem weights shall be of appropriate size and weight for shade band. Hem weight shall be continuous inside a sealed hem pocket. Hem pocket construction and hem weights shall be similar, for all shades within one room.
 - b. Shade Band and Shade Roller Attachment:
 - 1) Use extruded aluminum shade roller tube of a diameter and wall thickness required to support shade fabric without excessive deflection. Roller tubes less than 1.55 inch (39.37-mm) in diameter for manual shades, and less than 2.55 inches (64.77-mm) for motorized shades are not acceptable.
 - 2) Provide for positive mechanical engagement with drive/brake mechanism.
 - 3) Provide for positive mechanical attachment of shade band to roller tube; shade band shall be made removable/replaceable with a "snap-on" "snap-off" spline mounting, without having to remove shade roller from shade brackets.
 - 4) Mounting spline shall not require use of adhesives, adhesive tapes, staples, and/or rivets.
 - 5) Any method of attaching shade band to roller tube that requires the use of adhesive, adhesive tapes, staples, and/or rivets is not acceptable.
- I. Use only Delrin Engineered Plastics for all plastic components of shade hardware. Styrene based plastics, and/or polyester, or reinforced polyester will not be acceptable.
- J. Provide shade hardware system that allows for operation of multiple shade bands offset by a maximum of 8-45 degrees from the motor axis between shade bands (4-22.5 degrees) on each side of the radial line, by a single shade motor (multi-banded shade, subject to manufacturer's design criteria).

- K. Total hanging weight of shade band shall not exceed 80% of the rated lifting capacity of the shade motor and tube assembly.
- L. Shade Motor Drive System:
 - 1. Shade Motors:
 - a. Tubular, asynchronous (non-synchronous) motors, with built-in reversible capacitor operating at 110v AC (60hz), single phase, temperature Class A, thermally protected, totally enclosed, maintenance free with line voltage power supply equipped with locking disconnect plug assembly furnished with each motor.
 - b.. Conceal motors inside shade roller tube.
 - c. Maximum current draw for each shade motor of 1.8 amps.
 - d. Use motors rated at the same nominal speed for all shades in the same room. Quiet operation of up to 46 dBa within three feet, open air.
- M. Motor Control Systems:
 - 1. Regular mode shall allow for shades to move to any position between the upper and lower limits set by the installer. Upper and lower stopping points (operating limits) of shade bands shall be programmed into motors via a hand held removable program module/configurator.
- N. Accessories:
 - 1. Provide exposed extruded aluminum closure mount, tile support and removable closure panel to provide access to shades.
- O. Roller Shade Fabrication:
 - 1. Product Description: Roller shade consisting of a roller, a means of supporting the roller, flexible sheet(s) or band(s) of material carried by the roller, a means of attaching the material to the roller, a bottom bar, and motorized operating mechanism that lifts and lowers the shade.
 - 2. Concealed Components: Noncorrodible or corrosion-resistant-coated materials.
 - a. Lifting Mechanism: With permanently lubricated moving parts.
 - 3. Installation Brackets: Designed for easy removal and reinstallation of shade, for supporting roller, and operating hardware and for hardware position and shade mounting method indicated.
 - 4. Fabricate units to completely fill existing openings from head to sill and jamb to jamb.

5. Fabricate shade cloth to hang flat without buckling or distortion. Fabricate with heat-sealed trimmed edges to hang straight without curling or raveling. Shade cloth to run true and straight without shifting sideways more than 1/8 inch per 8 feet.
6. Installation Fasteners: As recommended by shade manufacturer for each window type/size per bracket, fabricated from metal noncorrosive to shade hardware and adjoining construction; type designed for securing to supporting substrate; and supporting shades and accessories under conditions of normal use.
7. For railroaded shadebands, provide seams in railroaded multi-width shadebands as required to meet size requirements and in accordance with seam alignment as acceptable to A/E. Seams shall be properly located. Furnish battens in place of plain seams when the width, height, or weight of the shade exceeds manufacturer's standards. In absence of such standards, assure proper use of seams or battens as required to, and assure the proper tracking of the railroaded multi-width shadebands.

2.2 MANUAL OPERATED ROLLER SHADES

- A. Rollers: Extruded-aluminum tube of diameter and wall thickness required to support and fit internal components of operating system and the weight and width of shade band material without sagging; designed to be easily removable from support brackets; with removable spline fitting integral channel in tube for attaching shade material. Provide capacity for roller shade band(s) per roller, as indicated in the Roller Shade Schedule.
- B. Direction of Roll: Regular, from back of roller. Verify with A/E.
- C. Mounting Brackets: Galvanized or zinc-plated steel.
- D. Bottom Bar: Steel or extruded aluminum, with RF welded seams. Provide concealed, by pocket of shade material, internal-type bottom bar with concealed weight bar as required for smooth, properly balanced shade operation.
- E. Mounting: Top mount.
- F. Shade Operation: Manual; with continuous-loop bead-chain, clutch, and cord tensioner and bracket lift operator.
 1. Position of Clutch Operator: See Roller Shade Schedule.
 2. Clutch: Capacity to lift size and weight of shade; sized to fit roller or provide adaptor.
 3. Loop Length: Full length of roller shade.
 4. Bead Chain: Stainless steel.
 5. Cord Tensioner Mounting: See Roller Shade Schedule.

6. Operating Function: Stop and hold shade at any position in ascending or descending travel.

G. Roller Shade Fabrication:

1. Product Description: Roller shade consisting of a roller, a means of supporting the roller, a flexible sheet or band of material carried by the roller, a means of attaching the material to the roller, a bottom bar, and an operating mechanism that lifts and lowers the shade.
2. Concealed Components: Noncorrodible or corrosion-resistant-coated materials.
 - a. Lifting Mechanism: With permanently lubricated moving parts.
3. Installation Brackets: Designed for easy removal and reinstallation of shade, for supporting roller, and operating hardware and for hardware position and shade mounting method indicated.
4. Installation Fasteners: No fewer than two fasteners per bracket, fabricated from metal noncorrosive to shade hardware and adjoining construction; type designed for securing to supporting substrate; and supporting shades and accessories under conditions of normal use.

2.3 AUTOMATED DAYLIGHTING SOLAR TRACKING SHADE CONTROL SYSTEM FOR RS-1A AND RS-1B (MOTORIZED SHADES)

- A. Solar Tracking Control System: Automated Computer Shade Control System.
- B. Solar Evaluation and Sky Modeling System shall utilize approved scientific solar algorithms, which shall provide the following for every window under considerations in the building from sunrise to sunset, 365-1/4 days per year, as follows:
 1. Solar heat gain in real time reported in BTU's / (W/M2) multiple times each minute 24/7.
 2. Incident angle on every window.
 3. Profile angle on every window.
 4. Direct radiation on every window.
 5. Diffuse radiation on every window.
 6. Surface azimuth.
 7. Solar surface azimuth.
 8. Window geometry / profile.
 9. Geometry of the solar ray and window geometry to determine solar penetration.
 10. Adjustment by solar penetration.

11. Geometry of the solar ray, window geometry, and allowable solar penetration calculated to determine incremental shade position.
 - a. An algorithm integrated with the Solar Radiometers to provide in real time, a microclimatic sky condition for the project, 7/24/365, which shall be the basis of determining a clear, cloudy or overcast sky condition.
 - b. The system will then adjust the shades incrementally on the window to provide protection from direct solar radiation while maximizing view and daylighting for the project.
12. Adjustment by BTU / W-M 2 solar load on every RS-1A and RS-1B window in the project 7/24/365.
13. Sky modeling and evaluation for clear, cloudy, bright, overcast sky condition - utilizing total solar measuring devices.
14. Sky modeling algorithms utilizing the instantaneous, real time total solar data to determine sky condition.
 - a. Control System shall adjust the shade position to maximize energy management, view and personal comfort based on micro-climactic conditions.
 - b. The goal is to maximize view without Thermal or Visual discomfort through Thermal Comfort as assured by Solar Tracking.
 - (1) Control Modules: Control system shall be capable of optimizing the position of the shades (incrementally), to continuously deploy the shades in response to changes in Proactive and Reactive requirements.
 - (2) Solar Tracking Module - Base Control System, Thermal Comfort:
 - (a) Proactive Algorithms (Primary):
 - (1) Sun angle.
 - (2) Solar intensity - Total Light Spectrum.
 - (3) BTU Load.
 - (b) Reactive Algorithms: Real-time sky conditions via roof mounted radiometers.
 - c. Incremental Positioning: Shades shall be capable of being aligned at up to 104 positions based on serial command. The Control System shall be capable of staggering the operation of shade motors to assure balanced loading of the electrical system.

- d. Continuous Operation: 24 hours per day, 7 days per week, 365-1/4 days per year. Shade positioning resolution shall be calculated every 60 seconds.
- C. Graphic User Interface GUI): Configure screen as follows:
- 1. PC-GUI shall provide access to all adjustable parameters displaying current values including but not limited to:
 - a. Radiation
 - b. Shade position
 - c. User defined requirements
 - 2. Displays Real-Time Microclimatic Sky Conditions.
 - 3. Key-Zone/Sensor Monitoring:
 - a. On main screen; able to display current operation of "Key-Zones" or "Sensors" anywhere in the building.
 - 4. Alarms - On Main Screen: able to display overrides due to but not limited to:
 - a. Touch Screen
 - b. Main Control System
 - c. Remote (3rd Party Interface (BMS, AV, etc.)).
 - 5. Internal Diagnostic Function
 - a. Network-based system diagnostic module which monitors and verifies the operating status of the various nodes on the system. In case a problem is detected the issue is noted in the "Alert" section on the main application screen and logged within the system event log. If internet access is available then email alert notification can be configured to be issued to a predefined set of email addresses. When the alert is cleared, this event will also be logged within the system event log.
 - 6. Manual/Master Override:
 - a. Interactive Floor Plan: PC shall provide a map of each floor showing the shade motor groups, control zones and sensor locations with their real time position of each control zone.
 - b. Universal Command View: From the main screen the Universal Command View shall provide whole floor and whole building emergency control.
 - 7. Reports/Analysis:
 - a. Data Storage/Event Log: Continual record of each day's activities including shade position and shade mode changes.
 - (1) Stored on a change of state basis.

- (2) Archived based on user defined file size.
 - b. Sensor Data: Daily record of sensor's data stored into a history file on a 60 second basis, stored on a repetitive basis:
 - (1) Roof mounted radiometers.
 - (2) Interior/exterior photo sensors.
 - c. Control Zone Timeline Visual Record of Current Day's Activity by Zone:
 - (1) Reporting by Zone of current day operation by intermediate stop locations.
 - d. Trending Reports:
 - (1) Daily Report: Sky, Sensors, Even Log and Timeline.
 - (2) Shade Position Report: Percentage of time shade at each position.
 - (3) Override Report: Reason for override, percentage of day overridden up/down,
 - e. Interface with Other Report Writers:
 - (1) Event log and sensor data available in native MBD format.
 - (2) Available in SQL format.
- D. Override: Control Software shall incorporate an Override Event Scheduler such that the Owner may customize position of shades by motor, group, zone or whole building for any event, night or weekend requirements.
 - 1. Manual Local Override:
 - a. Wall Switches.
 - b. Touch Screens.
 - c. Virtual Shade Control Switch (via IP).
 - 2. Master Override:
 - a. Solar Tracking System shall have capability of whole building control for master override by zone or by motor.
 - b. Touch Screen shall have capability of whole floor control for master override by zone or by motor.
 - 3. Remote Off-Site-Monitoring:
 - a. IP Interface for monitoring, maintenance and software upgrades.
 - b. Provide Maintenance, support and licensing contract.
- E. Wall Switches:
 - 1. Conference Center: Shades shall be operated by 5 and 10-button low voltage standard switches, or programmable intelligent

- switches (IS). Standard switch shall be wired to a motor splitter.
2. Intelligent switches may be installed anywhere on the bus line. Each IS shall be capable of storing one control level address to be broadcast along the bus line.
 3. An address that is transmitted by either a switch or central controller shall be responded to by those motors with the same address in their control table.
 4. IS shall provide for interface with other low voltage input devices via a set of dry contact terminals located on the switch.
 5. Standard switch or IS may control an individual, sub-group or group of motors in accordance with the address in each motor.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance.
 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER SHADE INSTALLATION - MANUAL

- A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions, and located so shade band clears face of mullions.

3.3 ROLLER SHADE INSTALLATION - MOTORIZED

- A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions, and located so shade band clears face of mullions and no closer than 2-inches to interior face of glass.
- B. Allow proper clearances for window operation hardware.
- C. Single-Source Responsibility for Motorized Interior Roller Shades: To control the responsibility for performance of motorized roller shade systems, assign the design, engineering, and installation of motorized roller shade systems, motors, controls, and electrical control wiring specified in this Section to a single manufacturer and their authorized installer. The A/E will not produce a set of electrical drawings for the installation of control wiring for the motors, or motor controllers

of the motorized roller shades. Power wiring (line voltage), shall be provided by the roller shade installer, in accordance with the requirements provided by the manufacturer. Coordinate the following with the roller shade installer:

1. Contractor shall provide power panels and circuits of sufficient size to accommodate roller shade manufacturer's requirements, as indicated on the mechanical and electrical drawings.
 2. Contractor shall coordinate with requirements of roller shade installer, before inaccessible areas are constructed.
 3. Roller shade installer shall run line voltage as dedicated home runs (of sufficient quantity, in sufficient capacity as required) terminating in junction boxes in locations designated by roller shade installer.
 4. Roller shade installer shall provide and run all line voltage (from the terminating points) to the motor controllers, wire all roller shade motors to the motor controllers, and provide and run low voltage control wiring from motor controllers to switch/control locations designated by the A/E. All above-ceiling and concealed wiring shall be plenum-rated, or installed in conduit, as required by the electrical code having jurisdiction.
 5. Contractor shall provide conduit with pull wire in all areas, which might not be accessible to roller shade installer due to building design, equipment location or schedule.
- D. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 SOLAR SHADE CONTROL SYSTEM INSTALLATION

- A. Automated SolarTrac System: Provide factory-certified field service engineer to ensure proper system installation and operation under following parameters.
1. Minimum experience of 2 years training in the electrical/electronic field.
 2. Certified by the equipment manufacturer on the system installed.
- B. The automated shade control system will be tested as an entire system. Final testing shall be successfully completed prior to the first move-in date.
1. Verify programming with Owner.
 2. Final Acceptance shall be upon successful demonstration of all testing.

- C. During testing the following will be measured to determine system performance:
1. Response of system (demonstrated by deployment of shade) if average illumination of window wall at sensor exceeds 2,000 cd/m² or other value established by Owner.
 2. Sunlight penetration distance shall not exceed the Owner specified distance for each shade control zone.
 3. Response to variable external conditions including, but not limited to: partly sunny days; shading from other buildings in the neighboring urban landscape; and reflections from other buildings in the neighboring urban landscape.
 4. Proper consistent action of all shade groups on each façade for a 30 day period.
 5. The shade log shall be plotted for each shade motor group for the 30-day period. The log shall be used to demonstrate to the Owner that the automated shade movement meets the specified criteria in these specifications.
 6. Return from manual override to automatic mode shall be demonstrated to be in accordance with these specifications using the log and also through direct observation under partly cloudy conditions.
 7. All aspects of rezoning, control monitoring, logging, fault diagnostics and reporting shall be demonstrated to the Owner.
- D. Final Acceptance shall be upon successful demonstration of all testing requirements described in these specifications.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate and maintain systems. A minimum 20 hours of one-on-one training shall be provided to the Owner and a separate 20 hours training shall be provided one-on-one to the Owner's representative.
- B. All building occupants shall receive an electronic-based educational guide in .pdf format on the general workings of the shade control system and specific instructions on how to use the manual override feature.

3.6 CLEANING AND PROTECTION

- A. Protect installed products until completion of project.
- B. Clean roller shade surfaces after installation, according to manufacturer's written instructions.

- C. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Acceptance.
- D. Replace damaged roller shades that cannot be repaired, in a manner approved by A/E, before time of Acceptance.

3.7 ROLLER SHADE SCHEDULE

A. RS-1A: CORRIDOR, 1B600

- 1. Bracket: ceiling mounted, for single motorized shades in conjunction with roof-mounted sun sensor system: see further information on color/type/fascia in Section 09 06 00.
- 2. Shade Fabric: see Section 09 06 00.
- 3. Fabrication—Solar Shades
 - a. Standard (non-railroaded) single bands meeting at mullions on wider window openings.
- 4. Opening size: See drawings. Widths vary and must be field measured.
- 5. Separate manual group override from Group RS-1B.

B. RS-1B: SHARED WAITING, 1B602

- 1. Bracket: ceiling-mounted, for single motorized shades in conjunction with roof-mounted sun sensor system: see further information on color/type/fascia in Section 09 06 00.
- 2. Shade Fabric: see Section 09 06 00.
- 3. Fabrication—Solar Shades
 - a. Standard (non-railroaded) single bands meeting at mullion on wider window openings.
- 4. Opening size: See drawings. Widths vary and must be field measured.
- 5. Separate manual group override from Group RS-1A.

C. RS-2: PULMONARY GROUP ROOM, 1B653

- 1. Bracket: ceiling-mounted, for manual double shade. See further information on colors/type/fascia in Section 09 06 00.
- 2. Shade Fabrics: Solar Shade and Blackout: see Section 09 06 00.
- 3. Fabrication—Solar Shade.
 - a. Standard (non-railroaded) single band.
- 4. Fabrication—Blackout Shade
 - a. Railroaded single band
- 5. Opening size: See drawings. Must be field measured.

6. Clutch operation: Left or Right may be required depending on furniture placement. Drive chain must be accessible for use. Note Left or Right location on Window Treatment Schedule submittal.
- D. RS-3: ROOMS: RESP. 1B661, PHYSICIANS 1B662, DIRECTOR 1B663, and PHYSIOLOGY LAB 1B677
1. Bracket: ceiling mounted, for manual single shade. See further information on colors/type/fascia in Section 09 06 00.
 2. Shade Fabric: Solar Shade: see Section 09 06 00.
 3. Fabrication-Solar Shades
 - a. Standard (non-railroaded) single band.
 4. Opening sizes: See drawings. Widths vary and must be measured.
 5. Clutch operation: Left or Right may be required depending on furniture placement. Drive chain must be accessible for use. Note Left or Right location on Window Treatment Schedule submittal.

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SECTION 12 48 13
FLOOR MATS AND FRAMES

PART 1 - GENERAL

1.1 DESCRIPTION

This section covers roll-up mats in surface-mounted frames.

1.2 RELATED WORK

A. Color: Section 09 06 00, SCHEDULE FOR FINISHES.

1.3 SUBMITTALS

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES, furnish the following:
- B. Shop Drawings: Showing design, materials, items penetrating floor mats and frames, construction and installation.
- C. Samples for Verification: For each type of product indicated.
 - 1. Floor Mat: 12-inch square assembled section of floor mat.
- D. Maintenance Data: For floor mats and frames to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain floor mats and frames through one source from a single manufacturer.

1.5 PROJECT CONDITIONS

- A. Field Measurements: Indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 ROLL-UP MATS

- A. Roll-up, Aluminum-Rail Hinged Mats (RUFM-1): Extruded-aluminum tread rails 1-1/2 inches (38 mm) wide by 1/2 inch thick, sitting on continuous vinyl cushions.
 - 1. Tread Inserts: Refer to Section 09 06 00.
 - 2. Colors, Textures and Patterns of Inserts: Refer to Section 09 06 00.
 - 3. Rail Color: Refer to Section 09 06 00.
 - 4. Hinges: Aluminum.
 - 5. Mat Size: As indicated on Drawings.
- B. Structural Performance: Provide roll-up mats and frames capable of withstanding the following loads and stresses within limits and under conditions indicates:
 - 1. Wheel load of 750 pounds per wheel.

2.2 FABRICATION

- A. Floor Mats: Shop fabricated 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 surfaces of aluminum frames that will contact cementitious material with manufacturer's standard protective coating.

2.3 ALUMINUM FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Examine substrates and floor conditions for compliance with requirements for location, sizes, and other conditions affecting installation of floor mats and frames.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install mat frames to comply with manufacturer's written instructions. Set mat tops at height recommended by manufacturer for most effective cleaning action; coordinate top of mat surfaces with bottom of doors that swing across mats to provide clearance between door and mat.

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SECTION 12 59 00
SYSTEMS FURNITURE

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. This section specifies furnishing and installation of systems furniture both horizontal and vertical.
- B. Provide systems furniture as detailed on Drawings, including related components and accessories required to form an integral unit.
Components shown on Drawings but not specified below shall be included as part of the work under this section, and applicable portions of the specification shall apply to these items. Each like item of the system shall be of the same design and other products that are considered integral to the system shall be manufactured by one manufacturer.

1.2 RELATED WORK:

- A. Section 09 06 00, SCHEDULE FOR FINISHES: Color and finishes of the units.
- B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements that are common to more than one section of Division 26.
- C. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Raceways and outlet boxes for wiring.
- D. Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Cables and wiring.
- E. Section 26 27 26, WIRING DEVICES: Wiring devices to be installed in Systems Furniture.
- F. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path to ground for possible ground currents.
- G. Section 26 51 00, INTERIOR LIGHTING: Lighting fixture requirements when installed in or connected to the Systems Furniture.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- B. In accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, submit the following:
 - 1. Shop Drawings:
 - a. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
 - b. Include electrical ratings, dimensions, mounting details, front view, materials, and connection diagrams.

2. Certifications: Two weeks prior to the final inspection, deliver four copies of the following certifications to the COR:
 - a. Certification by the manufacturer that the equipment conforms to the requirements of the drawings and specifications.
 - b. Certification by the Contractor that the equipment has been properly installed, adjusted, and tested in accordance with the manufacturer's recommendations.
 - c. Samples:
 - 1) Solid surface materials, 150 mm (six inch) square, each color.
 - 2) Plastic Laminate, 2-inches square, each color.
 - d. Shop Drawings (1/2 full size):
 - 1) All furniture, showing details of construction, including materials, hardware and accessories.
 - 2) Fastenings and method of installation.

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 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
A1008-10.....Steel, Sheet, Cold-Rolled, Carbon, Structural, High
Strength Low Alloy
- C. High Pressure Laminate: PR-046
- D. National Fire Protection Association (NFPA):
70-11.....National Electrical Code (NEC)
99-12.....Health Care Facilities
- E. Underwriters Laboratories, Inc. (UL):
UL listed in product category SECTIONS AND UNITS. This standard used to investigate listed products in this category is NFPA 70 (NEC).

1.5 QUALITY ASSURANCE

- A. Manufacturer is regularly engaged in design and manufacture of the types of products and scope similar to the requirements of this project for a period of not less than five years.
- B. Installer is approved by manufacturer of products to be installed.
- C. Installer has successfully completed at least three projects of scope and type similar to requirements of this project.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver all components to site in manufacturer's clearly identified containers.

- B. Deliver, receive, and store in a secured space in a manner to prevent damage.
- C. Time deliveries to assure components are available at site when required for installation.

1.7 WARRANTIES

- A. Written warranty on entire system: Limited lifetime warranty stating products will be free from defects in materials and workmanship for as long as original retain purchaser owns such product. Exceptions warranted for three years: Task lights and powder-coated items.

PART 2 - PRODUCTS

2.1 MODULAR FURNITURE

- A. Shall be UL listed.
- B. Shall conform to the following:
 - 1. Applicable requirements in NFPA 70 (NEC) and NFPA 99.
 - 2. Assembly and all components shall be UL listed or labeled.
- C. System description shall include, but not be limited to, the following:
 - 1. Base cabinets with drawers, laminate kick plate, and drawer insert dividers
 - 2. Overhead cabinets with doors and horizontal slots at bottom
 - 3. Overhead cabinet with doors and vertical slots at bottom
 - 4. Work surfaces
 - 5. Side and back splashes
 - 6. Slope tops for overhead cabinets
 - 7. Under-cabinet mounted lighting

2.2 UNDER CABINET MOUNTED LIGHTING

- A. Task lighting
 - 1. Daisy chain.
 - 2. Refer to Drawings for location
 - 3. Under cabinet mounted behind two-inch cabinet fascia

2.3 SLOPE TOPS FOR OVERHEAD CABINETS

- A. Top and Side: Plastic Laminate. See Section 09 06 00.

2.4 WORK SURFACE

- A. General Work Surface
 - 1. Refer to Drawings for size and location.
 - 2. With back and side splash. Refer to Drawings for size and location.
 - 3. Finish and Color: See Section 09 06 00.

2.5 CABINETS

- A. Wall Cabinet: Double door cabinet with horizontal slots at bottom.
 - 1. Refer to Drawings for size and location.
 - 2. Cabinet Pull: Se 09 06 00 for finish, color, style and hinge type.

- B. Wall Cabinet: double door cabinet with vertical slots at bottom
 - 1. Refer to Drawings for size and location.
 - 2. Cabinet pull and hinge type: See Section 09 06 00 for finish, color and style.
- C. Drawer Module
 - 1. Shall be 24" deep. Widths as shown on Drawings.
 - 2. Shall accommodate drawers as shown on Drawings with full-extension ball-bearing slides.
 - 3. Provide a pull as listed in Section 09 06 00.
 - 4. Drawers shall accommodate a removable plastic insert divider system.
- D. No locks on cabinets.

2.6 FINISH

- A. Colors shall be selected from manufacturer's standard line as scheduled in Section 09 06 00.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect areas in which work is to be performed for acceptability to receive work.
- B. Assure that walls scheduled to receive attachment of system components are adequately reinforced to accept installation of this work.
- C. Assure that wall, floor, and ceiling work is finished.
- D. Report all discrepancies to Contractor for correction.
- E. Proceeding with work constitutes acceptance of existing conditions.

3.2 INSTALLATION

- A. Assure that adjoining work is not damaged by installation of this work.
- B. Provide temporary protection as required, and repair all damage to such work.
- C. Sequence work to allow work by electrical contractor to be performed without interference.
- D. Coordinate work with other operations in same area to avoid conflicts.
- E. Assemble and install all items in strict accordance with manufacturer's printed instructions.
 - 1. Anchor all fixed components firmly, square, level, plumb.
- F. Horizontal support elements:
 - 1. Install at heights indicated with all tops, shelves, and writing surfaces level within 1/8" (3) across width.
- G. Vertical support elements:
 - 1. Install plumb, spaced as indicated on shop drawings.
 - 2. Align slots to assure hanging units are level.

3. Adjust components and system for correct function and operation in strict accordance with manufacturer's written instructions.

3.3 CLEANING AND REPAIR

- A. Repair, if acceptable, or replace all damaged and improperly operating items.
- B. Immediately after installation and adjustment, clean all surfaces to remove all marks, soil and foreign matter.
- C. Just prior to Final Acceptance, recheck all components and perform all required additional cleaning.
- D. Upon completion, remove surplus materials, debris, tools and equipment.

- - - E N D - - -