VA | U.S. Department of Veterans Affairs

Specifications

Buffalo VA Medical Center

3495 Bailey Avenue | Buffalo, NY 14215

Parking Ramp Expansion
Building Number 29

VA Contract No. 36C24222C0022
Station Project No. 528-18-375
Bancroft-AE Project No. 21-113

Issue for Bid

Volume 1 of 2
Divisions 00-14

08-09-2024

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DIVISION 00

DEPARTMENT OF VETERANS AFFAIRS
VHA MASTER SPECIFICATIONS

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Reference Project Drawing G002 for the complete List of Drawings.

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DIVISION 01

SECTION 01 00 00
GENERAL REQUIREMENTS

GENERAL

1.1 SAFETY REQUIREMENTS

A. Refer to section 01 35 26, SAFETY REQUIREMENTS for safety and infection control requirements.

1.2 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 construction of a parking structure addition as required by the drawings and specifications.

B. Visits to the site by Bidders will be allowed during a designated Pre-Bid walkthrough. Additional site visits, if necessary, may be made only by appointment with the project Contracting Officer (CO).

C. Offices of Bancroft Architects and Engineers, 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 an independent third party testing laboratory retained by the General Contractor, the Contractor shall notify the laboratory 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 workdays 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. Performing on-site work outside of normal VA working hours will require approval form the Contracting Officer and the Contracting Officer Representative (COR). Requests shall be submitted via email at least 72 hours prior to the requested date and at no additional cost to the Government. Approvals are subject to the availability of on-site staff. Normal working hours for this contract will be from 8:00AM to 5:00PM (local time) Monday through Friday except for weekends and established Federal Holidays.

1.3 STATEMENT OF BID ITEM(S)

A. **ITEM I, GENERAL CONSTRUCTION (BASE BID):** WORK INCLUDES AN ADDITION OF TWO NEW PARKING LEVELS TO THE TOP OF THE EXISTING THREE-LEVEL PARKING STRUCTURE. A NEW STAIR TOWER WITH TWO ELEVATORS WILL BE CONSTRUCTED FOR THE WHOLE COMBINED HEIGHT OF THE GARAGE. ADJACENT PARKING, DROP OFF, AND ROADWAY WORK WILL BE RECONFIGURED AS INDICATED IN THE DOCUMENTS.

1. ADDITION OF TWO NEW PARKING LEVELS OF APPROXIMATELY 53,000 GSF EACH TO THE TOP OF THE EXISTING THREE-STORY PARKING STRUCTURE.
2. ADDITION OF A NEW STAIR TOWER WITH FOOTPRINT OF APPROXIMATELY 1,500 GSF TO INCLUDE NEW STAIRS AND TWO NEW ELEVATORS SPANNING THE FULL HEIGHT OF THE COMBINED GARAGE LEVELS.
3. ADDITION OF SCREENING AND SIGNAGE THROUGHOUT THE GARAGE FOR SAFETY AND WAYFINDING.
4. NEW ROADWAY TO THE EAST OF THE GARAGE FOR BETTER TRAFFIC FLOW AND FUTURE PARKING GARAGE EXPANSION.
5. RECONFIGURED ACCESSIBLE PARKING AND DROP-OFF LANE AT THE NORTH SIDE OF THE PARKING GARAGE.

6. RECONFIGURED PEDESTRIAN CROSSINGS FROM THE PARKING GARAGE TO THE MEDICAL CENTER ENTRANCE.
7. RESTORATION WORK ON EXISTING PARKING STRUCTURE LEVELS.
8. REPAINTING OF PARKING STRIPING AS SHOWN AND REQUIRED.

B. **ITEM II, OFFSITE PARKING LOT REQUIREMENTS (BASE BID):** THE CONTRACTOR WILL BE RESPONSIBLE FOR PROVIDING A MINIMUM OF TWO PARKING LOTS, ONE NORTH OF THE BUFFALO VAMC AND ONE SOUTH OF THE BUFFALO VAMC THAT PROVIDE A MINIMUM OF 200 PARKING SPACES EACH. THE EXACT NUMBER OF PARKING SPACES PROVIDED MAY BE GREATER THAN 200, BUT MAY NOT BE LESS THAN 200 FOR EACH LOT. 10% OF THE PARKING SPACES SHALL BE SET ASIDE FOR ADA, WITH ADA VAN SPACES PROVIDED AT A RATE OF 1 OUT OF EVERY 6 ADA SPACES. THE PURPOSE OF THE PARKING LOTS IS TO REPLACE ON-CAMPUS PARKING IMPACTED / LOST DURING CONSTRUCTION. PARKING LOTS MUST BE LOCATED WITHIN A 15-MINUTE DRIVE TO THE BUFFALO VAMC. OFFSITE IMPACT PARKING MUST BE PROVIDED AND AVAILABLE TO THE VA PRIOR TO STARTING CONSTRUCTION ON SITE. OFFSITE IMPACT PARKING WOULD NO LONGER BE REQUIRED ONCE THE PROJECT HAS BEEN COMPLETED AND TURNED OVER / ACCEPTED BY THE VA. THE OFFSITE IMPACT PARKING AVAILABILITY MUST BE SHOWN ON THE PROJECT SCHEDULE TO ENSURE AVAILABILITY ALIGNS WITH THE START OF ONSITE CONSTRUCTION. PROPOSED PARKING LOT LOCATIONS AND ARRANGEMENTS MUST BE SUBMITTED TO THE VA FOR REVIEW AND APPROVAL AS A PRE-CONSTRUCTION SUBMITTAL IN ACCORDANCE WITH PROJECT SPECIFICATION SECTION 01 33 23. THE CONTRACTOR SHALL PROVIDE THE VA WITH A FOLLOW-ON SUBMITTAL THAT VERIFIES ALL LEGAL AGREEMENTS ARE IN PLACE TO ALLOW THE VA TO PARK ON THE OFFSITE LOTS.

THE FOLLOWING STANDARD CONDITIONS AND REQUIREMENTS SHALL APPLY TO ANY PREMISES OFFERED FOR USE:

1. **QUALITY OF PARKING AREA**

   THE PARKING AREAS SHALL HAVE A SMOOTH HARD ASPHALT OR CONCRETE SURFACES, PROPERLY DRAINED SO AS NOT TO LEAVE PUDDLES, AND

SECURED BY A CHAIN LINK FENCE, OR OTHERWISE CLEARLY DELINEATED AS PARKING RESERVED FOR THE GOVERNMENT. PARKING SPACES SHALL BE STRIPED WITH PAINTED LINES THAT CLEARLY INDICATE EACH PARKING SPACE, AND THE DIVIDING OR ACCESS LANES BETWEEN THEM. ALL PARKING SPACES SHALL BE CLEARLY AND NEWLY PAINTED (STRIPED) IN TRAFFIC YELLOW OR WHITE. NON ADA PARKING SPACES SHALL BE AT LEAST 9′ WIDE AND 18′ LONG. STRIPES SHALL BE A MINIMUM OF 3″ WIDE. THE CONTRACTOR SHALL HAVE MANAGEMENT CONTROL OF THE PARKING LOTS.

2. **UPKEEP**

- THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING ALL UTILITIES NECESSARY FOR PARKING LOT AND GOVERNMENT OPERATIONS. ALL ASSOCIATED COSTS ARE TO BE INCLUDED AS PART OF THE BID.
- THE CONTRACTOR SHALL MAINTAIN PARKING LOTS CLEAN AND FREE FROM TRASH AND DEBRIS.
- THE CONTRACTOR SHALL MAINTAIN THE SURFACE OF THE PARKING LOT IN GOOD CONDITION, FREE OF POTHOLES, OR ANY AREAS THAT MAY HEAVE BECAUSE OF FROST. ANY AREAS OF COMPLETED PAVEMENT THAT ARE DEFECTIVE OR DAMAGED SHALL BE REMOVED AND PATCHED BY THE CONTRACTOR WITH LIKE MATERIAL BEFORE OCCUPANCY BY THE GOVERNMENT. IF SUCH DAMAGE OCCURS DURING THE *DURATION OF CONSTRUCTION*, IT SHALL BE REPAIRED WITHIN 7 DAYS OF NOTIFICATION WITH MINIMAL DISRUPTION TO THE NUMBER OF SPACES AVAILABLE.
- THE CONTRACTOR SHALL REPAINT PARKING SPACE LINES AND ADA MARKINGS AS NEEDED.
- THE CONTRACTOR SHALL INSTALL AND MAINTAIN LIGHTING AND LIGHTING FIXTURES THAT WILL LIGHT THE PARKING LOTS DURING THE HOURS OF DARKNESS, TO A LEVEL THAT PERSONS ENTERING, LEAVING OR PASSING THROUGH THE PARKING LOTS MAY EASILY SEE

INTO PURSES, READ PAPERS, AND EASILY SEE ANY OTHER PERSON OR PERSONS WALKING THROUGH THE SPACE.

- THE CONTRACTOR SHALL BE RESPONSIBLE FOR PEST CONTROL. ANY ANIMAL, WILD OR DOMESTIC, OR INSECTS (BEES, WASPS) SHALL BE REMOVED FROM THE PARKING AREA IMMEDIATELY ONCE REPORTED TO THE CONTRACTOR.
- THE CONTRACTOR SHALL BE RESPONSIBLE TO MAINTAIN AND REPAIR FENCING IN THE EVENT IT IS DAMAGED. REPAIRS NEED TO BE MADE WITHIN TEN (10) DAYS FROM TIME THAT IT IS REPORTED.

3. **SPACE IDENTIFICATION**

ADA AND ADA VAN SPACES SHALL BE SIZED AND CLEARLY MARKED WITH PAVEMENT MARKINGS AND SIGNAGE IN ACCORDANCE WITH THE MOST RECENT ADA PARKING STALL REQUIREMENTS. THE PARKING LOT SHALL BE POSITIVELY IDENTIFIED FOR VA USE ONLY THROUGH THE USE OF UPRIGHT SIGNS AT THE ENTRANCES TO THE PARKING LOT. THE SIGNS SHALL REFLECT THE HOURS PARKING IS SPECIFICALLY RESERVED FOR VA USE ONLY. INDIVIDUAL PARKING SPOT SIGNS/STENCILS IDENTIFYING PARKING STALLS AS RESERVED FOR GOVERNMENT USE ARE NOT REQUIRED.

4. **SNOW AND ICE REMOVAL**

THE CONTRACTOR SHALL PROVIDE SNOW REMOVAL SERVICES ON ALL DAYS FOR WHICH THE GOVERNMENT HAS DESIGNATED NORMAL WORK HOURS. THE CONTRACTOR SHALL CLEAR PARKING LOTS IF THE ACCUMULATION OF SNOW EXCEEDS TWO INCHES. THE CONTRACTOR SHALL CLEAR SIDEWALKS, WALKWAYS AND OTHER ENTRANCES BEFORE ACCUMULATION EXCEEDS 1.5 INCHES. THE SNOW REMOVAL SHALL TAKE PLACE NO LATER THAN 5:00 AM, WITH NO EXCEPTION OTHER THAN AREA WIDE TRAVEL BANS / STATES OF EMERGENCY. SHOULD ACCUMULATION CONTINUE THROUGHOUT THE DAY, THE CONTRACTOR SHALL PROVIDE SUCH ADDITIONAL SNOW REMOVAL SERVICES TO PREVENT ACCUMULATION GREATER THAN THE MAXIMUM SPECIFIED IN THIS PARAGRAPH. IN ADDITION TO SNOW

REMOVAL, THE CONTRACTOR SHALL KEEP WALKWAYS, SIDEWALKS AND PARKING LOTS FREE OF ICE DURING THE NORMAL HOURS. THE CONTRACTOR SHALL REMOVE EXCESS BUILDUP OF SAND AND/OR ICE MELT TO MINIMIZE SLIPPING HAZARDS.

5. **DEDICATED SHUTTLE DROP OFF AND PICKUP AREAS**

   OUTSIDE OF VEHICLE PARKING SPACES, THE CONTRACTOR SHALL PROVIDE A MINIMUM OF TWO OVERSIZED PARKING SPACES TO ACCOMMODATE FULL SIZE BUS PARKING / STAGING TO ACCOMMODATE PASSENGER PICKUPS AND DROP-OFFS. THE GOVERNMENT WILL PROVIDE SHUTTLE SERVICES, INCLUDING VEHICLES, DRIVERS AND ALL FUEL AND VEHICLE MAINTENANCE.

6. **AMERICANS WITH DISABILITIES ACT**

   THE PARKING LOTS MUST BE HANDICAPPED ACCESSIBLE, ADA COMPLIANT, AND IF REQUIRED, BE PROVIDED BY NEW CONSTRUCTION OR MODIFICATION TO AN EXISTING PARKING LOT.

7. **SITE SECURITY**

   THE CONTRACTOR SHALL PROVIDE A MINIMUM OF 1 SECURITY GUARD ON EACH PARKING LOT PROVIDED, MONDAY THROUGH FRIDAY, 5:30AM TO 6:30PM (NOT INCLUDING FEDERAL HOLIDAYS). SECURITY SHALL BE RESPONSIBLE FOR PATROLLING EACH PARKING LOT PROVIDED, AND HELP PREVENT VEHICLE BREAK-INS, DAMAGES, AND CONTACT FIRST RESPONDERS IF / WHEN NEEDED OR REQUESTED BY GOVERNMENT EMPLOYEES.

C. **DEDUCT #1**: INCLUDES ALL BASE BID WORK CONTAINED IN ITEMS I & II, EXCEPT DELETE ALL SITE RELATED WORK IN PARKING LOT B.

1. THIS DEDUCT DELETES:
   a. THE NEW TRAFFIC ISLANDS ADJACENT TO PARKING LOT B.
   b. SIGNAGE AND STRIPING AT THE NORTH END OF PARKING LOT B.
   c. ADDITIONAL HANDICAP PARKING AND RELOCATION OF THE EXISTING WHEELCHAIR HUT.

d. PARKING LOT B WOULD REMAIN AS EXISTING WITH NO SCOPE OF WORK, REFER TO CIVIL DRAWINGS FOR ADDITIONAL INFORMATION.

D. **DEDUCT #2:** INCLUDES ALL BASE BID WORK CONTAINED IN ITEMS I & II, EXCEPT SUBSTITUTE OR REMOVE VINYL WAYFINDING GRAPHICS.

1. THIS DEDUCT:
   a. SUBSTITUTES THE USE VINYL WALL GRAPHICS ON THE SOUTH WALL OF STAIR #1 FOR SOLID COLOR PAINT, ALL LEVELS.
   b. DELETES VINYL GRAPHICS FROM NEW ELEVATOR DOORS, ALL LEVELS, SUBSTITUTES THE USE OF VINYL WALL GRAPHICS ON THE EAST WALL OF STAIR #2 FOR SOLID COLOR PAINT.
   c. ALL LEVELS, THE SUBSTITUTION DOES NOT ALTER THE SCOPE AS INDICATED IN THE DRAWINGS.
   d. VINYL GRAPHICS WILL REMAIN ON THE GLAZED ENTRY WALL TO STAIR #1 AS INDICATED IN THE DRAWINGS.
   e. REFER TO ARCHITECTURAL WAYFINDING SHEETS FOR ADDITIONAL INFORMATION.

E. **DEDUCT #3:** INCLUDES ALL BASE BID WORK CONTAINED IN ITEMS I & II, EXCEPT DELETE PHOTOVOLTAIC CANOPY.

1. THIS DEDUCT:
   a. DELETES ALL SOLAR PANELS, ELECTRICAL COMPONENTS, AND ASSOCIATED STRUCTURE FROM THE UPPER LEVEL OF THE PARKING GARAGE.
   b. DELETES ALL LINEAR SUSPENDED LIGHT FIXTURES UNDER THE CANOPY.
   c. INSTALLS SALVAGED LIGHT POLES ON THE UPPER LEVEL OF THE GARAGE.
   d. REFER TO ARCHITECTURAL PLANS, ARCHITECTURAL SECTIONS, AND ELECTRICAL LIGHTING PLANS FOR ADDITIONAL INFORMATION.
   e. INSTALLS SURFACE MOUNTED S28E SIGNS (PARKING EXIT / ELEVATOR), POSSIBLE LOCATIONS WOULD BE NORTH, SOUTH, AND EAST SIDES.

F. **DEDUCT #4**: INCLUDES ALL BASE BID WORK CONTAINED IN ITEMS I & II, EXCEPT DELETE SELECT EXTERIOR SCREEN SYSTEMS AND LARGE SIGNAGE.

1. THIS DEDUCT DELETES THE FOLLOWING PROPOSED EXTERIOR SCREEN SYSTEMS AND LARGE SIGNAGE:
   a. PORTION OF EXTERIOR ARCHITECTURAL SCREEN SYSTEM FROM THE EXTERIOR FAÇADE ON THE SOUTH ELEVATION OF THE PARKING GARAGE.
   b. CURTAIN GLAZING SYSTEM ON THE EXTERIOR FAÇADE ON THE WEST ELEVATION OF THE PARKING GARAGE.
   c. METAL 'VA' LETTER SIGNAGE ACCOMPANYING THE GLAZING AND SCREEN SYSTEMS MENTIONED ABOVE ON BOTH THE WEST AND SOUTH ELEVATIONS.
   d. REFER TO ARCHITECTURAL PLANS AND ELEVATIONS FOR ADDITIONAL INFORMATION.

G. **DEDUCT #5**: INCLUDES ALL BASE BID WORK CONTAINED IN ITEMS I & II, EXCEPT DELETE PORTION OF STRUCTURAL RESTORATION WORK.

1. THIS DEDUCT DELETES THE FOLLOWING PORTIONS OF STRUCTURAL RESTORATION WORK WITHIN THE EXISTING GARAGE:
   a. JOINT SEALANT WORK.
   b. RECOAT EXISTING WATER PROOFING MEMBRANE.
   c. REPLACE DAMAGED WATERPROOFING MEMBRANE.
   d. INJECT LEAKING WALL CRACKS.
   e. REPLACE STAIR TOWER JOINT SEALANTS.
   f. PLUMBING REPAIR ALLOWANCE.
   g. APPLY SILANE SEALER WITH CORROSION INHIBITOR.
   h. WATERPROOFING MEMBRANE STRIPS TO SUPPORTED LEVELS.
   i. REFER TO STRUCTURAL RESTORATION DRAWINGS AND SPECIFICATIONS FOR ADDITIONAL INFORMATION.

H. **DEDUCT #6**: INCLUDES ALL BASE BID WORK CONTAINED IN ITEMS I & II, EXCEPT DELETE INFILL SCREEN SYSTEMS.

1. THIS DEDUCT DELETES THE ARCHITECTURAL SCREEN SYSTEMS INFILLING OPENINGS AT ALL LEVELS OF THE GARAGE.
   a. REFER TO ARCHITECTURAL PLANS AND ELEVATIONS FOR ADDITIONAL INFORMATION.

I. **DEDUCT #7:** INCLUDES ALL BASE BID WORK CONTAINED IN ITEMS I & II, EXCEPT DELETE ONE ELEVATOR INSTALLATION.

1. THIS DEDUCT DELETES THE INSTALLATION OF ONE ELEVATOR WITHIN THE NEW STAIR / ELEVATOR TOWER.
   a. THE PRECAST STRUCTURE WILL CONTINUE TO BE CONSTRUCTED AS DESIGNED WITH BOTH ELEVATOR SHAFTS.
   b. ONLY ONE ELEVATOR WILL BE INSTALLED ON ONE SIDE OF THE SHAFT.
   c. DOOR OPENINGS WHERE THE SECOND ELEVATOR WOULD HAVE BEEN BUILT WILL BE FILLED IN WITH CONCRETE MASONRY UNITS.

J. **DEDUCT #8:** INCLUDES ALL BASE BID WORK CONTAINED IN ITEMS I & II, EXCEPT SUBSTITUTE GLASS GUARDRAILS.

1. THIS DEDUCT SUBSTITUTES THE GLASS GUARDRAILS IN STAIR #1 FOR PAINTED STEEL GUARDRAILS.
   a. PAINTED STEEL GUARDRAILS SHALL MATCH THOSE BEING CONSTRUCTED IN STAIR #2.
   b. STAINLESS STEEL HANDRAIL SHALL REMAIN AS DESIGNED.
   c. REFER TO ENLARGED ARCHITECTURAL PLANS FOR ADDITIONAL INFORMATION.

K. **DEDUCT #9:** INCLUDES ALL BASE BID WORK CONTAINED IN ITEMS I & II, EXCEPT SUBSTITUTE ALUMINUM CURTAINWALL FOR PRECAST CONCRETE PANELS.

1. THIS DEDUCT:
   a. DELETES ALUMINUM WINDOWS / OPENINGS IN SOUTH WALL OF STAIR #1.
   b. SUBSTITUTES A PORTION OF ALUMINUM CURTAINWALL FOR PRECAST CONCRETE CONSTRUCTION IN STAIR #1.

c. SUBSTITUTION WILL ALSO ELIMINATE A PORTION OF STEEL STRUCTURAL FRAMING WITHIN STAIR #1.

L. **DEDUCT #10:** I INCLUDES ALL BASE BID WORK CONTAINED IN ITEM I, EXCEPT DELETE OFFSITE PARKING LOT REQUIREMENTS.

1. THIS DEDUCT DELETES:

a. ALL CONTRACTOR PROVIDED OFFSITE PARKING LOT REQUIREMENTS AS OUTLINED IN SECTION 1.3.B ABOVE.

1.4 SPECIFICATIONS AND DRAWINGS FOR CONTRACTOR

A. Drawings and contract documents may be obtained from the website where the solicitation is posted. Additional copies will be at Contractor's expense.

1.5 CONSTRUCTION SECURITY REQUIREMENTS

A. Security Plan:

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

B. Security Procedures:

1. General Contractor’s employees shall not enter the project site without appropriate badge. They may also be subject to inspection of their personal effects when entering or leaving the project site.
2. Before starting work the General Contractor shall give one week’s notice to the Contracting Officer so that security arrangements can be provided for the employees. This notice is separate from any notices required for utility shutdown described later in this section.

3. No photography of VA premises is allowed without written permission of the Contracting Officer. Patients and staff are not to be photographed at any time.
4. VA reserves the right to close down or shut down the project site and order General Contractor's employees off the premises in the event of a national emergency. The General Contractor may return to the site only with the written approval of the Contracting Officer.

C. Key Control:

1. The General Contractor shall provide duplicate keys and lock combinations to the Contracting officers representative (COR) for the purpose of security inspections of every area of project including toolboxes and parked machines and take any emergency action.
2. Doors shall be installed without cores, unless needed for temporary security. Prior to project turn over, contractor shall remove temporary cores and VA will install final permanent cores.

D. Document Control:

1. Before starting any work, the General Contractor/Sub Contractors shall submit an electronic security memorandum describing the approach to following goals and maintaining confidentiality of "sensitive information".
2. The General Contractor is responsible for safekeeping of all drawings, project manual and other project information. This information shall be shared only with those with a specific need to accomplish the project.
3. Certain documents, sketches, videos or photographs and drawings may be marked "Law Enforcement Sensitive" or "Sensitive Unclassified". Secure such information in separate containers and limit the access to only those who will need it

for the project. Return the information to the Contracting Officer upon request.

4. These security documents shall not be removed or transmitted from the project site without the written approval of Contracting Officer.
5. All paper waste or electronic media such as CD's and diskettes shall be shredded and destroyed in a manner acceptable to the VA.
6. Notify Contracting Officer and Site Security Officer immediately when there is a loss or compromise of "sensitive information".
7. All electronic information shall be stored in specified location following VA standards and procedures using an Engineering Document Management Software (EDMS).
   a) Security, access and maintenance of all project drawings, both scanned and electronic shall be performed and tracked through the EDMS system.
   b) "Sensitive information" including drawings and other documents may be attached to e-mail provided all VA encryption procedures are followed.

E. Motor Vehicle Restrictions

1. Vehicle authorization request shall be required for any vehicle entering the site and such request shall be submitted 24 hours before the date and time of access. Access shall be restricted to picking up and dropping off materials and supplies.
2. All parking for the General Contractor and their employees shall occur within the Contractor staging area. Contractor to coordinate with VA Medical Center Facility Manager.

1.6 OPERATIONS AND STORAGE AREAS (FAR 52.236-10)

A. The Contractor shall confine all operations (including storage of materials) on Government premises to areas authorized or approved by the Contracting Officer. The Contractor shall hold and save the Government, its officers and agents, free and harmless from liability of any nature occasioned by the Contractor's performance.

B. Temporary buildings (e.g., storage sheds, shops, offices) and utilities may be erected by the Contractor only with the approval of the Contracting Officer and shall be built with labor and materials furnished by the Contractor without expense to the Government. The temporary buildings and utilities shall remain the property of the Contractor and shall be removed by the Contractor at its expense upon completion of the work. With the written consent of the Contracting Officer, the buildings and utilities may be abandoned and need not be removed.

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

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

E. Workers are subject to rules of Medical Center applicable to their conduct.

F. Execute work in such a manner as to interfere as little as possible with work being done by others. Keep roads clear of construction materials, debris, standing construction equipment and vehicles at all times.

G. Execute work so as to interfere as little as possible with normal functioning of Medical Center as a whole, including operations of utility services, fire protection systems and any existing equipment, and with work being done by others.

1. Do not store materials and equipment in other than assigned areas.
2. Provide unobstructed access to Medical Center areas required to remain in operation.
3. Where access by Medical Center personnel to vacated portions of buildings is not required, storage of Contractor's materials and equipment will be permitted subject to fire and safety requirements.

H. Utilities Services: Where necessary to cut existing pipes, electrical wires, conduits, cables, etc., of utility services, or of fire protection systems or communications systems (except telephone), they shall be cut and capped at suitable places where shown; or, in absence of such indication, where directed by COR. All such actions shall be coordinated with the COR or Utility Company involved:

1. Whenever it is required that a connection fee be paid to a public utility provider for new permanent service to the construction project, for such items as water, sewer, electricity, gas or steam, payment of such fee shall be the responsibility of the Government and not the Contractor.

I. Phasing:

1. The Medical Center must maintain its operation 24 hours a day 7 days a week. Therefore, any interruption in service must be

scheduled and coordinated with the COR to ensure that no lapses in operation occur. It is the CONTRACTOR'S responsibility to develop a work plan and schedule detailing, at a minimum, the procedures to be employed, the equipment and materials to be used, the interim life safety measure to be used during the work, and a schedule defining the duration of the work with milestone subtasks. The work to be outlined shall include, but not be limited to:

2. To ensure such executions, Contractor shall furnish the COR with a schedule of approximate 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 dates to ensure accomplishment of this work in successive phases mutually agreeable to Medical Center Director, COR and Contractor.

J. Construction Fence: Before construction operations begin, Contractor shall provide a chain link construction fence, 2.1m (seven feet) minimum height, around the construction area indicated on the drawings. Provide gates as required for access with necessary hardware, including hasps and padlocks. Fasten fence fabric to terminal posts with tension bands and to line posts and top and bottom rails with tie wires spaced at maximum 375mm (15 inches). Bottom of fences shall extend to 25mm (one inch) above grade. Remove the fence when directed by COR.

K. When a building and/or construction site is turned over to Contractor, Contractor shall accept entire responsibility including upkeep and maintenance therefore:

1. Contractor shall maintain a minimum temperature of 4 degrees C (40 degrees F) at all times, except as otherwise specified.

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

L. Utilities Services: Maintain existing utility services for Medical Center at all times. Provide temporary facilities, labor, materials, equipment, connections, and utilities to assure uninterrupted services. Where necessary to cut existing water, steam, gases, sewer or air pipes, or conduits, wires, 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 [Chief Engineer] [Chief of Facilities Management]. 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 a detailed work plan, the Medical Center Director’s prior knowledge and written approval. Refer to specification Sections 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, 27 05 11 REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS and 28 05 00, COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY for additional requirements.

2. Contractor shall submit a request to interrupt any such services to COR, in writing, 7 days in advance of proposed interruption. Request shall state reason, date, exact time of, and approximate duration of such interruption.
3. Contractor will be advised (in writing) of approval of request, or of which other date and/or time such interruption will cause least inconvenience to operations of Medical Center Interruption time approved by Medical Center may occur at other than Contractor's normal working hours.
4. Major interruptions of any system must be requested, in writing, at least 15 calendar days prior to the desired time and shall be performed as directed by the COR.
5. In case of a contract construction emergency, service will be interrupted on approval of COR. Such approval will be confirmed in writing as soon as practical.
6. Whenever it is required that a connection fee be paid to a public utility provider for new permanent service to the construction project, for such items as water, sewer, electricity, gas or steam, payment of such fee shall be the responsibility of the Government and not the Contractor.

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

N. To minimize interference of construction activities with flow of Medical Center traffic, comply with the following:
   1. Keep roads, walks and entrances to grounds, to parking and to occupied areas of buildings clear of construction materials, debris and standing construction equipment and vehicles.
   2. Method and scheduling of required cutting, altering and removal of existing roads, walks and entrances must be approved by the COR.

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

P. Coordination of Construction with Cemetery Director: The burial activities at a National Cemetery shall take precedence over construction activities. The Contractor must cooperate and coordinate with the Cemetery Director, through the COR, in arranging construction schedule to cause the least possible interference with cemetery activities in actual burial areas. Construction noise during the interment services shall not disturb the service. Trucks and workers shall not pass through the service area during this period:
   1. The Contractor is required to discontinue his work sufficiently in advance of Easter Sunday, Mother's Day, Father's Day, Memorial Day, Veteran's Day and/or Federal holidays, to permit him to clean up all areas of operation adjacent to existing burial plots before these dates.
   2. Cleaning up shall include the removal of all equipment, tools, materials and debris and leaving the areas in a clean, neat condition.

1.7 ALTERATIONS

A. Survey: Before any work is started, the Contractor shall make a thorough survey with the COR and a representative of VA Supply Service, 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 and/or Supply Representative, to be in such condition that their use is impossible or impractical, shall be furnished and/or replaced by Contractor with new items in accordance with specifications which will be furnished by Government. Provided the contract work is changed by reason of this subparagraph B, the contract will be modified accordingly, under provisions of clause entitled "DIFFERING SITE CONDITIONS" (FAR 52.236-2) and "CHANGES" (FAR 52.243-4).

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 workers 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 DISPOSAL AND RETENTION

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

1. Reserved items which are to remain property of the Government are noted on drawings or in specifications as items to be stored. Items that remain property of the Government shall be

removed or dislodged from present locations in such a manner as to prevent damage which would be detrimental to re-installation and reuse. Store such items where directed by COR.

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

1.9 PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS (FAR 52.236-9)

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

B. The Contractor shall protect from damage all existing improvements and utilities at or near the work site and on adjacent property of a third party, the locations of which are made known to or should be known by the Contractor. The

Contractor shall repair any damage to those facilities, including those that are the property of a third party, resulting from failure to comply with the requirements of this contract or failure to exercise reasonable care in performing the work. If the Contractor fails or refuses to repair the damage promptly, the Contracting Officer may have the necessary work performed and charge the cost to the Contractor.

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

D. Refer to FAR clause 52.236-7, "Permits and Responsibilities," which is included in General Conditions. A National Pollutant Discharge Elimination System (NPDES) permit is required for this project. The Contractor is considered an "operator" under the permit and has extensive responsibility for compliance with permit requirements. VA will make the permit application available at the (appropriate medical center) office. The apparent low bidder, contractor and affected subcontractors shall furnish all information and certifications that are required to comply with the permit process and permit requirements. Many of the permit requirements will be satisfied by completing construction as shown and specified. Some requirements involve the Contractor's method of operations and operations planning and the Contractor is responsible for employing best management practices. The affected activities often include, but are not limited to the following:

1. Designating areas for equipment maintenance and repair;
2. Providing waste receptacles at convenient locations and provide regular collection of wastes;

3. Locating equipment wash down areas on site, and provide appropriate control of wash-waters;
4. Providing protected storage areas for chemicals, paints, solvents, fertilizers, and other potentially toxic materials; and
5. Providing adequately maintained sanitary facilities.

1.10 RESTORATION

A. Remove, cut, alter, replace, patch and repair existing work as necessary to install new work. Except as otherwise shown or specified, do not cut, alter or remove any structural work, and do not disturb any ducts, plumbing, steam, gas, or electric work without approval of the COR. Existing work to be altered or extended and that is found to be defective in any way, shall be reported to the COR before it is disturbed. Materials and workmanship used in restoring work, shall conform in type and quality to that of original existing construction, except as otherwise shown or specified.

B. Upon completion of contract, deliver work complete and undamaged. Existing work (walls, ceilings, partitions, floors, mechanical and electrical work, lawns, paving, roads, walks, etc.) disturbed or removed as a result of performing required new work, shall be patched, repaired, reinstalled, or replaced with new work, and refinished and left in as good condition as existed before commencing work.

C. At Contractor's own expense, Contractor shall immediately restore to service and repair any damage caused by Contractor's workers to existing piping and conduits, wires, cables, etc., of utility services or of fire protection systems and communications systems (including telephone) 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 "DIFFERING SITE CONDITIONS" (FAR 52.236-2).

1.11 PHYSICAL DATA – SOIL CONDITIONS

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 MJ Engineering and Land Surveying, P.C.

(FAR 52.236-4)

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

C. A copy of the soil report will be made available for inspection by bidders upon request to the Engineering Officer at the VA Medical Center, and shall be considered part of the contract documents.

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

1.12 PROFESSIONAL SURVEYING SERVICES

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

1.13 LAYOUT OF WORK

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

(FAR 52.236-17)

B. Establish and plainly mark center lines for each building and corner of column lines and/or addition to each existing building, and such other lines and grades that are reasonably necessary to properly assure that location, orientation, and elevations established for each such structure and/or addition, roads,

parking lots, are in accordance with lines and elevations shown on contract drawings.

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

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

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

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

3. Lines and elevations of sewers and of all outside distribution systems.
4. Lines of elevations of all swales and interment areas.
5. Lines and elevations of roads, streets and parking lots.

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

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

G. 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".

1.14 AS-BUILT DRAWINGS

A. The contractor shall maintain two full size sets of as-built drawings which will be kept current during construction of the project, to include all contract changes, modifications and clarifications.

B. All variations shall be shown in the same general detail as used in the contract drawings. To ensure compliance, as-built drawings shall be made available for the COR review, as often as requested.

C. Contractor shall deliver two approved completed sets of as-built drawings in the electronic version (scanned PDF) to the COR

within 15 calendar days after each completed phase and after the acceptance of the project by the COR.

D. Paragraphs A, B, & C shall also apply to all shop drawings.

1.15 WARRANTY MANAGEMENT

A. Warranty Management Plan: Develop a warranty management plan which contains information relevant to FAR 52.246-21 Warranty of Construction in at least 30 days before the planned pre-warranty conference, submit one electronic copy of the warranty management plan. Include within the warranty management plan all required actions and documents to assure that the Government receives all warranties to which it is entitled. The plan must be in narrative form and contain sufficient detail to render it suitable for use by future maintenance and repair personnel, whether tradesman, or of engineering background, not necessarily familiar with this contract. The term "status" as indicated below must include due date and whether item has been submitted or was approved. Warranty information made available during the construction phase must be submitted to the Contracting Officer for approval prior to each monthly invoice for payment. Assemble approved information in a binder and turn over to the Government upon acceptance of the work. The construction warranty period will begin on the date of the project acceptance and continue for the product warranty period. A joint 4 month and 9 month warranty inspection will be conducted, measured from time of acceptance, by the Contactor and the Contracting Officer. Include in the warranty management plan, but not limited to, the following:

1. Roles and responsibilities of all personnel associated with the warranty process, including points of contact and telephone numbers within the company of the Contractor, subcontractors, manufacturers or suppliers involved.

2. Furnish with each warranty the name, address and telephone number of each of the guarantor's representatives nearest project location.
3. Listing and status of delivery of all Certificates of Warranty for extended warranty items, to include roofs, HVAC balancing, pumps, motors, transformers and for systems such as fire protection and alarm systems, sprinkler systems and lightning protection systems, etc.
4. A list for each warranted equipment item, feature of construction or system indicating:
   a. Name of item.
   b. Model and serial numbers.
   c. Location where installed.
   d. Name and phone numbers of manufacturers and suppliers.
   e. Name and phone numbers of manufacturers or suppliers.
   f. Names, addresses and phone numbers of sources of spare parts.
   g. Warranties and terms of warranty. Include one-year overall warranty of construction, including the starting date of warranty of construction. Items which have extended warranties must be indicated with separate warranty expiration dates.
   h. Starting point and duration of warranty period.
   i. Summary of maintenance procedures required to continue the warranty in force.
   j. Cross-reference to specific pertinent Operation and Maintenance manuals.
   k. Organizations, names and phone numbers of persons to call for warranty service.
   l. Typical response time and repair time expected for various warranted equipment.

5. The plans for attendance at the 4 and 9-month post construction warranty inspections conducted by the government.
6. Procedure and status of tagging of all equipment covered by extended warranties.
7. Copies of instructions to be posted near selected pieces of equipment where operation is critical for warranty and/or safety reasons.

B. Performance & Payment Bonds: The Performance & Payment Bonds must remain effective throughout the construction period.

1. In the event the Contractor fails to commence and diligently pursue any construction warranty work required, the Contracting Officer will have the work performed by others, and after completion of the work, will charge the remaining construction warranty funds of expenses incurred by the Government while performing the work, including, but not limited to administrative expenses.
2. In the event sufficient funds are not available to cover the construction warranty work performed by the Government at the contractor’s expenses, the Contracting Officer will have the right to recoup expenses from the bonding company.
3. Following oral or written notification of required construction warranty repair work, the Contractor shall respond in a timely manner. Written verification will follow oral instructions. Failure to respond will be cause for the Contracting Officer to proceed against the Contractor.

C. Pre-Warranty Conference: Prior to contract completion, and at a time designated by the Contracting Officer, the Contractor shall meet with the Contracting Officer to develop a mutual understanding with respect to the requirements of this section. Communication procedures for Contractor notification of construction warranty defects, priorities with respect to the

type of defect, reasonable time required for Contractor response, and other details deemed necessary by the Contracting Officer for the execution of the construction warranty will be established/ reviewed at this meeting. In connection with these requirements and at the time of the Contractor's quality control completion inspection, furnish the name, telephone number and address of a licensed and bonded company which is authorized to initiate and pursue construction warranty work action on behalf of the Contractor. This point of contract will be located within the local service area of the warranted construction, be continuously available and be responsive to Government inquiry on warranty work action and status. This requirement does not relieve the Contractor of any of its responsibilities in conjunction with other portions of this provision.

D. Contractor's Response to Construction Warranty Service Requirements:

E. Following oral or written notification by the Contracting Officer, the Contractor shall respond to construction warranty service requirements in accordance with the "Construction Warranty Service Priority List" and the three categories of priorities listed below. Submit a report on any warranty item that has been repaired during the warranty period. Include within the report the cause of the problem, date reported, corrective action taken, and when the repair was completed. If the Contractor does not perform the construction warranty within the timeframe specified, the Government will perform the work and back charge the construction warranty payment item established.

1. First Priority Code 1. Perform onsite inspection to evaluate situation, and determine course of action within 4 hours, initiate work within 6 hours and work continuously to completion or relief.

2. Second Priority Code 2. Perform onsite inspection to evaluate situation, and determine course of action within 8 hours, initiate work within 24 hours and work continuously to completion or relief.
3. Third Priority Code 3. All other work to be initiated within 3 work days and work continuously to completion or relief.
4. The "Construction Warranty Service Priority List" is as follows:
   a) Code 1-Life Safety Systems
      1) Fire suppression systems.
      2) Fire alarm system(s).
   b) Code 1-Air Conditioning Systems
      1) Air conditioning leak in part of the building, if causing damage.
      2) Air conditioning system not cooling properly.
   c) Code 1 Doors
      1) Overhead doors not operational, causing a security, fire or safety problem.
      1) Interior, exterior personnel doors or hardware, not functioning properly, causing security, fire or safety problem.
   d) Code 3-Doors
      1) Overhead doors not operational.
      2) Interior/exterior personnel doors or hardware not functioning properly.
   e) Code 1-Electrical
      1) Power failure (entire area or any building operational after 1600 hours).
      2) Security lights.
      3) Smoke detectors.
   f) Code 2-Electrical

1) Power failure (no power to a room or part of building). Receptacle and lights not operational (in a room or part of building).

g) Code 3-Electrical

1) Exterior lights not operational.

h) Code 1-Gas

1) Leaks and pipeline breaks.

i) Code 1-Heat

1) Power failure affecting heat.

j) Code 1-Plumbing

1) Hot water heater failure.
2) Leaking water supply pipes

k) Code 2-Plumbing

1) Flush valves not operating properly
2) Fixture drain, supply line or any water pipe leaking.
3) Toilet leaking at base.

l) Code 3- Plumbing

1) Leaky faucets.

m) Code 3-Interior

1) Floors damaged.
2) Paint chipping or peeling.
3) Casework damaged.

n) Code 1-Roof Leaks

1) Damage to property is occurring.

o) Code 2-Water (Exterior)

1) No water to facility.

p) Code 2-Water (Hot)

1) No hot water in portion of building listed.

q) Code 3

1) All work not listed above.

F. Warranty Tags: At the time of installation, tag each warranted item with a durable, oil and water-resistant tag approved by the Contracting Officer. Attach each tag with a copper wire and spray with a silicone waterproof coating. Also submit two record copies of the warranty tags showing the layout and design. The date of acceptance and the QC signature must remain blank until the project is accepted for beneficial occupancy. Show the following information on the tag.

Warranty Tags
Type of product/material
Model number
Serial number
Contract number
Warranty period from/to
Inspector’s signature
Construction Contractor
Address
Telephone number
Warranty Contact
Address
Telephone number
Warranty response time priority code

1.16 USE OF ROADWAYS

A. For hauling, use only established public roads and roads on Medical Center property and, when authorized by the COR, such temporary roads which are necessary in the performance of contract work. Temporary roads shall be constructed and restoration performed 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.

1.17 RESIDENT ENGINEER'S FIELD OFFICE (NOT USED)

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 written approval and compliance with the following provisions:

1. Permission to use each unit or system must be given by COR in writing. If the equipment is not installed and maintained in accordance with the written agreement and 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. Installation of temporary electrical equipment or devices shall be in accordance with NFPA 70, National Electrical Code, (2014 Edition), Article 590, *Temporary Installations.* Voltage supplied to each item of equipment shall be verified to be correct and it shall be determined that motors are not overloaded. The electrical equipment shall be thoroughly cleaned before using it and again immediately before final inspection including vacuum cleaning and wiping clean interior and exterior surfaces.

3. Units shall be properly lubricated, balanced, and aligned. Vibrations must be eliminated.
4. Automatic temperature control systems for preheat coils shall function properly and all safety controls shall function to prevent coil freeze-up damage.
5. The air filtering system utilized shall be that which is designed for the system when complete, and all filter elements shall be replaced at completion of construction and prior to testing and balancing of system.
6. All components of heat production and distribution system, metering equipment, condensate returns, and other auxiliary facilities used in temporary service shall be cleaned prior to use; maintained to prevent corrosion internally and externally during use; and cleaned, maintained and inspected prior to acceptance by the Government.

B. Prior to final inspection, the equipment or parts used which show wear and tear beyond normal, shall be replaced with identical replacements, at no additional cost to the Government.

C. This paragraph shall not reduce the requirements of the mechanical and electrical specifications sections.

D. Any damage to the equipment or excessive wear due to prolonged use will be repaired replaced by the contractor at the contractor’s expense.

1.19 TEMPORARY USE OF EXISTING ELEVATORS (NOT USED)

1.20 TEMPORARY USE OF NEW ELEVATORS

A. The Contractor and his personnel shall be permitted use of new elevator(s) subject to the following provisions:

1. Contractor shall make arrangements with the COR for use of elevator(s). Contractor may obtain elevator(s) for exclusive use.

2. Prior to the use of elevator(s), the Contractor shall have the elevator(s) inspected and accepted by an ASME accredited, certified elevator safety inspector. The acceptance report shall be submitted to the COR.
3. Submit to the COR the schedule and procedures for maintaining equipment. Indicate the day or days of the week and total hours required for maintenance. A report shall be submitted to the COR monthly indicating the type of maintenance conducted, hours used, and any repairs made to the elevator(s).
4. The Contractor shall be responsible for enforcing the maintenance procedures as per VA and manufacturers recommendations and requirements.
5. During temporary use of elevator(s) all repairs, equipment replacement and cost of maintenance shall be the responsibility of the Contractor.
6. Personnel for operating elevator(s) shall not be provided by the Department of Veterans Affairs.
7. Contractor shall cover and provide maximum protection of the entire elevator(s) installation.
8. The Contractor shall arrange for the elevator company to perform operation of the elevator(s) so that an ASME accredited, certified elevator safety inspector can evaluate the equipment. The Contractor shall be responsible for any costs of the elevator company.
9. All elevator(s) parts worn or damaged during temporary use shall be removed and replaced with new parts at the contractor’s expense. This shall be determined by an ASME accredited certified elevator safety inspector after temporary use and before acceptance by the Government. Submit report to the COR for approval.

10. Elevator shall be tested as required by the testing section of the elevator(s) specifications before acceptance by the Department of Veterans Affairs. The Contractor shall be responsible for all cost associated with testing and inspection.

1.21 TEMPORARY TOILETS

A. Provide where directed, (for use of all Contractor's workers) 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. *Contractor may have for use of Contractor's workers, such toilet accommodations as may be assigned to Contractor by Medical Center. Contractor shall keep such places clean and be responsible for any damage done thereto by Contractor's workers. Failure to maintain satisfactory condition in toilets will deprive Contractor of the privilege to use such toilets.

1.22 AVAILABILITY AND USE OF UTILITY SERVICES

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

C. Contractor shall install meters at Contractor's expense and furnish the Medical Center a monthly record of the Contractor's usage of electricity as hereinafter specified.

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

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

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

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

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

1. Obtain water by connecting to the Medical Center water distribution system. Provide reduced pressure backflow preventer at each connection as per code. 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 discretion) of use of water from Medical Center's system.

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

1.23 NEW TELEPHONE EQUIPMENT

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

1.24 TESTS

A. The contractor shall provide a written testing plan with component level, equipment level, sub-system level and system level breakdowns. The plan will provide a schedule and a written sequence of what will be tested, how and what the expected outcome will be. This document will be submitted for approval prior to commencing work. The contractor shall document the results of the approved plan and submit for approval with the as built documentation.

B. 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.

C. 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.

D. Electrical systems shall be balanced, controlled and coordinated. A system is defined as the entire system which must be coordinated to work together during normal operation to produce results for which the system is designed.

E. All related components shall be functioning when any system component is tested. Tests shall be completed within a reasonably period of time during which operating and environmental conditions remain reasonably constant and are typical of the design conditions.

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

1.25 INSTRUCTIONS

A. Contractor shall furnish Maintenance and Operating manuals (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 coincidental with the delivery of the equipment to the job site. Manuals shall be complete, detailed guides for the maintenance and operation of equipment. They shall include complete information necessary for starting, adjusting, maintaining in continuous operation for long periods of time and dismantling and reassembling of the complete units and sub-assembly components. Manuals shall include an index covering all component parts clearly cross-referenced to diagrams and illustrations. Illustrations shall include "exploded" views showing and identifying each separate item. Emphasis shall be placed on the use of special tools and instruments. The function of each piece of equipment, component, accessory and control

shall be clearly and thoroughly explained. All necessary precautions for the operation of the equipment and the reason for each precaution shall be clearly set forth. Manuals must reference the exact model, style and size of the piece of equipment and system being furnished. Manuals referencing equipment similar to but of a different model, style, and size than that furnished will not be accepted.

C. Instructions: Contractor shall provide qualified, factory-trained manufacturers' representatives to give detailed training 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 contractor shall submit a course outline with associated material to the COR for review and approval prior to scheduling training to ensure the subject matter covers the expectations of the VA and the contractual requirements. 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 Medical Center.

C. Contractor shall be prepared to receive this equipment from Government and store or place such equipment not less than 90 days before Completion Date of project.

1. Storage space for equipment will be provided by the Government and the Contractor shall be prepared to unload and store such equipment therein upon its receipt at the Medical Center.

D. Notify the Contracting Officer in writing, 60 days in advance, of date on which Contractor will be prepared to receive equipment furnished by Government. Arrangements will then be made by the Government for delivery of equipment.

1. Immediately upon delivery of equipment, Contractor shall arrange for a joint inspection thereof with a representative of the Government. At such time the Contractor shall acknowledge receipt of equipment described, make notations, and immediately furnish the Government representative with a written statement as to its condition or shortages.
2. Contractor thereafter is responsible for such equipment until such time as acceptance of contract work is made by the Government.

E. Equipment furnished by the Government will be delivered in a partially assembled (knock down) condition in accordance with existing standard commercial practices, complete with all fittings, fastenings, and appliances necessary for connections to respective services installed under contract. All fittings and appliances (i.e., couplings, ells, tees, nipples, piping, conduits, cables, and the like) necessary to make the connection

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

F. Completely assemble and install the Government furnished equipment in place ready for proper operation in accordance with specifications and drawings.

G. Furnish supervision of installation of equipment at construction site by qualified factory trained technicians regularly employed by the equipment manufacturer.

1.27 RELOCATED ITEMS

A. Contractor shall disconnect, dismantle as necessary, remove and reinstall in new location, all existing equipment and items indicated or otherwise shown to be relocated by the Contractor.

B. Perform relocation of such equipment or items at such times and in such a manner as directed by the COR.

C. Suitably cap existing service lines, such as steam, condensate return, water, drain, gas, air, vacuum and/or electrical, at the main 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)

1.29 CONSTRUCTION SIGN

A. Provide a Construction Sign where directed by the COR. All wood members shall be of framing lumber. Cover sign frame with 0.7 mm (24 gage) galvanized sheet steel nailed securely around edges and on all bearings. Provide three 100 by 100 mm (4 inch by 4 inch) posts (or equivalent round posts) set 1200 mm (four feet) into ground. Set bottom of sign level at 900 mm (three feet) above ground and secure to posts with through bolts. Make posts full height of sign. Brace posts with 50 x 100 mm (two by four inch) material as directed.

B. Paint all surfaces of sign and posts two coats of white gloss paint. Border and letters shall be of black gloss paint, except project title which shall be blue gloss paint.

C. Maintain sign and remove it when directed by the COR.

D. Detail Drawing of construction sign showing required legend and other characteristics of sign is attached hereto and made a part of this specification.

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. Drawing details in VA Signage Design Manual, Section 11 Specialty Signs (found on VA TIL) show required legend and other

characteristics of sign and are attached hereto and is made a part of this specification.

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 of construction progress and at selected milestones including electronic indexing, navigation, storage and remote access to the documentation, as per these specifications. The commercial photographer or the subcontractor used for this work shall meet the following qualifications:

1. Demonstrable minimum experience of three (3) years in operation providing documentation and advanced indexing/navigation systems including a representative portfolio of construction projects of similar type, size, duration and complexity as the Project.
2. Demonstrable ability to service projects throughout North America, which shall be demonstrated by a representative portfolio of active projects of similar type, size, duration and complexity as the Project.

B. Photographic documentation elements:

1. Each digital image shall be taken with a professional grade camera with minimum size of 6 megapixels (MP) capable of producing 200x250mm (8 x 10 inch) prints with a minimum of 2272 x 1704 pixels and 400x500mm (16 x 20 inch) prints with a minimum 2592 x 1944 pixels.
2. Indexing and navigation system shall utilize actual AUTOCAD construction drawings, making such drawings interactive on an on-line interface. For all documentation referenced herein, indexing and navigation must be organized by both time (date-stamped) and location throughout the project.

3. Documentation shall combine indexing and navigation system with inspection-grade digital photography designed to capture actual conditions throughout construction and at critical milestones. Documentation shall be accessible on-line through use of an internet connection. Documentation shall allow for secure multiple-user access, simultaneously, on-line.
4. Before construction, the building pad, adjacent streets, roadways, parkways, driveways, curbs, sidewalks, landscaping, adjacent utilities and adjacent structures surrounding the building pad and site shall be documented. Overlapping photographic techniques shall be used to ensure maximum coverage. Indexing and navigation accomplished through interactive architectural drawings. If site work or pad preparation is extensive, this documentation may be required immediately before construction and at several pre-determined intervals before building work commences.
5. Construction progress for all trades shall be tracked at pre-determined intervals, but not less than once every thirty (30) calendar days ("Progressions"). Progression documentation shall track both the exterior and interior construction of the building. Exterior Progressions shall track 360 degrees around the site and each building. Interior Progressions shall track interior improvements beginning when stud work commences and continuing until Project completion.
6. As-built condition of pre-foundation utilities and site utilities shall be documented prior to pouring footers, 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 ensure 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 ensure 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 ensure 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 ensure maximum coverage. Indexing and navigation accomplished through interactive architectural drawings.
10. Miscellaneous events that occur during any Contractor site visit, or events captured by the Department of Veterans Affairs independently, shall be dated, labeled and inserted into a Section in the navigation structure entitled

"Slideshows," allowing this information to be stored in the same "place" as the formal scope.

11. Customizable project-specific digital photographic documentation of other details or milestones. Indexing and navigation accomplished through interactive architectural plans.
12. Monthly (29 max) exterior progressions (360 degrees around the project) and slideshows (all elevations and building envelope). The slideshows allow for the inclusion of Department of Veterans Affairs pictures, aerial photographs, and timely images which do not fit into any regular monthly photo path.
13. Weekly (21 Max) Site Progressions - Photographic documentation capturing the project at different stages of construction. These progressions shall capture underground utilities, excavation, grading, backfill, landscaping and road construction throughout the duration of the project.
14. Regular (8 max) interior progressions of all walls of the entire project to begin at time of substantial framed or as directed by the COR through to completion.
15. Detailed Exact-Built of all Slabs for all project slab pours just prior to placing concrete or as directed by the COR.
16. Detailed Interior exact built overlapping photos of the entire building to include documentation of all mechanical, electrical and plumbing systems in every wall and ceiling, to be conducted after rough-ins are complete, just prior to insulation and or drywall, or as directed by COR.
17. Finished detailed Interior exact built overlapping photos of all walls, ceilings, and floors to be scheduled by COR prior to occupancy.

18. In event a greater or lesser number of images than specified above are required by the COR, adjustment in contract price will be made in accordance with clause entitled "CHANGES" (FAR 52.243-4).

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

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

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

F. Upon completion of the project, final copies of the documentation (the "Permanent Record") with the indexing and navigation system embedded (and active) shall be provided in an electronic media format, typically a DVD or external hard-drive. Permanent Record shall have Building Information Modeling (BIM) interface capabilities. On-line access terminates upon delivery of the Permanent Record.

1.32 FINAL ELEVATION DIGITAL IMAGES

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

B. Photographs shall be taken upon completion, including landscaping. They shall be taken on a clear sunny day to obtain sufficient detail to show depth and to provide clear, sharp pictures. Pictures shall be 400 mm x 500 mm (16 by 20 inches), printed on regular weight paper, matte finish archival grade

photographic paper and produced by a RA4 process from the digital image with a minimum 300 PPI. Identifying data shall be carried on label affixed to back of photograph without damage to photograph and shall be similar to that provided for final construction photographs.

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

1.33 HISTORIC PRESERVATION (NOT USED)

1.34 VA TRIRIGA CPMS (NOT USED)

1.35 CLEANING AND CLOSEOUT

A. After construction is complete

a. Pressure wash all louvers

b. Wash storefront glazing

c. Clean adjacent buildings impacted by construction activity associated with this project.

1.36 ADDITIONAL PROJECT REQUIREMENTS

A. Infection Control:

1. An Infection Control permit has been issued for this project. At a minimum, the permit requires the contractor to construct barriers / fencing, contain and utilize proper dust control measures. Additional infection control measures for this

project may be required to maintain the safety of patients, visitors and employees.

B. Status Reports:

1. The Contractor shall provide monthly status reports throughout the duration of the contract, or more frequently as directed by the COR or CO. The reports should include at a minimum the items listed below. The status report will be supplied as a digital product to the Government in a Microsoft Word compatible format (*.DOC) or Portable Document Format (*.PDF) that can be emailed to COR, however, note that the VA email cannot accept file sizes larger than 5mb. Files over that size may be provided through an internet-based file sharing software such as sharepoint. The reporting period will begin at Notice to Proceed.
    a) Photographs of work taken during the reporting period, specifically the following iterations:
    b) As built (pre-demo) images of any exposed building structural element, electric, plumbing or other utility system
    c) Completed demolition, showing base condition
    d) Progress photos
    e) Photos of any area of concern
    f) Photos of items subsequently hidden or covered as construction progresses
    g) Progress Report Update
    h) Itemized list of progress completed during the reporting period
    i) Itemized list of tasks behind schedule
    j) Updated project schedule

k) Any Requests for future work, i.e. access, Shutdowns, Utility coordination, VA Engineering team assistance, etc.

l) Project and safety issues, or other concerns

m) Certified Payroll

An updated project schedule and project progress status report shall be supplied with each invoice. Invoices will not be processed without these documents.

C. Meetings:

1. Meetings will be held once each month, or more or less frequently as directed by the COR or CO. Meetings will start after the initial kickoff meeting. Meeting location and exact schedule will be arranged as agreed upon between the VA and Contractor. The intent of the meetings is to discuss the project schedule, status of submittals and RFIs, construction progress, cause of delays, issues / concerns and safety, and review the status report.

   a. The Contractor shall provide meeting minutes to document discussions had during the meeting. The contents of meeting minutes shall include but is not limited to the following information/topics:

      1) Meeting attendees

      2) Narrative to describe contents of meeting (will likely mirror the meeting agenda)

      3) List of action items (for both the Government and the Contractor)

      4) Meeting minutes may be organized in Contractor specified format. Meeting minutes will be supplied as a digital product to the Government in a Microsoft Word compatible format (*.DOC) or Portable Document Format (*.PDF).

5) The Contractor shall provide draft meeting minutes within 5 business days of the meeting. The Government will review and provide comments back to the Contractor within 3 business days of receipt of the draft meeting minutes. The Contractor shall finalize the meeting minutes and submit the final meeting minutes to the Government within 3 business days of receipt of Government comments.
6) The Contractor shall provide a meeting agenda 3 business days prior to the scheduled date of the meeting.
7) Meeting agendas may be organized in Contractor specified format. Meeting agendas will be supplied as a digital product to the Government in a Microsoft Word compatible format (*.DOC) or Portable Document Format (*.PDF). Meeting agendas shall be submitted via email to the COR.

D. Kickoff Meeting and Site Survey:

1. The Contractor shall conduct a kick-off meeting at the VAMC. During the kick-off meeting the Contractor shall discuss the approach to the project, review the project schedule, and review their plan to address any risks associated with the effort.
2. In conjunction with the Kick-off Meeting, the Contractor will be given another opportunity to survey areas to assess current site conditions and gather information necessary to carry out required tasks.

E. Project Submittals:

1. The contractor shall provide submittals and shop drawings for review prior to starting physical construction work. The exact number and type of submittals required to start physical

construction will ultimately be determined by the CO or COR, and is dependent on the contractors proposed / VA approved project schedule and sequencing. Submittals must be approved prior to starting any work associated with the submittal. A base submittal log is included in section 01 33 23 of the project specifications.

2. Provide a transmittal with each submittal containing project title, location, project number, date, subcontractor name if applicable, associated section of the specifications, product identification, and revision number if submittal is not initially approved.
3. The contractor is advised to carefully review project documents to develop an understanding of the number and type of submittals required. The contractor shall assume that any products, materials or equipment that is part of parking ramp expansion construction will require a submittal and approval prior to use / integration. In addition to products, materials and equipment; the contractor will be required to submit work plans, phasing plans, accident prevention plan, activity hazard analysis, fire safety plan and lift plans.
4. *All submittals must be submitted in advance of work / as early as possible as to not cause scheduling delays. It is recommended that the contractor submit a minimum of 30 days in advance of any work that depends on approval of a submittal.

F. Preconstruction Conference:

1. Contractor shall attend a Preconstruction Conference. This meeting will be a follow-up to the project Kick Off Meeting.
   a. In preparation for this meeting the Contractor shall submit:

1) An updated work plan that adds additional details based upon approved submittal information.
2) Revised or new Activity Hazard Analysis (AHA) based on approved submittals.
3) Any additional clarifying details about the work to be performed that have been updated based upon the approved submittals.
4) Any action items resulting from this meeting shall be addressed prior to ordering any materials or starting construction work.

G. Construction Inspections:

1. Periodic formal and informal construction inspections will be performed by VA staff or approved agents throughout the construction process to assess the quality and compliance of the project in comparison to the Contract Documents. Typical inspection examples include review of safety, ICRA requirements, demolition, preparation for and installation of final elements and finishes.
2. Any findings identified during an inspection as having a negative impact on the project will be photographed, documented in writing, and provided to the contractor.
3. The Contractor shall respond in writing and provide evidential proof of compliance / rectification / resolution to each finding identified.
4. Some findings may require resolution prior to moving to the next construction process.

H. Verification:

1. Inspection of completed work shall be conducted jointly before final acceptance of the constructed product. The groups that will participate in the verification process include:
   a. Prime Contractor
   b. Subcontractor (as applicable)
   c. VA Engineering and approved agents
2. Any work that does not pass inspection, the Contractor shall troubleshoot the issue and determine the root cause of the problem.
3. If the root cause is the result of the construction work, the Contractor shall repair and/or replace the faulty construction work and any subsequent damage at no additional cost to the Government.
4. If the root cause is the result of faulty equipment or materials (manufacturer defect), the Contractor shall coordinate with the manufacturer / supplier to repair and / or replace the faulty equipment or materials and any subsequent damage at no additional cost to the Government.

- - - E N D - - -

SECTION 01 32 16.15
PROJECT SCHEDULES
(SMALL PROJECTS – DESIGN/BID/BUILD)

1.1 DESCRIPTION

A. The Contractor will develop a fully Resource loaded (cost) Network Analysis System (NAS) plan/diagram and computer generated schedule demonstrating fulfillment of the entire contract requirements, will keep the plan and computer generated schedule up-to-date in accordance with the specification requirements of this section and will utilize the plan for scheduling, coordinating, mitigating and monitoring work under this contract (including all activities of subcontractors, equipment vendors and suppliers) and verification of every Periodic Progress Schedule Updates and Progress Payment Submission of the work under this contract.

1.2 PROJECT SCHEDULER

A. Designate a qualified 3rd-party scheduling consultant who will develop and maintain the project schedule.

B. The scheduling consultant must have five (5) years of experience as a lead project scheduler or previous scheduling experience on at least three (3) projects of similar size and scope.

C. The scheduling consultant must be prepared to discuss, in detail, the proposed sequence of work and methods of operation, and how that information will be communicated through the progress schedule at the preconstruction meeting.

D. The scheduling consultant is required to attend a monthly schedule meeting and make site visits to prepare, develop, and maintain the progress schedules.

1.3 SUBMITTALS

A. Initial Schedule:

1. Submit an initial schedule within 7 calendar days after Notice to Proceed (NTP).
   a. Include full schedule details for the first 60 calendar days of work starting on the NTP date and show the schedule ending on or before the Contract Completion Date (CCD).
   b. Provide a summary bar chart schedule (acceptable formats include, but are not limited to, Microsoft Excel, Microsoft Project, Oracle Primavera P6, and Gantt Chart).

c. Show the proposed sequence, durations, early and late start dates for major work activities.
d. Show the proposed calendar dates for starting and finishing initial contract activities including, but not limited to, set up of construction site, site layouts, travel routes, waste, and staffing areas.

2. Conduct a schedule review meeting with the Government within 14 calendar days after NTP. At this meeting, plan to discuss the proposed schedule for the entire project, including both the detailed first 60-day period covered by the initial schedule as well as the following summary schedule. If deviations to the staging, phasing, or sequencing required by the contract documents are proposed, be prepared to discuss these deviations.
3. The Government will respond by approving the initial schedule, rejecting the schedule and identifying the reason for rejection, or by asking the contractor for additional information clarifying the proposed schedule activities and timelines.
4. The Government will use the approved initial schedule to monitor progress until the baseline schedule is approved.
5. The Government may withhold progress payments until the initial schedule is approved.

B. Schedule of Costs.

1. No more than 30 calendar days after receipt of the Notice to Proceed, prepare and submit a schedule of costs to the Government for review, in accordance with the technical and schedule submittal requirements listed in this is specification.
2. The approved Schedule of Costs will serve as a tool in addition to the required monthly schedule update to determine progress payments to the Contractor for work completed.
3. The costs shown on the Schedule of Costs must represent true costs and the work activities/events match the project schedule work activities/events. The VA Contracting Officers Representative (VA COR) may require the Contractor to submit its original estimate sheets or other supporting documentation to substantiate the detailed makeup of the cost schedule.
4. The total costs of all work activities/events listed on the Schedule of Costs must equal the total contract price. The breakdown must

include all line items specified in the contract and work activities shown on the schedule.

5. The Contractor is responsible for regularly updating the Schedule of Costs to reflect any approved changes to the contract scope or cost structure. Updates must be submitted for approval to the Contracting Officer to ensure continued accuracy and compliance with contract requirements.
6. Failure to submit or maintain an accurate and approved Schedule of Costs may result in delayed progress payments and potential penalties as outlined in the contract agreement.
7. All documentation related to the Schedule of Costs, including original estimate sheets and cost substantiation documents, must be maintained and made available for review upon request by the Contracting Officer or VA COR.

C. Baseline Schedule.

1. No more than 30 calendar days after approval of the initial schedule, prepare and submit a baseline schedule to the Government for review, in accordance with the technical and schedule submittal requirements listed in this specification.
2. The Government will respond by accepting the baseline schedule, rejecting the schedule and identifying the reason for rejection, or by asking for more information.
3. Address the reasons for rejection or provide the information requested and resubmit the revised baseline schedule no more than 10 calendar days after the Government’s response.
4. The Government may withhold progress payments until the baseline schedule is approved.
5. No stored material work activities will be shown or approved be on the baseline schedule.
6. The Baseline Schedule Critical Path of the project shall be limited to:
   a. No more than 20% of the work activities shall be on the critical and near-critical path(s). Critical path is defined as activities with zero (0) day total float. Near-Critical path(s) is defined as activities with one (1) to twenty (20) days of total float.
   b. Multiple Critical paths will not be allowed.
7. The Baseline Schedule shall contain sufficient detail such that no more than 5% of work activities have durations exceeding 20 work

days, in accordance with DCMA 14-point Schedule Assessment Guidelines.

D. Monthly Schedule Update.

1. Prepare and submit a monthly schedule update to the Government that depicts the status of the project as of the end of the month, in accordance with the technical and schedule submittal requirements listed in this specification.
2. The update must reflect a new data date, work performed up to, but not including, the new data date, and the plan for completing the project.
3. Submit the schedule update by the first Monday of the following month.
4. The Government may withhold progress payments until the monthly schedule update is approved.
5. Each monthly schedule update must be submitted with the associated schedule log.

E. Revised Schedule.

1. The Government has the right to request a revised schedule.
2. Circumstances leading to such a request include, but are not limited to:
   a. A projected or forecasted delay to scheduled interim or project completion dates.
   b. A significant difference between the actual sequence or duration of work and that depicted in the schedule.
3. Prepare and submit the revised schedule no more than 10 calendar days after the Government’s request in accordance with the technical and schedule submittal requirements listed in this specification.
4. The Government will respond by accepting the revised schedule, rejecting the schedule and identifying the reasons for rejection, or by requesting more information. Address the reasons for rejection or submit the information requested no more than 10 calendar days after the Government’s request.
5. The Government may withhold progress payments until the revised schedule is approved.

F. Final Schedule.

1. Within 30 calendar days of final acceptance of the project, submit a final schedule with actual start and finish dates for each activity.

2. Include with the submission a certification signed by a principal of the firm stating: “To the best of my knowledge, the enclosed final schedule reflects the actual start and finish dates of the activities contained herein.”

G. The Government’s approval of any schedule, whether initial, baseline, update, or revised, does not modify the contract or constitute endorsement or validation by the Government of the Contractor's logic, activity durations, or assumptions in creating the schedule. By approving the schedule, the Government does not guarantee that the project can be performed or completed as scheduled. If the Contractor or the Government discover errors after the schedule has been approved, correct the error(s) in the next schedule submission.

1.4 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. Distribute overhead, profit, and general conditions proportionally across all work activities/events along the project's length (critical path). 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 and 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. Negative work activity/event cost data will not be acceptable, except on VA issued contract changes.

B. The Contractor shall cost load work activities/events for guarantee period services, test, balance and adjust various systems in accordance with the provisions in Article, FAR 52.232 – 5 (PAYMENT UNDER FIXED PRICE CONSTRUCTION CONTRACTS) and VAAR 852.232 – //Article 70 Without NAS-CPM// //Article 71 Including NAS-CPM//for (PAYMENTS UNDER FIXED PRICE CONSTRUCTION).

C. In accordance with FAR 52.236 – 1 (PERFORMANCE OF WORK BY THE CONTRACTOR), 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 of the project for which the Contractor's forces will perform the work.

D. The Contractor shall cost load work activities/events for all Bid Items. The sum of each Bid Item work shall equal the value of the bid item in the Contractors' bid.

E. With prior written approval from the Contracting Officer, the Contractor may request payment for suitably stored and maintained materials/equipment that conform to specifications and are ready for installation, in accordance with the provisions in VAAR 852.232 - //Article 70 Without NAS-CPM// //Article 71 Including NAS-CPM//for (PAYMENTS UNDER FIXED PRICE CONSTRUCTION). Requests must include comprehensive documentation, such as invoices, proof of payment, and evidence of secure storage with appropriate insurance. Upon approval, payment for materials will be made in accordance with contract provisions, and title to the materials shall vest in the Owner. The contractor is responsible for replacement of non-confirming or damaged materials at no additional cost to the owner. Payment for stored materials will be reflected on the schedule by cost-loading the delivery activity to represent payment upon material receipt at the site, while the installation activity will be separately cost-loaded to represent payment under completion of installation. These schedule will clearly delineate submittal, procurement, delivery (cost-loaded for stored material payment), and installation (cost-loaded for installed material payment) as distinct activities.

1.5 PROJECT SCHEDULE REQUIREMENTS

A. Show on the project schedule the sequence of work activities/events required for complete performance of all items of work. The Contractor shall:

1. 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 Facilities 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.

2. 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.

3. Break up the work into activities/events of a duration no longer than 20 work days each or one reporting period, 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 VA COR may approve the showing of a longer duration. The duration for VA approval of any required submittal, shop drawing, or other submittals will follow review requirements as specified in Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

4. 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.

5. The schedule shall be generally numbered in such a way to reflect either discipline, phase or location of the work.

B. The Contractor shall submit the following supporting data in addition to the project schedule:

1. The appropriate project calendar including working days and holidays.

2. The planned number of shifts per day.

3. The number of hours per shift.

C. Failure of the Contractor to include this data shall delay the review of the submittal until the Contracting Officer is in receipt of the missing data.

D. To the extent that the Project Schedule or any revised Project Schedule shows anything not jointly agreed upon, it shall not be deemed to have

been approved by the VA COR. 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 VA COR's approval of the Project Schedule.

E. Separate Cost-Loaded Activities for Adjusting and Testing Systems:
   1. The CPM shall include separate cost-loaded activities for the adjustment and testing of systems in accordance with the provisions in VAAR 852.232 - //Article 70 Without NAS-CPM// //Article 71 Including NAS-CPM//for (PAYMENTS UNDER FIXED PRICE CONSTRUCTION). The percentages provided shall be used to determine the cost of adjust and test work activities/ events, identifying the value of the work for payment purposes.

1.6 TECHNICAL REQUIREMENTS

A. Software Compatibility Requirements.
   1. The Government uses Oracle Primavera P6 Professional and Microsoft Project Professional to schedule and monitor its construction projects.
   2. Prepare and maintain the schedule using one of the following software options:
      a. Oracle Primavera P6 Professional (Version 22 or higher unless pre-approved)
      b. Microsoft Project Professional (Version 2021 or Higher)

B. Schedule Requirements.
   1. Calculate the schedule using the Retained Logic scheduling option unless written authorization is obtained from the Government to use the Progress Override scheduling option.
   2. At least 90% of all schedule activities shall be assigned to Finish-to-Start (FS) relationships.
   3. Do not use the following types of logic relationships:
      a. Negative lags
      b. Lead and lag time activities
      c. Start-to-finish or finish-to-finish relationships
      Open ends. Only the first activity will have no predecessor, and only the last activity will have no successor.
      d. Constraints (a limited number of constraints may be used only with the Government's written authorization).

e. Manually modified dates (manually modify dates may be used only with the Government's written authorization).

4. For any logic relationships that do not meet the criteria above in 1.6.B.2, the contractor must provide justification for the noncompliance to obtain the Government's authorization to proceed. If the Government does not provide written authorization, the contractor must resubmit the schedule submission.
5. Include the following work activities, as applicable:
   a. Work to be performed by the contractor, subcontractors, and suppliers.
   b. Work to be performed by the Government, other contractors, and third parties such as permitting authorities or other entities required for completion of the project.
   c. The project start date, scheduled completion date, and other contractually mandated milestones, start and finish dates for phases, and site access or availability dates.
   d. Submittals and Government review and approval of submittals (Reference specification section 01 33 23 for submission requirements).
   e. Fabrication, delivery, installation, testing, and similar activities for materials, equipment, and related items.
   f. Sampling and testing periods.
   g. Settlement or surcharge periods.
   h. Cure periods.
   i. Utility notifications, shutdowns, relocations, and similar activities.
   j. Installation, erection and removal, and similar activities related to temporary systems or structures such as temporary electrical systems or shoring.
   k. Punch list, substantial completion, final cleanup, and similar activities.
   l. Required acceptance testing, inspections, or similar activities.
   m. Durations for receipt of permits or acquisition of rights of way.
6. Define the following attributes for each activity in the schedule:
   a. A unique alphanumeric Activity ID.
   b. A unique descriptive name, using such clear, concise attributes as work type, location so each activity is easily understood. Avoid name abbreviations or overly long activity names to ensure

each activity can be objectively measured and clearly understood by all stakeholders.

c. A duration stated in workdays of no more than 20 workdays unless a longer duration is requested by the contractor and approved by the Government.

d. Uses codes for responsibility, phasing, and staging.

1.7 SCHEDULE SUBMISSION REQUIREMENTS

A. Preparing Schedule on Owner's Database. If the schedule is prepared using My Primavera in the owner's database, then for each schedule submission, submit the following items:

1. A transmittal letter to the owner identifying which schedule in the database is being submitted for review.
2. A narrative report.

B. Preparing Schedule on Separate Database. If the schedule is prepared using Primavera Version 6.0, Primavera for Contractors, or another software compatible with Primavera Version 6.0, then, for each schedule submission, submit the following items:

1. A transmittal letter
2. A narrative report
3. A Primavera Version 6.0 compatible electronic file of the schedule.
4. The critical path in bar chart format (Longest Path sort)
5. Work paths with total float values within 20 workdays of the critical path's total float value in bar chart format. For example, if the critical path has a total float value of zero, then show all the work paths with total float values of 20 or less.
6. An activity network diagram plotted in color, on E-size paper, with each sheet of the plot including a title, match data for diagram correlation, a page number, and a legend. The activity network diagram should only be submitted with schedules with revised relationships or activity durations.
7. An updated schedule log associated with each Monthly Schedule Update.
8. A project S-Curve in both graphical and tabular format, displaying both schedule and cost data.
9. A Predecessor/Successor report with the following items for each activity:

   Activity ID and description

   a.Original duration

b. Remaining duration
c. Calendar ID
d. Predecessors and Successors
e. Early start date
f. Early finish date
g. Late start date
h. Late finish date
i. Total float
j. Relationship type
k. Lags
l. Constraints

C. Preparing Schedule on using Microsoft Project Professional, submit the following items:
1. A transmittal letter
2. A narrative report
3. A Microsoft Project Professional .mpp electronic file of the schedule.
   a. The critical path in bar chart format (Longest Path sort)
   b. Work paths with total float values within 20 workdays of the critical path’s total float value in bar chart format. For example, if the critical path has a total float value of zero, then show all the work paths with total float values of 20 or less.
   c. An activity network diagram plotted in color, on E-size paper, with each sheet of the plot including a title, match data for diagram correlation, a page number, and a legend. The activity network diagram should only be submitted with schedules with revised relationships or activity durations.
   d. A project S-Curve in both graphical and tabular format, displaying both schedule and cost data.
   e. A Predecessor/Successor report with the following items for each activity:
      1) WBS and Task Name
      2) Baseline duration
      3) Remaining duration
      4) Predecessors and Successors
      5) Early start date
      6) Early finish date

7) Late start date
8) Late finish date
9) Total slack
10) Constraints

f. A Lag report displaying all lags within the project schedule.

D. Narrative Reports for the Initial and Baseline Schedule. For each submission of the initial and baseline schedule provide a narrative report that includes the following information:

1. Explanation of the overall plan to complete the project, including where the work will begin and how the work and crews will flow through the project
2. Use and application of the workdays per week, number of shifts per day, number of hours per shift, holidays observed, and how the schedule accommodates adverse weather days for each month of activity
3. If the project is a multi-year project, then identify the work to be completed in each construction season
4. A statement explaining why the scheduled completion date is forecast to occur before or after the contract completion date.
5. An explanation stating why any of the contract milestone dates are forecast to occur late.
6. A description of problems or issues anticipated
7. A description of anticipated delays, including:
   a. Identification of the delayed activity by activity ID and description
   b. Type of delay
   c. Cause of the delay
   d. Effect of the delay on other activities, milestones, and completion dates
   e. Identification of the actions needed to avoid or mitigate the delay
   f. A description of the critical path
   g. A description of work paths with total float values within 20 workdays of the critical path’s total float value. For example, if the critical path has a total float value of zero, then describe all the work paths with total float values of 20 or less.

h. A statement identifying constraints and an explanation of the reason for and purpose of each constraint.

i. A statement describing the status of required permits.

j. The statement describing the reason for the use of each lag.

E. Narrative Reports for the Monthly Schedule Update and Revised Schedule. For each submission of the monthly schedule update and revised schedule provide a narrative report that includes the following information:

1. A description of the status of the scheduled completion date (and any contract milestone date(s)) since the last schedule submitted
2. A statement explaining why the scheduled completion date is forecast to occur before or after the contract completion date. An explanation stating why any of the contract milestone dates are forecasted to occur late
3. A description of the work performed since the last schedule update
4. A description of unusual labor, shift, equipment, or material conditions or restrictions encountered or anticipated
5. A description of the problems encountered or anticipated since the last schedule submission
6. A statement that identifies and describes any current and anticipated delays. A discussion of delays in the narrative report does not constitute notice and does not replace the need for the contractor to provide notice as required by the contract. Include the following:

   a. Identification of the delayed activity by activity ID and description

   b. Type of delay

   c. Cause of the delay

   d. Effect of the delay on other activities, milestones, and completion dates

   e. Identification of the actions needed to avoid or mitigate the delay

   f. A description of the critical path

   g. A description of changes in the critical path and schedule completion date (for the project or its milestones) from the last schedule submission

   h. Descriptions of the status of work paths that have total float values within 20 workdays of the critical path identified in the previous schedule submission

i. Descriptions of work paths with total float values within 20 workdays of the critical path's total float value. For example, if the critical path has a total float value of negative 25, then show all the near-critical paths with total float values of negative 5 or less.

j. A statement or Schedule Comparison Report that identifies the changes made between the previous schedule submission and the current proposed schedule, including, but not limited to:

1) Data date
2) Completion date
3) Activity code assignments
4) Scheduling options
5) Activity descriptions
6) Added activities
7) Deleted activities
8) Added activity relationships
9) Deleted activity relationships
10) Activity original durations
11) Activity remaining durations
12) Activity actual start and finishes
13) Percent complete
14) Constraints
15) Activity resources
16) Activity costs
17) Activity coding

k. A statement providing the status of pending items, including, but not limited to:

1) Permits
2) Change orders
3) Time extension requests
4) Noncompliance or similar notices are indicating deficiencies in the contractor's performance.

7. Prior to Baseline Schedule Acceptance.

a. At the time of the Pre-Construction Conference, prior to the issuance of the project Notice to Proceed, the Contractor and the Contractor's Scheduling Consultant, will arrange a separate meeting with the Contracting Officer and/or the VA COR to discuss the requirements of this specification in detail. The Contractor

and the Contractor’s scheduling consultant, will acknowledge, in writing, their understanding and compliance with the requirement of this specification.

b. With exception of bonds, insurance, and limited mobilization cost associated with preparatory work such as site trailers, staging areas, haul roads etc., the approval of the baseline NAS schedule is a condition precedent to:

1) Processing of contractor’s pay request(s) for any construction activities/items of work.

2) Review of any schedule updates.

c. Government review comments on the contractor’s schedule will not relieve the contractor from compliance with requirements of this specification section and the remaining contract documents.

1.8 QUALITY ASSURANCE

A. Quality assurance of the schedule must conform to the following standards

1. DCMA 14-point Schedule Assessment Guidelines
2. GAO’s Schedule assessment guide - Best Practices for Project Schedules Appendix II.

1.9 PAYMENT TO THE CONTRACTOR

A. Monthly, the contractor shall submit an application and certificate for payment using // VA Form 10-6001a // or //the AIA application and certificate for payment documents G702 & 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, FAR 52.232 – 5 (PAYMENT UNDER FIXED-PRICE CONSTRUCTION CONTRACTS) and VAAR 852.232 – //Article 70 Without NAS-CPM// //Article 71 Including NAS-CPM//for (PAYMENTS UNDER FIXED PRICE CONSTRUCTION). The Contractor shall be entitled to a monthly progress payment upon approval of estimates as determined from the currently approved updated project schedule. Monthly payment requests shall include: a listing of all agreed upon project schedule changes and associated data; and electronic files of the resulting monthly updated schedule, provided in both PDF and native scheduling software formats.

B. Approval of the Contractor’s monthly Application for Payment shall be contingent, among other factors, on the submittal of a satisfactory monthly update of the project schedule.

C. Payment for adjust and test activities will be made only after the Contractor has demonstrated that each of the systems is substantially complete and operates as required by the contract. The Contractor must adequately document

1.10 PAYMENT AND PROGRESS REPORTING

A. Monthly schedule update meetings will be held on dates mutually agreed to by the VA COR and the Contractor. Contractor and their scheduling consultant shall attend all monthly schedule update meetings. The Contractor shall accurately update the Project Schedule and all other data required and provide this information to the VA COR three work days in advance of the schedule update 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 Project Schedule.
4. Changes in activity/event sequence and/or duration which have been made, pursuant to the provisions of following Article, ADJUSTMENT OF CONTRACT COMPLETION.
5. Completion percentage for all completed and partially completed activities/events.
6. Logic and duration revisions required by this section of the specifications.
7. Activity/event duration and percent complete shall be updated independently.

B. After completion of the joint review, the contractor shall generate an updated computer-produced calendar-dated schedule and supply the VA COR with reports in accordance with the Article, PROJECT SCHEDULE REQUIREMENTS, specified.

C. After completing the monthly schedule update, the contractor’s representative or scheduling consultant shall rerun all current period contract change(s) against the prior approved monthly 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 Contractor shall use the schedule logic and/or durations provided and approved by

the COR. After each rerun 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 1.3 and 1.7. This electronic submission is separate from the regular monthly 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 network diagram is approved, the contractor must recreate all manual progress payment updates on this approved network diagram 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.

D. Following approval of the Baseline Schedule, the VA, the General Contractor, its approved CPM Consultant, VA COR, and all subcontractors needed, as determined by the SRE, shall meet to discuss the monthly 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 monthly 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.

1.11 RESPONSIBILITY FOR COMPLETION

A. If it becomes apparent from the current revised monthly progress schedule that phasing or contract completion dates will not be met, the Contractor shall execute some or all 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 VA Contracting Officer for the proposed schedule changes. If such actions are approved, the representative schedule revisions shall be incorporated by the Contractor into the Project Schedule before the next update, at no additional cost to the Government.

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 clearly explained narrative justification, CPM data and supporting evidence as the VA COR 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 network, 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 FAR 52.243 – 4 (Changes). 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 network diagram.

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.

- - - END - - -

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

PART 1 – GENERAL

1.1 DESCRIPTION

A. This specification defines the general requirements and procedures for submittals. A submittal is information submitted for VA review to establish compliance with the contract documents.

B. Detailed submittal requirements are found in the technical sections of the contract specifications. The Contracting Officer may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective technical specifications at no additional cost to the government.

C. VA approval of a submittal does not relieve the Contractor of the responsibility for any error which may exist. The Contractor is responsible for fully complying with all contract requirements and the satisfactory construction of all work, including the need to check, confirm, and coordinate the work of all subcontractors for the project. Non-compliant material incorporated in the work will be removed and replaced at the Contractor's expense.

1.2 DEFINITIONS

A. Preconstruction Submittals: Submittals which are required prior to issuing contract notice to proceed or starting construction. For example, Certificates of insurance; Surety bonds; Site-specific safety plan; Construction progress schedule; Schedule of values; Submittal register; List of proposed subcontractors.

B. Shop Drawings: Drawings, diagrams, and schedules specifically prepared to illustrate some portion of the work. Drawings prepared by or for the Contractor to show how multiple systems and interdisciplinary work will be integrated and coordinated.

C. Product Data: Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions, and brochures, which describe and illustrate size, physical appearance, and other characteristics of materials, systems, or equipment for some portion of the work. Samples of warranty language when the contract requires extended product warranties.

D. Samples: Physical examples of materials, equipment, or workmanship that illustrate functional and aesthetic characteristics of a material or product and establish standards by which the work can be judged. Color samples from the manufacturer's standard line (or custom color samples if specified) to be used in selecting or approving colors for the project. Field samples and mock-ups constructed to establish standards by which the ensuing work can be judged.

E. Design Data: Calculations, mix designs, analyses, or other data pertaining to a part of work.

F. Test Reports: Report which includes findings of a test required to be performed by the Contractor on an actual portion of the work. Report which includes finding of a test made at the job site or on sample taken from the job site, on portion of work during or after installation.

G. Certificates: Document required of Contractor, or of a manufacturer, supplier, installer, or subcontractor through Contractor. The purpose is to document procedures, acceptability of methods, or personnel qualifications for a portion of the work.

H. Manufacturer's Instructions: Pre-printed material describing installation of a product, system, or material, including special notices and MSDS concerning impedances, hazards, and safety precautions.

I. Manufacturer's Field Reports: Documentation of the testing and verification actions taken by manufacturer's representative at the job site on a portion of the work, during or after installation, to confirm compliance with manufacturer's standards or instructions. The documentation must indicate whether the material, product, or system has passed or failed the test.

J. Operation and Maintenance Data: Manufacturer data that is required to operate, maintain, troubleshoot, and repair equipment, including manufacturer's help, parts list, and product line documentation. This data shall be incorporated in an operations and maintenance manual.

K. Closeout Submittals: Documentation necessary to properly close out a construction contract. For example, Record Drawings and as-built drawings. Also, submittal requirements necessary to properly close out a phase of construction on a multi-phase contract.

1.3 SUBMITTAL REGISTER

A. The submittal register will list items of equipment and materials for which submittals are required by the specifications. This list may not be all inclusive and additional submittals may be required by the specifications. The Contractor is not relieved from supplying submittals required by the contract documents but which have been omitted from the submittal register.

B. The submittal register will serve as a scheduling document for submittals and will be used to control submittal actions throughout the contract period.

C. The VA will provide the initial submittal register in electronic format. Thereafter, the Contractor shall track all submittals by maintaining a complete list, including completion of all data columns, including dates on which submittals are received and returned by the VA.

D. After receipt of Notice to Proceed, the Contractor shall submit the initial submittal register for the Contracting Officer's review. See Specification Section 01 32 16.15 – Project Schedules for deliverable deadline for producing the initial submittal register.

D. An acceptable submittal register form is found at the end of this specification section for Contractor reference.

E. The Contractor shall update the submittal register as submittal actions occur and maintain the submittal register at the project site until final acceptance of all work by Contracting Officer.

F. The Contractor shall submit formal monthly updates to the submittal register in electronic format. Each monthly update shall document actual submission and approval dates for each submittal.

1.4 SUBMITTAL SCHEDULING

A. Submittals are to be scheduled, submitted, reviewed, and approved prior to the acquisition of the material or equipment.

B. Coordinate scheduling, sequencing, preparing, and processing of submittals with performance of work so that work will not be delayed by submittal processing. Allow time for potential resubmittal.

C. No delay costs or time extensions will be allowed for time lost in late submittals or resubmittals.

D. All submittals are required to be approved prior to the start of the specified work activity.

1.5 SUBMITTAL PREPARATION

A. Each submittal is to be complete and in sufficient detail to allow ready determination of compliance with contract requirements.

B. Collect required data for each specific material, product, unit of work, or system into a single submittal. Prominently mark choices, options, and portions applicable to the submittal. Partial submittals will not be accepted for expedition of construction effort. Submittal will be returned without review if incomplete.

C. If available product data is incomplete, provide Contractor-prepared documentation to supplement product data and satisfy submittal requirements.

D. All irrelevant or unnecessary data shall be removed from the submittal to facilitate accuracy and timely processing. Submittals that contain the excessive amount of irrelevant or unnecessary data will be returned without review.

E. Provide a transmittal form for each submittal with the following information:

1. Project title, location and number.
2. Construction contract number.
3. Date of the drawings and revisions.
4. Name, address, and telephone number of subcontractor, supplier, manufacturer, and any other subcontractor associated with the submittal.
5. List paragraph number of the specification section and sheet number of the contract drawings by which the submittal is required.
6. When a resubmission, add alphabetic suffix on submittal description. For example, submittal 18 would become 18A, to indicate resubmission.
7. Product identification and location in project.

F. The Contractor is responsible for reviewing and certifying that all submittals are in compliance with contract requirements before submitting for VA review. Proposed deviations from the contract requirements are to be clearly identified. All deviations submitted must include a side by side comparison of item being proposed against item

specified. Failure to point out deviations will result in the VA requiring removal and replacement of such work at the Contractor's expense.

G. Stamp, sign, and date each submittal transmittal form indicating action taken.

H. Stamp used by the Contractor on the submittal transmittal form to certify that the submittal meets contract requirements is to be similar to the following:

CONTRACTOR

(Firm Name)

_____Approved

_____Approved with corrections as noted on submittal data and/or attached sheets(s)

SIGNATURE: _____

TITLE: _____

DATE: _____

1.6 SUBMITTAL FORMAT AND TRANSMISSION

A. Provide submittals in electronic format, with the exception of material samples. Use PDF as the electronic format, unless otherwise specified or directed by the Contracting Officer.

B. Compile the electronic submittal file as a single, complete document. Name the electronic submittal file specifically according to its contents.

C. Electronic files must be of sufficient quality that all information is legible. Generate PDF files from original documents so that the text included in the PDF file is both searchable and can be copied. If documents are scanned, Optical Character Resolution (OCR) routines are required.

D. Provide all electronic documents (submittals) through an electronic FTP file sharing system. Confirm that the electronic FTP file sharing system can be accessed from the VA computer network. The Contractor is responsible for setting up, providing, and maintaining the electronic FTP file sharing system for the construction contract period of performance.

F. Provide hard copies of submittals when requested by the Contracting Officer. Up to 3 additional hard copies of any submittal may be requested at the discretion of the Contracting Officer, at no additional cost to the VA.

1.7 SAMPLES

A. Submit two sets of physical samples showing range of variation, for each required item.

B. Where samples are specified for selection of color, finish, pattern, or texture, submit the full set of available choices for the material or product specified.

C. When color, texture, or pattern is specified by naming a particular manufacturer and style, include one sample of that manufacturer and style, for comparison.

D. Before submitting samples, the Contractor is to ensure that the materials or equipment will be available in quantities required in the project. No change or substitution will be permitted after a sample has been approved.

E. The VA reserves the right to disapprove any material or equipment which previously has proven unsatisfactory in service.

F. Physical samples supplied maybe requested back for use in the project after reviewed and approved.

1.8 OPERATION AND MAINTENANCE DATA

A. Submit data specified for a given item within 30 calendar days after the item is delivered to the contract site.

B. In the event the Contractor fails to deliver O&M Data within the time limits specified, the Contracting Officer may withhold from progress payments 50 percent of the price of the item with which such O&M Data are applicable.

1.9 TEST REPORTS

COR may require specific test after work has been installed or completed which could require contractor to repair test area at no additional cost to contract.

1.10 VA REVIEW OF SUBMITTALS AND RFIS

A. The VA will review all submittals for compliance with the technical requirements of the contract documents. The Architect-Engineer for this project will assist the VA in reviewing all submittals and determining contractual compliance. Review will be only for conformance with the applicable codes, standards and contract requirements.

B. Period of review for submittals begins when the VA COR receives submittal from the Contractor.

C. Period of review for each resubmittal is the same as for initial submittal.

D. VA review period is 21 calendar days for submittals.

E. VA review period is 21 calendar days for RFIs.

F. The VA will return submittals to the Contractor with the following notations:

1. "Approved": authorizes the Contractor to proceed with the work covered.
2. "Approved as noted": authorizes the Contractor to proceed with the work covered provided the Contractor incorporates the noted comments and makes the noted corrections.
3. "Disapproved, revise and resubmit": indicates noncompliance with the contract requirements or that submittal is incomplete. Resubmit with appropriate changes and corrections. No work shall proceed for this item until resubmittal is approved.
4. "Not reviewed": indicates submittal does not have evidence of being reviewed and approved by Contractor or is not complete. A submittal marked "not reviewed" will be returned with an explanation of the reason it is not reviewed. Resubmit submittals after taking appropriate action.

1.11 APPROVED SUBMITTALS

A. The VA approval of submittals is not to be construed as a complete check, and indicates only that the general method of construction, materials, detailing, and other information are satisfactory.

B. VA approval of a submittal does not relieve the Contractor of the responsibility for any error which may exist. The Contractor is responsible for fully complying with all contract requirements and the satisfactory construction of all work, including the need to check, confirm, and coordinate the work of all subcontractors for the project. Non-compliant material incorporated in the work will be removed and replaced at the Contractor's expense.

C. After submittals have been approved, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.

D. Retain a copy of all approved submittals at project site, including approved samples.

1.12 WITHHOLDING OF PAYMENT

Payment for materials incorporated in the work will not be made if required approvals have not been obtained.

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PROJECT SUBMITTAL LOG

Project Location: **Buffalo VAMC** Project Title: **Parking Ramp Expansion** PROJECT NO.: **528-18-375**

Contractor:

Architect-Engineer: BANCROFT ARCHITECTS + ENGINEERS

		SUBMITTAL RECEIVED / ISSUE / RETURN DATES								REVIEW COMMENTS			
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Divison 00 - Special Sections													
00 01 10	Table of Contents												
00 01 15	List of Drawing Sheets												
Division 01 - General Requirements													
01 00 00	**General Requirements**												
A.	Quality Control Plan												
B.	Fire Safety Plan Plan												
C.	Waste Management Plan												
D.	Construction Sign												
E.	Safety Sign												
F.	Schedule of Values (required to VA only)												
G.	Construction Schedule (required to VA only)												
H.	Health and Safety Plan (required to VA only)												
01 32 16.15	**Project Schedules (Small Projects-Design/Bid/Build)**												
A.	Project Schedules												
01 33 23	**Shop Drawings, Product Data, and Samples**												
A.	Submittal Register												
01 35 26	**Safety Requirements**												
A.	Accident Prevention Plan												
01 42 19	**Reference Standards**												
01 45 00	**Quality Control Plan**												
01 45 29	**Testing Laboratory Services**												
01 45 35	**Special Inspections**												
01 57 19	**Temporary Environmental Controls**												
01 58 16	**Temporary Interior Signage**												
01 74 19	**Construction Waste Management**												
A.	Construction Waste Plan												
01 81 13	**Sustainable Construction Requirements**												
A.	Sustainable Action Plan												
01 91 00	**General Commissioning Requirements**												
Division 02 - Existing Conditions													
02 21 13	**Site Surveys**												
02 41 00	**Selective Demolition**												
Division 03 - Concrete													
03 30 00	**Cast-in-Place Concrete**												
03 30 53	**(Short-Form) Cast-in-Place Concrete**												
03 41 33	**Precast Structural Pretension Concrete**												
Division 04 - Masonry													
04 05 13	**Masonry Mortaring**												
04 05 16	**Masonry Grouting**												
04 20 00	**Unit Masonry**												

PROJECT SUBMITTAL LOG

Project Location: **Buffalo VAMC** Project Title: **Parking Ramp Expansion** PROJECT NO.: **528-18-375**

Contractor:

Architect-Engineer: BANCROFT ARCHITECTS + ENGINEERS

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Division 05 - Metals													
05 12 00	**Structural Steel Framing**												
05 50 00	**Metal Fabrications**												
A.	Surgical Light support												
B.	Equpment wall support brackets												
Division 06 - Wood, Plastic and Composites													
06 10 00	**Rough Carpentry**												
A.	Mfr. Literature and data												
Division 07 - Thermal and Moisture Protection													
07 11 13	**Bituminous Dampproofing**												
07 22 00	**Roof and Deck Insulation**												
07 53 23	**EPDM Roofing**												
07 60 00	**Flashing and Sheet Metal**												
07 71 00	**Roof Specialties**												
07 72 00	**Roof Accessories**												
07 92 00	**Joint Sealants**												
A.	Sealants												
07 95 13	**Expansion Joint Cover Assemblies**												
Division 08 - Openings													
08 11 13	**Hollow Metal Doors and Frames**												
A.	Product Data- hollow metal frames												
B.	Shop Drawings												
08 41 13	**Aluminum-Framed Entrances and Storefronts**												
08 71 00	**Door Hardware**												
A.	Product Data												
B.	Samples												
C.	Schedule												
08 80 00	**Glazing**												
A.	Product Data (Treatment Room Exterior Window)												
B.	Shop Drawing (Treatment Room Exterior Window)												
08 90 00	**Louvers and Vents**												
A.	Product Data (Treatment Room Exterior Window)												
B.	Shop Drawing (Treatment Room Exterior Window)												
Division 09 - Finishes													
09 06 00	**Schedule for Finishes**												
09 90 00	**Painting**												
A.	Product Data												
B.	Product Samples												
C.	Painting Schedule												
Division 10 - Specialities													
10 13 00	**Directories**												

PROJECT SUBMITTAL LOG

Project Location: **Buffalo VAMC** Project Title: **Parking Ramp Expansion** PROJECT NO.: **528-18-375**

Contractor:

Architect-Engineer: BANCROFT ARCHITECTS + ENGINEERS

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10 14 00	**Signage**												
A.	Product Data												
B.	Schedule												
C.	Samples												
10 44 13	**Fire Extinguisher Cabinets**												
	FEC Product Data												
Division 11 - Equipment													
Division 12 - Furnishings													
Division 13 - Special Construction													
Division 14 - Conveying Equipment													
14 21 00	**Electric Traction Elevators**												
Division 21 - Fire Suppression													
Division 22 - Plumbing													
22 05 11	**Common Work Results for Plumbing**												
22 05 12	**General Motor Requirements for Plumbing Equipment**												
22 05 23	**General-Duty Valves for Plumbing Piping**												
A.	Product Data												
B.	Test Reports												
C.	Shop Drawings												
D.	Testing Certificate												
22 14 00	**Facility Storm Drainage**												
22 14 29	**Sump Pumps**												
Division 23 - Heating, Ventilating, and Air Conditioning (HVAC)													
23 05 11	**Common Work Results for HVAC**												
23 05 93	**Testing, Adjusting and Balancing for HVAC**												
A.	Name/qualified of TAB agency and specialist												
B.	Design Review report												
C.	Duct Air Leakage report												
D.	System Readiness report												
E.	Final report												
23 34 00	**HVAC Fans**												
23 82 00	**Convection Heating and Cooling Units**												
A.	Room fan coil units												
Division 25 - Integrated Automation													
Division 26 - Electrical													
26 05 11	**Requirements for Electrical Installations**												
26 05 19	**Low-Voltage Electrical Power Conductors and Cables**												
A.	Electrical ratings and insulation type for each conductor and cable.												
B.	Splicing materials and pulling lubricant												
C.	Control wiring												
D.	Splices												

PROJECT SUBMITTAL LOG

Project Location: **Buffalo VAMC** Project Title: **Parking Ramp Expansion** PROJECT NO.: **528-18-375**

Contractor:

Architect-Engineer: BANCROFT ARCHITECTS + ENGINEERS

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E.	Connection and Terminations												
26 05 26	**Grounding and Bonding for Electrical Systems**												
A.	Shop Drawings, Test Reports, Certificates												
B.	Grounding and												
C.	Grounding Connectors												
D.	Equipment rack and cabinet ground basrts												
E.	Ground terminal blocks												
F.	Grounding bus bar												
26 05 33	**Raceway and Boxes for Electrical Systems**												
A.	Conduits/ Fittings/ Boxes- Product Data												
B.	Conduits/ Fittings/ Boxes- Product Data												
26 05 73	**Overcurrent Protective Device Coordination Study**												
26 08 00	**Commissioning of Electrical Systems**												
26 09 23	**Lighting Control**												
A.	Electrick time switch												
B.	Indoor occupancy sensors												
26 24 16	**Panelboards**												
A.	Enclosures and Trims												
B.	Molded case circuit breaker												
26 27 26	**Wiring Devices**												
A.	Product Data												
B.	Product Data- resubmittal												
26 29 11	**Motor Controllers**												
26 51 00	**Interior Lighting**												
A.	Product Data												
B.	Product Data-Resubmitted												
C.	Shop Drawings												
26 56 00	**Exterior Lighting**												
Division 27 - Communications													
27 05 11	**Requirements for Communications Installations**												
27 05 26	**Grounding and Bonding for Communications Systems**												
A.	Grounding and bonding communication systems												
B.	Ground rods												
C.	Splices and Termination components												
D.	Telecommunications system ground busbars												
E.	Equipment rack an cabinet ground bars												
F.	Splice case ground access												
G.	Irreversible common lugs												
H.	Antioxidant joint caps.												
27 05 33	**Raceways and Boxes for Communcations Systems**												
A.	Conduit												

PROJECT SUBMITTAL LOG

Project Location: **Buffalo VAMC** Project Title: **Parking Ramp Expansion** PROJECT NO.: **528-18-375**

Contractor:

Architect-Engineer: BANCROFT ARCHITECTS + ENGINEERS

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B.	Metallic Tubing												
C.	Fittings												
D.	Outlet, splice and pull boxes												
E.	Wireways												
27 05 61	**Leased Space Communications Equipment and Systems**												
27 08 00	**Commissioning of Communications Systems**												
27 10 00	**Control, Communication and Signal Wiring**												
A.	Control Wiring												
B.	Communication and Signal wiring												
27 11 00	**Communications Equipment Room Fittings**												
27 15 00	**Communiation Structured Cabling**												
A.	Pictoral layouts of equipment rooms												
B.	Conduit and Cable systems												
27 31 00	**Voice Communications Switching and Routing Equipment**												
27 31 31	**Voice Communication Switching & Routing Equipment Extension**												
A.	Interface cabinet layout												
B.	Distribution cabinet layout												
C.	Systems drawings												
27 32 41	**Two-Way Radio Equipment and Systems**												
27 41 31	**Master Antenna Television Equipment and Systems**												
27 51 23	**Intercommunications and Program Systems**												
Division 28 - Electronic Safety and Security													
28 05 00	**Common Work Results for Electronic Safety and Security**												
28 05 13	**Conductors and Cables for Electronic Safety and Security**												
A.	UTP Cable and hardware												
B.	Optical Fiber Cable and hardware												
C.	Coaxial Cable and hardware												
D.	RS-232 Cable												
E.	RS-485 Cable												
F.	Low-Voltage Control Cable												
G.	Control Circuit Conductors												
H.	Fire Alarm Wire and cable												
I.	Identifying products												
J.	Lubricant Compound												
K.	Fireproofing tape												
28 05 26	**Grounding and Bonding for Electronic Safety and Security**												
A.	Grounding conductors												
B.	Grounding rods												
C.	Splices and temrinal components												
D.	Equipment rack and cabinet ground bars												
E.	Ground terminal blocks												

PROJECT SUBMITTAL LOG

Project Location: **Buffalo VAMC** Project Title: **Parking Ramp Expansion** PROJECT NO.: **528-18-375**

Contractor:

Architect-Engineer: BANCROFT ARCHITECTS + ENGINEERS

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F.	Splice case ground accessories												
G.	Computer room ground												
H.	Security Control room ground												
28 05 28.33	**Conduits and Backboxes for Electronic Safety and Security**												
A.	Conduit												
B.	Wireway and raceways												
C.	Conduit fittings												
D.	Conduit xxx												
E.	Outlet, junction and wall boxes												
F.	Cabinets												
G.	Wireways												
H.	Warning tape												
I.	Sleeves for raceways												
J.	Grout												
28 08 00	**Commissioning of Electronic Safety and Security Systems**												
28 13 00	**Physical Access Control System**												
28 23 00	**Video Surveillance**												
28 26 00	**Electronic Personal Protection System**												
28 31 00	**Fire Detection and Alarm**												
A.	Conduit, boxes and wire												
B.	Voice Communication system												
C.	Speakers												
D.	Strobes												
E.	Smoke Detectors												
F.	Heat Detectors												
G.	Duct Smoke Detectors												
H.	Address Reporting Interface Device												
28 52 31	**Emergency Call System**												
Division 31 - Earthwork													
31 20 00	**Earthwork**												
31 63 26	**Drilled Caissons**												
Division 32 - Exterior Improvements													
32 05 23	**Cement and Concrete for Exterior Improvements**												
32 12 16	**Asphalt Paving**												
32 17 23	**Pavement Markings**												
32 90 00	**Planting**												
Division 33 - Utilities													
33 08 00	**Commissioning of Site Utility Systems**												
33 10 00	**Water Utilities**												
33 40 00	**Storm Sewer Utilities**												
Division 34 - Transportation													

PROJECT SUBMITTAL LOG

Project Location: **Buffalo VAMC** Project Title: **Parking Ramp Expansion** PROJECT NO.: **528-18-375**

Contractor:

Architect-Engineer: BANCROFT ARCHITECTS + ENGINEERS

		SUBMITTAL RECEIVED / ISSUE / RETURN DATES								REVIEW COMMENTS			
Section Number	Division Description (MODIFY PER PROJECT SPECIFICATIONS)	Submittal Number	CONTRACTOR TO VA & A/E	**A/E required due date**	**AE to Consulant**	**Rec' from Consultant**	A/E Reviewed Submittal to VA	BAE to VA	Reviewed By	No Exceptions Taken	Conforms as Noted	Rejected: Revise & Resubmit	Comments
34 71 13	**Passive Vehicle Barriers**												
Division 48 - Electrical Power Generation													
48 14 00	**Solar Energy Electrical Power Generation System**												

SECTION 01 33 24
ELECTRONIC SUBMITTAL PROCEDURES
(WEB-BASED SERVICE)

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies requirements for provision and use of an electronic, web-based service for submittal and tracking of construction submittals for the Project.

1.2 REFERENCED DOCUMENTS

A. Additional submittal requirements: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

1.3 SUMMARY:

A. The intent of electronic web-based submittals is to expedite the construction process by reducing paperwork, improving information flow, and decreasing turnaround time.

B. Shop drawing and product data submittals shall be transmitted to Architect in electronic (PDF) format using a web-based service designed specifically for transmitting and tracking submittals between construction team members.

C. The electronic submittal process is not intended for color samples, color charts, or physical material samples.

1.4 GENERAL DESCRIPTION OF PROCEDURES:

A. Submittal Preparation - Contractor may use any or all the following options:

1. Subcontractors and Suppliers provide electronic (PDF) submittals to Contractor via the submittal exchange website.
2. Subcontractors and Suppliers provide paper submittals to General Contractor who electronically scans and converts to PDF format.
3. Subcontractors and Suppliers provide paper submittals to Scanning Service which electronically scans and converts to PDF format.

B. Contractor shall review, comment, and apply electronic stamp certifying that the submittal (as noted) complies with the requirements of the Contract Documents including verification of manufacturer/product, dimensions and coordination of information with other parts of the work.

C. Contractor shall transmit each submittal to Architect and Owner (simultaneously) using the web-based submittal exchange service.

D. Architect/COR review comments will be made available on web-based submittal exchange service. Contractor shall receive email notice of completed review.

E. Distribution of reviewed submittals to subcontractors and suppliers is the responsibility of the Contractor.

1.5 REQUIREMENTS AND RESPONSIBILITIES

A. Submittal Exchange Service shall provide:

1. Web-based tracking and approval system.
2. Automated email notice for new submittals and reminders for submittals approaching the review deadline.
3. Tracking and exchange of ITC/RFI/CO’s and other similar document as well as product and equipment submittals.
4. Means for tracking of the status such documents including whether they have been approved and released by the Owner.
5. Organized storage of submittals that is accessible for review by the designated construction team members at any time.
6. Submit a complete set of submittals on CD to the Owner at the end of the Project. Include all submittals included product submittals, shop drawings, ITC/RFI/CO’s and other similar submittals.

B. Contractor responsibilities:

1. Training in the use of the service by the team members shall be at the option of the Contractor and, if chosen, shall be paid by the Contractor.

2. Contractor shall have or obtain required hardware and software: Internet Service and Equipment Requirements:
   a. Email address and Internet access at Contractor's main office.
   b. Adobe Acrobat (www.adobe.com), Bluebeam PDF Revu (www.bluebeam.com), or other similar PDF review software for applying electronic stamps and comments.
3. Contractor shall prepare or have prepared all required submittals in the PDF format required.
   a. PDF files must be readable. As a rule, a resolution of 300 dpi should be used.
   b. If the Architect can download more readable product data directly from the manufacturer's website than was submitted by the Contractor, the Architect shall reserve the right to reject the submittal.
4. Other responsibilities for submittals shall be as described in Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
   a. Color samples, color charts, or physical material samples shall be submitted as described in Section 01 33 23.

1.6 ACCEPTABLE SERVICES

A. Submittal Exchange or other system proposed by the contractor and approved by the COR.

- - - END - - -

SECTION 01 35 26
SAFETY REQUIREMENTS

INTRODUCTION

This document is a modified version of the 01 35 26 (Safety Requirements) available from the Technical Information Library (TIL). It has been modified by VA Western New York Healthcare System (VAWNYHS) to include site specific information and delete irrelevant information. This VAWNYHS modified version of the 01 35 26 (Safety Requirements) should be used as the basis of construction efforts conducted at VAWNYHS.

The unmodified version of 01 35 26 (Safety Requirements) can be found on the Department of Veteran's Affairs, Office of Construction and Facilities Management (CFM) website:

http://www.cfm.va.gov/til/index.asp

As new versions of 01 35 26 (Safety Requirements) are posted on the TIL by CFM, VAWNYHS will review, modify, and publish a new local version at:

G:\MS-Engineering-SOP\Projects\General\Doc Templates\SPECIFICATIONS- Local Masters

When a project specific modification to this document has been made, enter the project information below and update the Record of Revisions table with the publish date and author.

VA Project Number: 528-375
VA Project Name: Parking Ramp Extension

Recommended file name for the project specific revision is:

01 35 26 - Safety Requirements - 2024.01.19 - 528-375.docx

RECORD OF REVISIONS

Date	Nature of Revision	Author
01 Feb 2017	Baseline document from TIL	CFM

Date	Nature of Revision	Author
28 Sep 2017	VAWNYHS site specific modification	VAWNYHS
01 Aug 2022	Baseline document from TIL	
02 Aug 2022	VAWNYHS site specific modification	

SECTION 01 35 26
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As new versions of 01 35 26 (Safety Requirements) are posted on the TIL by CFM, VAWNYHS will review, modify, and publish a new local version at:

G:\MS-Engineering-SOP\Projects\General\Doc Templates\SPECIFICATIONS- Local Masters

When a project specific modification to this document has been made, enter the project information below and update the Record of Revisions table with the publish date and author.

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VA Project Name: Parking Ramp Extension

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Buffalo VA Medical Center
Buffalo, NY 14215
Parking Ramp Expansion
Bancroft Architects + Engineers

SECTION 01 35 26
SAFETY REQUIREMENTS

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Appendix A: Summary of Revisions

SECTION 01 35 26
SAFETY REQUIREMENTS

1.1 APPLICABLE PUBLICATIONS

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

B. American Society of Safety Engineers (ASSE)

A10.1-2011	Pre-Project & Pre-Task Safety and Health Planning
A10.34-2012	Protection of the Public on or Adjacent to Construction Sites
A10.38-2013	Basic Elements of an Employer’s Program to Provide a Safe and Healthful Work Environment American National Standard Construction and Demolition Operations

C. American Society for Testing and Materials (ASTM)

E84-2013	Surface Burning Characteristics of Building Materials

D. The Facilities Guidelines Institute (FGI)

FGI Guidelines-2010	Guidelines for Design and Construction of Healthcare Facilities

E. National Fire Protection Association (NFPA)

10-2018	Standard for Portable Fire Extinguishers
30-2018	Flammable and Combustible Liquids Code
51B-2019	Standard for Fire Prevention During Welding, Cutting and Other Hot Work
70-2020	National Electrical Code

70B-2019	Recommended Practice for Electrical Equipment Maintenance
70E-2018	Standard for Electrical Safety in the Workplace
99-2018	Health Care Facilities Code
241-2019	Standard for Safeguarding Construction, Alteration, and Demolition Operations

F. New York Code of Rules and Regulations (NYCRR)

6 NYCRR 363	Solid Municipal Waste Disposal
6 NYCRR 364	Hazardous Waste Disposal.

G. The Joint Commission (TJC)

TJC Manual	Comprehensive Accreditation and Certification Manual

H. U.S. Nuclear Regulatory Commission

10 CFR 20	Standards for Protection Against Radiation

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

29 CFR 1904	Reporting and Recording Injuries & Illnesses
29 CFR 1910	Safety and Health Regulations for General Industry
29 CFR 1926	Safety and Health Regulations for Construction Industry
CPL 2-0.124	Multi-Employer Citation Policy

J. U.S Environmental Protection Agency (EPA)

40 CFR 239-259	Non-Hazardous Wastes
40 CFR 260-273	Hazardous Waste
40 CFR 279	Management of Used Oil

40 CFR 61 National Emission Standards for Hazardous Air Pollutants

40 CFR Subchapter R Toxic Substances Control Act

K. U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1 (2014) Safety -- Safety and Health Requirements Manual

L. UNIFIED FACILITIES GUIDE SPECIFICATIONS

UFGS-01 35 26 Governmental Safety Requirements

M. Veteran Health Administration

VHA Directive 7712 Fire Protection Reviews of Delegated Construction Projects

VHA Directive 7715 Safety and Health During Construction

1.2 DEFINITIONS

A. Critical Lift. A lift with the hoisted load exceeding 75% of the crane's maximum capacity; lifts made out of the view of the operator (blind picks); lifts involving two or more cranes; personnel being hoisted; and special hazards such as lifts over occupied facilities, loads lifted close to power-lines, and lifts in high winds or where other adverse environmental conditions exist; and any lift which the crane operator believes is critical.

N. OSHA "Competent Person" (CP). One who is capable of identifying existing and predictable hazards in the surroundings and working conditions which are unsanitary, hazardous or dangerous to employees, and who has the authorization to take prompt corrective measures to eliminate them (see 29 CFR 1926.32(f)). Each CP must be designated in writing.

C. Competent Person, Confined Space. The CP, Confined Space, is a person meeting the competent person requirements as defined EM 385-1-1 Appendix Q, with thorough knowledge of OSHA's Confined Space Standard,

29 CFR 1910.146, and designated in writing to be responsible for the immediate supervision, implementation and monitoring of the confined space program, who through training, knowledge and experience in confined space entry is capable of identifying, evaluating and addressing existing and potential confined space hazards and, who has the authority to take prompt corrective measures with regard to such hazards.

D. Competent Person, Cranes and Rigging. The CP, Cranes and Rigging, as defined in EM 385-1-1 Appendix Q, is a person meeting the competent person requirements, who has been designated in writing to be responsible for the immediate supervision, implementation and monitoring of the Crane and Rigging Program, who through training, knowledge and experience in crane and rigging is capable of identifying, evaluating and addressing existing and potential hazards and, who has the authority to take prompt corrective measures with regard to such hazards.

E. Competent Person, Excavation/Trenching. A CP, Excavation/Trenching, is a person meeting the competent person requirements as defined in EM 385-1-1 Appendix Q and 29 CFR 1926, who has been designated in writing to be responsible for the immediate supervision, implementation and monitoring of the excavation/trenching program, who through training, knowledge and experience in excavation/trenching is capable of identifying, evaluating and addressing existing and potential hazards and, who has the authority to take prompt corrective measures with regard to such hazards.

F. Competent Person, Fall Protection. The CP, Fall Protection, is a person meeting the competent person requirements as defined in EM 385-1-1 Appendix Q and in accordance with ASSP Z359.0, who has been designated in writing by the employer to be responsible for immediate supervising, implementing and monitoring of the fall protection program, who through training, knowledge and experience in fall protection and rescue systems and equipment, is capable of identifying, evaluating and addressing existing and potential fall hazards and, who has the authority to take prompt corrective measures with regard to such hazards.

G. Competent Person, Scaffolding. The CP, Scaffolding is a person meeting the competent person requirements in EM 385-1-1 Appendix Q, and designated in writing by the employer to be responsible for immediate supervising, implementing and monitoring of the scaffolding program. The CP for Scaffolding has enough training, knowledge and experience in scaffolding to correctly identify, evaluate and address existing and potential hazards and also has the authority to take prompt corrective measures with regard to these hazards. CP qualifications must be documented including experience on the specific scaffolding systems/types being used, assessment of the base material that the scaffold will be erected upon, load calculations for materials and personnel, and erection and dismantling. The CP for scaffolding must have a documented minimum of 8-hours of scaffold training to include training on the specific type of scaffold being used (e.g. mast-climbing, adjustable, tubular frame), in accordance with EM 385-1-1 Section 22.B.02.

H. "Qualified Person". One who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training and experience, has successfully demonstrated his ability to solve or resolve problems relating to the subject matter, the work, or the project.

I. High Visibility Accident. Any mishap which may generate publicity or high visibility.

J. Accident/Incident Criticality Categories:

Near Miss - No impact – Near miss incidents result in no impact and are considered close calls. They are required to be investigated and reported to the VA;

Minor Incident/Accident – incidents that require first aid treatment only or result in minor equipment damage (less than $5000). These incidents must be investigated and reported to the VA;

Moderate Incident/Accident – Any work-related injury or illness that results in (a) through (g) below. These incidents must be investigated and are required to be reported to the VA;

1. Days away from work (any time lost after day of injury/illness onset);
2. Restricted work;
3. Transfer to another job;
4. Medical treatment beyond first aid;
5. Loss of consciousness;
6. A significant injury or illness diagnosed by a physician or other licensed health care professional, even if it did not result in (a) through (e) above or,
7. Any incident that leads to major equipment damage (greater than $5000).

Major Incident/Accident – Any mishap that leads to fatalities, hospitalizations, amputations, and losses of an eye as a result of contractors' activities. Or any incident which leads to major property damage (greater than $20,000) and/or may generate publicity or high visibility. These incidents must be investigated and are required to be reported to the VA as soon as practical, but not later than 2 hours after the incident.

K. Medical Treatment. Treatment administered by a physician or by registered professional personnel under the standing orders of a physician. Medical treatment does not include first aid treatment even through provided by a physician or registered personnel.

1.3 REGULATORY REQUIREMENTS

A. In addition to the detailed requirements included in the provisions of this contract, comply with 29 CFR 1926, comply with 29 CFR 1910 as incorporated by reference within 29 CFR 1926, comply with ASSE A10.34, and all applicable federal, state, and local laws, ordinances,

criteria, rules and regulations. Submit matters of interpretation of standards for resolution before starting work. Where the requirements of this specification, applicable laws, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirements govern except with specific approval and acceptance by the Engineering Manager, Facility Safety Manager, and Contracting Officer Representative.

1.4 CONTRACTOR SUBMITTALS

A. Accident Prevention Plan IAW Section 1.5, C.

B. Activity Hazard Analysis IAW Section 1.5, D.

C. Pre-award Contractor Evaluation Form (Prime Contractor and all subcontractors) IAW Section 1.5

1. OSHA 300 Forms for the last 3 years

2. OSHA 300A Forms for the last 3 years

3. Documentation on any OSHA violations in the last 3 years

4. Documentation on any Environmental violations in the last 3 years

D. Proof of Competency for specific tasks to include:

1. OSHA Cards (10 or 30 hours as applicable)

2. Crane Certifications (crane operator, rigger, crane signal person)

3. Confined Space

4. Power Industrial Truck (PIT)

5. Scaffolds

6. Fall Protection

7. Excavation

8. Hazardous Materials Removal (Lead, Asbestos, PCBs, Silica, etc.)

9. Lockout/Tagout (electrical, machine, equipment)

10. NFPA 70E

11. Explosive actuated tools

A. Preconstruction Risk Assessment (PCRA)

1. Safety Narrative:

a. This project will require coordination to ensure hospital functions are not impaired during construction to include warehouse and food and nutrition services, life safety features are maintained and staff/patients are not exposed.

b. If a Guideline is not met, additional actions are required based upon the risk assessment. If required, additional safety actions shall be performed and implemented PRIOR to start of work involving locations affected by the assessment.

c. All required ILSM's shall be in accordance with the facility ILSM Policy and developed separate from this assessment. If required, ILSM's shall be performed and implemented PRIOR to start of work involving locations affected by the ILSM.

2. General Safety

a. Air Quality: Will there be any compromise to the quality of building air?

1) Asbestos

i. Concern:

ii. Area/Equipment Impacted:

iii. Control Activities Needed:

2) Lead

i. Concern:

ii. Area/Equipment Impacted:

iii. Control Activities Needed:

3) Dust

i. Concern:

ii. Area/Equipment Impacted:

iii. Control Activities Needed:

4) Silica

iv. Concern:

v. Area/Equipment Impacted:

vi. Control Activities Needed:

5) Other Hazardous Chemicals

i. Concern:

ii. Area/Equipment Impacted:

iii. Control Activities Needed:

b. Ventilation: Will there be any compromise to the building ventilation or air handling systems?

1) Concern:

2) Area/Equipment Impacted:

3) Control Activities Needed:

c. Moisture & Temperature: Are there any anticipated moisture or temperature concerns?

1) Concern:

2) Area/Equipment Impacted:

3) Control Activities Needed:

d. Utilities: Are there any anticipated utility disruptions?

1) Communication/Telephone

i. Concern:

ii. Area/Equipment Impacted:

iii. Control Activities Needed:

2) Electrical Systems

i. Concern:

ii. Area/Equipment Impacted:

iii. Control Activities Needed:

3) Security Systems

i. Concern:

ii. Area/Equipment Impacted:

iii. Control Activities Needed:

4) Steam Systems

i. Concern:

ii. Area/Equipment Impacted:

iii. Control Activities Needed:

5) HVAC

i. Concern:

ii. Area/Equipment Impacted:

iii. Control Activities Needed:

6) Medical Gases/Vacuum

i. Concern:

ii. Area/Equipment Impacted:

iii. Control Activities Needed:

7) Natural Gas

i. Concern:

ii. Area/Equipment Impacted:

iii. Control Activities Needed:

8) Sewer/Sanitary

i. Concern:

ii. Area/Equipment Impacted:

iii. Control Activities Needed:

9) Water

i. Concern:

ii. Area/Equipment Impacted:

iii. Control Activities Needed:

10) Fire Suppression

iv. Concern:

v. Area/Equipment Impacted:

vi. Control Activities Needed:

11) Fire Detection

vii. Concern:

viii. Area/Equipment Impacted:

ix. Control Activities Needed:

12) Other

e. Noise: Will there be any unusually loud or high-pitched noise levels anticipated?

1) Concern:

2) Area/Equipment Impacted:

3) Control Activities Needed:

f. Vibration: Will vibration levels be excessive to effect the operation of hospital type equipment or machinery?

1) Concern:

2) Area/Equipment Impacted:

3) Control Activities Needed:

g. Emergency Management: Does construction present any conflicts or challenges to the facility EM Plan?

1) Concern:

2) Area/Equipment Impacted:

3) Control Activities Needed:

h. Security: Will the construction anticipate general security concerns?

1) Concern:

2) Area/Equipment Impacted:

3) Control Activities Needed:

i. Other Anticipated Hazards Not Listed Elsewhere

1) Off-tour Construction necessary?

i. Concern:

ii. Area/Equipment Impacted:

iii. Control Activities Needed:

2) Permit Required Confined Space (PRCS) Entry necessary?

i. Concern:

ii. Area/Equipment Impacted:

iii. Control Activities Needed:

3) Welding, cutting or brazing necessary that requires Hot Work permit?

i. Concern:

ii. Area/Equipment Impacted:

iii. Control Activities Needed:

4) Potential exposure to BBP or other infectious agents?

i. Concern:

ii. Area/Equipment Impacted:

iii. Control Activities Needed:

5) Excavation of soil?

i. Concern:

ii. Area/Equipment Impacted:

iii. Control Activities Needed:

6) Work on live electrical systems or hot taps?

i. Concern:

ii. Area/Equipment Impacted:

iii. Control Activities Needed:

7) Work on energized non-electrical systems?

i. Concern:

ii. Area/Equipment Impacted:

iii. Control Activities Needed:

8) Lift of materials with crane?

i. Concern:

ii. Area/Equipment Impacted:

iii. Control Activities Needed:

3. Life Safety

a. Exit Routes (Means of Egress Components)

9) Exit from occupied areas will remain unchanged?

i. Met:

ii. Actions Required:

iii. ILSM Required:

10) Exit stairs will remain unobstructed and fire separated?

i. Met:

ii. Actions Required:

iii. ILSM Required:

j. Fire Protection Systems

1) Fire alarm devices will remain functional & in-service throughout construction?

i. Met:

ii. Actions Required:

iii. ILSM Required:

2) Sprinkler systems will remain functional & in-service throughout construction?

i. Met:

ii. Actions Required:

iii. ILSM Required:

3) Fire Suppression systems (non-sprinkler) will remain functional & in-service throughout construction?

i. Met:

ii. Actions Required:

iii. ILSM Required:

4) FDC’s will remain functional & unobstructed?

i. Met:

ii. Actions Required:

iii. ILSM Required:

k. Smoke and Fire Barriers

1) All fire and smoke barriers will remain intact throughout?

i. Met:

ii. Actions Required:

iii. ILSM Required:

2) All vertical openings will remain intact throughout?

i. Met:

ii. Actions Required:

iii. ILSM Required:

l. Construction Spaces

1) Will be separated by non-combustible, smoke tight partitions?

i. Met:

ii. Actions Required:

iii. ILSM Required:

2) Egress From Inside Construction Space will be Obstructed

i. Met:

ii. Actions Required:

iii. ILSM Required:

3) At least 1 accessible and unobstructed exits are provided?

i. Met:

ii. Actions Required:

iii. ILSM Required:

4) Excessive distance to exits?

i. Met:

ii. Actions Required:

iii. ILSM Required:

m. General

1) Access to the Emergency Dept. will remain unobstructed?

i. Met:

ii. Actions Required:

iii. ILSM Required:

2) Access for emergency responders will remain unchanged?

i. Met:

ii. Actions Required:

iii. ILSM Required:

3) Is fireproofing being removed during construction?

i. Met:

ii. Actions Required:

iii. ILSM Required:

B. Contractor evaluation

1. No contractor or subcontractor may begin work unless they have been approved to do so.
2. All contractors and subcontractors must complete the Pre-Award Contractor Evaluation Form and meet the following requirements (MCP00-053):
   a. Have no more than 3 serious, 1 repeat, or 1 willful violation
   b. Have no environmental violations (state or federal)
   c. Must not have an Experience Modification Rate (EMR) greater than 1.0
3. In addition, all contractors and subcontractors must submit all required documents per the Pre-Award Contractor Evaluation Form

C. Accident Prevention Plan (APP)

1. The APP (aka Construction Safety & Health Plan) shall interface with the Contractor's overall safety and health program. Include any portions of the Contractor's overall safety and health

program referenced in the APP in the applicable APP element and ensure it is site-specific. The Government considers the Prime Contractor to be the "controlling authority" for all worksite safety and health of each subcontractor(s). Contractors are responsible for informing their subcontractors of the safety provisions under the terms of the contract and the penalties for noncompliance, coordinating the work to prevent one craft from interfering with or creating hazardous working conditions for other crafts, and inspecting subcontractor operations to ensure that accident prevention responsibilities are being carried out.

2. The APP shall be prepared as follows:

   a. Written in English by a qualified person who is employed by the Prime Contractor articulating the specific work and hazards pertaining to the contract (model language can be found in ASSE A10.33). Specifically articulating the safety requirements found within these VA contract safety specifications.

   b. Address both the Prime Contractors and the subcontractors work operations.

      1) Describe the methods to evaluate past safety performance of potential subcontractors in the selection process. Also, describe innovative methods used to ensure and monitor safe work practices of subcontractors.

   c. State measures to be taken to control hazards associated with materials, services, or equipment provided by suppliers.

   d. Address all the elements/sub-elements and in order as follows:

      1) **SIGNATURE SHEET.** Title, signature, and phone number of the following:

i. Plan preparer (Qualified Person such as corporate safety staff person or contracted Certified Safety Professional with construction safety experience);

ii. Plan approver (company/corporate officers authorized to obligate the company);

iii. Plan concurrence (e.g., Chief of Operations, Corporate Chief of Safety, Corporate Industrial Hygienist, project manager or superintendent, project safety professional). Provide concurrence of other applicable corporate and project personnel (Contractor).

2) **BACKGROUND INFORMATION.** List the following:

i. Contractor;

ii. Contract number;

iii. Project name;

iv. Brief project description, description of work to be performed, and location; phases of work anticipated (these will require an AHA).

3) **STATEMENT OF SAFETY AND HEALTH POLICY.** Provide a copy of current corporate/company Safety and Health Policy Statement, detailing commitment to providing a safe and healthful workplace for all employees. The Contractor's written safety program goals, objectives, and accident experience goals for this contract should be provided.

4) **RESPONSIBILITIES AND LINES OF AUTHORITIES.** Provide the following:

i. A statement of the Prime Contractor's ultimate responsibility for the implementation of its SOH program;

ii. Identification and accountability of personnel responsible for safety at both corporate and project level. Contracts specifically requiring safety or industrial hygiene personnel shall include a copy of their resumes.

iii. The names of all SSHO, Competent, and Qualified Person(s) (including a designee (alternate) for the SSHO and all CPs) and proof of competency/qualification to SSHO, Competent, and Qualified Person(s) requirements (listed in section 1.6) must be attached

iv. Requirements that no work shall be performed unless a designated competent person is present on the job site;

v. Requirements for pre-task Activity Hazard Analysis (AHAs);

vi. Lines of authority;

vii. Policies and procedures regarding noncompliance with safety requirements (to include disciplinary actions for violation of safety requirements) should be identified;

5) **SUBCONTRACTORS AND SUPPLIERS.** If applicable, provide procedures for coordinating SOH activities with other employers on the job site:

i. Identification of subcontractors and suppliers (if known);

ii. Safety responsibilities of subcontractors and suppliers.

6) **TRAINING.**

i. Site-specific SOH orientation training at the time of initial hire or assignment to the project for every employee before working on the project site is required.

ii. VAWNYHS Contractor Orientation training is required. Training at the time of initial hire or assignment to the project or proof of current training evidenced by a valid picture contractor badge is required before working on the project. Training is provided by VA Safety Office or their designee. Contract employees must provide proof of the OSHA 10-hour Construction Safety training to participate in the orientation class. Upon completion of the training, workers will be issued a picture contractor badge from the Police. This badge must be worn at all times when at the facility. Badge expires after 3 years and must be renewed.

iii. Mandatory training and certifications that are applicable to this project (e.g., explosive actuated tools, crane operator, rigger, crane signal person, fall protection, electrical lockout/NFPA 70E, machine/equipment lockout, confined space, etc…) and any requirements for periodic retraining/recertification are required.

iv. Procedures for ongoing safety and health training for supervisors and employees shall be established to address changes in site hazards/conditions.

v. OSHA 10-hour training is required for all workers on site and the OSHA 30-hour training is required for Trade Competent Persons (CPs)

7) **SAFETY AND HEALTH INSPECTIONS.**

i. Specific assignment of responsibilities for a minimum daily job site safety and health inspection during periods of work activity: Who will conduct (e.g., "SSHO and CPs"), proof of inspector's training/qualifications, when inspections will be conducted, procedures for documentation, deficiency tracking system, and follow-up procedures. Any external inspections/certifications that may be required (e.g., contracted CSP or CSHT)

8) **ACCIDENT/INCIDENT INVESTIGATION & REPORTING.** The Contractor shall conduct mishap investigations of all Moderate and Major as well as all High Visibility Incidents. The APP shall include accident/incident investigation procedure & identify person(s) responsible to provide the following to the Contracting Officer Representative:

i. Exposure data (man-hours worked);

ii. Accident/incident investigation reports;

iii. Project site injury and illness logs.

9) **PLANS (PROGRAMS, PROCEDURES) REQUIRED.** Based on a risk assessment of contracted activities and on mandatory OSHA compliance programs, the Contractor shall address

all applicable occupational, patient, and public safety risks in site-specific compliance and accident prevention plans. These Plans shall include but are not be limited to procedures for addressing the risks associates with the following (EM 385-1-1 Section Reference):

i. Fatigue Management Plan (01.A.20);
ii. Emergency Plans (01.E);
iii. Site Sanitation/Housekeeping Plan (02);
iv. Medical Support Agreement (03.A.01);
v. Blood-Borne Pathogen Program (03.A.05);
vi. Exposure Control Plan (03.A.05);
vii. Automatic External Defibrillator (AED) Program (03.B.04);
viii. Site Layout Plan (04.A);
ix. Access/Haul Road Plan (04.B);
x. Hearing Conservation Program (05.C);
xi. Respiratory Protection Plan (05.G);
xii. Health Hazard Control Program (06.A);
xiii. Hazard Communication Program (06.B.01);
xiv. Process Safety Management Program (06.B.04);
xv. Lead Compliance Plan (06.C.02 & specifications);
xvi. Asbestos Abatement Plan (06.C.03 & specifications);
xvii. Radiation Safety Program (06.F);
xviii. Abrasive Blasting Procedures (06.I.01);
xix. Heat Stress Monitoring Plan (HSMP) (06.J.02);
xx. Cold Stress Monitoring Plan (CSMP) (06.J.04)
xxi. Indoor Air Quality Management (06.L);
xxii. Mold Remediation Plan (06.L.04);
xxiii. Chromium (VI) Exposure Evaluation (06.M);
xxiv. Crystalline Silica Evaluation (06.N.02);
xxv. Lighting Plan for Night Operations (07.A.06);
xxvi. Traffic Control Plan (08.C.05);
xxvii. Fire Prevention Plan (09);

xxviii. Electrical Safety, Arc Flash Hazard Analysis, and Assured Equipment Grounding Control Program (AEGCP) (11, Appendix E);

xxix. Hazardous Energy Control Program & Procedures (12);

xxx. Standard Pre-Lift Plan – Load Handling Equipment (16.A.03);

xxxi. Critical Lift Plan – Load Handling Equipment (16.H);

xxxii. Fall Protection and Prevention Plan (21.D);

xxxiii. Demolition/Renovation Plan (to include engineering survey) (23.A);

xxxiv. Rope Access Work Plan (24.H);

xxxv. Excavation/Trenching Plan (25.A.01);

xxxvi. Fire Prevention and Protection Plan for Underground Construction (26.D.01);

xxxvii. Compressed Air Work Plan for Underground Construction (26.I.01);

xxxviii. Erection and Removal Plan for Formwork and Shoring (27.C);

xxxix. Precast Concrete Plan (27.D.01);

xl. Lift-Slab Plans (27.E);

xli. Masonry Bracing Plan (27.F.01);

xlii. Steel Erection Plan (28.B);

xliii. Explosives Safety Site Plan (ESSP) (29.A);

xliv. Blasting Plan (29.A; 26.J);

xlv. Tree Felling and Maintenance Program (31.A.01);

xlvi. Confined Space Entry Procedures (34.A.05, 06, 07, 08);

xlvii. Sediment and Erosion Control Plan

xlviii. Stormwater and Wastewater Management Plan

xlix. Solid Waste Management Plan

3. Submit the APP to the Contracting Officer Representative and for review and acceptance by the Safety Department for compliance with contract requirements in accordance with Section 01 33 23,

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

4. Once accepted by the Contracting Officer Representative and the Safety Department, the APP and attachments will be posted in a visible location on the jobsite and enforced as part of the contract. Disregarding the provisions of this contract or the accepted APP will be cause for stopping of work, at the discretion of the Contracting Officer in accordance with FAR Clause 52.236-13, Accident Prevention, until the matter has been rectified.

5. Once work begins, changes to the accepted APP shall be made with the knowledge and concurrence of the Contracting Officer Representative, Construction Safety Officer, and SSHO. Should any severe hazard exposure, i.e. imminent danger, become evident, stop work in the area, secure the area, and develop a plan to remove the exposure and control the hazard. Notify the Contracting Officer immediately upon discovery. Eliminate/remove the hazard. In the interim, take all necessary action to restore and maintain safe working conditions in order to safeguard onsite personnel, visitors, the public (as defined by ASSE/SAFE A10.34-2012) and the environment.

D. **Activity Hazard Analyses (AHAS**)

1. AHAs are also known as Job Hazard Analyses, Job Safety Analyses, and Activity Safety Analyses. Before beginning each work activity involving a type of work presenting hazards not experienced in previous project operations or where a new work crew or sub-contractor is to perform the work, the Contractor(s) performing that work activity shall prepare an AHA (Example electronic AHA forms can be found on the US Army Corps of Engineers web site.

2. AHAs shall define the activities being performed and identify the work sequences, the specific anticipated hazards (to workers on

the job site as well as the VAWNYHS staff, patients, and visitors), site conditions, equipment, materials, and the control measures to be implemented to eliminate or reduce each hazard to an acceptable level of risk.

3. Work shall not begin until the AHA for the work activity has been accepted by the Contracting Officer Representative in consultation with the Safety Department and discussed with all engaged in the activity, including the Contractor, subcontractor(s), and Government on-site representatives at preparatory and initial control phase meetings.

   a. The names of the Competent/Qualified Person(s) required for a particular activity (for example, excavations, scaffolding, fall protection, other activities as specified by OSHA and/or other State and Local agencies) shall be identified and included in the AHA. Certification of their competency/qualification shall be submitted to the Government Designated Authority (GDA) (Contracting Officer Representative) for acceptance prior to the start of that work activity.

   b. The AHA shall be reviewed and modified as necessary to address changing site conditions, operations, or change of competent/qualified person(s).

      1) The names of competent and qualified persons shall be submitted as an attachment to the AHA. Those listed must be Competent or Qualified for the type of work involved in the AHA and familiar with current site safety issues.

      2) If a new Competent or /Qualified Person (not on the original list) is added, the list shall be updated (an administrative action not requiring an updated AHA). The new person shall acknowledge in writing that he or she has reviewed the AHA and is familiar with current site safety issues.

c. Submit AHAs to the Contracting Officer Representative in consultation with the Safety Department for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES for review at least fifteen (15) calendar days prior to the start of each phase. Subsequent AHAs shall be formatted as amendments to the APP. The analysis should be used during daily inspections to ensure the implementation and effectiveness of the activity's safety and health controls.

d. The AHA list will be reviewed periodically (at least monthly) at the Contractor supervisory safety meeting and updated as necessary when procedures, scheduling, or hazards change.

e. Develop the activity hazard analyses using the project schedule as the basis for the activities performed. All activities listed on the project schedule will require an AHA. The AHAs will be developed by the contractor, supplier, or subcontractor and provided to the prime contractor (Site Safety and Health Officer) for review and approval and then submitted to the Contracting Officer Representative.

E. **Preconstruction Conference**

1. Contractor representatives who have a responsibility or significant role in implementation of the accident prevention program, as required by 29 CFR 1926.20(b)(1), on the project shall attend the preconstruction conference to gain a mutual understanding of its implementation. This includes the project superintendent, subcontractor superintendents, and any other assigned safety and health professionals. The Preconstruction Conference shall be scheduled with the Contracting Officer Representative prior to work commencement. Before the Preconstruction Conference can be scheduled, the APP and all AHAs must be submitted to the Contracting Officer Representative and approved by Safety Department.

2. Discuss the details of the submitted APP to include incorporated plans, programs, procedures and a listing of anticipated AHAs that will be developed and implemented during the performance of the contract. This list of proposed AHAs will be reviewed at the conference and an agreement will be reached between the Contractor, Contracting Officer Representative in consultation with the Safety Department as to which phases will require an analysis. In addition, establish a schedule for the preparation, submittal, review, and acceptance of AHAs to preclude project delays.

3. Deficiencies in the submitted APP will be brought to the attention of the Contractor within fourteen (14) days of submittal, and the Contractor shall revise the plan to correct deficiencies and re-submit it for acceptance. Do not begin work until there is an accepted APP.

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

A. The Prime Contractor shall designate a minimum of one SSHO at each project site that will be identified as the SSHO to administer the Contractor's safety program and government-accepted Accident Prevention Plan.

B. The SSHO has to be a separate qualified individual from the Prime Contractor's Superintendent and/or Quality Control Manager with duties only as the SSHO.

C. Each subcontractor shall designate a minimum of one CP in compliance with 29 CFR 1926.20 (b)(2) that will be identified as a CP to administer their individual safety programs.

D. Each designated SSHO and CP must have an alternate assigned for each role. Each alternate must meet the same requirements and carry out the same duties as the primary person in that role. All names must be listed in the APP.

1. The SSHO or the alternate will maintain a presence on the site during construction operations in accordance with FAR Clause 52.236-6: Superintendence by the Contractor. CPs will maintain

presence during their construction activities in accordance with above mentioned clause. A listing of the designated SSHO and all known CPs shall be submitted prior to the start of work as part of the APP with the training documentation and/or AHA as listed in Section A.1.1I below.

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

E. SSHO Qualifications:

1. As a minimum the Prime Contractor SSHO must have completed the OSHA 30-hour Construction Safety class and have five (5) years of construction industry safety experience or three (3) years if he/she possesses a Certified Safety Professional (CSP) or certified Construction Safety and Health Technician (CSHT) certification or have a safety and health degree from an accredited university or college. The SSHO shall maintain a competency through 24 hours of safety and health related course work every 4 years.

F. SSHO Duties:

1. Conduct daily safety and health inspections and maintain a written log which includes area/operation inspected, date of inspection, identified hazards, recommended corrective actions, estimated and actual dates of corrections. Attach safety inspection logs to the Contractors' daily production report.
2. Complete required incident reports for all accidents and near missed and conduct investigations and complete.
3. Use and maintain OSHA's Form 300 to log work-related injuries and illnesses occurring on the project site for Prime Contractors and subcontractors, and make available to the Contracting Officer, Contracting Officer Representative, or Construction Safety Officer

upon request. Post and maintain the Form 300A on the site Safety Bulletin Board.

4. Maintain the Safety Bulletin Board
5. Maintain applicable safety reference material on the job site.
6. Attend the pre-construction meeting conference, pre-work meetings including preparatory meetings, and periodic in-progress meetings.
7. Review, approve, and enforce the requirements the APP and AHAs
8. Establish a system for tracking safety deficiencies that lists and monitors outstanding deficiencies until resolution.
9. Ensure subcontractor compliance with all safety and health requirements.
10. Maintain a list of hazardous chemicals on site and their material Safety Data Sheets (SDS).
11. Maintain a weekly list of high hazard activities involving energy, equipment, excavation, entry into confined space, and elevation, and be prepared to discuss details during project meetings.
12. Provide and keep a record of site safety orientation for Contractor employees, subcontractor employees, and site visitors.
13. Superintendent, QC Manager, and SSHO are subject to dismissal if the above or any other required duties are not being effectively carried out.

G. CP Qualifications:

1. Each subcontractor must designate a CP and there must be a CP for specialized activities (29 CFR 1926): Asbestos, Lead, Ionizing Radiation, Electrical, Confined Spaces, Cranes and Derricks, Rigging, Steel Erection, Personal Protective Equipment (Hearing Protection), Demolition, Fall Protection, Fire Safety/Life Safety, Ladder, Scaffolds, and Trenches/Excavations.
2. The CP for these activities must be designated in writing and meet the requirements for the specific activity.
3. The CP for Confined Space Entry must supervise the entry into each permit required confined space in accordance with EM 385-1-1, Section 34 and 29 CFR 1926 Subpart AA. Any work involved in operations that handle combustible or hazardous materials, the CP

must have the ability to understand and enforce the air sampling and Personal Protective Equipment (PPE) required for the entry.

H. CP Duties:

1. These Competent Persons can have collateral duties as the subcontractor's superintendent and/or work crew lead persons as well as fill more than one specialized CP role.

I. Training

1. The designated Prime Contractor SSHO must meet the requirements of all applicable OSHA standards and be capable (through training, experience, and qualifications) of ensuring that the requirements of 29 CFR 1926.16 and other appropriate Federal, State and local requirements are met for the project. As a minimum the Prime Contractor SSHO must have completed the OSHA 30-hour Construction Safety class and have five (5) years of construction industry safety experience or three (3) years if he/she possesses a Certified Safety Professional (CSP) or certified Construction Safety and Health Technician (CSHT) certification or have a safety and health degree from an accredited university or college.

2. All designated CPs shall have completed the OSHA 30-hour Construction Safety course within the past 5 years.

3. In addition to the OSHA 30 Hour Construction Safety Course, all CPs with high hazard work operations such as operations involving asbestos, confined space, electrical, cranes, demolition, work at heights/fall protection, fire safety/life safety, ladder, rigging, scaffolds, and trenches/excavations shall have a specialized formal course in the hazard recognition & control associated with those high hazard work operations. Documented "repeat" deficiencies in the execution of safety requirements will require retaking the requisite formal course.

4. All other construction workers shall have the OSHA 10-hour Construction Safety Outreach course and any necessary safety training to be able to identify hazards within their work environment.

5. Submit training records associated with the above training requirements to the Contracting Officer Representative for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES fifteen (15) calendar days prior to the date of the preconstruction conference for acceptance.

6. Prior to any worker for the contractor or subcontractors beginning work, they shall undergo a safety briefing provided by the Prime Contractor SSHO or his/her designated representative. As a minimum, this briefing shall include information on the site-specific hazards, construction limits, VAMC safety guidelines, means of egress, break areas, work hours, locations of restrooms, use of VAMC equipment, emergency procedures, accident reporting etc... Documentation shall be provided to the Contracting Officer Representative that individuals have undergone contractor’s safety briefing.

7. VAWNYHS Safety Office will conduct site specific safety training for al contractor and subcontractor personnel (to include the Prime Contractor SSHO) performing work at VAWNYHS locations. Proof of OSHA training (Submittal 1) must be submitted prior to attending this training session. Training will cover safety and health concerns specific to the facility and the work environment, emergency management, security, infection control, campus polices such as smoking, parking, using VAWNYHS facilities, etc. Upon completion of the training, workers will be issued a picture contractor badge from the Police. This badge must be worn at all times when at the facility. Badge expires after 3 years and must be renewed.

8. Ongoing safety training will be accomplished in by the Prime Contractor SSHO the form of weekly documented safety meeting (reference section 1.6 Safety Meetings.

1.7 SAFETY MEETINGS

A. Safety meetings will include a review of past activities, a plan for new or changed operations, review pertinent aspects of appropriate AHA (by trade), establish safe working procedures for anticipated hazards, and provide pertinent Safety and Occupational Health (SOH) training and motivation. Document meeting minutes to include the date, persons in attendance, subjects discussed, and names of individual(s) who conducted the meeting. Maintain documentation on-site and furnish copies to the Contracting Officer Representative and Construction Safety Officer upon request. Notify the Contracting Officer Representative of all scheduled meetings at least 7 calendar days in advance.

1. Weekly meetings for all workers: The SSHO must conduct meetings at least once a week for workers and CPs from the prime contractor and subcontractors.
2. Monthly supervisory meetings: At least monthly leadership from the Prime Contractor (Site Superintendent) will meet with all supervisors from subcontractors as well as the SSHO and all CPs.

1.8 DISPLAY OF SAFETY INFORMATION-SAFETY BULLETIN BOARD

A. Safety Bulletin Board

1. The Prime Contractor in consultation with the Contracting Officer Representative shall erect and maintain a SOH bulletin board in a commonly accessed area in clear view of the on-site workers. The bulletin board shall be continually maintained and updated and placed in a location that is protected against the elements and unauthorized removal. It shall contain, at minimum, the following information:
   a. A map denoting the route to the nearest emergency care facility;
   b. Emergency phone numbers;
   c. A copy of the most current APP

d. OSHA Form 300A, Summary of Work Related Injuries and Illnesses, posted in accordance with OSHA requirements (from February 1 to April 30 of the year following the issuance of this form)

e. A copy of the SOH deficiency tracking log printed with the date of posting

1. This will be updated at least once per week or when information on the log has been updated.

f. A summary of all reported incidents, accidents, and near misses

1. This will be updated at least once per week or when information on the log has been updated.

g. A posting of a monthly incidence and DART rate

1. This will be updated at least once per month

h. All active permits (confined space, hot work, etc)

i. SOH promotional posters

j. Date of last lost workday injury and date of last OSHA recordable injury;

k. OSHA Safety and Health Poster

l. A copy of the hazardous material inventory, identification of use, approximate quantities and site map detailing location

m. Minutes from the last weekly safety meeting conducted by the SSHO

1.9 INSPECTIONS

A. The SSHO shall conduct frequent and regular safety inspections (daily) of the site and each of the subcontractors CPs shall conduct frequent and regular safety inspections (daily) of their work operations as required by 29 CFR 1926.20(b)(2). Each week, the SSHO shall conduct a formal documented inspection of the entire construction areas with the subcontractors' CPs present in their work areas. All deficiencies and corrective actions must be logged in the SOH tracking system and reported to the to the Contracting Officer Representative on a weekly basis.

B. A Certified Safety Professional (CSP) with specialized knowledge in construction safety, a certified Construction Safety and Health Technician (CSHT) or other qualified professional shall randomly conduct a monthly site safety inspection. The CSP or CSHT can be a corporate safety professional or independently contracted. The CSP or CSHT will provide their certificate number on the required report for verification as necessary.

1. Results of the inspection will be documented with tracking of the identified hazards to abatement.

2. The Contracting Officer Representative will be notified immediately prior to start of the inspection and invited to accompany the inspection.

C. The inspector must be accompanied by the Contracting Officer Representative, Site Superintendent, SSHO, or other designated person who has completed the necessary safety training to be in the project area.

1. Identified hazard and controls will be discussed to come to a mutual understanding to ensure abatement and prevent future reoccurrence.

2. A report of the inspection findings with status of abatement will be provided to the Contracting Officer Representative within one week of the onsite inspection.

1.10 ACCIDENTS/INCIDENTS, OSHA 300 LOGS, AND MAN-HOURS

A. The prime contractor shall establish and maintain an accident/incident reporting, recordkeeping, and analysis system to track and analyze all injuries and illnesses, high visibility incidents, and accidental property damage (both government and contractor) that occur on site. Notify the Contracting Officer Representative as soon as practical, but no more than two four hours after any accident meeting the definition of a Major incidents, High Visibility Incidents, or any weight handling and hoisting equipment accident (maximum 4 hour notification for moderate incidents and 24 hours maximum notification for minor

incidents and near misses). Within notification include contractor name; contract title; type of contract; name of activity, installation or location where accident occurred; date and time of accident; names of personnel injured; extent of property damage, if any; extent of injury, if known, and brief description of accident (to include type of construction equipment used, PPE used, etc.). Preserve the conditions and evidence on the accident site until the Contracting Officer Representative determines whether a government investigation will be conducted.

B. Conduct an accident investigation for all Near Misses, Minor, Moderate and Major incidents as defined in paragraph DEFINITIONS, and property damage accidents to establish the root cause(s) of the accident. Complete VA Form 2162 (or equivalent), and provide the report to the Contracting Officer Representative within five (5) calendar days of the accident. The Contracting Officer Representative will provide copies of any required or special forms.

C. A summation of all man-hours worked by the contractor and associated sub-contractors for each month will be collected by the SSHO and used to calculate a monthly incidence and DART (Days Away Restricted or Transferred based on the incidents reported for each month (29 CFR 1904). This will be posted on the safety bulletin board.

D. A summation of all Near Misses, Minor, Moderate, and Major incidents experienced on site by the contractor and associated sub-contractors for each month will be provided to the Contracting Officer Representative monthly. This summary will also be posted on the safety bulletin board.

E. The contractor and associated sub-contractors' OSHA 300 logs will be made available as part of the pre-award contractor evaluation.

1.11 PERSONAL PROTECTIVE EQUIPMENT (PPE)

A. PPE is governed in all areas by the nature of the work the employee is performing and should be identified in AHAs. For example, specific PPE required for performing work on electrical equipment is identified in NFPA 70E, Standard for Electrical Safety in the Workplace.

B. Mandatory PPE includes:

1. Hard Hats – unless written authorization is given by the Safety Department in circumstances of work operations that have limited potential for falling object hazards such as during finishing work or minor remodeling, must be worn by each person on the site. With authorization to relax the requirement of hard hats, if a worker becomes exposed to an overhead falling object hazard, then hard hats would be required in accordance with the OSHA regulations.

2. Safety glasses - unless written authorization is given by the Safety Department in circumstances of no eye hazards, appropriate safety glasses meeting the ANSI Z.87.1 standard must be worn by each person on site.

3. Appropriate Safety Shoes – based on the hazards present, safety shoes meeting the requirements of ASTM F2413-11 shall be worn by each person on site unless written authorization is given by the Safety Department.

4. Hearing protection - Use personal hearing protection at all times in designated noise hazardous areas or when performing noise hazardous tasks.

5. Appropriate Class Reflective Vests- based on the hazards present high visibility vests or shirts will be worn by each person on site unless written authorization is given by the Safety Department

1.12 INFECTION CONTROL

A. Infection Control is critical in all medical center facilities. Interior construction activities causing disturbance of existing dust, or creating new dust, must be conducted within ventilation-controlled areas that minimize the flow of airborne particles into patient areas. Exterior construction activities causing disturbance of soil or creates dust in some other manner must be controlled.

B. An AHA associated with infection control will be performed by VA personnel in accordance with FGI Guidelines (i.e. Infection Control Risk Assessment (ICRA)). The ICRA procedure found on the American Society for Healthcare Engineering (ASHE) website will be utilized. Risk classifications of Class II or lower will require approval by the Infection Control Officer via Contracting Officer Representative before beginning any construction work. Risk classifications of Class III or higher will require a permit before beginning any construction work. Infection Control permits will be issued by the Infection Control Officer via Contracting Officer Representative. The Infection Control Permits will be posted outside the appropriate construction area. More than one permit may be issued for a construction project if the work is located in separate areas requiring separate classes.

Area of Work	ICRA Class	Notes

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

1. Class I requirements:

a. During Construction Work:

1) Notify the Contracting Officer Representative.

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

3) Ceiling tiles: Immediately replace a ceiling tiles displaced for visual inspection. No more than 1 ceiling tile can be removed at any time in patient care areas.

b. Upon Completion:

1) Clean work area upon completion of task

2) Notify the Contracting Officer Representative

2. Class II requirements:

    a. During Construction Work:

        1) Notify the Contracting Officer Representative.

        2) Provide active means to prevent airborne dust from dispersing into atmosphere such as wet methods or tool mounted dust collectors where possible.

        3) Water mist work surfaces to control dust while cutting.

        4) Seal unused doors with duct tape.

        5) Block off and seal air vents.

        6) Remove or isolate HVAC system in areas where work is being performed.

    b. Upon Completion:

        1) Wipe work surfaces with cleaner/disinfectant.

        2) Contain construction waste before transport in tightly covered containers.

        3) Wet mop and/or vacuum with HEPA filtered vacuum before leaving work area.

        4) Upon completion, restore HVAC system where work was performed

        5) Notify the Contracting Officer Representative.

3. Class III requirements:

    a. During Construction Work:

        1) Obtain permit from the Infection Control Officer via Contracting Officer Representative.

2) Remove or Isolate HVAC system in area where work is being done to prevent contamination of duct system.

3) Complete all critical barriers i.e. sheetrock, plywood, plastic, to seal area from non-work area or implement control cube method (cart with plastic covering and sealed connection to work site with HEPA vacuum for vacuuming prior to exit) before construction begins. Install construction barriers and ceiling protection carefully, outside of normal work hours.

4) Maintain negative air pressure, 0.01 inches of water gauge, within work site utilizing HEPA equipped air filtration units and continuously monitored with a digital display, recording and alarm instrument, which must be calibrated on installation, maintained with periodic calibration and monitored by the contractor.

5) Contain construction waste before transport in tightly covered containers.

6) Cover transport receptacles or carts. Tape covering unless solid lid.

b. Upon Completion:

1) Do not remove barriers from work area until completed and thoroughly cleaned and the project is inspected by the Contracting Officer Representative and Infection Control Officer.

2) Remove construction barriers and ceiling protection carefully to minimize spreading of dirt and debris associated with construction, outside of normal work hours.

3) Vacuum work area with HEPA filtered vacuums.

4) Wet mop area with cleaner/disinfectant.

5) Upon completion, restore HVAC system where work was performed.

6) Return permit to the Contracting Officer Representative.

4. Class IV requirements:

a. During Construction Work:

1) Obtain permit from the Infection Control Officer via Contracting Officer Representative

2) Isolate HVAC system in area where work is being done to prevent contamination of duct system.

3) Complete all critical barriers i.e. sheetrock, plywood, plastic, to seal area from non-work area or implement control cube method (cart with plastic covering and sealed connection to work site with HEPA vacuum for vacuuming prior to exit) before construction begins. Install construction barriers and ceiling protection carefully, outside of normal work hours.

4) Maintain negative air pressure (0.01 inches of water gauge) within work site utilizing HEPA equipped air filtration units and continuously monitored with a digital display, recording and alarm instrument, which must be calibrated on installation, maintained with periodic calibration and monitored by the contractor.

5) Seal holes, pipes, conduits, and punctures.

6) Construct anteroom and require all personnel to pass through this room so they can be vacuumed using a HEPA vacuum cleaner before leaving work site or they can wear cloth or paper coveralls that are removed each time they leave work site.

7) All personnel entering work site are required to wear shoe covers. Shoe covers must be changed each time the worker exits the work area.

b. Upon Completion:

1) Do not remove barriers from work area until thoroughly cleaned and completed project is inspected by the Contracting Officer Representative and Infection Control Officer.

2) Remove construction barriers and ceiling protection carefully to minimize spreading of dirt and debris associated with construction, outside of normal work hours.

3) Contain construction waste before transport in tightly covered containers.

4) Cover transport receptacles or carts. Tape covering unless solid lid.

5) Vacuum work area with HEPA filtered vacuums.

6) Wet mop area with cleaner/disinfectant.

7) Upon completion, restore HVAC system where work was performed.

8) Return permit to the Contracting Officer Representative.

D. Barriers shall be erected as required based upon classification (Class III & IV worksites require barriers). Barriers shall be constructed as follows:

1. Class III and IV (Single Room) - closed door with masking tape applied over the frame and door is acceptable for projects that can be contained in a single room.

2. Where dust control is the only hazard for construction, demolition or reconstruction not capable of containment within a single room, and an agreement is reached with the Contracting Officer Representative and Infection Control Officer:

    a. Airtight plastic barrier that extends from the floor to ceiling. Seams must be sealed with duct tape to prevent dust and debris from escaping.

3. Class III construction, demolition or reconstruction not capable of containment within a single room must have the following barriers erected and made presentable on hospital occupied side:

    a. Class III & IV (where dust control is the only hazard, and an agreement is reached with the Resident Engineer and Medical Center) - Airtight plastic barrier that extends from the floor to ceiling. Seams must be sealed with duct tape to prevent dust and debris from escaping

    b. Class III & IV - Drywall barrier erected with joints covered or sealed to prevent dust and debris from escaping.

    c. Class III & IV - Seal all penetrations in existing barrier airtight

    d. Class III & IV - Barriers at penetration of ceiling envelopes, chases and ceiling spaces to stop movement air and debris

    e. Class III & IV - At elevators shafts or stairways within the field of construction, overlapping flap minimum of two feet wide of polyethylene enclosures for personnel access.

4. Class IV construction, demolition or reconstruction not capable of containment within a single room must have the following barriers erected and made presentable on hospital occupied side:

a. Drywall barrier erected with joints covered or sealed to prevent dust and debris from escaping.

b. Seal all penetrations in existing barrier airtight

c. Barriers at penetration of ceiling envelopes, chases and ceiling spaces to stop movement air and debris

d. Anteroom or double entrance openings that allow workers to remove protective clothing or vacuum off existing clothing

e. At elevators shafts or stairways within the field of construction, overlapping flap minimum of two feet wide of polyethylene enclosures for personnel access.

E. Products and Materials:

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

2. Barrier Doors: Self Closing Two-hour fire-rated

3. Dust proof two-hour fire-rated drywall

4. High Efficiency Particulate Air-Equipped filtration machine rated at 95% capture of 0.3 microns including pollen, mold spores and dust particles. HEPA filters should have ASHRAE 85 or other prefilter to extend the useful life of the HEPA. Provide both primary and secondary filtrations units. Maintenance of equipment and replacement of the HEPA filters and other filters will be in accordance with manufacturer’s instructions.

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

6. Adhesive Walk-off Mats: Provide minimum size mats of 24 inches x 36 inches

7. Disinfectant: Hospital-approved disinfectant or equivalent product

8. Portable Ceiling Access Unit for access to ceiling tiles in occupied patient care areas

F. Before any construction on site begins, all contractor personnel involved in the construction or renovation activity shall be educated and trained in infection prevention measures established by the medical center. Proof of training will be a picture contractor badge issued by the VA Police.

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

H. Medical center Infection Control personnel will monitor for airborne disease (e.g. aspergillosis) during construction. Infection Control will maintain surveillance of patient bacteria laboratory reports and monitor for concerns. A particle count baseline will be established by the Safety Department prior to the start of work and reevaluated periodically during construction to determine impact of construction activities on indoor air quality. Contractor will need to identify additional dust control measures if particle levels increase or patient bacteria laboratory reports show trending of disease.

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

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

2. Exhaust hoses shall be exhausted so that dust is not reintroduced to the medical center.

3. Adhesive Walk-off/Carpet Walk-off Mats shall be used at all interior transitions from the construction area to occupied medical center area. These mats shall be changed as often as required to maintain clean work areas directly outside construction area at all times.

4. Vacuum and wet mop all transition areas from construction to the occupied medical center at the end of each workday. Vacuum shall utilize HEPA filtration. Maintain surrounding area frequently. Contain debris as it is created. Transport these outside the construction area in containers with tightly fitting lids. Removal of debris must be coordinated with Contracting Officer Representative to minimize impact on patients and facility operations. Elevator #6 in Buffalo will not be used for transportation of debris or supplies.

5. The contractor shall not haul debris through patient-care areas without prior approval of the Resident Engineer and the Medical Center. When, approved, debris shall be hauled in enclosed dust proof containers or wrapped in plastic and sealed with duct tape. No sharp objects should be allowed to cut through the plastic. Wipe down the exterior of the containers with a damp rag to remove dust before container leaves the work area. All equipment, tools, material, etc. transported through occupied areas shall be made free from dust and moisture by vacuuming and wipe down.

6. There shall be no standing water during construction. This includes water in equipment drip pans and open containers within the construction areas. All accidental spills must be cleaned up and dried within 12 hours. Remove and dispose of porous materials that remain damp for more than 72 hours.

7. At completion, remove construction barriers and ceiling protection carefully, outside of normal work hours. Vacuum and clean all surfaces free of dust after the removal.

J. 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.

K. Exterior Construction

1. Contractor shall verify that dust will not be introduced into the medical center through intake vents, or building openings. HEPA filtration on intake vents is required where dust may be introduced.

2. Dust created from disturbance of soil such as from vehicle movement will be wetted with use of a water truck as necessary

3. All cutting, drilling, grinding, sanding, or disturbance of materials shall be accomplished with tools equipped with either local exhaust ventilation (i.e. vacuum systems) or wet suppression controls.

1.13 TUBERCULOSIS SCREENING

A. Based on the VAWNYHS Tuberculosis Pre-Construction Risk Assessment for the transmission of Tuberculosis (TB) to the contracted construction workers, a pre-placement tuberculin screening is not required.

A. **Fire Safety Plan:** Establish and maintain a site-specific fire protection program in accordance with 29 CFR 1926. Prior to start of work, prepare a plan detailing project-specific fire safety measures, including periodic status reports, and submit to Contracting Officer Representative as part of the Accident Prevention Plan for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

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

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

D. **Temporary 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, ¾ hour fire/smoke rated doors with self-closing devices.

2. Install 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.

   a. For construction efforts lasting less than one work shift:

      1) Install and maintain temporary construction partitions to provide smoke-tight separations between construction and adjoining areas. Airtight plastic barrier must extend from the floor to ceiling. Seams must be sealed with duct tape to prevent dust and debris from escaping.

2) Sheet Plastic must be fire retardant polystyrene, 6-mil thickness meeting local fire codes.

b. For construction efforts lasting more than one work shift and where sprinkler coverage is maintained throughout the project:

1) Install and maintain temporary one-hour fire rated construction partitions to provide smoke-tight separations between construction areas and adjoining areas. Extend the partitions through suspended ceilings to floor slab deck or roof. Seal joints and penetrations. At door openings, install Class C, ¾ hour fire/smoke rated doors with self-closing devices.

2) Maintain integrity of existing two-hour fire-rated barriers as shown on drawings such as 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 assemblies to maintain fire ratings. Seal penetrations with listed through-penetration firestop materials in accordance with Section 07 84 00, FIRESTOPPING and as specified in 1.14. S. Fire Stopping.

c. For construction efforts lasting more than one work shift and where sprinkler coverage is not maintained throughout project:

1) Install and maintain temporary two-hour fire rated construction partitions to provide smoke-tight separations between construction areas and adjoining areas. Extend the partitions through suspended ceilings to floor slab deck or roof. Seal joints and penetrations. At door openings, install Class C, 1½ hour fire/smoke rated doors with self-closing devices.

2) Maintain integrity of existing two-hour fire-rated barriers as shown on drawings such as 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 assemblies to maintain fire ratings. Seal penetrations with listed through-penetration firestop materials in accordance with Section 07 84 00, FIRESTOPPING and as specified in 1.14. R. Fire Stopping.

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

F. **Means of Egress:** Do not block exiting for occupied buildings, including paths from exits to roads. Minimize disruptions and coordinate with Contracting Officer Representative.

G. **Egress Routes for Construction Workers:** Maintain free and unobstructed egress. SSHO will inspect egress routes daily. SSHO will report findings and corrective actions weekly to the Contracting Officer Representative.

H. **Fire Extinguishers:** Provide and maintain extinguishers in construction areas and temporary storage areas in accordance with 29 CFR 1926, NFPA 241 and NFPA 10 for the duration of the construction effort whether work is actively being done or not.

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

J. **Standpipes:** Install and extend standpipes up with each floor in accordance with 29 CFR 1926 and NFPA 241. Do not charge wet standpipes subject to freezing until weather-protected.

K. **Sprinklers:** Construct construction barriers IAW Section AD based on sprinkler coverage. Install, test and activate new automatic sprinklers prior to removing construction barriers.

L. **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. Ensure interim life safety measures approved by Contracting Officer Representative in consultation with the Safety Department are in place for impairments more than 4 hours in a 24-hour period. Request interruptions in accordance with Article, OPERATIONS AND STORAGE AREAS, and coordinate with Contracting Officer Representative. All existing or temporary fire protection systems (fire alarms, sprinklers) located in construction areas shall be tested as coordinated with the medical center. Parameters for the testing and results of any tests performed shall be recorded and copies provided to the Contracting Officer Representative.

M. **Fire Alarm Notification Devices:** Construction area must maintain at least one audiovisual notification device and one pull station in the means of egress to allow communication of fire alarm information in the event of a fire or establish equivalent notification system that complies with 29 CFR 1926.150.

N. **Smoke Detectors:** To prevent accidental operation, smoke detectors will be removed in the construction area. Heat detectors will be installed to comply with NFPA 72. Heat detectors must be programed into the facility fire system. Coordinate with Contracting Officer Representative.

O. **Hot Work:** Perform and safeguard hot work operations in accordance with NFPA 241, NFPA 51B and 29 CFR 1926 Subpart J. All hot work will require a permit. All hot work permits expire at the end of the work day. Coordinate with and obtain a permit from the Contracting Officer Representative at least two [2] hours in advance. Designate contractor's responsible project-site SSHO to monitor hot work activities.

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

Q. **Smoking:** **Smoking is prohibited** except in designated smoking areas.

R. **Impaired Areas:** If required, submit documentation to the Contracting Officer Representative that personnel have been trained in the fire safety aspects of working in areas with impaired structural or compartmentalization features.

S. **Firestopping:**

1. All structural elements exposed as part of the construction effort shall have fireproofing reapplied as soon as practicable.

2. All penetrations through floors, walls, and ceilings (discovered during demolition and created during construction) must be sealed and/or repaired as soon as practicable.

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

1.14 ELECTRICAL

A. All electrical work shall comply with NFPA 70 (NEC), NFPA 70B, NFPA 70E, 29 CFR Part 1910 Subpart J – General Environmental Controls, 29 CFR Part 1910 Subpart S – Electrical, and 29 CFR 1926 Subpart K in addition to other references required by contract.

B. All qualified persons performing electrical work under this contract shall be licensed journeyman or master electricians. All apprentice electricians performing under this contract shall be deemed unqualified persons unless they are working under the immediate supervision of a licensed electrician or master electrician.

C. All electrical work will be accomplished de-energized and in the Electrically Safe Work Condition (refer to NFPA 70E for Work Involving Electrical Hazards, including Exemptions to Work Permit). Any Contractor, subcontractor or temporary worker who fails to fully comply with this requirement is subject to immediate termination in accordance with FAR clause 52.236-5(c). Only in rare circumstances, where achieving an electrically safe work condition prior to beginning work would increase or cause additional hazards or is infeasible due to equipment design or operational limitations is energized work

permitted. The Contracting Officer Representative in consultation with the Safety Department and with approval of the Medical Center Director will make the determination if the circumstances would meet the exception outlined above. An AHA and permit specific to energized work activities will be developed, reviewed, and accepted by the VA prior to the start of that activity.

1. Development of a Hazardous Electrical Energy Control Procedure is required prior to de-energization. A single Simple Lockout/Tagout Procedure for multiple work operations can only be used for work involving qualified person(s) de-energizing one set of conductors or circuit part source. Task specific Complex Lockout/Tagout Procedures are required at all other times.

2. Energized electrical work (live work) under NFPA 70E, shall only be performed by qualified persons wearing appropriate shock protective (voltage rated) gloves and arc rated personal protective clothing and equipment, using Underwriters Laboratories (UL) tested and appropriately rated contact electrical testing instruments or equipment appropriate for the environment in which they will be used.

3. Personal Protective Equipment (PPE) and electrical testing instruments will be readily available for inspection by the Contracting Officer Representative and Construction Safety Officer.

D. Before beginning any electrical work, an Activity Hazard Analysis (AHA) will be conducted to include Shock Hazard and Arc Flash Hazard analyses (NFPA Tables can be used only as a last alterative and it is strongly suggested a full Arc Flash Hazard Analyses be conducted). Work shall not begin until the AHA for the work activity has been accepted by the Contracting Officer Representative and discussed with all engaged in the activity, including the Contractor, subcontractor(s), and Government on-site representatives at preparatory and initial control phase meetings.

E. Ground-fault circuit interrupters. GFCI protection shall be provided where an employee is operating or using cord- and plug-connected tools

related to construction activity supplied by 125-volt, 15-, 20-, or 30-ampere circuits. Where employees operate or use equipment supplied by greater than 125-volt, 15-, 20-, or 30- ampere circuits, GFCI protection or an assured equipment grounding conductor program shall be implemented in accordance with NFPA 70E - 2015, Chapter 1, Article 110.4(C)(2).

1.15 FALL PROTECTION

A. All work with a fall protection threshold of greater than 6 feet (1.8 m) shall comply with 29 CFR 1926 Subpart M, L, and R as applicable. A site specific written fall protection plan shall be submitted as part of the APP and must be submitted to the Contracting Officer Representative and reviewed for acceptance.

1. The use of a Safety Monitoring System (SMS) as a fall protection method is prohibited.

2. The use of Controlled Access Zone (CAZ) as a fall protection method is prohibited.

3. A Warning Line System (WLS) may ONLY be used on floors or flat or low-sloped roofs (between 0 - 18.4 degrees or 4:12 slope) and shall be erected around all sides of the work area (See 29 CFR 1926.502(f) for construction of WLS requirements). Working within the WLS does not require FP. No worker shall be allowed in the area between the roof or floor edge and the WLS without FP. FP is required when working outside the WLS. Work on a roof having a slope greater than 4:12 (vertical to horizontal) requires a personal fall arrest system, guardrails with toe-boards, or safety nets.

4. Fall protection while using a ladder will be governed by the OSHA requirements.

5. Fall Protection Equipment

   a. Install and use guardrails and safety nets in accordance with EM 385-1-1, Section 21.F.01 and 29 CFR 1926 Subpart M.

b. Only a full-body harness with a shock-absorbing lanyard or self-retracting lanyard is an acceptable personal fall arrest body support device. The use of body belts is not acceptable. Harnesses must have a fall arrest attachment affixed to the body support (usually a Dorsal D-ring) and specifically designated for attachment to the rest of the system. Snap hooks and carabineers must be self-closing and self-locking, capable of being opened only by at least two consecutive deliberate actions and have a minimum gate strength of 1633 kg 3,600 lbs in all directions. Use webbing, straps, and ropes made of synthetic fiber. The maximum free fall distance when using fall arrest equipment must not exceed 1.8 m 6 feet, unless the proper energy absorbing lanyard is used. Always take into consideration the total fall distance and any swinging of the worker (pendulum-like motion), that can occur during a fall, when attaching a person to a fall arrest system. Equip all full body harnesses with Suspension Trauma Preventers such as stirrups, relief steps, or similar in order to provide short-term relief from the effects of orthostatic intolerance in accordance with EM 385-1-1, Section 21.I.06.

6. Rescue and Evacuation Plan

a. A Rescue and Evacuation Plan is required when personal fall arrest systems are used.

b. It must include the following: methods of rescue; methods of self-rescue or assisted-rescue; equipment used; training requirement; specialized training for the rescuers; procedures for requesting rescue and medical assistance; and transportation routes to a medical facility.

c. Include the Rescue and Evacuation Plan within the Activity Hazard Analysis (AHA) for the phase of work, and in the Fall Protection and Prevention Plan within the APP. The plan must be in accordance with the requirements of EM 385-1-1 Section

21.N (Rescue Plan and Procedures), ASSP Z359.2, and ASSP Z359.4.

1.17 SCAFFOLDS AND OTHER WORK PLATFORMS

A. All scaffolds and other work platforms construction activities shall comply with 29 CFR 1926 Subpart L.

B. The fall protection (FP) threshold height requirement is 6 ft (1.8 m) as stated in Section 1.16.

C. The following hierarchy and prohibitions shall be followed in selecting appropriate work platforms.

1. Scaffolds, platforms, or temporary floors shall be provided for all work except that can be performed safely from the ground or similar footing.

2. Ladders less than 20 feet may be used as work platforms only when use of small hand tools or handling of light material is involved.

3. Ladder jacks, lean-to, and prop-scaffolds are prohibited.

4. Emergency descent devices shall not be used as working platforms.

D. Contractors shall use a scaffold tagging system in which all scaffolds are tagged by the Competent Person. Tags shall be color-coded: green indicates the scaffold has been inspected and is safe to use; red indicates the scaffold is unsafe to use. Tags shall be readily visible, made of materials that will withstand the environment in which they are used, be legible and shall include:

1. The Competent Person’s name and signature;

2. Dates of initial and last inspections.

E. Mast Climbing work platforms: When access ladders, including masts designed as ladders, exceed 20 ft (6 m) in height, positive fall protection shall be used.

E. General Requirements

1. Scaffold platforms greater than 6 m 20 feet in height must be accessed by use of a scaffold stair system.
2. Ladders commonly provided by scaffold system manufacturers are prohibited for accessing scaffold platforms greater than 6 m 20 feet maximum in height.
3. An adequate gate is required.
4. Employees performing scaffold erection and dismantling must be qualified.
5. Scaffold must be capable of supporting at least four times the maximum intended load and provide appropriate fall protection as delineated in the accepted fall protection and prevention plan.
6. Stationary scaffolds must be attached to structural building components to safeguard against tipping forward or backward.
7. Special care must be given to ensure scaffold systems are not overloaded.
8. Side brackets used to extend scaffold platforms on self-supported scaffold systems for the storage of material are prohibited. The first tie-in must be at the height equal to 4 times the width of the smallest dimension of the scaffold base.
9. Scaffolding other than suspended types must bear on base plates upon wood mudsills (51 mm x 254 mm x 203 mm 2 in x 10 in x 8 in minimum) or other adequate firm foundation.
10. Scaffold or work platform erectors must have fall protection during the erection and dismantling of scaffolding or work platforms that are more than 1.83 meters 6 feet.

1.18 ELEVATED AERIAL WORK PLATFORMS (AWPS)

A. General Requirements:

1. Workers must be anchored to the basket or bucket in accordance with manufacturer's specifications and instructions (anchoring to the boom may only be used when allowed by the manufacturer and permitted by the CP).
2. Lanyards used must be sufficiently short to prohibit worker from climbing out of basket.
3. The climbing of rails is prohibited.
4. Lanyards with built-in shock absorbers are acceptable.

5. Self-retracting devices are not acceptable.
6. Tying off to an adjacent pole or structure is not permitted unless a safe device for 100 percent tie-off is used for the transfer.
7. Use of AWPs must be operated, inspected, and maintained as specified in the operating manual for the equipment and delineated in the AHA.
8. Operators of AWPs must be designated as qualified operators.
9. Maintain proof of qualifications on site for review and include in the AHA.

1.19 EXCAVATION AND TRENCHES

A. All excavation and trenching work shall comply with 29 CFR 1926 Subpart P. Excavations less than 5 feet in depth require evaluation by the contractor's "Competent Person" (CP) for determination of the necessity of an excavation protective system where kneeing, laying in, or stooping within the excavation is required.

B. All excavations and trenches 24 inches in depth or greater shall require a written trenching and excavation permit. The permit shall have two sections, one section will be completed prior to digging or drilling and the other will be completed prior to personnel entering the excavations greater than 5 feet in depth. Each section of the permit shall be provided to the Contracting Officer Representative prior to proceeding with digging or drilling and prior to proceeding with entering the excavation. After completion of the work and prior to opening a new section of an excavation, the permit shall be closed out and provided to the Contracting Officer Representative. The permit shall be maintained onsite and the first section of the permit shall include the following:

1. Estimated start time & stop time

2. Specific location and nature of the work.

3. Indication of the contractor's "Competent Person" (CP) in excavation safety with qualifications and signature. Formal course in excavation safety is required by the contractor's CP.

4. Indication of whether soil or concrete removal to an offsite location is necessary.

5. Indication of whether soil samples are required to determine soil contamination.

6. Indication of coordination with local authority (i.e. "UDig NY (811)") or contractor's effort to determine utility location with search and survey equipment.

7. Indication of review of site drawings for proximity of utilities to digging/drilling.

The second section of the permit for excavations greater than five feet in depth shall include the following:

8. Determination of OSHA classification of soil. Soil samples will be from freshly dug soil with samples taken from different soil type layers as necessary and placed at a safe distance from the excavation by the excavating equipment. A pocket penetrometer will be utilized in determination of the unconfined compression strength of the soil for comparison against OSHA table (Less than 0.5 Tons/FT2 – Type C, 0.5 Tons/FT2 to 1.5 Tons/FT2 – Type B, greater than 1.5 Tons/FT2 – Type A without condition to reduce to Type B).

9. Indication of selected protective system (sloping/benching, shoring, shielding). When soil classification is identified as "Type A" or "Solid Rock", only shoring or shielding or Professional Engineer designed systems can be used for protection. A Sloping/Benching system may only be used when classifying the soil as Type B or Type C. Refer to Appendix B of 29 CFR 1926, Subpart P for further information on protective systems designs.

10. Indication of the spoil pile being stored at least 2 feet from the edge of the excavation and safe access being provided within 25 feet of the workers.

11. Indication of assessment for a potential toxic, explosive, or oxygen deficient atmosphere where oxygen deficiency (atmospheres

containing less than 19.5 percent oxygen) or a hazardous atmosphere exists or could reasonably be expected to exist. Internal combustion engine equipment is not allowed in an excavation without providing force air ventilation to lower the concentration to below OSHA PELs, providing sufficient oxygen levels, and atmospheric testing as necessary to ensure safe levels are maintained.

C. As required by OSHA 29 CFR 1926.651(b)(1), the estimated location of utility installations, such as sewer, telephone, fuel, electric, water lines, or any other underground installations that reasonably may be expected to be encountered during excavation work, shall be determined prior to opening an excavation.

1. The planned dig site will be outlined/marked in white prior to locating the utilities.

2. Used of the American Public Works Association Uniform Color Code is required for the marking of the proposed excavation and located utilities.

3. 811 will be called two business days before digging on all local or State lands and public Right-of Ways.

4. Digging will not commence until all known utilities are marked.

5. Utility markings will be maintained.

D. Excavations will be hand dug or excavated by other similar safe and acceptable means as excavation operations approach within 3 feet of identified underground utilities. Exploratory bar or other detection equipment will be utilized as necessary to further identify the location of underground utilities.

E. Excavations greater than 20 feet in depth require a Professional Engineer designed excavation protective system.

1.20 EQUIPMENT

A. Material Handling Equipment (MHE)

1. Material handling equipment such as forklifts must not be modified with work platform attachments for supporting employees unless specifically delineated in the manufacturer's printed operating instructions. Material handling equipment fitted with personnel work platform attachments are prohibited from traveling or positioning while personnel are working on the platform.
2. The use of hooks on equipment for lifting of material must be in accordance with manufacturer's printed instructions. Material Handling Equipment Operators must be trained in accordance with OSHA 29 CFR 1910, Subpart N. Operators of forklifts or power industrial trucks must be licensed in accordance with OSHA.

B. Load Handling Equipment (LHE)

1. All crane work shall comply with 29 CFR 1926 Subpart CC and EM 385-1-1 Section 16.

2. Prior to operating a crane, the operator must be licensed, qualified or certified to operate the crane. Thus, all the provisions contained with Subpart CC are effective and there is no "Phase In" date.

3. Contractors shall submit a Certificate of Compliance (COC) for each piece of LHE prior to being brought on site. The COC shall be submitted to the Contracting Officer Representative for acceptance (see EM 385-1-1 Form 16-1 for an example). The COC states that the LHE and the rigging equipment meets applicable regulations (to include inspections and tests) as required by the manufacturers and the requirements of EM 385-1-1. It must be signed by a Competent Person for Crane and Rigging and placed on the LHE.
4. Inspection records must be maintained in accordance by EM 385-1-1, Section 16.D, including shift, monthly, and annual inspections, the signature of the person performing the inspection, and the serial number or other identifier of the LHE that was inspected.
5. Take steps to ensure that wind speed does not contribute to loss of control of the load during lifting operations. At wind speeds greater than 20 mph, the operator, rigger and lift supervisor must

cease all crane operations, evaluate conditions and determine if the lift may proceed. Base the determination to proceed or not on wind calculations per the manufacturer and a reduction in LHE rated capacity if applicable. Include this maximum wind speed determination as part of the activity hazard analysis plan for that operation.

6. Standard Lift Plan: A detailed lift plan (see EM 385-1-1 Form 16-2 for an example) for all lifts shall be submitted to the Contracting Officer Representative fifteen [15] days prior to the scheduled lift for review and acceptance. Plan must include:

   a. Roles, qualifications, and responsibilities of personnel involved in the lift and their copies of their qualifications

   b. Operations affected by the lift

   c. Area Preparation: load handling location and path of travel, blocking/cribbing, overhead lines, ground stability, Crane load analysis

   d. Siting of crane and path of swing

   e. Weather Conditions

   f. Copies of the Certificate of Compliance (COC) for each piece of LHE

7. Critical Lift Plan: Critical lifts require a more comprehensive lift plan to minimize the potential of crane failure and/or catastrophic loss (see EM 385-1-1 Form 16-3 for an example). The plan must be reviewed and accepted by the Prime Contractor before being submitted to the VA for review. The lift will not be allowed to proceed without prior acceptance of the lift plan. This plan must be submitted to the Contracting Officer Representative thirty [30] days prior to the scheduled lift for review and acceptance.

8. Lifts of Personnel: Any lift involving personnel is considered a critical lift and requires the submittal of a critical lift plan as defined in in EM 385-1-1, Section 16.H (Critical Lifts). In addition, any lift of personnel also requires compliance with the requirements of 29 CFR 1926.1400 and EM 385-1-1, Section 16.T.

9. Crane operators shall not carry loads

   a. Over the general public or VAMC personnel

   b. Over any occupied building unless

   c. The top two floors are vacated or

   d. Overhead protection with a design live load of 300 psf is provided

10. Crane operations will be scheduled on weekends to minimize impact on patient care activities at the facility, unless written approval is received from the COR and CSO.

1.21 CONTROL OF HAZARDOUS ENERGY (LOCKOUT/TAGOUT)

A. All installation, maintenance, and servicing of equipment or machinery shall comply with 29 CFR 1910.147 and EM-385-1-1 Section 12 except for specifically referenced operations in 29 CFR 1926 such as concrete & masonry equipment [1926.702(j)], heavy machinery & equipment [1926.600(a)(3)(i)], and process safety management of highly hazardous chemicals (1926.64). Control of hazardous electrical energy during the installation, maintenance, or servicing of electrical equipment shall comply with Section 1.14 to include NFPA 70E and other VA specific requirements discussed in the section.

B. Utility Outages

1. The Prime Contractor must submit a written request for utility outages at least fifteen 15 days in advance. At a minimum, the written request must include the location of the outage, utilities being affected, duration of outage, any necessary sketches, and a description of the means to fulfill energy isolation requirements in accordance with EM 385-1-1, Section 11.A.02 (Isolation) and EM

385-1-1, Section 12.D (Energy Isolating Devices and Procedures). In accordance with EM 385-1-1, Section 12.A.01, where outages involve Government or Utility personnel, coordinate with the Government on all activities involving the control of hazardous energy.

2. After the request is accepted the Contracting Officer Representative may request a pre-outage coordination meeting.

1.22 CONFINED SPACE ENTRY

A. All confined space entry shall comply with 29 CRF 1926 Subpart AA and EM-385-1-1 Section 34 except for specifically referenced operations in 29 CFR 1926.1201(b)(1)-(c).

B. A site-specific Confined Space Entry Plan (including permitting process) shall be developed and submitted as part of the APP to the Contracting Officer Representative for review and acceptance.

1.23 WELDING AND CUTTING

A. As specified in section A, Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate welding and cutting with Contracting Officer Representative in accordance with section 1.14, A.

1.24 LADDERS

A. All Ladder use shall comply with 29 CFR 1926 Subpart X.

B. All portable ladders shall be of sufficient length and shall be placed so that workers will not stretch or assume a hazardous position.

C. Manufacturer safety labels shall be in place on ladders

D. Step Ladders shall not be used in the closed position

E. Top steps or cap of step ladders shall not be used as a step

F. Portable ladders, used as temporary access, shall extend at least 3 ft (0.9 m) above the upper landing surface.

1. When a 3 ft (0.9-m) extension is not possible, a grasping device (such as a grab rail) shall be provided to assist workers in mounting and dismounting the ladder.

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

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

1.25 FLOOR AND WALL OPENINGS

A. All floor and wall openings shall comply with 29 CFR 1926 Subpart M.

B. Floor and roof holes/openings are any that measure over 2 in (51 mm) in any direction of a walking/working surface which persons may trip or fall into or where objects may fall to the level below. See Section 1.25, Paragraph C.2 for covering and labeling requirements. Skylights located in floors or roofs are considered floor or roof hole/openings.

C. All floor, roof openings or hole into which a person can accidentally walk or fall through shall be guarded either by a railing system with toe boards along all exposed sides or a load-bearing cover. When the cover is not in place, the opening or hole shall be protected by a removable guardrail system or shall be attended when the guarding system has been removed, or other fall protection system.

1. Covers shall be capable of supporting, without failure, at least twice the weight of the worker, equipment and material combined.

2. Covers shall be secured when installed, clearly marked with the word “HOLE”, “COVER” or “Danger, Roof Opening-Do Not Remove” or color-coded or equivalent methods (e.g., red or orange “X”).

Workers must be made aware of the meaning for color coding and equivalent methods.

DANGER

Hole in Floor / Roof

DROP OR FALL

- **Do not step or walk here**

FALLING OBJECTS

- **May cause falling object hazard on floor below**

3. Roofing material, such as roofing membrane, insulation or felts, covering or partly covering openings or holes, shall be immediately cut out. No hole or opening shall be left unattended unless covered.

4. Non-load-bearing skylights shall be guarded by a load-bearing skylight screen, cover, or railing system along all exposed sides.

5. Workers are prohibited from standing/walking on skylights.

1.26 ENVIRONMENTAL ASPECTS

A. Solid Waste Disposal

1. The contractor will dispose of non-hazardous solid waste and construction and demolition (C&D) debris in accordance with NFPA 241: Standard for Safeguarding Construction, Alteration, and Demolition Operations.

2. All waste from work areas will be removed daily using approved, covered waste carts.

3. Project waste and C&D debris will be transferred into dumpsters provided by the contractor. On-site dumpster locations will be identified in the Accident Prevention Plan (APP) for review and approval by the facility. Project dumpsters must be at least 10 feet from the exterior of buildings. The contractor will keep dumpsters well managed and emptied on a regular basis, such that they are without spillage and not overfilled.

4. Any liquids will be stabilized (solidified) prior to disposal transport in accordance with 6 NYCRR Part 360.

B. RCRA Hazardous and Universal Waste Disposal

1. The contractor will identify, contain, label, transport, and dispose all hazardous waste, as required in 40 CFR Parts 261 – 272, in accordance with the federal Resource Conservation and Recovery Act (RCRA). The contractor will properly package and manifest all hazardous waste prior to transportation and disposal. These hazardous waste operations and manifests will be reviewed and

approved by the facility VA Green Environmental Management Systems (GEMS) Manager.

2. In further accordance with RCRA, all universal waste, as defined by 40 CFR Part 273, including but not limited to all batteries and fluorescent lamps, and other mercury containing lamps and equipment, will be properly identified, contained, labeled, and recovered, recycled, or disposed by the contractor. The contractor will properly package and list all universal waste on a bill of lading (BOL) prior to transportation and recovery, recycling, or disposal. These universal waste operations and BOL(s) will be reviewed and approved by the facility GEMS Manager.

C. Recycling

1. The contractor will evaluate solid waste and C&D debris for appropriate recycling. All material that is recycled by the contractor will be quantified by type and weight and reported by the contractor to the Contracting Officer’s Representative (COR) and GEMS Manager throughout and at the conclusion of the project.

D. Asbestos

1. The contractor will properly contain and label all asbestos-containing material (ACM) for transportation and disposal. The contractor will provide all ACM transportation and disposal documentation to the COR and GEMS Manager throughout and at the conclusion of the project.

2. The contractor will provide 10-day notifications to the United States Environmental Protection Agency (USEPA) when ACM removal will exceed threshold quantities (40 CFR Part 61 [NESHAP]).

E. Stormwater Pollution Prevention

1. The contractor will make every effort to prevent adverse impacts from the project to the facility and municipal stormwater sewer system. Such efforts include but are not limited to prevention of chemical and petroleum spills and soil erosion, and protection of stormwater receivers from such potential impacts.

2. The contractor will take appropriate measures to mitigate any stormwater impacts from spills and sediment runoff. The contractor will provide adequate materials to protect stormwater receivers, such as dikes, filter socks, filter fabric, hay bales, absorbent pads, etc. These materials will be properly staged and maintained by the contractor throughout the duration of the project.

F. Fuel Tanks

1. The contractor will follow all applicable federal (40 CFR Part 281), New York State (6 NYCRR Part 613), and NFPA 30 regulations pertaining to on-site fuel storage tanks. The contractor will maintain, inspect, and provide signage and security of these tanks as required in these regulations.

2. The contractor shall provide appropriate secondary containment and adequate spill cleanup materials for on-site fuel tanks. These materials will be accessible to the contractor at all times and the contractor will be familiar with their use. The contractor will ensure that fill ports for these tanks are locked at all times except when in immediate use.

G. Chemical Spills

1. Prior to the commencement of construction, the contractor will provide the COR, Safety Manager, and GEMS Manager with a complete list of all chemicals to be used during the duration of the project. The contractor will have Safety Data Sheets readily available for review and in case of spill or emergency.

2. The contractor will properly store all chemicals with respect to containers, labeling, signage, compatibility, and security.

3. The contractor will have appropriate and adequate spill response and cleanup materials onsite at all times. The contractor will be familiar with these spill response materials and their rapid deployment.

H. National Environmental Protection Act (NEPA)

1. The contractor will be familiar with any construction measures that are necessary to prevent adverse environmental impacts to meet the requirements of NEPA. These measures may include but not be limited to noise reduction, dust control, traffic control, and prevention air, water, and soil impacts associated with construction, as stated in the associated Environmental Assessment (EA) or Environmental Impact Statement (EIS), if applicable.

I. The contractor will submit all applicable environmental information related to the project as dictated in the Preconstruction Risk Assessment as part of the Accident Prevention Plan (Section 1.5, E).

1.27 RADIATION SAFETY

A. **Radioactive Materials (RAM).** Sealed RAM devices are prohibited on VHA projects.

B. **X-Ray Generating Devices.** Devices which generate ionizing radiation must be of the x-ray based ionizing radiation source type (e.g. XRF Material Identifier). Prior to a Contractor bringing the device on the facility, the Radiation Safety Committee (RSC) will review the device and the use of the device. The contractor shall submit to the Contracting Officer Representative for the RSC approval, a completed, "Request to Use a Device Which Emits Ionizing Radiation in a Non-Experimental, Non-Human, or Non-Research Capacity" form. The RSC shall review and approve all submitted forms.

C. **Lasers.** Lasers of Class 3b or higher require the Contractor to submit a site specific plan as part of the APP (Section E). The Laser Safety Officer will review that portion of the plan.

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Appendix A: Summary of Revisions

Page/ Section	Change	Change	Purpose
Full Document	Updated	Language and formatting	To better align with 2022 TIL spec and EM 385-1-1
1, Document Notes	Added	"presence or absence" and "Consultation with the Safety Department before deletion or substitution is required."	The spec can be modified per project in consultation with the Safety Department prior to making changes.
1. Applicable Publications	Updated	Regulatory references	Updated references
	Added	New York Code of Rules and Regulations	For reference for added Environmental Aspects Section
		National Emission Standards for Hazardous Air Pollutants	For reference for added Environmental Aspects Section
		Toxic Substances Control Act	For reference for added Environmental Aspects Section
		U.S. Army Corp of Engineers EM 385-1-1	Updated references
		United Facilities Guide Specifications- UFGS 01 35 26	Updated references
4, Definitions	Added	OSHA Competent Person: "Each CP must be designated in writing."	To better align with EM 385-1-1
		Competent Person, Confined Space Definition	To better align with EM 385-1-1
		Competent Person, Cranes and Rigging Definition	To better align with EM 385-1-1
		Competent Person, Excavation/ Trenching Definition	To better align with EM 385-1-1
		Competent Person, Fall Protection Definition	To better align with EM 385-1-1
		Competent Person, Scaffolding Definition	To better align with EM 385-1-1
	Changed	Near Miss Definition to add requirement to complete an investigation	To better align with EM 385-1-1

8, Contractor Submittals	Changed	Section Name to "Contractor Submittals"	To define responsibility
	Added	Requirements for Pre-award Contractor Evaluation	As required by VHA Directive 7715
9, Preconstruction Activities	Added	Section Name "Preconstruction Activities"	To better define requirements of project phases
18, Contractor evaluation	Added	Requirements for Pre-award Contractor Evaluation	As required by VHA Directive 7715
24, Accident Prevention Plan, Plans (Programs, Procedures) Required	Added	Added several required plans/programs where applicable	To better align with EM 385-1-1
29, SSHO and CP	Added	Requirements for SSHO and CP Qualifications and Duties	To better align with EM 385-1-1
		Added the requirement for each SSHO and CP to have an alternate	To enforce the requirement that the SSHO or the alternate will maintain a presence on the site during construction operations in accordance with FAR Clause 52.236-6: Superintendence by the Contractor.
34, Safety Meeting	Added	Added section to define the requirements for regular safety meetings to be conducted and documented.	To better align with EM 385-1-1
34, Safety Bulletin Board	Added	Added Section to define the requirement for information that must be posted in a project area	To better align with EM 385-1-1
37, Accidents/Incidents, OSHA 300 Logs, and Man-Hours	Added	A summation of all man-hours worked by the contractor and associated sub-contractors for each month will be collected by the SSHO and used to calculate a monthly incidence and DART rates and posted on the safety bulletin board.	Alignment with TIL spec
38, PPE	Added	Reflective vests	Alignment with EM 385-1-1

57, Fall Protection	Added	The use of Safety Monitoring Systems and Controlled Access Zone are prohibited	Alignment with TIL spec
		Requirements for Warning Line Systems	Alignment with 2022 TIL spec and EM 385-1-1
		Specifications for Fall Protection Equipment	Alignment with EM 385
		Rescue and Evacuation Plan	Alignment with EM 385
59, Scaffolding and Other Work Platforms	Added	General Requirements	Alignment with EM 385
60, Elevated Aerial Work Platforms (AWPS)	Added	General Requirements	Alignment with EM 385
63, Equipment	Added	Section for Material Handling Equipment	Alignment with EM 385
	Changed	Section for Cranes to Load Handling Equipment	Alignment with EM 385
	Added	Define requirements for Standard Lift Plans and Critical Lift Plans	Alignment with EM 385
66, Control of Hazardous Energy	Added	Requirements for Utilities Outages	Alignment with EM 385
70, Environmental Aspects	Added	Sections added to cover the requirements for Waste disposal, Recycling, Stormwater Pollution Prevention, Fuel tanks, Chemical Spills, and NEPA.	Compliance with 40 CFR and 6 NYCRR

11-01-20

SECTION 01 42 19
REFERENCE STANDARDS

PART 1 - GENERAL

1.1 DESCRIPTION

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

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

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

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

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

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

DEPARMENT OF VETERANS AFFAIRS
Office of Construction & Facilities Management
Facilities Quality Service (00CFM1A)
425 Eye Street N.W, (sixth floor)
Washington, DC 20001

Telephone Numbers: (202) 632-5249 or (202) 632-5178

Between 9:00 AM - 3:00 PM

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

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

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

AABC Associated Air Balance Council
https://www.aabc.com

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

AH American Hort

https://www.americanhort.org

AHAM Association of Home Appliance Manufacturers
http://www.aham.org

AIA American Institute of Architects

http://www.aia.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
https://aitc-glulam.org

AMCA Air Movement and Control Association, Inc.
http://www.amca.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

ARPM Association for Rubber Product Manufacturers

https://arpm.com

ASABE American Society of Agricultural and Biological Engineers
https://www.asabe.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 International
http://www.asse-plumbing.org

ASTM American Society for Testing and Materials International
http://www.astm.org

AWI Architectural Woodwork Institute
https://www.awinet.org

AWS American Welding Society
https://www.aws.org

AWWA American Water Works Association
https://www.awwa.org

BHMA Builders Hardware Manufacturers Association
https://www.buildershardware.com

BIA The Brick Industry Association
http://www.gobrick.com

CAGI Compressed Air and Gas Institute
https://www.cagi.org

CGA Compressed Gas Association, Inc.
https://www.cganet.com

CI The Chlorine Institute, Inc.
https://www.chlorineinstitute.org

CISCA Ceilings and Interior Systems Construction Association
https://www.cisca.org

CISPI Cast Iron Soil Pipe Institute
https://www.cispi.org

CLFMI Chain Link Fence Manufacturers Institute
https://www.chainlinkinfo.org

CPA Composite Panel Association

https://www.compositepanel.org

CPMB Concrete Plant Manufacturers Bureau
https://www.cpmb.org

CRA California Redwood Association
http://www.calredwood.org

CRSI Concrete Reinforcing Steel Institute
https://www.crsi.org

CTI Cooling Technology Institute
https://www.cti.org

DHA Decorative Hardwoods Association

https://www.decorativehardwoods.org

DHI Door and Hardware Institute
https://www.dhi.org

EGSA Electrical Generating Systems Association
http://www.egsa.org

EEI	Edison Electric Institute https://www.eei.org
EPA	United States Environmental Protection Agency https://www.epa.gov
ETL	ETL Testing Services http://www.intertek.com
FAA	Federal Aviation Administration https://www.faa.gov
FCC	Federal Communications Commission https://www.fcc.gov
FPS	Forest Products Society http://www.forestprod.org
GANA	Glass Association of North America http://www.glasswebsite.com
FM	Factory Mutual Global Insurance https://www.fmglobal.com
GA	Gypsum Association https://gypsum.org
GSA	General Services Administration https://www.gsa.gov
HI	Hydraulic Institute http://www.pumps.org
ICC	International Code Council https://shop.iccsafe.org
ICEA	Insulated Cable Engineers Association https://www.icea.net

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

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

IGMA Insulating Glass Manufacturers Alliance

https://www.igmaonline.org

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

MBMA Metal Building Manufacturers Association
https://www.mbma.com

MSS Manufacturers Standardization Society of the Valve and Fittings Industry
http://msshq.org

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

PHCC Plumbing-Heating-Cooling Contractors Association
https://www.phccweb.org

NBS National Bureau of Standards
See - NIST

NBBI The National Board of Boiler and Pressure Vessel Inspectors
https://www.nationalboard.org

NEC National Electric Code
See - NFPA National Fire Protection Association

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

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

NHLA National Hardwood Lumber Association
https://www.nhla.com

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

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

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

NPA National Particleboard Association
(See CPA, Composite Panel Association)

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

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

PCA Portland Cement Association
https://www.cement.org

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

PPI Plastics Pipe Institute
https://www.plasticpipe.org

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

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

RFCI Resilient Floor Covering Institute
https://www.rfci.com

RIS Redwood Inspection Service
(See Western Wood Products Association)

https://www.wwpa.org

SCMA Southern Cypress Manufacturers Association
http://www.cypressinfo.org

SDI Steel Door Institute
http://www.steeldoor.org

SJI Steel Joist Institute
https://www.steeljoist.org

SMACNA Sheet Metal & Air-Conditioning Contractors' National Association
https://www.smacna.org

SSPC The Society for Protective Coatings
https://www.sspc.org

STI Steel Tank Institute
https://www.steeltank.com

SWI Steel Window Institute
https://www.steelwindows.com

TCNA Tile Council of North America

https://www.tcnatile.com

TEMA Tubular Exchanger Manufacturers Association
http://www.tema.org

TPI Truss Plate Institute
https://www.tpinst.org

UBC The Uniform Building Code
(See ICC)

UL Underwriters' Laboratories Incorporated
https://www.ul.com

ULC Underwriters' Laboratories of Canada
https://www.ulc.ca

WCLB West Coast Lumber Inspection Bureau
http://www.wclib.org

WDMA Window and Door Manufacturers Association

https://www.wdma.com

WRCLA Western Red Cedar Lumber Association
https://www.realcedar.com

WWPA Western Wood Products Association
http://www.wwpa.org

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SECTION 01 45 00
QUALITY CONTROL

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies requirements for Contractor Quality Control (CQC) for Design-Bid-Build (DBB) or Design-Build (DB) construction projects. This section can be used for both project types.

1.2 APPLICABLE PUBLICATIONS

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

B. ASTM International (ASTM)

1. D3740 - (2012a) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
2. E329 - (2014a) Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction

1.3 SUBMITTALS

Government approval is required for all submittals. CQC inspection reports shall be submitted under this Specification section and follow the [Applicable CQC Control Phase (Preparatory, Initial, or Follow-Up)]: [Applicable Specification section] naming convention.

1. Preconstruction Submittals
   a. Interim CQC Plan
   b. CQC Plan
   c. Additional Requirements for Design Quality Control (DQC) Plan
2. Design Data
   a. Discipline-Specific Checklists
   b. Design Quality Control
3. Test Reports
   a. Verification Statement

PART 2 PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

Establish and maintain an effective quality control (QC) system. that complies with the FAR Clause 52.246.12 titled "Inspection of Construction". QC consists of plans, procedures, and organization necessary to produce an end product which complies with the Contract requirements. The QC system covers all design and construction operations, both onsite and offsite, and be keyed to the proposed design and construction sequence. The project superintendent will be held responsible for the quality of work and is subject to removal by the Contracting Office or Authorized designee for non-compliance with the quality requirements specified in the Contract. In this context the highest-level manager responsible for the overall construction activities at the site, including quality and production is the project superintendent. The project superintendent maintains a physical presence at the site at all times and is responsible for all construction and related activities at the site, except as otherwise acceptable to the Contracting Officer.

3.2 CQC PLAN:

A. Submit the CQC Plan no later than 15days after receipt of Notice to Proceed (NTP) proposed to implement the requirements of the FAR Clause 52.246.12 titled "Inspection of Construction". The Government will consider an Interim CQC Plan for the first 15 business days of NTP. Design and/or construction will be permitted to begin only after acceptance of the CQC Plan or acceptance of an Interim plan applicable to the particular feature of work to be started. Work outside of the accepted Interim CQC Plan will not be permitted to begin until acceptance of a CQC Plan or another Interim CQC Plan containing the additional work scope is accepted.

B. Content of the CQC Plan: Include, as a minimum, the following to cover all design and construction operations, both onsite and offsite, including work by subcontractors, designers of record consultants,

architects/engineers (A/E), fabricators, suppliers, and purchasing agents:

1. A description of the QC organization, including a chart showing lines of authority and acknowledgement that the CQC staff will implement the three-phase control system for all aspects of the work specified. Include a CQC System Manager that reports to the project superintendent.
2. The name, qualifications (in resume format) duties, responsibilities, and authorities of each person assigned a CQC function.
3. A copy of the letter to the CQC System Manager signed by an authorized official of the firm which describes the responsibilities and delegates sufficient authorities to adequately perform the functions of the CQC System Manager, including authority to stop work which is not in compliance with the Contract. Letters of direction to all other various quality control representatives outlining duties, authorities, and responsibilities will be issued by the CQC System Manager. Furnish copies of these letters to the Contracting Officer or Authorized designee.
4. Procedures for scheduling, reviewing, certifying, and managing submittals including those of subcontractors, designers of record, consultants, A/E’s offsite fabricators, suppliers and purchasing agents. These procedures must be in accordance with Section 01 33 23 Shop Drawings, Product Data, and Samples.
5. Control, verification, and acceptance of testing procedures for each specific test to include the test name, specification paragraph requiring test, feature of work to be tested, test frequency, and person responsible for each test. (Laboratory facilities approved by the Contracting Officer or Authorized designee are required to be used)
6. Procedures for tracking Preparatory, Initial, and Follow-Up control phases and control, verification, and acceptance tests including documentation.

7. Procedures for tracking design and construction deficiencies from identification through acceptable corrective action. Establish verification procedures that identified deficiencies have been corrected.
8. Reporting procedures, including proposed reporting formats.
9. A list of the definable features of work. A definable feature of work is a task which is separate and distinct from other tasks has separate control requirements, and is identified by different trades or disciplines, or it is work by the same trade in a different environment. Although each section of specifications can generally be considered as a definable feature of work, there are frequently more than one definable feature under a particular section. This list will be agreed upon during the Coordination meeting.
10. Coordinate schedule work with Special Inspections required by Section 01 45 35 Special Inspections, the Statement of Special Inspections and Schedule of Special Inspections. Where the applicable Code issue by the International Code Council (ICC) calls for inspections by the Building Official, the Contractor must include the inspections in the CQC Plan and must perform the inspections required by the applicable ICC. The Contractor must perform these inspections using independent qualified inspectors. Include the Special Inspection Plan requirements in the CQC Plan.

C. Additional Requirements for Design Quality Control (DQC) Plan: The following additional requirements apply to the DQC Plan for DB projects only and not DBB projects:
   1. Submit and maintain a DQC Plan as an effective QC program which assures that all services required by this contract are performed and provided in a manner that meets professional architectural and engineering quality standards. As a minimum, all documents must be technically reviewed by competent, independent reviewers identified in the DQC Plan. The same element that produced the product may not perform the independent technical review (ITR). Correct errors and deficiencies in the design documents prior to submitting them to the Government.

2. Include the design schedule in the master project schedule, showing the sequence of events involved in carrying out the project design tasks within the specific Contract period. This should be at a detailed level of scheduling sufficient to identify all major design tasks, including those that control the flow of work. Include review and correction periods associated with each item. This should be a forward planning as well as a project monitoring tool. The schedule reflects calendar days and not dates for each activity. If the schedule is changed, submit a revised schedule reflecting the change within 7 calendar days. Include in the DQC Plan the discipline-specific checklists to be used during the design and quality control of each submittal. Submit at each design phase as part of the project documentation these completed discipline-specific checklists.
3. Implement the DQC Plan by a DQC Manager who has the responsibility of being cognizant of and assuring that all documents on the project have been coordinated. This individual must be a person who has verifiable engineering or architectural design experience and is a Professional Engineer or Registered Architect within the state of Construction location. Notify the Contracting Officer or Authorized designee, in writing, of the name of the individual, and the name of an alternate person assigned to the position.

D. Acceptance of Plan: Acceptance of the Contractor’s plan is required prior to the start of design and construction. Acceptance is conditional and will be predicated on satisfactory performance during the design and construction. The Government reserves the right to require the Contractor to make changes in the CQC Plan and operations including removal of personnel as necessary, to obtain the quality specified.

E. Notification of Changes: After acceptance of the CQC Plan, notify the Contracting Officer or Authorized designee in writing of any proposed change. Proposed changes are subject to acceptance by the Government prior to implementation by the Contractor.

3.3 COORDINATION MEETING:

After the Preconstruction Conference Post-award Conference before start of design or construction, and prior to acceptance by the Government of the CQC Plan, meet with the Contracting Officer or Authorized designee to discuss the Contractor's quality control system. Submit the CQC Plan a minimum of 5 business days prior to the Coordination Meeting. During the meeting, a mutual understanding of the system details must be developed, including the forms for recording the CC operations, design activities (if applicable), control activities, testing, administration of the system for both onsite and offsite work, and the interrelationship of Contractor's Management and control with the Government's Quality Assurance. Minutes of the meeting will be prepared by the Government, signed by both the Contractor and Contracting Officer or Authorized designee and will become a part of the contract file. There can be occasions when subsequent conferences will be called by either party to reconfirm mutual understandings or address deficiencies in the CQC system or procedures which can require corrective action by the Contractor.

3.4 QUALITY CONTROL ORGANIZATION:

A. Personnel Requirements: The requirements for the CQC organization are a Safety and Health Manager, CQC System Manager, a Design Quality Manager (if applicable), and sufficient number of additional qualified personnel to ensure safety and Contract compliance. The Safety and Health Manager shall satisfy the requirements of Specification 01 35 26 Safety Requirements and reports directly to a senior project (or corporate) official independent from the CQC System Manager. The Safety and Health Manager will also serve as a member of the CQC Staff. Personnel identified in the technical provisions as requiring specialized skills to assure the required work is being performed properly will also be included as part of the CQC organization. The Contractor's CQC staff maintains a presence at the site at all times during progress of the work and have complete authority and responsibility to take any action necessary to ensure Contract compliance. The CQC staff will be subject to acceptance by the

Contracting Officer or Authorized designee. Provide adequate office space, filing systems, and other resources as necessary to maintain an effective and fully functional CQC organization. Promptly complete and furnish all letters, material submittals, shop drawings submittals, schedules and all other project documentation to the CQC organization. The CQC organization is responsible to maintain these documents and records at the site at all times, except as otherwise acceptable to the Government.

B. CQC System Manager: Identify as CQC System Manager an individual within the onsite work organization that is responsible for overall management of CQC and has the authority to act in all CQC matters for the Contractor. The CQC system Manager is required to be a graduate engineer, graduate architect, or a graduate of construction management, with PM or SRE to determine qualifications based on project complexity at construction review The CQC System Manger is assigned as CQC System Manager but has duties as project superintendent in addition to quality control. Identify in the plan an alternate to serve in the event of the CDQC System Manager’s absence. The requirements for the alternate are the same as the CQC System Manager.

C. CQC Personnel: In addition to CQC personnel specified elsewhere in the contract, provide as part of the CQC organization specialized personnel to assist in the CQC System Manager for the following areas, as applicable: electrical, mechanical, civil, structural, environmental, architectural, materials technician submittals clerk, Commissioning Agent/LEED specialist, and low voltage systems. These individuals or specified technical companies are directly employed by the General Contractor and cannot be employed by a supplier or subcontractor on this project; be responsible to the CQC System Manager; be physically present at the construction site during work on the specialized personnel’s areas of responsibility; have the necessary education or experience in accordance with the Experience Matrix listed herein. These individuals can perform other duties but need to be allowed sufficient time to perform the specialized personnel’s assigned quality controls duties as described in the CQC Plan. A single person can cover

more than one area provided that the single person is qualified to perform QC activities in each designated and that workload allows.

EXPERIENCE MATRIX

Area	Qualifications
Civil	Graduate Civil Engineer or Construction Manager with 2 years experience in the type of work being performed on this project or technician with 5 years related experience.
Mechanical	Graduate Mechanical Engineer with 2 years experience or construction professional with 5 years of experience supervising mechanical features of work in the field with a construction company.
Electrical	Graduate Electrical Engineer with 2 years related experience or construction professional with 5 years of experience supervising electrical features of work in the field with a construction company.
Structural	Graduate Civil Engineer (with Structural Track or Focus), Structural Engineer, or Construction Manager with 2 years experience or construction professional with 5 years experience supervising structural features of work in the field with a construction company.
Architectural	Graduate Architect with 2 years experience or construction professional with 5 years of related experience.
Environmental	Graduate Environmental Engineer with 3 years experience.
Submittals	Submittal Clerk with 1 year experience.
Concrete, Pavement, and Soils	Materials Technician with 2 years experience for the appropriate area.
Testing, Adjusting, and Balancing (TAB)	Specialist must be a member of AABC or an experienced technicaion of the firm certified by the NEBB.
Design Quality Control Manager	Registered Architect or Professional Engineer

D. Additional Requirements: In addition to the above experience and education requirements, the CQC System Manager and Alternate CQC System Manager are required to have completed the Construction Quality Management (CQM) for Construction course. If the CQC System Manager does not have a current specification, obtain the CQM for Contractors course identification within 90 days of award. This course is periodically offered by the Naval Facilities Engineering Command and the Army Corps of Engineers. Contact the Contracting Officer or Authorized designee for information on the next scheduled class.

E. Organizational Changes: Maintain the CQC staff at full strength at all times. When it is necessary to make changes to the CQC staff, revise the CQC Plan to reflect the changes and submit the changes to the Contracting Officer or Authorized designee for acceptance.

3.5 **SUBMITTALS AND DELIVERABLES:** Submittals have to comply with the requirements in Section 01 33 23 Shop Drawings, Product Data, and Samples. The CQC organization is responsible for certifying that all submittals and deliverables are in compliance with the contract requirements. When Section 01 91 00 General Commissioning Requirements is included in the contract, the submittals required by the section have to be coordinated with the Section 01 33 23 Shop Drawings, Product Data, and Samples to ensure adequate time is allowed for each type of submittal required.

3.6 CONTROL:

A. CQC is the means by which the Contractor ensures that the construction, to include that of subcontractors and suppliers, complies with the requirements of the contract. At least three phases of control are required to be conducted by the CQC System Manager for each definable feature of the construction work as follows:

1. Preparatory Phase: This phase is performed prior to beginning work on each definable feature of work after all required plans/documents/materials are approved/accepted, and after copies are at the work site. This phase includes:

a. A review of each paragraph of applicable specifications, references codes, and standards. Make available during the preparatory inspection a copy of those sections of referenced codes and standards applicable to that portion of the work to be accomplished in the field. Maintain and make available in the field for use by Government personnel until final acceptance of the work.
b. Review of the Contract drawings.
c. Check to assure that all materials and equipment have been tested, submitted, and approved.
d. Review of provisions that have been made to provide required control inspection and testing.
e. Review Special Inspections required by Section 01 45 35 Special Inspections, that Statement of Special Inspections and the Schedule of Specials Inspections.
f. Examination of the work area to assure that all required preliminary work has been completed and is in compliance with the Contract.
g. Examination of required materials, equipment, and sample work to assure that they are on hand conform to approved shop drawings or submitted data, and are properly stored.
h. Review of the appropriate Activity Hazard Analysis (AHA) to assure safety requirements are met.
i. Discussion of procedures for controlling quality of the work including repetitive deficiencies. Document construction tolerances and workmanship standards – contract defined or industry standard if not contract defined - for that feature of work.
j. Check to ensure that the portion of the plan for the work to be performed has been accepted by the Contracting Officer.
k. Discussion of the initial control phase.
l. The Government needs to be notified at least 48 hours or 2 business days in advance of beginning the Preparatory control phase. Include a meeting conducted by the CQC System Manager and

attended by the superintendent, other CQC personnel (as applicable), and the foreman responsible for the definable feature. Document the results of the Preparatory phase actions by separate minutes prepared by the CQC System Manager and attach to the daily CQC report. Instruct applicable workers as to the acceptable level of workmanship required in order to meet contract specifications.

B. Initial Phase: This phase is accomplished at the beginning of a definable feature of work. Accomplish the following:

1. Check work to ensure that it is in full compliance with contract requirements. Review minutes of the Preparatory meeting.
2. Verify adequacy of controls to ensure full contract compliance. Verify the required control inspection and testing is in compliance with the contract.
3. Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Compare with required sample panels as appropriate.
4. Resolve all differences.
5. Check safety to include compliance with an upgrading of the safety plan and activity hazard analysis. Review the activity analysis with each worker.
6. The Government needs to be notified at least 48 hours or 2 business days in advance of beginning the initial phase for definable features of work. Prepare separate minutes of this phase by the CQC System Manager and attach to the daily CQC report. Indicate the exact location of initial phase for definable feature of work for future reference and comparison with Follow-Up phases.
7. The initial phase for each definable feature of work is repeated for each new crew to work onsite, or any time acceptable specified quality standards are not being met.
8. Coordinate scheduled work with Special Inspections required by Section 01 45 35 Special Inspections, the Statement of Special Inspections, and the Schedule of Special Inspections.

C. Follow-Up Phase: Perform daily checks to assure control activities,

including control testing, are providing continued compliance with contract requirements until the completion of the particular feature of work. Record the checks in the CQC documentation. Conduct final Follow-Up checks and correct all deficiencies prior to the start of additional features of work which may be affected by the deficient work. Do not build upon nor conceal non-conforming work. Coordinate scheduled work with Special Inspections required by Section 01 45 35 Special Inspections, the Statement of Special Inspections, and the Schedule of Special Inspections

D. Additional Preparatory and Initial Phases on the same definable features of work if: the quality ongoing work is unacceptable; if there are changes in the applicable CQC staff, onsite production supervision or work crew; if work on a definable feature is resumed after a substantial period of inactivity, or if other problems develop.

3.7 TESTS

A. Testing Procedure: Perform specified or required tests to verify that control measures are adequate to provide a product which conforms to contract requirements. Upon request, furnish to the Government duplicate samples of test specimens for possible testing by the Government. Testing includes operation and acceptance test when specified. Procure the services of a Department of Veteran Affairs approved testing laboratory or establish an approved testing laboratory at the project site. Perform the following activities and record and provide the following data:

1. Verify that testing procedures comply with contract requirements.
2. Verify that facilities and testing equipment are available and comply with testing standards.
3. Check test instrument calibration data against certified standards.
4. Verify that recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.
5. Record results of all tests taken, both passing and failing on the CQC report for the date taken. Specification paragraph reference, location where tests were taken, and the unique sequential control

number identifying the test. If approved by the Contracting Officer or Authorized designee, actual test reports are submitted later with a reference to the test number and date taken. Provide an information copy of tests performed by an offsite or commercial test facility directly to the Contracting Officer or Authorized designee. Failure to submit timely test reports as stated results in nonpayment for related work performed and disapproval of the test facility for this Contract.

B. Testing Laboratories: All testing laboratories must be validated through the procedures contained in Specification section 01 45 29 Testing Laboratory Services.

1. Capability Check: The Government reserves the right to check laboratory equipment in the proposed laboratory for compliance with the standards set forth in the contract specifications and to check the laboratory technician’s testing procedures and techniques. Laboratories utilized for testing soils, concrete, asphalt and steel is required to meet criteria detailed in ASTM D3740 and ASTM E329.
2. Capability Recheck: If the selected laboratory fails the capability check, the Contractor will be assessed a charge equal to value of recheck to reimburse the Government for each succeeding recheck of the laboratory or the checking of a subsequently selected laboratory. Such costs will be deducted from the Contract amount due the Contractor.

C. Onsite Laboratory: The Government reserves the right to utilize the Contractor’s control testing laboratory and equipment to make assurance tests, and to check the Contractor’s testing procedures, techniques, and test results at no additional cost to the Government.

3.8 COMPLETION INSPECTION

A. Punch-Out Inspection: Conduct an inspection of the work by the CQC system Manager near the end of the work, or any increment of the work established by the specifications. Prepare and include in the CQC documentation a punch list of items which do not conform to the approved drawings and specifications. Include within the list of deficiencies the estimated date by which the deficiencies will be

corrected. Make a second inspection the CQC System Manager or staff to ascertain that all deficiencies have been corrected. Once this is accomplished, notify the Government that the facility is ready for the Government Pre-Final Inspection.

B. Pre-Final Inspection: The Government will perform the Pre-Final Inspection to verify that the facility is complete and ready to be occupied. A Government Pre-Final Punch List may be developed as a result of this inspection. Ensure that all items on this list have been corrected before notifying the Government, so that a Final Acceptance Inspection with the customer can be scheduled. Correct any items noted on the Pre-Final Inspection in a timely manner. These inspections and any deficiency corrections required by this paragraph need to be accomplished within the time slated for completion of the entire work or any particular increment of the work if the project is divided into increments by separate construction completion dates.

C. Final Acceptance Inspection: The Contractor's QC Inspection personnel, plus the superintendent or other primary management person, and the Contracting Officer's Authorized designee is required to be in attendance at the Final Acceptance Inspection. Additional Government personnel can also be in attendance. The Final Acceptance Inspection will be formally scheduled by the Contracting Officer's or Authorized designee based upon results of the Pre-Final Inspection. Notify the Contracting Officer through the Resident Engineer office at least 14 days prior to the Final Acceptance Inspection and include the Contractor's assurance that all specific items previously identified to the Contractor as being unacceptable, along with all remaining work performed under the contract, will be complete and acceptable by the date schedule for the Final Acceptance Inspection. Failure of the Contractor to have all contract work acceptably complete for this inspection will be cause for the Contracting Officer to bill the Contractor for the Government's additional inspection cost in accordance with FAR Clause 52.246-12 titled "Inspection of Construction".

3.9 DOCUMENTATION

A. Quality Control Activities: Maintain current records providing factual evidence that required QC activities and tests have been performed. Include in these records the work of subcontractors and suppliers on an acceptable form that includes, as a minimum, the following information:
   1. The name and area of responsibility of the Contractor/Subcontractor
   2. Operating plant/equipment with hours worked, idle, or down for repair.
   3. Work performed each day, giving location, description, and by whom. When Network Analysis (NAS) is used, identify each phase of work performed each day by NAS activity number.
   4. Test and control activities performed with results and references to specification/drawing requirements. Identify the Control Phase (Preparatory, Initial, and/or Follow-Up). List deficiencies noted, along with corrective action.
   5. Quantity of materials received at the site with statement as to acceptability, storage, and reference to specification/drawing requirements.
   6. Submittals and deliverables reviewed, with Contract reference, by whom, and action taken.
   7. Offsite surveillance activities, including actions taken.
   8. Job safety evaluations stating what was checked, results, and instructions or corrective actions.
   9. Instructions given/received and conflicts in plans and specifications.
   10. Provide documentation of design quality control activities. For independent design reviews, provide, as a minimum, identification of the Independent Technical Reviewer (ITR) team, the ITR review comments, responses, and the record of resolution of the comments.

B. Verification Statement: Indicate a description of trades working on the project; the number of personnel working; weather conditions encountered; and any delays encountered. Cover both conforming and deficient features and include a statement that equipment and materials incorporated in the work and workmanship comply with the Contract.

Furnish the original and one copy of these records in report form to the Government daily with 1 week after the date covered by the report, except that reports need not be submitted for days on which no work is performed. As a minimum, prepare and submit on report for every 7 days of no work and on the last day of a no work period. All calendar days need to be accounted for throughout the life of the contract. The first report following a day of no work will be for that day only. Reports need to be signed and dated by the CQC System Manager. Include copies of test reports and copies of reports prepared by all subordinate QC personnel within the CQC System Manager Report.

3.10 SAMPLE FORMS

Consult the COR for station Standard Forms. If not available from the Staton, templates of various quality control reports can be found on the Whole Building Design Guide website at https://www.wbdg.org/FFC/NAVGRAPH/01%2045%2000.00%2020_quality_control_reports.pdf

3.11 **NOTIFICATION OF NONCOMPLIANCE:** The Contracting Officer or Authorized designee will notify the Contractor of any detected noncompliance with the foregoing requirements. The Contractor should take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the work site will be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Contracting Officer can issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders will be made the subject of claim for extension of time or for excess costs or damages by the Contractor.

--- End of Section ---

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 the General Contractor.

1.2 APPLICABLE PUBLICATIONS:

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

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

T27-11.....Standard Method of Test for Sieve Analysis of Fine and Coarse Aggregates

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

T99-10.....Standard Method of Test for Moisture-Density Relations of Soils Using a 2.5 Kg (5.5 lb.) Rammer and a 305 mm (12 in.) Drop

T104-99 (R2007).....Standard Method of Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate

T180-10.....Standard Method of Test for Moisture-Density Relations of Soils using a 4.54 kg (10 lb.) Rammer and a 457 mm (18 in.) Drop

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

T310-13.....Standard Method of Test for In-place Density and Moisture Content of Soil and Soil-aggregate by Nuclear Methods (Shallow Depth)

C. American Concrete Institute (ACI):

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

D3740-11.....Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection

of Soil and Rock as used in Engineering Design and Construction

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

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

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

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

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

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

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

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

F3125/F3125M-15.....Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions

E. American Welding Society (AWS):

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

1.3 REQUIREMENTS:

A. Accreditation Requirements: Construction materials testing laboratories must be accredited by a laboratory accreditation authority and will be required to submit a copy of the Certificate of Accreditation and Scope of Accreditation. The laboratory’s scope of accreditation must include the appropriate ASTM standards (i.e.; E329, C1077, D3666, D3740, A880, E543) listed in the technical sections of the specifications. Laboratories engaged in Hazardous Materials Testing shall meet the requirements of OSHA and EPA. The policy applies to the specific

laboratory performing the actual testing, not just the "Corporate Office."

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

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

   a. See Part 3 of this Section for additional reporting requirements based on portion of the Work.

D. Verbal Reports: Give verbal notification to Contracting Officer's Representative immediately of any irregularity.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EARTHWORK:

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

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

2. Provide full time observation of fill placement and compaction and field density testing in building areas and provide 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 and/or ASTM D1557.
2. Make field density tests in accordance with the primary testing method following ASTM D6938 wherever possible. Field density tests utilizing ASTM D1556, or ASTM D2167 shall be utilized on a case-by-case basis only if there are problems with the validity of the results from the primary method due to specific site field conditions. Should the testing laboratory propose these alternative methods, they should provide satisfactory explanation to the Contracting Officer’s Representative before the tests are conducted.
   a. Building Slab Subgrade: At least one test of subgrade for every 185 m^2 (2000 square feet) of building slab, but in no case fewer than three tests. In each compacted fill layer, perform one test for every 185 m^2 (2000 square feet) of overlaying building slab, but in no case fewer than three tests.
   b. Foundation Wall Backfill: One test per 30 m (100 feet) of each layer of compacted fill but in no case fewer than two tests.
   c. Pavement Subgrade: One test for each 335 m^2 (400 square yards), but in no case fewer than two tests.
   d. Curb, Gutter, and Sidewalk: One test for each 90 m (300 feet), but in no case fewer than two tests.
   e. Trenches: One test at maximum 30 m (100 foot) intervals per 1200 mm (4 foot) of vertical lift and at changes in required density, but in no case fewer than two tests.
   f. Footing Subgrade: At least one test for each layer of soil on which footings will be placed. Subsequent verification and approval of each footing subgrade may be based on a visual

comparison of each subgrade with related tested subgrade when acceptable to Contracting Officer's Representative. In each compacted fill layer below wall footings, perform one field density test for every 30 m (100 feet) of wall. Verify subgrade is level, all loose or disturbed soils have been removed, and correlate actual soil conditions observed with those indicated by test borings.

C. Fill and Backfill Material Gradation: One test per 500 cubic yards stockpiled or in-place source material. Gradation of fill and backfill material shall be determined in accordance with ASTM C136.

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

E. Testing Materials: Test suitability of on-site and off-site borrow as directed by Contracting Officer's Representative.

3.2 FOUNDATION PILES(NOT USED)

3.3 FOUNDATION CAISSONS:

A. Special Inspections and Tests: Perform all testing and inspections indicated for Cast-in-Place Deep Foundation Elements in the "Required Special Inspections and Tests" section of the Building Code and as additionally required by the Authorities Having Jurisdiction. See Section 01 45 35 for additional requirements.

B. Other Inspections and Tests: Perform the following testing and inspections additionally if not otherwise included in Special Inspections and Tests requirements above:

1. Drilled Pier Excavations

a. Observe each Drilled Pier excavation, including but not limited to excavation (earth auger drilling) procedure and depth, inspection of Drilled Pier shaft or bell bottoms, verification of the Drilled Pier's attained bearing capacity, must be inspected and tested by the Testing Agency before placing concrete or reinforcing steel.

b. Inspection and Testing of Drilled Pier Bearings: See requirements below based on stratum.

c. Daily Reports: Perform specified observations and tests, including any additional field testing procedures which may be required, and prepare a report on a daily basis. For each

excavation as-placed, estimate to the greatest accuracy possible, the actual-to-theoretical volume of concrete ratio and indicate the value in the report.

2. Drilled Pier Installations
   a. Observe each Drilled Pier installation, including the installation of permanent and/or temporary casing, placement of reinforcing steel, placement of concrete, and withdrawal of casing, as applicable.
   b. Inspection and Testing of Drilled Pier Installations
      1) Review placement of reinforcing steel in piers as specified herein, including but not limited to rebar extension above the shaft cut-off elevation.
      2) Obtain samples of grout concrete placed in piers and test as outlined below and in Section 01 45 29 for Concrete work.
   c. Daily Reports: Perform specified observations and tests, including any additional field testing procedures which may be required, and prepare a report on a daily basis.
      1) Geotechnical Engineer (Testing Agency) representative at the Project site observing Drilled Pier installations must also review and confirm by signature/date the Installer’s Report as specified in Section 31 63 29.
   d. Review of Installation Reports: Testing Agency’s representative at the Project site observing the Drilled Pier installation must review and confirm by signature/date the Contractor’s Installation Reports as specified in Part 1 of this Section.

C. 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.

D. Maintain a record of concrete used in each caisson. Compare records with calculated volumes.

E. Inspect percussion hole in bottom of each caisson to determine that material is capable of supporting design load.

F. Inspect sides and bottom of each caisson for compliance with contract documents.

G. 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.

H. Caissons Bearing on Rock: The bottom of each pier must be examined by drilling and probing to a depth below bottom elevation to determine whether voids, clay seams, or solution channels exist, as directed by Geotechnical Engineer (Testing Agency).
   1. Coordinate with Contractor to ensure presence of equipment and personnel necessary to perform in-hole standard penetration tests and test drilling.
   2. Extracted cores must be examined by Geotechnical Engineer (Testing Agency), who will determine any further course of action.

I. For Drilled Piers not bearing on rock, bearing substrate must be examined by Geotechnical Engineer (Testing Agency), who will determine any further course of action.

3.4 LANDSCAPING:

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

B. Submit laboratory test report of topsoil to Contracting Officer’s Representative.

3.5 ASPHALT CONCRETE PAVING:

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

specified in the applicable state highway standards and specifications.

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

3.6 SITE WORK CONCRETE:

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

3.7 FORMWORK FOR CONCRETE:

A. All formwork must be inspected prior to the placement of concrete reinforcing.

B. Using qualified personnel on-site, Testing Agency will inspect formwork using the latest Contract Documents and approved Design Submittal as follows:
   1. For general conformance to formwork layout depicted in the Design Submittal including accessories, and shoring provisions.
   2. For compliance with required grade and quality of form material.
   3. For compliance with required concrete work location and layout including joint locations.
   4. For compliance with specified tolerances.
   5. For surface imperfections that may adversely affect concrete suitability or finish.
   6. For compliance with form joint sealing requirements of this Section.
   7. For surface cleanliness and to verify presence of properly applied form coatings.

3.8 CONCRETE (INCLUDES ALL GROUTING OTHER THAN FOR MASONRY):

A. Concrete Batch Plant Inspection and Materials Testing: Inspection at the batching plant is required only when no documentation exists of a

similar inspection conducted by the appropriate agency of the State where work is to be performed or other authority having jurisdiction, conducted not more than 12 months prior to awarding the contract on the subject project. See Section 03 30 00 - CAST-IN-PLACE CONCRETE for additional information.

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

B. Field Inspection and Materials Testing for Concrete:

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 standard 6”x12” cylinders for each 40 m^3 (50 cubic yards) or less of each concrete type, and at least four cylinders for any one day's pour for each concrete type. Label each cylinder with an identification number. Contracting Officer’s Representative may require additional cylinders to be molded and cured under job conditions. Each set of four cylinders shall be known as a “sample”.
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 every truck. For concrete not required to be air-entrained, test every 80 m^3 (100 cubic yards) at random. For pumped concrete, initially test concrete at both the hopper and the discharge end of the hose to determine change in air content.
6. If slump or air content fall outside specified limits, make another test immediately from another portion of same batch.
7. Record batch and discharge time for every truckload and report this information to the Contracting Officer’s Representative on the same form as entrained air content. Notify Contracting Officer’s Representative immediately if concrete time in transit does not conform to ASTM C94.
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 forms for clean lines just prior to concrete placement and notify Resident Engineer and Construction Manager of unsatisfactory condition. Submit report if unsatisfactory condition has not been corrected.
12. Inspect the reinforcing steel placement, including bar size, bar spacing, top, sides, and bottom concrete cover, proper tie into the chairs, and grade of steel prior to concrete placement. Submit detailed report of observations.
13. Observe conveying, placement, and consolidation of concrete for conformance to specifications.
14. Observe condition of formed surfaces upon removal of formwork prior to repair of surface defects and observe repair of surface defects.
15. Observe curing procedures for conformance with specifications, record dates of concrete placement, start of preliminary curing, start of final curing, end of curing period.
16. 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.
17. Observe preparations for protection from hot weather, cold weather, sun, and rain, and preparations for curing.
18. Observe concrete mixing:
    a. Monitor and record amount of water added at project site.
    b. Observe minimum and maximum mixing times.
19. Measure concrete flatwork for levelness and flatness as follows:
    a. Perform Floor Tolerance Measurements in accordance with Section 03 30 00 Article “Concrete Finishes”.

b. Perform all floor tolerance measurements within 48 hours after slab installation and prior to removal of shoring and formwork.

c. Provide the Contractor and the Contracting Officer's Representative with the results of all profile tests, including a running tabulation of the overall floor tolerance measurements values for all slabs installed to date, within 72 hours after each slab installation.

D. Laboratory Tests of Field Concrete Samples:

1. Test compression test cylinders for strength in accordance with ASTM C39. For each test series, test one cylinder at 7 days and one cylinder at 28 days. Use remaining cylinder as a spare tested as directed by Contracting Officer's Representative. Compile laboratory test reports as follows: Compressive strength test shall be result of one cylinder, except when one cylinder shows evidence of improper sampling, molding or testing, in which case it shall be discarded and strength of spare cylinder shall be used.

2. Make weight tests of hardened lightweight structural concrete in accordance with ASTM C567.

3. Furnish certified compression test reports (duplicate) to Contracting Officer's Representative. In test report, indicate the following information:

a. Cylinder identification number and date cast.

b. Specific location at which test samples were taken.

c. Type of concrete, slump, and percent air.

d. Compressive strength of concrete in MPa (psi).

e. Weight of lightweight structural concrete in kg/m^3 (pounds per cubic feet).

f. Weather conditions during placing.

g. Temperature of concrete in each test cylinder when test cylinder was molded.

h. Maximum and minimum ambient temperature during placing.

i. Ambient temperature when concrete sample in test cylinder was taken.

j. Date delivered to laboratory and date tested.

C. Field Inspection and Materials Testing for Grout:

1. Provide a technician at site of placement at all times to perform grout sampling and testing.
2. Test Specimens
   a. Samples must be obtained in accordance with ASTM C172.
   b. Curing and testing of grout cubes must be in accordance with ASTM C109. Grout specimens must be restrained from expansion as described in ASTM C942.
3. Sampling Requirements: Grout mixes must be sampled and tested by making a set of six (6) two-inch cubes for each fifty (50) yards or fraction thereof of grout placed, but not less than one set for each day during which grouting is performed. Two cubes must be tested at 7 days for information, two cubes must be tested at 28 days for acceptance, and two cubes must be held in reserve.
4. Schedules for Strength Testing: Schedule specimen testing as follows:
   a. Two (2) cubes must be tested at seven (7) days for information.
   b. Two (2) cubes must be tested at twenty-eight (28) days for acceptance, which must be based on average strength value between these 2 cubes.
   c. Keep two (2) cubes in reserve. Testing may be required as determined by the Architect/Engineer based on acceptance testing.
5. Other inspections:
   a. Grouting under base plates.
   b. Grouting anchor bolts and reinforcing steel in hardened concrete.

D. Acceptance Criteria for Strength Testing: Acceptance of strength test results will be based on the following requirements:

1. Strength level of concrete/grout mixture shall be acceptable if (a) and (b) are satisfied:
   (a) Every arithmetic average of any three consecutive strength tests equals or exceeds f_c'.
   (b) No strength test falls below f_c' by more than 500psi if f_c' is 5000psi or less; or by more than 0.10 f_c' if f_c' exceeds 5000psi.
2. If either of the requirements the above paragraph are not satisfied, steps must be taken to increase the average of strength results.
3. In-place concrete testing may be used when properly correlated with field-cured and standard-cured (ASTM C192) cylinder test results.

This testing, if requested by the Contractor, must be approved by the COR and the Architect in writing upon submitting a proposal and description, and paid for by the Contractor.

E. Special Reporting Requirements Related to Strength Testing: Reports of cylinder or cube tests must be submitted as specified herein within five (5) days of laboratory testing. Results of field tests, as described herein below, must be submitted within 24 hours of obtaining.

1. General: In the interest of the project record and streamlining of response to adverse conditions, it is strongly recommended that all non-compliant report data be easily distinguishable.
2. Concrete Mixes
   a. Test Reports: Reports must, as a minimum, include:
      1) Project data including project name and address, concrete supplier, supplier's delivery ticket number and mix identification number, Testing Agency's test or cylinder identification number, and location of pour.
      2) Temperature record from the sensors installed in the freshly placed concrete under the cold weather as defined by ACI 306, at no longer than 12-hour increments.
   b. Field Monitoring Reports: Results of field testing at time of sampling including but not limited to the following:
      1) Date and time of sampling;
      2) Batch/Mix Identification;
      3) Location of the concrete placement with respect to elevation or level of the structure and proximity to major column lines;
      4) Method of concrete placement (bucketing, pumping, etc.);
      5) Amount of water, if any, added at site prior to sampling;
      6) Ambient air temperature and weather conditions;
      7) Concrete temperature, concrete slump and air content;
      8) Concrete wet unit weight for lightweight concrete only;
      9) Time concrete was batched and time when placement was finished;
      10) Specification limits for concrete temperature, slump, air content, and indication of conformance to the contract requirements.

c. Lab Testing: Results of laboratory testing including date test specimens were transported to laboratory, date and age of concrete at time of testing, compressive strength of each cylinder tested, average compressive strength of tested cylinders, and specified design strength of concrete represented by the test.

3. Grout Mixes:

a. Test Reports: Reports must, as a minimum, include:

1) Project data including project name and address, material supplier, and mix identification, Testing Agency's cube identification number, and location of grouting.

b. Lab Testing: Results of laboratory testing including date test specimens were transported to laboratory, date and age of grout at time of testing, compressive strength of each cube tested, average compressive strength of tested cubes, and specified design strength of grout represented by the test.

F. Additional Testing: Contractor must bear the cost of testing and inspection resulting as a consequence of the following:

1. Work not in compliance with the Contract Documents.
2. Testing requested by the Contractor or Subcontractor such as additional cylinders for early breaks, etc.
3. Testing to verify the adequacy of work done without prior notice, without proper supervision, or contrary to standard construction practice.

3.9 REINFORCEMENT AND METALLIC EMBEDMENTS:

A. General:

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

6. For welded reinforcement, review and approve welder qualifications and welding procedures in accordance with applicable sections of AWS D1.4.

B. Tests and Inspections During Construction: Perform the following testing and inspections additionally if not otherwise included in required Special Inspections and Tests:

1. Prior to the depositing of concrete:
   a. Review completed installation of all concrete reinforcement.
   b. Review all mechanical splice couplers.
   c. Review all steel reinforcement welding.

3.10 (NOT USED)

3.11 PRESTRESSED CONCRETE:

A. Inspection at Plant: Forms, placement and concrete cover of reinforcing steel and tendons, placement and finishing of concrete, and tensioning of tendons.

B. Concrete Testing: Test concrete including materials for concrete required in Article, CONCRETE of this section, except make two test cylinders for each day's production of each strength of concrete produced.

C. Test tendons for conformance with ASTM A416 and furnish report to Contracting Officer’s Representative.

D. Inspect members to insure that specification requirements for curing and finishes have been met.

3.12 ERECTION OF STRUCTURAL PRECAST CONCRETE:

A. Welding and Materials:

1. Inspection of welding by the Testing Agency will be such as to assure that the work conforms to specified requirements, and will include:
   a. Ascertainment that the welding is performed only by welding operators and welders who are properly certified. The Testing Agency must witness such qualification testing of welding operators and welders, as may be required.
   b. Ascertainment that the approved welding procedure (including surface preparation) is followed without deviation, unless specific approval for change is obtained from the Architect.

c. Ascertainment that the fit-up, joint preparation, size, contour, extent of reinforcement, and length and location of welds conform to specified requirements and the Contract Drawings, and that no specified welds are omitted or unspecified welds added without approval of the Architect/Engineer.

d. Ascertainment that electrodes used for manual shielded metal-arc welding and the electrodes and flux used for submerged arc welding conform to the requirements of AWS Code.

e. Verify that quality of welds comply with the requirements of paragraph 8.15, "Quality of Welds," AWS D1.1.

2. The Testing Agency must perform inspections and tests for field welding as follows:

   a. All welds: 100 percent visual.

   b. All other structural welds: 10 percent magnetic particle per ASTM E709 (10 percent dye-penetrant for stainless steel per ASTM E165).

3. Additional Testing and Inspection Required:

   a. Any rejected welds must be visually inspected after repairs.

   b. In addition, if repaired welds are discovered to be defective, the remaining uninspected welds must receive such radiographic, ultrasonic or magnetic particle inspection as may be required by the Architect.

   c. All cost of additional testing and inspection required by this paragraph must be borne by the Contractor.

4. The welding inspector will have the authority to reject weldments. Such rejection may be based on visual inspection where in his/her opinion the weldment would not pass a more detailed investigation.

6. Reports by the Testing Agency's inspector will contain, as a minimum, an adequate description of each weld tested. The report must have the identifying mark of the welder responsible for the weld, a critique of any defects noted by visual inspection or testing, and a statement regarding the acceptability of the weld tested, as judged by current AWS standards. Reports must be distributed as early as possible but not later than one (1) work week after the tests have been performed. The Architect must be

notified by phone if, in the judgment of the inspector, test results require immediate comment.

B. Grouting Below and Between Structural Precast Concrete Components During Construction

1. Inspections:

a. Prior to each day's grout installation for each installation type, observe substrate conditions and surface preparation to verify compliance with manufacturer's written preparation recommendations.

b. Observe the following on a schedule of not less than once each day that grouting operations are in progress:

1) Implementation of special precautions and/or protections relating to hot weather or cold weather operations (as applicable).

2) Mixing of grout in accordance with manufacturer's instructions.

c. Continuously observe all grout placement operations to verify presence of grout as indicated in the Contract Documents and/or the approved Precast Concrete Shop Drawings. Verify grout installations are free of voids.

d. Inspect grout installations periodically to verify maintenance of curing temperature and techniques.

3. Testing: Testing grout for strength as described in CONCRETE Article above.

4. Coordination: Coordinate with other Independent Inspection and Testing requirements of Section 03 60 00.

3.13 MASONRY:

A. Mortar Tests:

1. Laboratory compressive strength test:

a. Comply with ASTM C780. All samples shall consist of a set of four cubes.

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 cube at 7 days and 2 cubes at 28 days.

2. Frequency: Take two samples during first week of operation; one sample per week after initial test until masonry completion.

B. Grout Tests:

1. Laboratory compressive strength test:
   a. Comply with ASTM C1019. All samples shall consist of four grout prisms 3” x 3” x 6” or taller.
   b. Test one sample at 7 days and 2 prisms at 28 days.
   c. Frequency: Perform test for each 230 m^2 (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 m^2 (5000 square feet) of wall area.

D. Prism Tests: For each type of wall construction indicated, test masonry prisms per ASTM C1314 for each 460 m^2 (5000 square feet) of wall area. Prepare one set of prisms for testing at 7 days and one set for testing at 28 days.

3.14 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. Welding and Materials, General:

1. Inspection of welding by the Testing Agency will be such as to assure that the work conforms to specified requirements, and will include:
   a. Ascertainment that the welding is performed only by welding operators and welders who are properly certified. The Testing

Agency must witness such qualification testing of welding operators and welders, as may be required.

b. Ascertainment that the approved welding procedure (including surface preparation) is followed without deviation, unless specific approval for change is obtained from the Architect.

c. Ascertainment that the fit-up, joint preparation, size, contour, extent of reinforcement, and length and location of welds conform to specified requirements and the Contract Drawings, and that no specified welds are omitted or unspecified welds added without approval of the Architect/Engineer.

d. Ascertainment that electrodes used for manual shielded metal-arc welding and the electrodes and flux used for submerged arc welding conform to the requirements of AWS Code.

e. Verify that quality of welds comply with the requirements of paragraph 8.15, "Quality of Welds," AWS D1.1.

D. Fabrication and Erection:

1. Weld Inspection:

a. All welds: 100 percent visual.

b. Inspect welding equipment for capacity, maintenance and working condition.

c. Verify specified electrodes and handling and storage of electrodes in accordance with AWS D1.1.

d. Inspect preparation and assembly of materials to be welded for conformance with AWS D1.1.

e. Inspect preheating and interpass temperatures for conformance with AWS D1.1.

f. Measure 25 percent of fillet welds.

g. Welding Magnetic Particle Testing: Test in accordance with ASTM E709 for a minimum of:

1) 20 percent of all shear plate fillet welds at random, final pass only.

2) 20 percent of all continuity plate and bracing gusset plate fillet welds, at random, final pass only.

3) 100 percent of tension member fillet welds (i.e., hanger connection plates and other similar connections) for root and final passes.

4) 20 percent of length of built-up column member partial penetration and fillet welds at random for root and final passes.
5) 100 percent of length of built-up girder member partial penetration and fillet welds for root and final passes.
6) 10 percent of all other welds.

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

i. Welding Radiographic Testing: Test in accordance with ASTM E94, and AWS D1.1 for 5 percent of all full penetration welds at random.

j. Verify that correction of rejected welds are made in accordance with AWS D1.1.

k. Testing and inspection do not relieve the Contractor of the responsibility for providing materials and fabrication procedures in compliance with the specified requirements.

l. Additional Testing and Inspection Required:
1) If more than 10 percent of the ultrasonically inspected welds are rejected, then 100 percent of all such welds must be ultrasonically tested after the repairs.
2) In addition, if defective welds are discovered, the remaining uninspected welds must receive such ultrasonic or magnetic particle inspection as may be required by the Architect/Engineer.
3) All cost of additional testing and inspection required by this paragraph must be borne by the Contractor.

m. The welding inspector will have the authority to reject weldments. Such rejection may be based on visual inspection where in his/her opinion the weldment would not pass a more detailed investigation.

n. Reports by the Testing Agency’s inspector must contain, as a minimum, an adequate description of each weld tested. The report must have the identifying mark of the welder responsible for the

weld, a critique of any defects noted by visual inspection or testing, and a statement regarding the acceptability of the weld tested, as judged by current AWS standards. Reports must be distributed as early as possible but not later than one (1) work week after the tests have been performed. The Architect/Engineer must be notified by phone if, in the judgment of the inspector, test results require immediate comment.

o. Radiographic testing may be substituted for ultrasonic.

2. Bolted Connections: Visually inspect all bolted connections to ascertain that all bolts, nuts and required washers have been installed and are of proper type and that all faying surfaces have been brought into snug contact.

2. Bolt Inspection:

a. Inspect the bolt tightness of 10 percent of the bolts (minimum of 2), selected at random in each high strength bolted connection on the project. If rejectable bolts are found in any connection, all the remaining bolts in that connection must be inspected for tightness. Inspection procedure must be in accordance with "Specification for Structural Joints Using ASTM A325 or A490 Bolts" approved by Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation (Research Council on Structural Connections). Cost of additional inspection required by this paragraph must be borne by the Contractor.

b. Inspect high-strength bolted connections in accordance AISC Specifications for Structural Joints Using ASTM F3125 Bolts.

c. 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 F3125 Bolts. Inspect all bolts in connection when one or more are rejected.

d. 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 F3125 Bolts. Inspect all bolts in connection when one or more are rejected.

e. Bolts installed by turn-of-nut tightening may be inspected with calibrated wrench when visual inspection was not performed during tightening.

f. Snug Tight Connections: Inspect 10 percent of connections verifying that plies of connected elements have been brought into snug contact.

g. Inspect field erected assemblies; verify locations of structural steel for plumbness, level, and alignment.

E. Grouting Below Structural Steel Components and at Structural Steel Interface Joints:

1. Inspections:

a. Prior to each day's grout installation for each installation type, observe substrate conditions and surface preparation to verify compliance with manufacturer's written preparation recommendations.

b. Observe the following on a schedule of not less than once each day that grouting operations are in progress:

1) Implementation of special precautions and/or protections relating to hot weather or cold weather operations (as applicable).

2) Mixing of grout in accordance with manufacturer's instructions.

c. Continuously observe all grout placement operations to verify presence of grout as indicated in the Contract Documents and/or the approved Precast Concrete Shop Drawings. Verify grout installations are free of voids.

d. Inspect grout installations periodically to verify maintenance of curing temperature and techniques.

2. Testing: Testing grout for strength as described in CONCRETE Article above.

3. Coordination: Coordinate with other Independent Inspection and Testing requirements of Section 03 60 00.

F. Submit inspection reports, record of welders and their certification, and identification, and instances of noncompliance to Contracting Officer's Representative.

3.15 METAL FABRICATIONS:

A. Bolted Connections: Visually inspect all bolted connections to ascertain that all bolts, nuts and required washers have been installed and are of proper type and that all faying surfaces have been brought into snug contact.

B. Welding and Materials

1. Inspection of welding by the Testing Agency must be such as to assure that the work conforms to specified requirements, and must include:

   a. Ascertainment that the welding is performed only by welding operators and welders who are properly certified. The Testing Agency must witness such qualification testing of welding operators and welders, as may be required.

   b. Ascertainment that the approved welding procedure (including surface preparation) is followed without deviation, unless specific approval for change is obtained from the Architect/Engineer.

   c. Ascertainment that the fit-up, joint preparation, size, contour, extent of reinforcement, and length and location of welds conform to specified requirements and the Contract Drawings, and that no specified welds are omitted or unspecified welds added without approval of the Architect/Engineer.

   D. Ascertainment that electrodes used for manual shielded metal-arc welding and the electrodes and flux used for submerged arc welding conform to the requirements of AWS Code.

   e. Verify that quality of welds meet the requirements of paragraph 8.15, “Quality of Welds,” AWS D1.1.

C. The Testing Agency must perform inspections and tests for welding in the Fabricator’s shop as follows:

   a. All welds: 100 percent visual.

D. The Testing Agency must perform inspections and tests for field welding as follows:

   a. All welds, including wall and shoring connections: 100 percent visual.

E. The welding inspector will have the authority to reject weldments. Such rejection may be based on visual inspection where in his/her opinion the weldment would not pass a more detailed investigation.

3.16 (NOT USED)

3.17 (not used)

3.18 (NOT USED)

3.19 POST-INSTALLED ANCHORS IN CONCRETE AND MASONRY (DRILLED-IN INSERTS):

A. Self-Expanding Inserts: Testing Agency must inspect self-expanding, drilled-in inserts shown on the Structural Drawings as follows:

1. Prior to installation, the Testing Agency must determine that the installing contractor has the proper materials and equipment for drilling holes in the receiving surface of required diameter and length.
2. All inserts must be visually inspected during installation to ensure that they have been installed perpendicular to the receiving surface and to proper depth.
3. Inspect 20 percent of all inserts at each structural level for a 'snug tight' condition. If at any time the number of rejectable inserts exceeds 10 percent of the number of inserts tested at that level, all inserts at that level must be tested by the same method and this 100 percent testing rate must be continued on all succeeding levels until 10 percent or less of the inserts tested at a level are found to be rejectable. Cost of additional testing required by this Paragraph must be borne by the installing contractor.

B. Epoxy-Bonded Inserts (Includes Connectors and Reinforcing Steel): The Testing Agency must inspect epoxy-bonded, drilled-in inserts as follows:

1. Testing Agency must be present at the site to observe the installation of the first fifty (50) inserts placed. Such observation must be to ensure that drilled holes are of required diameter and depth, holes are properly cleaned prior to installation of the insert, and that holes are completely filled with properly mixed epoxy after installation.

2. All inserts must be visually inspected after installation to ensure that the insert has been installed perpendicular to the receiving surface and to proper depth.
3. Inspect 20 percent of all inserts at each structural level for a 'snug tight' condition. If at any time the number of rejectable inserts exceeds 10 percent of the number of inserts tested at that level, all inserts at that level must be tested by the same method and this 100 percent testing rate must be continued on all succeeding levels until 10 percent or less of the inserts tested at a level are found to be rejectable. Cost of additional testing required by this paragraph must be borne by the installing contractor.

- - - E N D - - -

SECTION 01 45 35
SPECIAL INSPECTIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This guide specification will be applicable to both new buildings and existing building rehabilitations/renovations. In addition to the Special Inspection and testing specified requirements, a registered design professional must perform structural observations during construction. All observed deficiencies will be immediately reported to the Contracting Officer. The registered design professional performing these observations will be a representative of the Designer of Record (DOR) for the building being constructed.

B. Structural observations are required for the following project conditions per IBC Chapter 17:

1. Seismic Design Category D, E or F; and assigned to Risk Cat III, IV or V.
2. Seismic Design Category D, E or F; and with a height greater than 22860 mm 75 ft.
3. Seismic Design Category E, assigned to Risk Category I or II and the building is greater than two stories above grade plane.
4. Nominal design wind speed in excess of 49 m/sec 110 mph; and assigned to Risk Cat III, IV or V.
5. Nominal design wind speed in excess of 49 m/sec 110 mph; and with a height greater than 23 m 75 ft.

1.2 APPLICABLE PUBLICATIONS

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

B. American Society of Civil Engineers (ASCE)

1. ASCE 7 - (2010; Errata 2011; Supp 2 2013) Minimum Design Loads for Buildings and Other Structures

C. International Code Council (ICC)

2. ICC IBC - (2015) International Building Code

1.3 **GENERAL REQUIREMENTS**

A. Perform Special Inspections in accordance with the Statement of Special Inspections, Schedule of Special Inspections and Chapter 17 of ICC IBC. The Statement of Special Inspections and Schedule of Special Inspections are included as an attachment to this specification. Special Inspections are to be performed by an independent third party and are intended to ensure that the work of the prime contractor is in accordance with the Contract Documents and applicable building codes. Special inspections do not take the place of the three phases of control inspections performed by the Contractor's QC Manager or any testing and inspections required by other sections of the specifications.

B. Structural observations will be performed by the Government. The contractor must provide notification to the Contracting Officer 14 days prior .

1.4 **DEFINITIONS**

A. Continuous Special Inspections – The constant monitoring of specific tasks by a special inspector. These inspections must be carried out continuously over the duration of the particular tasks.

B. Periodic Special Inspections – Special Inspections by the special inspector who is intermittently present where the work to be inspected has been or is being performed. Specific time interval on a specific Special Inspection should be indicated on the Schedule of Special Inspections.

C. Perform – Perform these Special Inspections tasks for each welded joint or member.

D. Observe – Observe these Special Inspections items on a random daily basis. Operations need not be delayed pending these inspections.

E. Special Inspector (SI) – A qualified person retained by the contractor and approved by the Contracting Officer as having the competence necessary to inspect a particular type of construction requiring Special Inspections. The SI must be an independent third party hired directly by the Prime Contractor.

F. Associate Special Inspector (ASI) – A qualified person who assists the SI in performing Special Inspections but must perform inspection under the direct supervision of the SI and cannot perform inspections without the SI on site.

G. Third Party – A third party inspector must not be company employee of the Contractor or any Sub-Contractor performing the work to be inspected.

H. Special Inspector of Record (SIOR) – SIOR must be an independent third party hired directly by the Prime Contractor and is required for the following project conditions:

1. Seismic Design Category D, E, or F; and assigned to Risk Category III, IV, or V.
2. Seismic Design Category D, E, or F; and with a height greater than 22860mm 75 ft.
3. Seismic Design Category E, assigned to Risk Category I or II and the building is greater than two (2) stories above grade plane.
4. Nominal design wind speed in excess o f49 m/sec 100 mph; and assigned to Risk Category III, IV, or V.
5. Nominal design wind speed in excess of 49 mm/sec 100mph; and with a height greater than 23m 75ft.
6. In addition to these conditions, the DOR is encouraged to consider using an SIOR on large magnitude or critical projects where this additional level of quality control is affordable.

I. Contracting Officer – The Government official having overall authority for administrative contracting actions. Certain contracting actions may be delegated to the Contracting Officer's Representative (COR).

J. Contractor’s Quality Control (QC) Manager – An individual retained by the prime contractor and qualified in accordance with the Section 01 45 00.00 10 QUALITY CONTROL having the overall responsibility for the contractor's QC organization.

K. Designer of Record (DOR) – A registered design professional is contracted by the Government as an A/E responsible for the overall design and review of submittal documents prepared by others. The DOR is registered or licensed to practice their respective design profession as defined by the statutory requirements of the professional registration laws in state in which the design professional works. The DOR is also referred to as the Engineer of Record (EOR) in design code documents.

L. Statement of Special Inspections (SSI) – A document developed by the DOR identifying the material, systems, components and work required to have Special Inspections and covering the following:
   1. List of the Architectural Designated Seismic Systems – these components are in or attached to a Risk Category IV or V structure and are needed for continued operation of the facility or their failure could impair the continued operation of the facility.
   2. List of the Mechanical Designated Seismic Systems
      a. For Seismic Design Category C or Risk V, list the following:
         1) Heating, ventilation, and air-conditioning (HVAC) ductwork containing hazardous materials and anchorage of such ductwork
         2) Piping systems and mechanical units containing flammable, combustible, or highly toxic materials.
      b. For Seismic Design Category D, E, or F or Risk Category V list mechanical system that meet one of the following:
         1) Life safety component required to function after an earthquake
         2) Component that contains hazardous content,
         3) All components in an essential facility needed for continued operation after an earthquake.
   3. List of the Electrical Designated Systems
      a. For Seismic Design Category C or Risk V, list the anchorage of electrical equipment used for emergency or standby power systems.
      b. For Seismic Design Category D, E or F list electrical system that meet one of the following:
         1) Life safety component required to function after an earthquake
         2) Component that contains hazardous content,
         3) All components in an essential facility needed for continued operation after an earthquake.
   4. List of elements that are part of the progressive collapse resistance system.
      a. Provide a description of the following as they apply:
         1) Elements of the tie force system consisting of internal longitudinal and transverse, vertical, and peripheral tie.

2) Elements of the alternate path system.
3) Elements having enhanced local resistance. The Statement of Special Inspections and the Schedule of Special Inspections will be included as an attachment to this specification
   a) Schedule of Special Inspections – A schedule which lists each of the required Special Inspections, the extent to which each Special Inspections is to be performed, and the required frequency for each in accordance with ICC IBC Chapter 17. Templates can be found at the end of this specification section.
   b) Designated Seismic System – Those nonstructural components that require design in accordance with ASCE 7 Chapter 13 and for which the component importance factor, Ip, is greater than 1.0. This designation applies to systems that are required to be operational following the Design Earthquake for RC I - IV structures and following the MCER for RC V structures. All systems in RC V facilities designated as MC-1 in accordance with UFC 3-310-04 are considered part of the Designated Seismic Systems. Designated Seismic Systems will be identified by Owner and will have an Importance Factor Ip = 1.5.

M. Submittals: Government approval is required for all submittals. CQC Special Inspection reports shall be submitted under this Specification section and follow the [Special Inspection]: [Applicable Specification section or description] naming convention. Submit the following:
1. SD-01 Preconstruction Submittals;
2. SIOR Letter of Acceptance;
3. Special Inspections Project Manual;
4. Special Inspections Agency's Written Practices
5. NDT Procedures and Equipment’ Calibration Records;
6. SD-06 Test Reports;
7. Special Inspections
8. Daily Reports;
9. Special Inspections; Biweekly Reports;
10. SD-07 Certificates;
11. Fabrication Plant

12. Steel Truss Plant;
13. Wood Truss Plant;
14. AC472 Accreditation;
15. Steel Joist Institute Membership;
16. Precast Concrete Institute (PCI) Certified Plant;
17. Certificate of Compliance;
18. Special Inspector of Record Qualifications;
19. Special Inspector Qualifications;
20. Qualification Records for NDT technicians;
21. SD-11 Closeout Submittals;
22. Interim Final Report of Special Inspections;
23. Comprehensive Final Report of Special Inspections;

N. Special Inspector Qualifications: Submit qualifications for each SI, ASI, and the SIOR from the following certifying associations: Associated Air Balance Council (AABC); American Concrete Institute (ACI); Association of the Wall and Ceiling Industry (AWCI); American Welding Society (AWS); Factory Mutual (FM); International Code Council (ICC); Nondestructive Testing (NDT); National Institute for Certification in Engineering Technologies (NICET); Precast/Prestressed Concrete Institute (PCI); Post-Tensioning Institute (PTI); Underwriters Laboratories (UL). Qualifications should be in accordance with the following minimums; PM or SRE can restrict qualifications to the higher standards shown if multiple options are shown for a role based on complexity of project.

QUALIFICATIONS

Area	Special Inspector	Associated Special Inspector	SIOR
Steel Construction and High Strength Bolting	ICC Structural Steel and Bolting Special Inspector certificate with on year of related experience, or Registered Professional Engineer with related experience.	Engineer-In-Training with one year of related experience.	

Area	Special Inspector	Associated Special Inspector	SIOR
Welding Structural Steel (For highly complex steel use only AWS Certified Welding Inspectors)	ICC Welding Special Inspector certificate with one year of related experience or AWS Certified Welding Inspector	AWS Certified Associate Welding Inspector	
Nondestructive Testing of Welds	NDT Level II Certificate	NDT Level II Certificate plus one year of related experience	
Cold Formed Steel Framing	ICC Structural Steel and Bolting Special Inspector certificate with on year of related experience, or ICC Commercial Building Inspector with one year of experience; or Registered Professional Engineer with related experience.	Engineer-In-Training with one year of related experience.	
Concrete Construction	ICC Reinforced Concrete Special Inspector Certificate with one year of related experience, or ACI Concrete Construction Special Inspector, or NICET Concrete Technician Level III Certificate in Construction Materials Testing, or, Registered Professional Engineer with related experience	ACI Concrete Construction Special Inspector in Training, or Engineer-In-Training with one year of related experience	

Area	Special Inspector	Associated Special Inspector	SIOR
Prestressed Concrete Construction	ICC Pre-stressed Special Inspector Certificate with one year of related experience, or PCI Quality Control Technician/ Inspector Level II Certificate with one year of related experience, or Registered Professional Engineer with related experience.	PCI Quality Control Technician/ Inspector Level I Certificate with one year of related experience, or Engineer-In-Training with one year of related experience	
Post-Tensioned Concrete Construction	PTI Level 2 Unbonded PT Inspector Certificate, or Registered Professional Engineer with related experience	PTI Level 1 Unbonded PT Inspector Certificate with one year of related experience, or Engineer-In-Training with one year of related experience	
Masonry Construction	ICC Structural Masonry Special Inspector Certificate with one year of related experience, or Registered Professional Engineer with related experience	Engineer-In-Training with one year of related experience	
Wood	ICC Commercial Building Inspector Certificate with one year of related experience, or ICC Residential Building Inspector with on year of experience, or Registered Professional Engineer with related experience	Engineer-In-Training with one year of related experience	

Area	Special Inspector	Associated Special Inspector	SIOR
Verification of Site Soil Condition, Fill Placement, and Load-Bearing Requirements	ICC Soils Special Inspector Certificate with one year of related experience, or NICET Soils Technician Level II Certificate in Construction Material Testing, or NICET Geotechnical Engineering Technician Level II Construction or Generalist Certificate, or Geologist-In-Training with one year of related experience, or Registered Professional Engineer with related experience	NICET Soils Technician Level I Certificate in Construction Material Testing with one year of related experience, or NICET Geotechnical Engineering Technician Level I Construction, or Generalist Certificate with one year of related experience, or Engineer-In-Training with one year of related experience	
Deep Foundations	NICET Soils Technician Level II Certificate in Construction Material Testing, or NICET Geotechnical Engineering Technician Level II Construction or Generalist Certificate, or Geologist-In-Training with one year of related experience, or Registered Professional Engineer with related experience	NICET Soils Technician Level I Certificate in Construction Material Testing with one year of related experience, or NICET Geotechnical Engineering Technician Level I Construction or Generalist Certificate with one year of related experience, or Engineer-In-Training with one year of related experience	

Area	Special Inspector	Associated Special Inspector	SIOR
Sprayed Fire Resistant Manual	ICC Spray-applied Fireproofing Special Inspector Certificate, or ICC Fire Inspector I Certificate with one year of related experience, or Registered Professional Engineer with related experience	Engineer-In-Training with one year of related experience	
Mastic and Intumescent Fire Resistant Coatings	ICC Spray-applied Fireproofing Special Inspector Certificate, or ICC Fire Inspector I Certificate with one year of related experience, or Registered Professional Engineer with related experience	Engineer-In-Training with one year of related experience.	
Exterior Insulation and Finish Systems (EIFS)	AWCI EIFS Inspector Certificate, or Exterior Design Institute Certificate, or Registered Professional Engineer with related experience	Engineer-In-Training with one year of related experience	
Fire-Resistant Penetrations and Joints	Passed the UL Firestop Exam with one year of related experience, or Passed the FM Firestop Exam with one year of related experience, or Registered Professional Engineer with related experience	Engineer-In-Training with one year of related experience.	

Area	Special Inspector	Associated Special Inspector	SIOR
Smoke Control	AABC Technician Certification with one year of related experience, or Registered Professional Engineer with related experience	Engineer-In-Training with one year of related experience.	
SIOR			Registered Professional Engineer

PART 2 - PRODUCTS

2.1 FABRICATORS SPECIAL INSPECTION

A. Special Inspections of fabricator's work performed in the fabricator's shop is required to be inspected in accordance with the Statement of Special Inspections and the Schedule of Special Inspections unless the fabricator is certified by the approved agency to perform such work without Special Inspections. Submit the applicable certification(s) from the following list to the Contracting Officer for information to allow work performed in the fabricator's shop to not be subjected to Special Inspections.

B. The following certifications meet the requirements for fabricator approval in accordance with paragraph 1704.2.5.2 of IBC:

1. American Institute of Steel Construction (AISC) Certified Fabrication Plant, Category STD.
2. Truss Plate Institute (TPI) steel truss plate quality assurance program certification.
3. Truss Plate Institute (TPI) wood truss plate quality assurance program certification.
4. International Accreditation Service, AC472 Accreditation Steel Joist Institute Membership
5. Precast Concrete Institute (PCI) Certified Plant, Group C

C. At the completion of fabrication, submit a certificate of compliance, to be included with the comprehensive final report of Special

Inspections, stating that the materials supplied and work performed by the fabricator are in accordance the construction documents.

PART 3 - EXECUTION

3.1 RESPONSIBILIES MATRIX

Inspector	Responsibility	Condition
SIOR	a. Supervise all Special Inspectors required by the contract documents and the IBC. b. Submit a SIOR Letter of Acceptance to the Contracting Officer attesting to acceptance of the duties of SIOR, signed and sealed by the SIOR. c. Verify the qualifications of all of the Special Inspectors. d. Verify the qualifications of fabricators.	Applicable when SIOR is required
	e. Submit Special Inspections agency's written practices for the monitoring and control of the agency's operations to include the following: 1. The agency's procedures for the selection and administration of inspection personnel, describing the training, experience and examination requirements for qualifications and certification of inspection personnel. 2. The agency's inspection procedures, including general inspection, material controls, and visual welding inspection. f. Submit qualification records for nondestructive testing (NDT) technicians designated for the project. Submit NDT procedures and equipment calibration records for NDT to be performed and equipment to be used for the project.	Applicable when SIOR is required and when the structural design is required to follow AISC341 for seismic design of steel structures
	g. Prepare a Special Inspections Project Manual, which will cover the following: 1. Roles and responsibilities of the following individuals during Special Inspections: SIOR, SI, General Contractor, Subcontractors, QC Manager, and DOR. 2. Organizational chart and/or communication plan, indicating lines of communication 3. Contractor's internal plan for scheduling inspections. Address items such as timeliness of inspection requests, who to contact for inspection requests, and availability of alternate inspectors. Contractor's internal	Applicable when SIOR is required

Inspector	Responsibility	Condition
	plan for scheduling inspections. Address items such as timeliness of inspection requests, who to contact for inspection requests, and availability of alternate inspectors. 4. Indicate the government reporting procedures. 5. Propose forms or templates to be used by SI and SIOR to document inspections. 6. Indicate procedures for tracking nonconforming work and verification that corrective work is complete. 7. Indicate how the SIOR and/or SI will participate in weekly QC meetings. 8. Indicate how Special Inspections of shop fabricated items will be handled when the fabricator's shop is not certified per paragraph FABRICATOR SPECIAL INSPECTIONS. 9. Include a section in the manual that covers each specific item requiring Special Inspections that is indicated on the Schedule of Special Inspections. Provide names and qualifications of each special inspector who will be performing the Special Inspections for each specific item. Provide detail on how the Special Inspections are to be carried out for each item so that the expectations are clear for the General Contractor and the Subcontractor performing the work. Make a copy of the Special Inspections Project Manual available on the job site during construction. Submit a copy of the Special Inspections Project Manual for approval. h. Attend coordination and mutual understanding meeting where the information in the Special Inspections Project Manual will be reviewed to verify that all parties have a clear understanding of the Special Inspections provisions and the individual duties and responsibilities of each party. i. Maintain a 3- ring binder for the Special Inspector's daily and biweekly reports and the Special Inspections Project Manual. This file must be located in a conspicuous place in the project trailer/office to allow review by the Contracting Officer and the DOR. j. Submit a copy of the Special Inspector's daily reports to the QC Manager.	

Inspector	Responsibility	Condition
	k. Discrepancies that are observed during Special Inspections must be reported to the QC Manager for correction. If discrepancies are not corrected before the special inspector leaves the site the observed discrepancies must be documented in the daily report. l. Submit a biweekly Special Inspections report until all work requiring Special Inspections is complete. A report is required for each biweekly period in which Special Inspections activity occurs, and must include the following: 1. A brief summary of the work performed during the reporting time frame. 2. Changes and/or discrepancies with the drawings, specifications, and mechanical or electrical component certification if they require seismic systems, that were observed during the reporting period. 3. Discrepancies which were resolved or corrected. 4. A list of nonconforming items requiring resolution. 5. All applicable test results including nondestructive testing reports.	
QC Manager	a. If there is no SIOR, QC Manager must Supervise all Special Inspectors required by the contract documents and the IBC; Verify the qualifications of all of the Special Inspectors; Verify the qualifications of fabricators; Maintain a 3-ring binder for the Special Inspector's daily and biweekly reports. This file must be located in a conspicuous place in the project trailer/office to allow review by the Contracting Officer and the DOR.	Applicable when SIOR is not required
	b. Maintain a rework items list that includes discrepancies noted on the Special Inspectors daily report.	n/a
Special Inspectors	a. Inspect all elements of the project for which the special inspector is qualified to inspect and are identified in the Schedule of Special Inspections. b. Attend preparatory phase meetings related to the Definable Feature of Work (DFOW) for which the special inspector is qualified to inspect.	

Inspector	Responsibility	Condition
	c. Submit Special Inspections agency's written practices for the monitoring and control of the agency's operations to include the following: 1. The agency's procedures for the selection and administration of inspection personnel, describing the training, experience and examination requirements for qualifications and certification of inspection personnel. 2. The agency's inspection procedures, including general inspection, material controls, and visual welding inspection. d. Submit qualification records for nondestructive testing (NDT) technicians designated for the project. e. Submit NDT procedures and equipment calibration records for NDT to be performed and equipment to be used for the project.]	Applicable when SIOR is NOT required and when the structural design is required to follow AISC 341 for seismic design of steel structures
	f. Submit a copy of the daily reports to the QC Manager. g. Discrepancies that are observed during Special Inspections must be reported to the QC Manager for correction. If discrepancies are not corrected before the special inspector leaves the site the observed discrepancies must be documented in the daily report. h. Submit a biweekly Special Inspection Report until all inspections are complete. A report is required for each biweekly period in which Special Inspections activity occurs, and must include the following: 1. A brief summary of the work performed during the reporting time frame 2. Changes and/or discrepancies with the drawings, specifications, and mechanical or electrical component certification if they require seismic systems that were observed during the reporting period. 3. Discrepancies which were resolved or corrected. 4. A list of nonconforming items requiring resolution. 5. All applicable test result including nondestructive testing reports. j. At the completion of the project submit a comprehensive final report of Special Inspections that documents the Special	Applicable when SIOR is not required

Inspector	Responsibility	Condition
	Inspections completed for the project and corrections of all discrepancies noted in the daily reports. The comprehensive final report of Special Inspections must be signed, dated and indicate the certification of the special inspector qualifying them to conduct the inspection.	
	k. Submit daily reports to the SIOR	Applicable when SIOR is required

3.2 DEFECTIVE WORK

Check work as it progresses, but failure to detect any defective work or materials must in no way prevent later rejection if defective work or materials are discovered, nor obligate the Government to accept such work.

-- End of Section -

SCHEDULE OF SPECIAL INSPECTIONS

Reference 01 45 35 for all requirements not noted as part of this schedule.

INSPECTION DEFINITIONS:

PERFORM: Perform these tasks for each weld, fastener or bolted connection, and noted verification.

OBSERVE: Observe these items randomly during the course of each work day to insure that applicable requirements are being met. Operations need not be delayed pending these inspections at contractor's risk.

DOCUMENT: Document, with a report, that the work has been performed in accordance with the contract documents. This is in addition to any other reports required in the Special Inspections guide specification.

CONTINUOUS: Constant monitoring of identified tasks by a special inspector over the duration of performance of said tasks.

DESIGNER NOTES (to be deleted after reviewing):

1. This schedule contains minimum requirements. Do not delete applicable inspection tasks unless notes in blue indicate it is acceptable to do so.
2. Blue text = designers notes. The designer must review and edit all blue text in this schedule prior to inserting this schedule into the special inspections spec (UFGS 01 45 35).
3. Check section boxes with ANY inspection tasks applicable to your project. You may choose to delete unchecked sections or leave them in the scheduled unchecked.
4. Individual rows/tasks that that are not applicable to the project may be left in the section, as the inspector can determine whether they occur/apply (e.g. metal trusses in the light gauge framing section for example).
5. Design discipline sections are color coded for easier reference by designers. This schedule does NOT need to be printed in color.
6. When finished editing, delete this note box and save this schedule as a PDF and insert into the project specifications (special inspections section).

A. STRUCTURAL - STEEL – WELDING SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒

STEEL INSPECTION PRIOR TO WELDING – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.2.1, AISC 360-10: Table C-N5.4-1		
TASK	INSPECTION TYPE[1]	DESCRIPTION
1. Verify that the welding procedures specification (WPS) is available	**PERFORM**	
2. Verify manufacturer certifications for welding consumables are available	**PERFORM**	
3. Verify material identification	**PERFORM**	Type and grade.
4. Welder Identification System	**PERFORM**	The fabricator or erector, as applicable, shall maintain a system by which a welder who has welded a joint or member can be identified. Stamps, if used, shall be the low-stress type.
5. Fit-up of groove welds (including joint geometry)	OBSERVE	✓ Joint preparation ✓ Dimensions (alignment, root opening, root face, bevel) ✓ Cleanliness (condition of steel surfaces) ✓ Tacking (tack weld quality and location) ✓ Backing type and fit (if applicable)
6. Configuration and finish of access holes	OBSERVE	
7. Fit-up of fillet welds	OBSERVE	✓ Dimensions (alignment, gaps at root) ✓ Cleanliness (condition of steel surfaces) ✓ Tacking (tack weld quality and location)
STEEL INSPECTION DURING WELDING – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.2.1, AISC 360-10: Table C-N5.4-2		
TASK	INSPECTION TYPE	DESCRIPTION
8. Use of qualified welders	**PERFORM**	Welding by welders, welding operators, and tack welders who are qualified in conformance with requirements.
9. Control and handling of welding consumables	OBSERVE	✓ Packaging ✓ Electrode atmospheric exposure control
10. No welding over cracked tack welds	OBSERVE	
11. Environmental conditions	OBSERVE	✓ Wind speed within limits ✓ Precipitation and temperature
12. Welding Procedures Specification followed	OBSERVE	✓ Settings on welding equipment ✓ Travel speed ✓ Selected welding materials ✓ Shielding gas type/flow rate ✓ Preheat applied ✓ Interpass temperature maintained (min./max.) ✓ Proper position (F, V, H, OH) ✓ Intermix of filler metals avoided
13. Welding techniques	OBSERVE	✓ Interpass and final cleaning ✓ Each pass within profile limitations ✓ Each pass meets quality requirements

[1] **PERFORM**: Perform these tasks for each weld, fastener or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.

A. STRUCTURAL - STEEL – WELDING SECTION (CONTINUED)

STEEL INSPECTION AFTER WELDING – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 2015 1705.2.1, AISC 360-10: Table C-N5.4-3		
TASK	INSPECTION TYPE [1]	DESCRIPTION
14. Welds cleaned	OBSERVE	
15. Size, length, and location of all welds	**PERFORM**	Size, length, and location of all welds conform to the requirements of the detail drawings.
16. Welds meet visual acceptance criteria	**PERFORM AND DOCUMENT**	✓ Crack prohibition ✓ Weld/base-metal fusion ✓ Crater cross section ✓ Weld profiles ✓ Weld size ✓ Undercut ✓ Porosity
17. Arc strikes	**PERFORM**	
18. k-area	**PERFORM**	When welding of doubler plates, continuity plates or stiffeners has been performed in the k-area, visually inspect the web k-area for cracks.
19. Backing removed, weld tabs removed and finished, and fillet welds added where required	**PERFORM**	
20. Repair activities	**PERFORM AND DOCUMENT**	
21. Document acceptance or rejection of welded joint or member	**PERFORM**	

END SECTION

[1] **PERFORM**: Perform these tasks for each weld, fastener or bolted connection, and required verification.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.

B. STRUCTURAL - STEEL – BOLTING SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒

STEEL INSPECTION TASKS PRIOR TO BOLTING – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.2.1, AISC 360-10: Table C-N5.6-1		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Manufacture's certifications available for fastener materials	**PERFORM**	
2. Fasteners marked in accordance with ASTM requirements	OBSERVE	
3. Proper fasteners selected for joint detail (grade, type, bolt length if threads are to be excluded from shear plane)	OBSERVE	
4. Proper bolting procedure selected for joint detail	OBSERVE	
5. Connecting elements, including appropriate faying surface condition and hole preparation, if specified, meet applicable requirements	OBSERVE	
6. Proper storage provided for bolts, nuts, washers, and other fastener components	OBSERVE	
STEEL INSPECTION TASKS DURING BOLTING – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.2.1, AISC 360-10: Table C-N5.6-2		
TASK	INSPECTION TYPE [1]	DESCRIPTION
7. Fastener assemblies of suitable condition, placed in all holes and washers (if required) are positioned as required	OBSERVE	
8. Joint brought to the snug-tight condition prior to pretensioning operation	OBSERVE	
9. Fastener component not turned by the wrench prevented from rotating	OBSERVE	
10. Bolts are pretensioned in accordance with RCSC Specification, progressing systematically from the most rigid point toward the free edges	OBSERVE	
STEEL INSPECTION TASKS AFTER BOLTING – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.2.1, AISC 360-10: Table C-N5.6-3		
TASK	INSPECTION TYPE [1]	DESCRIPTION
11. Document acceptance or rejection of all bolted connections	**DOCUMENT**	

END SECTION

[1] **PERFORM**: Perform these tasks for each weld, fastener or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.

C. STRUCTURAL - STEEL - NON DESTRUCTIVE TESTING SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒

NONDESTRUCTIVE TESTING OF WELDED JOINTS – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.2.1, AISC 360-10: Section N5.5		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Use of qualified nondestructive testing personnel	**PERFORM**	Visual weld inspection and nondestructive testing (NDT) shall be conducted by personnel qualified in accordance with AWS D1.8 clause 7.2
2. CJP groove welds	OBSERVE	**[NOTE: DOR must delete this row if section D (SEISMIC PROVISIONS SECTION) is checked]** Dye penetrant testing (DT) and ultrasonic testing (UT) shall be performed on 20% of CJP groove welds for materials greater than 5/16" (8mm) thick. Testing rate must be increased to 100% if greater than 5% of welds tested have unacceptable defects.
3. Welded joints subject to fatigue	OBSERVE	Dye penetrant testing (DT) and Ultrasonic testing (UT) shall be performed on 100% of welded joints identified on contract drawings as being subject to fatigue.
4. Weld tab removal sites	OBSERVE	At the end of welds where weld tabs have been removed, magnetic particle testing shall be performed on the same beam-to-column joints receiving UT

END SECTION

[1] **PERFORM**: Perform these tasks for each weld, fastener or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.

D. STRUCTURAL - STEEL – AISC 341 REQUIREMENTS (SEISMIC PROVISIONS) SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒

NONDESTRUCTIVE TESTING OF WELDED JOINTS – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.2.1, AISC 341-10: Section J6.2		
TASK	INSPECTION TYPE [1]	DESCRIPTION
[NOTE: DOR may uncheck this section for projects NOT designed in accordance with AISC 341 (Seismic Provisions) or for projects designed according to AISC 341, but using an R value equal to 3]		
5. CJP groove welds	OBSERVE	Dye penetrant testing (DT) and ultrasonic testing (UT) shall be performed on 100% of CJP groove welds for materials greater than 5/16" thick (8mm).
6. Beam cope and access hole.	OBSERVE	At welded splices and connections, thermally cut surfaces of beam copes and access holes shall be tested using magnetic particle testing (MT) or dye penetrant testing (DT), when the flange thickness exceeds 1 1/2 in. for rolled shapes, or when the web thickness exceeds 1 1/2 in. for built-up shapes.
7. K-area NDT (AISC 341)	**PERFORM**	Where welding of doubler plates, continuity plates or stiffeners has been performed in the k-area, the web shall be tested for cracks using magnetic particle testing (MT). The MT inspection area shall include the k-area base metal within 3-inches of the weld. The MT shall be performed no sooner than 48 hours following completion of the welding.
8. Placement of reinforcing or contouring fillet welds	**DOCUMENT**	

END SECTION

[1] **PERFORM**: Perform these tasks for each weld, fastener or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.

E. STRUCTURAL - STEEL - COMPOSITE CONSTRUCTION (NOT APPLICABLE)

F. STRUCTURAL - STEEL - OTHER INSPECTIONS

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒

OTHER STEEL INSPECTIONS – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.2.1, AISC 341-10: Tables J8-1 & J10-1		
TASK	INSPECTION TYPE [2]	DESCRIPTION
1. Anchor rods and other embedments supporting structural steel	**PERFORM**	Verify the diameter, grade, type, and length of the anchor rod or embedded item, and the extent or depth of embedment prior to placement of concrete.
2. Fabricated steel or erected steel frame	OBSERVE	Verify compliance with the details shown on the construction documents, such as braces, stiffeners, member locations and proper application of joint details at each connection.
3. Reduced beam sections (RBS) where/if occurs	**DOCUMENT**	✓ Contour and finish ✓ Dimensional tolerances
4. Protected zones	**DOCUMENT**	No holes or unapproved attachments made by fabricator or erector
5. H-piles where/if occurs	**DOCUMENT**	No holes or unapproved attachments made by the responsible contractor
6. Verify presence of material certification for members and fasteners.	OBSERVE	
7. Inspect fabricated structural steel members and assemblies for compliance with the Contract Documents.	OBSERVE	

END SECTION

[1] See Concrete Construction Section for all concrete related inspection of composite steel construction.

[2] **PERFORM**: Perform these tasks for each weld, fastener or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.

G. STRUCTURAL - COLD-FORMED METAL DECK - PLACEMENT SECTION (NOT APPLICABLE)

H. STRUCTURAL - COLD-FORMED METAL DECK – WELDING SECTION
(NOT APPLICABLE)

I. STRUCTURAL - COLD-FORMED METAL DECK – FASTENING SECTION
(NOT APPLICABLE)

J. STRUCTURAL - LIGHT GAUGE STEEL FRAMING AND/OR LIGHT GAUGE TRUSSES SECTION
(NOT APPLICABLE)

K. STRUCTURAL - OPEN-WEB STEEL JOISTS SECTION
(NOT APPLICABLE)

L. STRUCTURAL - CONCRETE CONSTRUCTION SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒

CONCRETE CONSTRUCTION, INCLUDING COMPOSITE DECK – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC TABLE 1705.3 (ACI 318 REFERENCES NOTED IN IBC TABLE)		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Inspect reinforcement, including prestressing tendons, and verify placement.	OBSERVE	Verify prior to placing concrete that reinforcing is of specified type, grade and size; that it is free of oil, dirt and unacceptable rust; that it is located and spaced properly; that hooks, bends, ties, stirrups and supplemental reinforcement are placed correctly; that lap lengths, stagger and offsets are provided; and that all mechanical connections are installed per the manufacturer's instructions and/or evaluation report. Includes review of count and cover.
2. Reinforcing bar welding	OBSERVE	✓ Verify weldability of reinforcing bars other than ASTM A 706 ✓ Inspect single-pass fillet welds, maximum 5/16" in accordance with AWS D1.4
3. All other welding	**CONTINUOUS**	Visually inspect all welds in accordance with AWS D1.4
4. Cast in place anchors and post installed drilled anchors (downward inclined)	**CONTINUOUS**	Verify prior to placing concrete that cast in place anchors and post installed drilled anchors have proper embedment, spacing and edge distance.
5. Post-installed adhesive anchors in horizontal or upward inclined orientations	**CONTINUOUS AND DOCUMENT**	✓ Inspect as required per approved ICC-ES report ✓ Verify that installer is certified for installation of horizontal and overhead installation applications ✓ Inspect proof loading as required by the contract documents
6. Verify use of required mix design	**CONTINUOUS**	Verify that all mixes used comply with the approved construction documents
7. Prior to concrete placement, fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete	**CONTINUOUS**	At the time fresh concrete is sampled to fabricate specimens for strength test verify these tests are performed by qualified technicians.
8. Inspect concrete and/or shotcrete placement for proper application techniques	**CONTINUOUS**	Verify proper application techniques are used during concrete conveyance and depositing avoids segregation or contamination. Verify that concrete is properly consolidated.
9. Verify maintenance of specified curing temperature and technique	OBSERVE	Inspect curing, cold weather protection, and hot weather protection procedures.
10. N/A		

CONTINUED ON FOLLOWING PAGE

[1] **OBSERVE**: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.
CONTINUOUS: Constant monitoring of identified tasks by a special inspector over the duration of performance of said tasks.

L. STRUCTURAL - CONCRETE CONSTRUCTION (CONTINUED)

CONCRETE CONSTRUCTION, INCLUDING COMPOSITE DECK – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC TABLE 1705.3 (ACI 318 REFERENCES NOTED IN IBC TABLE)		
TASK	INSPECTION TYPE [1]	DESCRIPTION
11. Inspect erection of precast concrete members	OBSERVE	See related tasks below.
12. N/A		
13. Inspect formwork for shape, location and dimensions of the concrete member being formed.	OBSERVE	
14. Precast Concrete Member Fabrication: Verify presence of plant certification and manufacturer's quality control procedures.	OBSERVE	
15. Precast Concrete Member Fabrication: Verify proper concrete mix use.	OBSERVE	
16. Precast Concrete Member Fabrication: Verify proper placement of embedded items.	OBSERVE	
17. Precast Concrete Member Delivery: Inspect members for deficiencies on arrival.	**CONTINUOUS**	
18. Precast Concrete Member Erection: Inspect all connections for compliance with the Contract Documents.	**CONTINUOUS**	
19. Verify presence of all necessary materials certifications.	**CONTINUOUS**	
20. Inspect concrete placement for proper application techniques and methods.	**CONTINUOUS**	
21. Evaluate Strength of Concrete.	**CONTINUOUS**	
22. Inspect curing process and maintenance of specified curing temperature.	OBSERVE	
23. Verify weldability of reinforcing steel other than A706.	**CONTINUOUS**	
24. Inspect reinforcing bars weldments.	**CONTINUOUS**	

END SECTION

[1] **OBSERVE**: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.
CONTINUOUS: Constant monitoring of identified tasks by a special inspector over the duration of performance of said tasks.

M. STRUCTURAL - MASONRY CONSTRUCTION SECTION (ALL RISK CATEGORIES)

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒

MASONRY CONSTRUCTION – VERIFY THE FOLLOWING ARE IN COMPLIANCE AT START OF CONSTRUCTION IBC 1705.4 (ACI 530-13 TABLE 3.1.2 & 3.1.3)		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Compliance with approved submittals prior to start	OBSERVE	
2. Proportions of site-mixed mortar.	OBSERVE	
3. Grade and type of reinforcement, anchor bolts, and prestressing tendons and anchorages	OBSERVE	
4. Prestressing technique	OBSERVE	
5. Properties of thin bed mortar for AAC masonry	OBSERVE	
MASONRY CONSTRUCTION – VERIFY THE FOLLOWING ARE IN COMPLIANCE PRIOR TO GROUTING IBC 1705.4 (ACI 530-13 TABLE 3.1.2 & 3.1.3)		
TASK	INSPECTION TYPE [1]	DESCRIPTION
6. Grout space	OBSERVE **CONTINUOUS**	**[NOTE: DOR must either delete 'OBSERVE' for Risk Category IV/V, or delete 'CONTINUOUS' for Risk Categories I/II/ III]**
7. Proportions of site-prepared grout and prestressing grout for bonded tendons	OBSERVE	
8. Proportions of site-mixed grout and prestressing grout for bonded tendons	OBSERVE	
9. Placement of masonry units and mortar joints	OBSERVE	
10. Welding of reinforcement	**CONTINUOUS**	
MASONRY CONSTRUCTION – VERIFY THE FOLLOWING ARE IN COMPLIANCE DURING CONSTRUCTION IBC 1705.4 (ACI 530-13 TABLE 3.1.2 & 3.1.3)		
TASK	INSPECTION TYPE [1]	DESCRIPTION
11. Size and location of structural elements is in compliance	OBSERVE	
12. Preparation, construction, and protection of masonry during cold weather (temperature below 40°F (4.4°c) or hot weather (temp above 90°F (32.2°C))	OBSERVE	
13. Application and measurement of prestressing force	**CONTINUOUS**	
14. Placement of grout and prestressing grout for bonded tendons	**CONTINUOUS**	
15. Placement of AAC masonry units and construction of thin bed mortar joints	**CONTINUOUS**	Continuous for first 5000 square feet only (465 square meters).
16. Observe preparation of grout specimens, mortar specimens, and/or prisms	OBSERVE	
17. Type, size and placement of reinforcement, connectors, anchor bolts and prestressing tendons and anchorages, including details of anchorage of masonry to structural members, frames, or other construction	OBSERVE **CONTINUOUS**	**[NOTE: DOR must either delete 'OBSERVE' for Risk Category IV/V, or delete 'CONTINUOUS' for Risk Categories I/II/III]**

END SECTION

[1] **OBSERVE**: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.

CONTINUOUS: Constant monitoring of identified tasks by a special inspector over the duration of performance of said tasks.

N. STRUCTURAL - WOOD CONSTRUCTION – SPECIALTY ITEMS SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒

WOOD CONSTRUCTION – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.5		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. High-load diaphragms where applicable	OBSERVE	Verify thickness and grade of sheathing, size of framing members at panel edges, nail diameters and length, and the number of fastener lines and that fastener spacing is per approved contract documents.
2. Metal-plate connected wood trusses spanning 60 feet or greater	OBSERVE	Verify that the temporary installation restraint/bracing and the permanent individual truss member restraint/bracing are installed in accordance with the approved truss submittal package

END SECTION

O. STRUCTURAL - WOOD CONSTRUCTION - SEISMIC & WIND SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒

WOOD CONSTRUCTION SEISMIC AND WIND – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.5		
TASK	INSPECTION TYPE [1]	DESCRIPTION
[NOTE: DOR may uncheck this section where sheathing nailing/fasteners (both shearwall and roof) are consistently greater than 4" on center, or if the design wind speed is less than 110 mph (49 meters/sec) AND the seismic design category is A or B]		
1. Nailing, bolting, anchoring and other fastening of elements of the main wind/seismic force-resisting system	OBSERVE	Includes connectors for: shearwall sheathing, roof/floor sheathing, drag struts/collectors, braces, hold downs, roof and floor framing connections to exterior walls.

END SECTION

P. STRUCTURAL – ISOLATION AND ENERGY DISSIPATION SYSTEMS SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒

ISOLATION AND ENERGY DISSIPATION SYSTEMS – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC TABLE 1705.2.3		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Fabrication and installation	OBSERVE	Verify that fabrication and installation of isolator units and energy dissipation devices conform to manufacturer's recommendations and approved construction documents

END SECTION

[1] **OBSERVE**: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.

Q. GEOTECHNICAL - SOILS INSPECTION SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒

SOILS INSPECTION – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.6		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Materials below shallow foundations are adequate to achieve the design bearing capacity.	**CONTINUOUS**	
2. Excavations are extended to proper depth and have reached proper material	**CONTINUOUS**	
3. Verify use of proper materials, densities and lift thicknesses during placement and compaction of compacted fill	**CONTINUOUS**	During this task, periodically perform classification and testing of controlled fill materials.
4. Prior to placement of compacted fill, inspect subgrade and verify that site has been prepared properly.	OBSERVE	During fill placement, the special inspector shall verify that proper materials and procedures are used in accordance with the provisions of the approved geotechnical report

END SECTION

R. GEOTECHNICAL - DRIVEN DEEP FOUNDATION ELEMENTS SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒

DEEP DRIVEN FOUNDATION CONSTRUCTION – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.5		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Verify element materials, sizes and lengths comply with requirements	**CONTINUOUS**	
2. Inspect driving operations and maintain complete and accurate records for each element	**CONTINUOUS**	
3. Verify placement locations and plumbness, confirm type and size of hammer, record number of blows per foot of penetration, determine required penetrations to achiever design capacity, record tip and butt elevations and document ay damage to foundation element	**CONTINUOUS**	

END SECTION

[1] **OBSERVE**: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.

CONTINUOUS: Constant monitoring of identified tasks by a special inspector over the duration of performance of said tasks.

S. GEOTECHNICAL - HELICAL PILE FOUNDATIONS SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒

HELICAL PILE FOUNDATIONS – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.9		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Record installation equipment used, pile dimensions, tip elevations, final depth, final installation torque and other pertinent installation data. The approved geotechnical report and the contract documents shall be used to determine compliance	**CONTINUOUS**	

END SECTION

T. GEOTECHNICAL - CAST IN PLACE DEEP FOUNDATION ELEMENTS SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒

CAST IN PLACE DEEP FOUNDATION ELEMENTS (DRILLED CAISSONS) – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.8		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Inspect drilling operations and maintain complete and accurate records for each element.	**CONTINUOUS**	Includes, not by way of limitation: a) Verifying proper depth, materials, and bearing capacities, and b) Confirming absence of excessive standing water and cleanliness of bearing.
2. Verify placement locations and plumbness, confirm element diameters, bell diameters (if applicable), lengths, embedment into bedrock (if applicable and adequate end-bearing strata capacity. Record concrete or grout volumes.	**CONTINUOUS**	
3. Inspect reinforcement as assembled and installed.	**CONTINUOUS**	
4. Observe concrete placement and withdrawal of temporary casing.	**CONTINUOUS**	

END SECTION

[1] **CONTINUOUS:** Constant monitoring of identified tasks by a special inspector over the duration of performance of said tasks.

U. FIRE PROTECTION - SPRAYED FIRE-RESISTANT MATERIALS SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒

SPRAYED FIRE RESISTANT MATERIALS – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.14		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Surface condition	OBSERVE	Prior to application confirm that surface has been prepared per the approved fire-resistance design and manufacturer's instructions.
2. Application	OBSERVE	Prior to application confirm that the substrate meets the minimum ambient temperature per the approved fire-resistance design and manufacturer's instructions.
3. Material thickness	OBSERVE	Verify that the thickness of the SFRM to structural elements is not less than the thickness require by the fire-resistant design in more that 10 percent of the measurement, but in no case less than minimum allowable thickness required by 1705.14.
4. Material density	OBSERVE	Verify that the thickness of the SFRM to structural elements is not less than the thickness require by the fire-resistant design in more than 10 percent of the measurement, but in no case less than minimum allowable thickness required by IBC 1705.14.5
5. Bond strength	OBSERVE	Verify cohesive/adhesive bond strength of the cured SFRM applied to the structural element is not less than 150psf and according to IBC 1705.14.6

END SECTION

V. FIRE PROTECTION - MASTIC AND INTUMESCENT COATINGS SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒

MASTIC AND INTUMESCENT FIRE-RESISTANT COATINGS – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.15		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Surface preparation	OBSERVE	Inspections shall be performed in accordance with AWCI 12-B and the contract documents

END SECTION

W. FIRE PROTECTION – FIRE RESISTANT PENETRATIONS AND JOINTS SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒

FIRE RESISTANT PENETRATIONS AND JOINTS – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.17		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Inspections of penetration firestop systems conducted in accordance with ASTM E 2174.	OBSERVE	**[NOTE: This section applies to Risk Category III, IV, & V only. DOR may choose to uncheck this section where project is assigned to Risk Category I or II. Confirm Risk Category with Structural Engineer]**
2. Inspections of fire-resistant joint systems conducted in accordance with ASTM E 2393	OBSERVE	

END SECTION

[1] **OBSERVE**: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.

X. FIRE PROTECTION – SMOKE CONTROL SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒

SMOKE CONTROL – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.17		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Verify device locations and perform leakage testing	OBSERVE	Perform during erection of ductwork and prior to concealment
2. Pressure difference testing, flow measurements and detection and control verification	OBSERVE	Perform prior to occupancy and after sufficient completion

END SECTION

[1] **OBSERVE**: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.

Y. ARCHITECTURAL - EXTERIOR INSULATION AND FINISH SYSTEMS SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒

EXTERIOR INSULATION AND FINISH SYSTEMS (EIFS) – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.16		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Water resistive barrier coating applied over a sheathing substrate.	OBSERVE	Verify that water resistive barrier coating complies with ASTM E 2570. **[NOTE: not applicable to masonry or concrete wall applications. Uncheck this section in those cases]**

END SECTION

Z. ARCHITECTURAL – ARCHITECTURAL COMPONENTS

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒

ARCHITECTURAL COMPONENTS – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.12.5, 1705.12.7		
TASK	INSPECTION TYPE [1]	DESCRIPTION
[NOTE: This section is not applicable to Seismic Design Categories A, B, & C. Uncheck this section if one of those categories applies. Confirm Seismic Design Category with the structural engineer]		
1. Erection and fastening of exterior cladding and interior and exterior veneer.	OBSERVE	Verify appropriate materials, fasteners and attachment at commencement of work and at completion. **Inspector Note: Inspection not required if height is less than 30 feet or weight is less than 5psf**
2. Interior and exterior non-load bearing walls	OBSERVE	Verify appropriate materials, fasteners and attachment at commencement of work and at completion. **Inspector Note: Inspection not required if height is less than 30 feet. Also, Interior non-load bearing walls need not be inspected if weighing less than 15psf**
3. Access floors	OBSERVE	Verify that anchorage complies with approved construction documents. Inspection of post-installed anchors shall comply with approved ICC-ES report
4. Storage racks	OBSERVE	Verify that anchorage complies with approved construction documents. Inspection of post-installed anchors shall comply with approved ICC-ES report. **Inspector Note: Not required for racks less than 8 feet in height**

END SECTION

[1] **OBSERVE**: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.

AA. PLUMBING/MECHANICAL/ELECTRICAL DESIGNATED SEISMIC SYSTEMS SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒

PLUMBING, MECHANICAL AND ELECTRICAL - DESIGNATED SEISMIC SYSTEMS IBC 1705.12.4		
TASK	INSPECTION TYPE [1]	DESCRIPTION
[NOTE: This section is not applicable to Seismic Design Categories A or B. Uncheck this section if one of those categories applies. Confirm Seismic Design Category with structural engineer]		
1. Designated Seismic Systems equipment verification	OBSERVE	✓ Verify model number and serial number are in conformance with project specific seismic qualification (PSSQ) ✓ Verify Tag ID is correct and installed per specifications
2. Designated Seismic Systems equipment Mounting	OBSERVE	✓ Verify that Anchor Base Bolting is installed per PSSQ ✓ Verify that Equipment Bracing is Installed per PSSQ ✓ Verify that Bracing Attachments are installed per PSSQ
3. Designated Seismic Systems utility Conduit/Piping	OBSERVE	✓ Verify that Conduit/Piping is connected to the equipment per PSSQ (flex or rigid) ✓ Verify that Conduit/Piping is seismically supported independently of equipment and in accordance with PSSQ support requirements
4. Designated Seismic Systems clearance	OBSERVE	✓ Adjacent Equipment – Verify that there is adequate gap to eliminate possibility of pounding ✓ Conduit/Piping - Verify that there is adequate gap to eliminate possibility of pounding

END SECTION

[1] **OBSERVE**: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.

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 Contracting Officer’s Representative (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 Contracting Officer for approval, a written and/or graphic Environmental Protection Plan including, but not limited to, the following:

a. Name(s) of person(s) within the Contractor's organization who is (are) responsible for ensuring adherence to the Environmental Protection Plan.
b. Name(s) and qualifications of person(s) responsible for manifesting hazardous waste to be removed from the site.
c. Name(s) and qualifications of person(s) responsible for training the Contractor's environmental protection personnel.
d. Description of the Contractor's environmental protection personnel training program.
e. A list of Federal, State, and local laws, regulations, and permits concerning environmental protection, pollution control, noise control and abatement that are applicable to the Contractor's proposed operations and the requirements imposed by those laws, regulations, and permits.
f. Methods for protection of features to be preserved within authorized work areas including trees, shrubs, vines, grasses, ground cover, landscape features, air and water quality, fish and wildlife, soil, historical, and archeological and cultural resources.
g. Procedures to provide the environmental protection that comply with the applicable laws and regulations. Describe the procedures to correct pollution of the environment due to accident, natural causes, or failure to follow the procedures as described in the Environmental Protection Plan.
h. Permits, licenses, and the location of the solid waste disposal area.
i. Drawings showing locations of any proposed material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials. Include as part of an Erosion Control Plan approved by the District Office of the U.S. Soil Conservation Service and the Department of Veterans Affairs.
j. Environmental Monitoring Plans for the job site including land, water, air, and noise.

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

l. Inclusion of "best management practices" and methodologies.

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, topsoil, and landforms 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. Provide erosion control plans, in phases where required.

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 10-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 on the Erosion and Sediment Control Plan. Maintain temporary erosion and sediment control measures such as berms, dikes, drains,

sedimentation basins, grassing, and mulching, until permanent drainage and erosion control facilities are completed and operative.

6. Manage borrow areas on Government property to minimize erosion and to prevent sediment from entering nearby water courses or lakes.
7. Manage and control spoil areas on Government property to limit spoil to areas shown on the Staging and Phasing Plan and prevent erosion of soil or sediment from entering nearby water courses or lakes.
8. Protect adjacent areas from despoilment by temporary excavations and embankments.
9. Handle and dispose of solid wastes in such a manner that will prevent contamination of the environment. Place solid wastes (excluding clearing debris) in containers that are emptied on a regular schedule. Transport all solid waste off Government property and dispose of waste in compliance with Federal, State, and local requirements.
10. Store chemical waste away from the work areas in corrosion resistant containers and dispose of waste in accordance with Federal, State, and local regulations.
11. Handle discarded materials other than those included in the solid waste category as directed by the COR.

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

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

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

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

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

F. Reduction of Noise: Minimize noise using every action possible. Perform noise-producing work in less sensitive hours of the day or week as

directed by the COR. Maintain noise-produced work at or below the decibel levels and within the time periods specified.

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

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

2. Provide sound-deadening devices on equipment and take noise abatement measures that are necessary to comply with the requirements of this contract, consisting of, but not limited to, the following:
   a. Maintain maximum permissible construction equipment noise levels at 15 meter (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	SAWS	75
GENERATORS	75	VIBRATORS	75
COMPRESSORS	75		

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

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

Buffalo VA Medical Center

Buffalo, NY 14215

Design Parking Ramp Expansion

Bancroft Architects + Engineers

- - - E N D - - -

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:

D. Waste Management Plan development and implementation.

E. Techniques to minimize waste generation.

F. Sorting and separating of waste materials.

G. Salvage of existing materials and items for reuse or resale.

H. Recycling of materials that cannot be reused or sold.

I. 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. Sheathings
8. Cardboard, paper and packaging.
9. Bitumen roofing materials.
10. Plastics (eg, ABS, PVC).
11. Carpet and/or pad.
12. Gypsum board.
13. Insulation.
14. Paint.

15. Fluorescent lamps.

1.2 RELATED WORK

A. Section 02 41 00, DEMOLITION.

B. Section 01 00 00, GENERAL REQUIREMENTS.

1. D. Division 1 Sustainability specifications

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.

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 CORa 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.
         a) The names and locations of mixed debris reuse and recycling facilities or sites.
         b) The names and locations of trash disposal landfill facilities or sites.
         c) 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.

E. Target waste diversion rate by material and an overall diversion rate.

F. Final report documenting the results of implementation of the preconstruction waste management plan.

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. Green Building Initiative (GBI): Green Globes for New Construction 2019

1.7 RECORDS

A. Maintain records to document the quantity of waste generated; the quantity of waste diverted through sale, reuse, or recycling; and the quantity of waste disposed by landfill or incineration. Records shall be kept in accordance with the Green Globes for New Construction 2019 Technical Reference Manual.

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 13
SUSTAINABLE CONSTRUCTION REQUIREMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section describes general requirements and procedures to comply with federal mandates and U.S. Department of Veterans Affairs (VA) policies for sustainable construction.

B. The Design Professional has selected materials and utilized integrated design processes that achieve the Government's objectives. Contractor is responsible to maintain and support these objectives in developing means and methods for performing work and in proposing product substitutions or changes to specified processes. Obtain approval from Contracting Officer for all changes and substitutions to materials or processes. Proposed changes must meet, or exceed, materials or processes specified.

1.2 RELATED WORK

A. Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS.

B. Section 01 74 19 CONSTRUCTION WASTE MANANGEMENT.

1.3 DEFINITIONS

A. Recycled Content: Recycled content of materials is defined according to Federal Trade Commission Guides for the Use of Environmental Marketing Claims (16 CFR Part 260). Recycled content value of a material assembly is determined by weight. Recycled fraction of assembly is multiplied by cost of assembly to determine recycled content value.

1. "Post-Consumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
2. "Pre-Consumer" material is defined as material diverted from waste stream during the manufacturing process. Excluded is reutilization of materials such as rework, regrind, or scrap generated in a process and capable of being reclaimed within the same process that generated it.

B. Biobased Products: Biobased products are derived from plants and other renewable agricultural, marine, and forestry materials and provide an

alternative to conventional petroleum derived products. Biobased products include diverse categories such as lubricants, cleaning products, inks, fertilizers, and bioplastics.

C. Low Pollutant-Emitting Materials: Materials and products which are minimally odorous, irritating, or harmful to comfort and well-being of installers and occupants.

D. Volatile Organic Compounds (VOC): Chemicals that are emitted as gases from certain solids or liquids. VOCs include a variety of chemicals, some of which may have short- and long-term adverse health effects.

1.4 REFERENCE STANDARDS

A. Carpet and Rug Institute Green Label Plus program.

B. U.S. Department of Agriculture BioPreferred program (USDA BioPreferred).

C. U.S. Environmental Protection Agency Comprehensive Procurement Guidelines (CPG).

D. U.S. Environmental Protection Agency WaterSense Program (WaterSense).

E. U.S. Environmental Protection Agency ENERGY STAR Program (ENERGY STAR).

F. U. S. Department of Energy Federal Energy Management Program (FEMP).

G. Green Electronic Council EPEAT Program (EPEAT).

1.5 SUBMITTALS

A. All submittals to be provided by contractor to COR.

B. Sustainability Action Plan:

1. Submit documentation as required by this section; provide additional copies of typical submittals required under technical sections when sustainable construction requires copies of record submittals.
2. Within 30 days after Preconstruction Meeting provide a narrative plan for complying with requirements stipulated within this section.
3. Sustainability Action Plan must:
   a. Make reference to sustainable construction submittals defined by this section.
   b. Address all items listed under PERFORMANCE CRITERIA.
   c. Indicate individual(s) responsible for implementing the plan.

C. Low Pollutant-Emitting Materials Tracking Spreadsheet: Within 30 days after Preconstruction Meeting provide a preliminary Low Pollutant-Emitting Materials Tracking Spreadsheet. The Low Pollutant-Emitting

Materials Tracking Spreadsheet must be an electronic file and include all materials on Project in categories described under Low Pollutant-Emitting Materials in 01 81 13.

D. Construction Indoor Air Quality (IAQ) Management Plan:

1. Not more than 30 days after Preconstruction Meeting provide a Construction IAQ Management Plan as an electronic file including descriptions of the following:
   a. Instruction procedures for meeting or exceeding minimum requirements of ANSI/SMACNA 008-2008, Chapter 3, including procedures for HVAC Protection, Source Control, Pathway Interruption, Housekeeping, and Scheduling.
   b. Instruction procedures for protecting absorptive materials stored on-site or installed from moisture damage.
   c. Schedule of submission of photographs of on-site construction IAQ management measures such as protection of ducts and on-site stored oil installed absorptive materials.
   d. Instruction procedures if air handlers must be used during construction, including a description of filtration media to be used at each return air grille.
   e. 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.
   f. Instruction procedures and schedule for implementing building flush-out.

E. Product Submittals:

1. Recycled Content: Submit product data from manufacturer indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content (excluding MEP systems equipment and components).
2. Biobased Content: Submit product data for products to be installed or used which are included in any of the USDA BioPreferred program’s product categories. Data to include percentage of biobased content and source of biobased material.
3. Low Pollutant-Emitting Materials: Submit product data confirming compliance with relevant requirements for all materials on Project

in categories described under Low Pollutant-Emitting Materials in 01 81 13.

4. For applicable products and equipment, submit product documentation confirming ENERGY STAR label, FEMP certification, WaterSense, and/or EPEAT certification.

F. Sustainable Construction Progress Reports: Concurrent with each Application for Payment, submit a Sustainable Construction Progress Report to confirm adherence with Sustainability Action Plan.

1. Include narratives of revised strategies for bringing work progress into compliance with plan and product submittal data.
2. Include updated and current Low Pollutant-Emitting Materials Tracking Spreadsheet.
3. Include construction waste tracking, in tons or cubic yards, including waste description, whether diverted or landfilled, hauler, and percent diverted for comingled quantities; and excluding land-clearing debris and soil. Provide haul receipts and documentation of diverted percentages for comingled wastes.

G. Closeout Submittals: Within 14 days after Substantial Completion provide the following:

1. Final version of Low Pollutant-Emitting Materials Tracking Spreadsheet.
2. Manufacturer’s cut sheets and product data highlighting the Minimum Efficiency Reporting Value (MERV) for filtration media installed at return air grilles during construction if permanently installed air handling units are used during construction.
3. Manufacturer’s cut sheets and product data highlighting the Minimum Efficiency Reporting Value (MERV) for final filtration media in air handling units.
4. Minimum 18 construction photographs including six photographs taken on three different occasions during construction of ANSI/SMACNA 008-2008, Chapter 3 approaches employed, along with a brief description of each approach, documenting implementation of IAQ management measures, such as protection of ducts and on-site stored or installed absorptive materials.
5. Flush-out Documentation:

   a. Product data for filtration media used during flush-out.

b. Product data for filtration media installed immediately prior to occupancy.

c. Signed statement describing building air flush-out procedures including dates when flush-out was begun and completed and statement that filtration media was replaced after flush-out.

1.6 QUALITY ASSURANCE

A. Preconstruction Meeting: After award of Contract and prior to commencement of Work, schedule and conduct meeting with Contracting Officer's Representative and Architect to discuss the Project Sustainable Action Plan content as it applies to submittals, project delivery, required Construction Indoor Air Quality (IAQ) Management Plan, and other Sustainable Construction Requirements. The purpose of this meeting is to develop a mutual understanding of the Sustainable Construction Requirements and coordination of contractor's management of these requirements with the Contracting Officer and the Construction Quality Manager.

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

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. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.

B. Green Seal Standard GS-11, Paints, 1st Edition, May 20, 1993.

C. Green Seal Standard GC-03, Anti-Corrosive Paints, 2nd Edition, January 7, 1997.

D. Green Seal Standard GC-36, Commercial Adhesives, October 19, 2000.

E. South Coast Air Quality Management District (SCAQMD) Rule 1113, Architectural Coatings, rules in effect on January 1, 2004.

F. South Coast Air Quality Management District (SCAQMD) Rule 1168, July 1, 2005 and rule amendment date of January 7, 2005.

G. Sheet Metal and Air Conditioning National Contractors' Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction, 2nd Edition (ANSI/SMACNA 008-2008), Chapter 3.

H. California Department of Public Health Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, Version 1.1, Emission Testing method for California Specification 01350 (CDPH Standard Method V1.1-2010).

I. Federal Trade Commission Guides for the Use of Environmental Marketing Claims (16 CFR Part 260).

J. ASHRAE Standard 52.2-2007.

PART 2 – PRODUCTS

2.1 PERFORMANCE CRITERIA

A. Construction waste diversion from landfill disposal must comprise at least 50 percent of total construction waste, excluding land clearing debris and soil. Alternative daily cover (ADC) does not qualify as material diverted from disposal.

B. Low Pollutant-Emitting Materials:

1. Adhesives, sealants and sealant primers applied on site within the weatherproofing membrane must comply with VOC limits of SCAQMD Rule 1168:

a. Flooring Adhesives and Sealants:

1) Indoor carpet adhesives: 50 g/L.
2) Wood Flooring Adhesive: 100 g/L.
3) Rubber Floor Adhesives: 60 g/L.
4) Subfloor Adhesives: 50 g/L.
5) Ceramic Tile Adhesives and Grout: 65 g/L.
6) Cove Base Adhesives: 50 g/L.
7) Multipurpose Construction Adhesives: 70 g/L.
8) Porous Material (Except Wood) Substrate: 50 g/L.
9) Wood Substrate: 30 g/L.
10) Architectural Non-Porous Sealant Primer: 250 g/L.
11) Architectural Porous Sealant Primer: 775 g/L.
12) Other Sealant Primer: 750 g/L.
13) Structural Wood Member Adhesive: 140 g/L.

14) Sheet-Applied Rubber Lining Operations: 850 g/L.
15) Top and Trim Adhesive: 250 g/L.
16) Architectural Sealant: 250 g/L.
17) Other Sealant: 420 g/L.

b. Non-Flooring Adhesives and Sealants:
1) Drywall and Panel Adhesives: 50 g/L.
2) Multipurpose Construction Adhesives: 70 g/L.
3) Structural Glazing Adhesives: 100 g/L.
4) Metal-to-Metal Substrate Adhesives: 30 g/L.
5) Plastic Foam Substrate Adhesive: 50 g/L.
6) Porous Material (Except Wood) Substrate Adhesive: 50 g/L.
7) Wood Substrate Adhesive: 30 g/L.
8) Fiberglass Substrate Adhesive: 80 g/L.
9) Architectural Non-Porous Sealant Primer: 250 g/L.
10) Architectural Porous Sealant Primer: 775 g/L.
11) Other Sealant Primer: 750 g/L.
12) PVC Welding Adhesives: 510 g/L.
13) CPVC Welding Adhesives: 490 g/L.
14) ABS Welding Adhesives: 325 g/L.
15) Plastic Cement Welding Adhesives: 250 g/L.
16) Adhesive Primer for Plastic: 550 g/L.
17) Contact Adhesive: 80 g/L.
18) Special Purpose Contact Adhesive: 250 g/L.
19) Structural Wood Member Adhesive: 140 g/L.
20) Sheet Applied Rubber Lining Operations: 850 g/L.
21) Top and Trim Adhesive: 250 g/L.
22) Architectural Sealants: 250 g/L.
23) Other Sealants: 420 g/L.

2. Aerosol adhesives applied on site within the weatherproofing membrane must comply with the following Green Seal GS-36.
a. Aerosol Adhesive, General-Purpose Mist Spray: 65 percent VOCs by weight.
b. Aerosol Adhesive, General-Purpose Web Spray: 55 percent VOCs by weight.
c. Special-Purpose Aerosol Adhesive (All Types): 70 percent VOCs by weight.

3. Paints and coatings applied on site within the weatherproofing membrane must comply with the following criteria:
   a. VOC content limits for paints and coatings established in Green Seal Standard GS-11.
   b. VOC content limit for anti-corrosive and anti-rust paints applied to interior ferrous metal substrates of 250 g/L established in Green Seal GC-03.
   c. Clear wood finishes, floor coatings, stains, primers, sealers, and shellacs applied to interior elements must not exceed VOC content limits established in SCAQMD Rule 1113.
   d. Comply with the following VOC content limits:
      1) Anti-Corrosive/Antirust Paints: 250 g/L.
      2) Clear Wood Finish, Lacquer: 550 g/L.
      3) Clear Wood Finish, Sanding Sealer: 350 g/L.
      4) Clear Wood Finish, Varnish: 350 g/L.
      5) Floor Coating: 100 g/L.
      6) Interior Flat Paint, Coating or Primer: 50 g/L.
      7) Interior Non-Flat Paint, Coating or Primer: 150 g/L.
      8) Sealers and Undercoaters: 200 g/L.
      9) Shellac, Clear: 730 g/L.
      10) Shellac, Pigmented: 550 g/L.
      11) Stain: 250 g/L.
      12) Clear Brushing Lacquer: 680 g/L.
      13) Concrete Curing Compounds: 350 g/L.
      14) Japans/Faux Finishing Coatings: 350 g/L.
      15) Magnesite Cement Coatings: 450 g/L.
      16) Pigmented Lacquer: 550 g/L.
      17) Waterproofing Sealers: 250 g/L.
      18) Wood Preservatives: 350 g/L.
      19) Low-Solids Coatings: 120 g/L.
4. Carpet installed in building interior must comply with one of the following:
   a. Meet testing and product requirements of the Carpet and Rug Institute Green Label Plus program.
   b. Maximum VOC concentrations specified in CDPH Standard Method V1.1-2010, using office scenario at the 14 day time point.

5. Each non-carpet flooring element installed in building interior which is not inherently non-emitting (stone, ceramic, powder-coated metals, plated or anodized metal, glass, concrete, clay brick, and unfinished or untreated solid wood flooring) must comply with one of the following:
   a. Meet requirements of the FloorScore standard as shown with testing by an independent third-party.
   b. Maximum VOC concentrations specified in CDPH Standard Method V1.1-2010, using office scenario at 14 day time point.
6. Composite wood and agrifiber products used within the weatherproofing membrane must contain no added urea-formaldehyde resins.
7. Laminating adhesives used to fabricate on-site and shop-applied composite wood and agrifiber assemblies must not contain added urea-formaldehyde.

C. Recycled Content:
1. Any products being installed or used that are listed on EPA Comprehensive Procurement Guidelines designated product list must meet or exceed the EPA’s recycled content recommendations. The EPA Comprehensive Procurement Guidelines categories include:
   a. Building insulation.
   b. Cement and concrete.
   c. Consolidated and reprocessed latex paint.
   d. Floor tiles.
   e. Flowable fill.
   f. Laminated paperboard.
   g. Modular threshold ramps.
   h. Nonpressure pipe.
   i. Patio blocks.
   j. Railroad grade crossing surfaces.
   k. Roofing materials.
   l. Shower and restroom dividers/partitions.
   m. Structural fiberboard.
   n. Nylon carpet and nylon carpet backing.
   o. Compost and fertilizer made from recovered organic materials.
   p. Hydraulic mulch.

q. Lawn and garden edging.

r. Plastic lumber landscaping timbers and posts.

s. Park benches and picnic tables.

t. Plastic fencing.

u. Playground equipment.

v. Playground surfaces.

w. Bike racks.

D. Biobased Content:

1. Materials and equipment being installed or used that are listed on the USDA BioPreferred program product category list must meet or exceed USDA's minimum biobased content threshold. Refer to individual specification sections for detailed requirements applicable to that section.

   a. USDA BioPreferred program categories include:

      1) Adhesive and Mastic Removers.

      2) Carpets.

      3) Cleaners.

      4) Composite Panels.

      5) Corrosion Preventatives.

      6) Erosion Control Materials.

      7) Dust Suppressants.

      8) Fertilizers.

      9) Floor Cleaners and Protectors.

      10) Floor Coverings (Non-Carpet).

      11) Glass Cleaners.

      12) Hydraulic Fluids.

      13) Industrial Cleaners.

      14) Interior Paints and Coatings.

      15) Mulch and Compost Materials.

      16) Multipurpose Cleaners.

      17) Multipurpose Lubricants.

      18) Packaging Films.

      19) Paint Removers.

      20) Plastic Insulating Foam.

      21) Pneumatic Equipment Lubricants.

      22) Roof Coatings.

23) Wastewater Systems Coatings.

24) Water Tank Coatings.

25) Wood and Concrete Sealers.

26) Wood and Concrete Stains.

E. Materials, products, and equipment being installed which fall into a category covered by the WaterSense program must be WaterSense-labeled or meet or exceed WaterSense program performance requirements, unless disallowed for infection control reasons.

1. WaterSense categories include:

a. Bathroom Faucets

b. Commercial Toilets

c. Irrigation Controllers

d. Pre-Rinse Spray Valves

e. Residential Toilets

f. Showerheads

g. Spray Sprinkler Bodies

h. Urinals

F. Materials, products, and equipment being installed which fall into any of the following product categories must be Energy Star-labeled.

1. Applicable Energy Star product categories as of 09/14/2017 include:

a. Appliances:

1) Air Purifiers and Cleaners.

2) Clothes Dryers (Residential).

3) Clothes Washers (Commercial & Residential).

4) Dehumidifiers.

5) Dishwashers (Residential).

6) Freezers (Residential).

7) Refrigerators (Residential).

b. Electronics and Information Technology:

1) Audio/Video Equipment.

2) Computers.

3) Data Center Storage.

4) Digital Media Player.

5) Enterprise Servers.

6) Imaging Equipment.

7) Monitors.

8) Professional Displays.
9) Set-Top and Cable Boxes.
10) Telephones.
11) Televisions.
12) Uninterruptible Power Supplies.
13) Voice over Internet Protocol (VoIP) Phones.

c. Food Service Equipment (Commercial):
1) Dishwashers.
2) Fryers.
3) Griddles.
4) Hot Food Holding Cabinets.
5) Ice Makers.
6) Ovens.
7) Refrigerators and Freezers.
8) Steam Cookers.
9) Vending Machines.

d. Heating and Cooling Equipment:
1) Air-Source Heat Pumps (Residential).
2) Boilers.
3) Ceiling Fans (Residential).
4) Central Air Conditioners (Residential).
5) Ductless Heating and Cooling (Residential).
6) Furnaces (Residential).
7) Water Heaters.
8) Geothermal Heat Pumps (Residential).
9) Light Commercial Heating and Cooling Equipment.
10) Room Air Conditioners (Residential).
11) Ventilation Fans (Residential).

e. Other:
1) Decorative Light Strings.
2) Electric Vehicle Supply Equipment.
3) Laboratory-Grade Refrigerators and Freezers.
4) Light Bulbs.
5) Light Fixtures.
6) Pool Pumps.
7) Roof Products.

8) Water Coolers.

9) Windows, Doors, and Skylights.

G. Materials, products, and equipment being installed which fall into any of the following categories must be FEMP-designated. FEMP-designated product categories as of 09/14/2017 include:

1. Boilers (Commercial).
2. Dishwashers (Commercial).
3. Electric Chillers, Air-Cooled (Commercial).
4. Electric Chillers, Water-Cooled (Commercial).
5. Exterior Lighting.
6. Fluorescent Ballasts.
7. Fluorescent Lamps, General Service.
8. Ice Machines, Water-Cooled.
9. Industrial Lighting (High/Low Bay).
10. Light Emitting Diode (LED) Luminaires.

H. Electronic products and equipment being installed which fall into any of the following categories shall be EPEAT registered. Electronic products and equipment covered by EPEAT program as of 09/14/2017 include:

1. Computers.
2. Displays.
3. Imaging Equipment.
4. Televisions.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Construction Indoor Air Quality Management:

1. During construction, meet or exceed recommended control measures of ANSI/SMACNA 008-2008, Chapter 3.
2. Protect stored on-site and installed absorptive materials from moisture damage.
3. If permanently installed air handlers are used during construction, filtration media with a minimum efficiency reporting value (MERV) of 8 must be used at each return air grille, as determined by ASHRAE Standard 52.2-1999 (with errata but without addenda). Replace all filtration media immediately prior to occupancy.

4. Perform building flush-out as follows:
   a. After construction ends, prior to occupancy and with interior finishes installed, perform a building flush-out by supplying a total volume of 14000 cu. ft. of outdoor air per sq. ft. of floor area while maintaining an internal temperature of at least 60 degrees Fahrenheit and a relative humidity no higher than 60 percent. OR
   b. If occupancy is desired prior to flush-out completion, the space may be occupied following delivery of a minimum of 3500 cu. ft. of outdoor air per sq. ft. of floor area to the space. Once a space is occupied, it must be ventilated at a minimum rate of 0.30 cfm per sq. ft. of outside air or design minimum outside air rate determined until a total of 14000 cu. ft./sq. ft. of outside air has been delivered to the space. During each day of flush-out period, ventilation must begin a minimum of three hours prior to occupancy and continue during occupancy.
5. Provide construction dust control to comply with SCAQMD Rule 403.

-----END----

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. 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.

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

D. Commissioning is a systematic process of verifying that the building systems perform interactively according to the construction documents and the VA’s operational needs. The commissioning process shall encompass and coordinate the system documentation, equipment startup, control system calibration, testing and balancing, performance testing and training. Commissioning during the construction and post-occupancy phases is intended to achieve the following specific objectives according to the contract documents:

1. Verify that the applicable equipment and systems are installed in accordance with the contact documents and according to the manufacturer's recommendations.

2. Verify and document proper integrated performance of equipment and systems.
3. Verify that Operations & Maintenance documentation is complete.
4. Verify that all components requiring servicing can be accessed, serviced and removed without disturbing nearby components including ducts, piping, cabling or wiring.
5. Verify that the VA's operating personnel are adequately trained to enable them to operate, monitor, adjust, maintain, and repair building systems in an effective and energy-efficient manner.
6. Document the successful achievement of the commissioning objectives listed above.

E. 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 `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 Contracting Officer Representative (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.

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 (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 the 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 the 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, with appropriate technical guidance from the Commissioning Agent.

1.3 RELATED WORK

A. Section 01 00 00 GENERAL REQUIREMENTS.
B. Section 01 32.16.15 PROJECT SCHEDULES (SMALL PROJECTS - DESIGN/BID/BUILD)
C. Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES
D. Section 01 81 13 SUSTAINABLE CONSTRUCTION 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.

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 (see also VA-RE)
COBie	Construction Operations Building Information Exchange
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

List of Acronyms	
Acronym	Meaning
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-RE	VA Resident Engineer
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.

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.

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-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 (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 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**
Building Exterior Closure (NOT USED)	
Foundations (excluding structural)	Standard, special, slab-on-grade, vapor barriers, air barriers

Systems To Be Commissioned	
System	**Description**
Superstructure	Floor construction, roof construction, sunshades, connections to adjacent structures
Exterior Closure	Exterior walls, exterior windows, exterior doors, louvers, grilles and sunscreens,
Roofing	Roof system (including parapet), roof openings (skylights, pipe chases, ducts, equipment curbs, etc.)
Specialties (NOT USED)	
Equipment (NOT USED)	
Conveying Equipment	
Elevators	Interface with other systems (fire alarm, etc.) [ASTM testing and certification by Contractor's independent 3rd party certifying agent.]
Fire Suppression	
Fire Sprinkler Systems	Wet pipe system, dry pipe system, pre-action system, special agent systems
Plumbing	
Wastewater Pump Systems	Sump pumps
HVAC	
Noise and Vibration Control	Noise and vibration levels for critical equipment such as Air Handlers, Chillers, Cooling Towers, Boilers, Generators, etc. will be commissioned as part of the system commissioning
Direct Digital Control System	Operator Interface Computer, Operator Work Station (including graphics, point mapping, trends, alarms), Network Communications Modules and Wiring, Integration Panels. [DDC Control panels will be commissioned with the systems controlled by the panel]

Systems To Be Commissioned	
System	**Description**
HVAC Air Handling Systems	Air handling Units, packaged rooftop AHU, Outdoor Air conditioning units, humidifiers, DDC control panels
HVAC Terminal Unit Systems	VAV Terminal Units, CAV terminal units, fan coil units, fin-tube radiation, unit heaters
Solar Energy Heating Systems	Solar collectors, heat exchangers, storage tanks, solar-boosted domestic hot water heater, pumps, valves, instrumentation
Electrical	
Medium-Voltage Electrical Distribution Systems	Medium-Voltage Switchgear, Medium-Voltage Switches, Underground ductbank and distribution, Pad-Mount Transformers, Medium-Voltage Load Interrupter Switches,
Grounding & Bonding Systems	Witness 3rd party testing, review reports
Electric Power Monitoring Systems	Metering, sub-metering, power monitoring systems, PLC control systems
Electrical System Protective Device Study	Review reports, verify field settings consistent with Study
Secondary Unit Substations	Medium-voltage components, transformers, low-voltage distribution, verify breaker testing results (injection current, etc)
Low-Voltage Distribution System	Normal power distribution system, Life-safety power distribution system, critical power distribution system, equipment power distribution system, switchboards, distribution panels, panelboards, verify breaker testing results (injection current, etc)

Systems To Be Commissioned	
System	**Description**
Lighting & Lighting Control Systems	Emergency lighting, occupancy sensors, lighting control systems, architectural dimming systems, theatrical dimming systems, exterior lighting and controls
Communications	
Grounding & Bonding System	Witness 3rd party testing, review reports
Structured Cabling System	Witness 3rd party testing, review reports
Electronic Safety and Security	
Grounding & Bonding	Witness 3rd party testing, review reports
Physical Access Control Systems	Witness 3rd party testing, review reports
Access Control Systems	Witness 3rd party testing, review reports
Security Access Detection Systems	Witness 3rd party testing, review reports
Video Surveillance System	Witness 3rd party testing, review reports
Fire Detection and Alarm System	100% device acceptance testing, battery draw-down test, verify system monitoring, verify interface with other systems.
Renewable Energy Sources	
Solar Energy Electrical Power Generation Systems	Solar collector modules, DC-AC inverter, storage batteries, combiners, Switchgear, instrumentation, monitoring and control systems
Site Utilities	
Storm Drainage Utilities	Site Storm Water Distribution
Transportation (NOT USED)	

Systems To Be Commissioned	
System	**Description**
Integrated Systems Tests	
Loss of Power Response	Loss of power to building, loss of power to campus, restoration of power to building, restoration of power to campus.
Fire Alarm Response	Integrated System Response to Fire Alarm Condition and Return to Normal

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. Commissioning Agent: The designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process. The Contractor shall engage the CxA under this construction contract.
2. Contractor' Commissioning Manager: The designated person, company, or entity that plans, schedules and coordinates the commissioning activities for the construction team.
3. 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 Contractor shall engage the CxA under this construction contract.
2. User: Representatives of the facility user and operation and maintenance personnel.

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.

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. 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 Resident Engineer with copies to the Contractor and Architect.

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

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

I. Data for Commissioning:

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

1.14 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 seven 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 seven 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.

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 Office 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	O	P	O	
	Commissioning Meetings	L	A	O	P	O	
	Project Progress Meetings	P	A	O	L	O	
	Controls Meeting	L	A	O	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	O	P	N/A	
Cx Plan & Spec	Final Commissioning Plan	L	A	O	R	O	

Construction Phase		CxA = Commissioning Agent COR = Contracting Office 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
Schedules	Duration Schedule for Commissioning Activities	L	A	O	R	N/A	
OPR and BOD	Maintain OPR on behalf of Owner	L	A	O	R	O	
	Maintain BOD/DID on behalf of Owner	L	A	O	R	O	
Document Reviews	TAB Plan Review	L	A	R	R	O	
	Submittal and Shop Drawing Review	R	A	R	L	O	
	Review Contractor Equipment Startup Checklists	L	A	R	R	N/A	
	Review Change Orders, ASI, and RFI	L	A	R	R	N/A	
Site Observations	Witness Factory Testing	P	A	P	L	O	
	Construction Observation Site Visits	L	A	R	R	O	
	Final Pre-Functional Checklists	L	A	R	R	O	

Construction Phase		CxA = Commissioning Agent COR = Contracting Office 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
Functional Test Protocols	Final Functional Performance Test Protocols	L	A	R	R	O	
Technical Activities	Issues Resolution Meetings	P	A	P	L	O	
Reports and Logs	Status Reports	L	A	O	R	O	
	Maintain Commissioning Issues Log	L	A	O	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 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	RE	A/E	PC	O&M	Notes
Meetings	Commissioning Meetings	L	A	O	P	O	
	Project Progress Meetings	P	A	P	L	O	
	Pre-Test Coordination Meeting	L	A	O	P	O	
	Lessons Learned and Commissioning Report Review Meeting	L	A	O	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	O	P	O	
Cx Plan & Spec	Maintain/Update Commissioning Plan	L	A	O	R	O	
Schedules	Prepare Functional Test Schedule	L	A	O	R	O	
OPR and BOD	Maintain OPR on behalf of Owner	L	A	RO	R	O	
	Maintain BOD/DID on behalf of Owner	L	A	O	R	O	
Document Reviews	Review Completed Pre-Functional Checklists	L	A	R	R	O	
	Pre-Functional Checklist Verification	L	A	R	R	O	

Acceptance Phase		CxA = Commissioning Agent COR = Contracting Officer 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	RE	A/E	PC	O&M	Notes
	Review Operations & Maintenance Manuals	L	A	R	R	R	
	Training Plan Review	L	A	R	R	R	
	Warranty Review	L	A	R	R	O	
	Review TAB Report	L	A	R	R	O	
Site Observations	Construction Observation Site Visits	L	A	R	R	O	
	Witness Selected Equipment Startup	L	A	0	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	O	P	P	
Reports and Logs	Status Reports	L	A	O	R	O	
	Maintain Commissioning Issues Log	L	A	O	R	O	
	Final Commissioning Report	L	A	RO	R	R	
	Prepare Systems Manuals	L	A	O	R	R	

Acceptance Phase		CxA = Commissioning Agent COR = Contracting Officer 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	RE	A/E	PC	O&M	Notes

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

Warranty Phase		CxA = Commissioning Agent COR = Contracting Officer 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	RE	A/E	PC	O&M	Notes
Meetings	Post-Occupancy User Review Meeting	L	A	O	P	P	
Site Observations	Periodic Site Visits	L	A	O	O	P	
Functional Test Protocols	Deferred and/or seasonal Testing	L	A	O	P	P	
Technical Activities	Issues Resolution Meetings	L	S	O	O	P	
	Post-Occupancy Warranty Checkup and review of Significant Outstanding Issues	L	A	O	R	P	
Reports and Logs	Final Commissioning Report Amendment	L	A	O	R	R	
	Status Reports	L	A	O	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. Four weeks prior to equipment startup, the Contractor shall schedule startup and checkout with the VA and Commissioning Agent. The performance of the startup and checkout shall be directed and executed by the Contractor.

b. The Commissioning Agent will observe the startup procedures for selected pieces of primary equipment.

c. The Contractor shall execute startup and provide the VA and Commissioning Agent with a signed and dated copy of the completed startup checklists, and contractor tests.

d. Only individuals that have direct knowledge and witnessed that a line-item task on the Startup Checklist was actually performed shall initial or check that item off. It is not acceptable for witnessing supervisors to fill out these forms.

3.3 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.

3.4 PHASED COMMISSIONING (NOT USED)

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 Workstation located within the engineer’s office. Additionally, Priority level alarms shall be able to be monitored and viewed through an active alarm application. Priority level alarms are alarms which shall require reaction from the operator or maintenance personnel within a normal work shift, and not immediate action.

3. Maintenance alarms are intended to be minor issues which would require examination by maintenance personnel within the following shift. These alarms shall be generated in a scheduled report automatically by the DDC system at the start of each shift. The generated maintenance report will be printed to a printer located within the engineer's office.

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

D. The Contractor shall provide graphical trending through the DDC control system of systems being commissioned. Trending requirements are indicated below and included with the Systems Functional Performance Test Procedures. Trending shall occur before, during and after Systems Functional Performance Testing. The Contractor shall be responsible for producing graphical representations of the trended DDC points that show each system operating properly during steady state conditions as well as during the System Functional Testing. These graphical reports shall be submitted to the Resident Engineer and Commissioning Agent for review and analysis before, during dynamic operation, and after Systems Functional Performance Testing. The Contractor shall provide, but not limited to, the following trend requirements and trend submissions:

1. 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 Resident Engineer. Any pre-test trend analysis comments generated by the Commissioning Team should be addressed and resolved by the Contractor, as directed by the Resident Engineer, prior to the execution of Systems Functional Performance Testing.

2. Dynamic plotting – The Contractor shall also provide dynamic plotting during Systems Functional Performance testing at frequent intervals for points determined by the Systems Functional Performance Test Procedure. The graphical plots will be formatted and plotted at durations listed in the Systems Functional Performance Test Procedure.
3. Graphical plotting - The graphical plots shall be provided with a dual y-axis allowing 15 or more trend points (series) plotted simultaneously on the graph with each series in distinct color. The plots will further require title, axis naming, legend etc. all described by the Systems Functional Performance Test Procedure. If this cannot be sufficiently accomplished directly in the Direct Digital Control System then it is the responsibility of the Contractor to plot these trend logs in Microsoft Excel.
4. The following tables indicate the points to be trended and alarmed by system. 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.

Dual-Path 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		

Dual-Path Air Handling Unit Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
RA Temperature	AI	15 Min	24 hours	3 days	N/A		
RA Humidity	AI	15 Min	24 hours	3 days	P	>60% RH	10 min
Mixed Air Temp	AI	None	None	None	N/A		
SA Temp	AI	15 Min	24 hours	3 days	C	±5°F from SP	10 min
Supply Fan Speed	AI	15 Min	24 hours	3 days	N/A		
Return Fan Speed	AI	15 Min	24 hours	3 days	N/A		
RA Pre-Filter Status	AI	None	None	None	N/A		
OA Pre-Filter Status	AI	None	None	None	N/A		
After Filter Status	AI	None	None	None	N/A		
SA Flow	AI	15 Min	24 hours	3 days	C	±10% from SP	10 min
OA Supply Temp	AI	15 Min	24 hours	3 days	P	±5°F from SP	10 min
RA Supply Temp	AI	15 Min	24 hours	3 days	N/A		
RA CHW Valve Position	AI	15 Min	24 hours	3 days	N/A		
OA CHW Valve Position	AI	15 Min	24 hours	3 days	N/A		
OA HW Valve Position	AI	15 Min	24 hours	3 days	N/A		
OA Flow	AI	15 Min	24 hours	3 days	P	±10% from SP	5 min
RA Flow	AI	15 Min	24 hours	3 days	P	±10% from SP	5 min
Initial UVC Intensity (%)	AI	None	None	None	N/A		
Duct Pressure	AI	15 Min	24 hours	3 days	C	±25% from SP	6 min
CO2 Level	AI	15 Min	24 hours	3 days	P	±10% from SP	10 min
Supply Fan Status	DI	COV	24 hours	3 days	C	Status <> Command	10 min

Dual-Path Air Handling Unit Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
Return Fan Status	DI	COV	24 hours	3 days	C	Status <> Command	10 Min
High Static Status	DI	COV	24 hours	3 days	P	True	1 min
Fire Alarm Status	DI	COV	24 hours	3 days	C	True	5 min
Exhaust Fan #1 Status	DI	COV	24 hours	3 days	C	Status <> Command	10 min
Exhaust Fan #2 Status	DI	COV	24 hours	3 days	C	Status <> Command	10 min

Terminal Unit (VAV, CAV, etc.) Trending and Alarms (NOT USED)							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**

4-Pipe Fan Coil Trending and Alarms (NOT USED)							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**

2-Pipe Fan Coil Unit Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**

Unit Heater Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
Space Temperature	AI	15 Minutes	12 hours	3 days	P	±5°F from SP	10 min
Unit Heater ON/OFF	DO	COV	12 hours	3 days	M	Status <> Command	30 min

Steam and Condensate Pumps Trending and Alarms (NOT USED)							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**

Domestic Hot Water Trending and Alarms (NOT USED)							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**

Hydronic Hot Water Trending and Alarms (NOT USED)							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**

Chilled Water System Trending and Alarms (NOT USED)							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**

Condenser Water System Trending and Alarms (NOT USED)							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**

Steam Boiler System Trending and Alarms (NOT USED)							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**

Hot Water Boiler System Trending and Alarms (NOT USED							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**

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

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.

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

D. Failure Due to Manufacturer Defect: If 10%, or three, whichever is greater, of identical pieces (size alone does not constitute a difference) of equipment fail to perform in compliance with the Contract Documents (mechanically or substantively) due to manufacturing defect, not allowing it to meet its submitted performance specifications, all identical units may be considered unacceptable by the VA. In such case, the Contractor shall provide the VA with the following:

1. Within one week of notification from the VA, the Contractor shall examine all other identical units making a record of the findings. The findings shall be provided to the VA within two weeks of the original notice.
2. Within two weeks of the original notification, the Contractor shall provide a signed and dated, written explanation of the problem, cause of failures, etc. and all proposed solutions which shall include full equipment submittals. The proposed solutions shall not significantly exceed the specification requirements of the original installation.
3. The VA shall determine whether a replacement of all identical units or a repair is acceptable.
4. Two examples of the proposed solution shall be installed by the Contractor and the VA shall be allowed to test the installations for up to one week, upon which the VA will decide whether to accept the solution.
5. Upon acceptance, the Contractor shall replace or repair all identical items, at their expense and extend the warranty accordingly, if the original equipment warranty had begun. The replacement/repair work shall proceed with reasonable speed beginning within one week from when parts can be obtained.

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

3.8 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.

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 Resident Engineer, VA’s Operations and Maintenance personnel, and the Contractor. The purpose of this

conference will be to discuss and plan for Training and Demonstration of VA Operations and Maintenance personnel.

B. The Contractor shall provide training and demonstrations for fire suppression systems, plumbing systems equipment, HVAC operating equipment and systems, electrical systems, communication systems, and security systems. 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, indicating location, direction (by compass point), and elevation or story of construction.

----- END -----

DIVISION 02

SECTION 02 21 13
SITE SURVEYS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Researching and collecting documents informing surveys.
2. Performing topographic survey and utility survey.
3. Creating survey drawings.

1.2 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. American Land Title Association and American Congress on Surveying and Mapping (ALTA-ACSM):

1. Accuracy Standards for ALTA-ACSM Land Title Surveys.

C. Federal Geographic Data Committee (FGDC):

1. STD-007.03-98 - Geospatial Positioning Accuracy Standards Part 3: National Standard for Spatial Data Accuracy.
2. STD-007.04-02 - Geospatial Positioning Accuracy Standards Part 4: Standards for Architecture, Engineering, Construction (A/E/C) and Facility Management.

1.3 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Survey Drawings:

1. Prints: Two sets of black line, full size prints of each drawing.
2. Electronic Files: Consistent with computer-aided design (CAD) Standards described at www.cfm.va.gov/til/projReq.asp.

1.4 QUALITY ASSURANCE

A. Land Surveyor: One of the following:

1. Experienced professional land surveyor licensed in state in which project is located.
2. Experienced professional civil engineer licensed in state in which project is located and authorized to practice land surveying as civil engineer.

PART 2 - PRODUCTS

2.1 ACCESSORIES

A. Monuments: Iron pin, with driven 16 mm (5/8 inch) diameter, minimum 600 mm (24 inches) long to prevent displacement.

B. Stakes: Hardwood.

C. Flagging: Plastic, roll form, highly visible, solid color.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Research public and VA facility records for deeds, maps, monuments, plats, surveys, title certificates or abstracts, rights-of-way, easements, section line, other boundary line locations, and other documents pertaining to project site.

B. Research public and VA facility utility records for aerial, surface, and subgrade structures and utility service lines and easements.

3.2 PREPARATION

A. Coordinate with Contracting Officer's Representative for site access.

B. Coordinate with adjacent property owners when access to adjoining properties is required.

1. Notify Contracting Officer's Representative when access is denied.

3.3 SURVEYS

A. Perform survey on ground according to Accuracy Standards for ALTA-ACSM Land Title Surveys and FGDC STD-007.3 and FGDC STD-007.4.

1. Provide topo contours at 1’ intervals

B. Boundary Survey:

1. Locate permanent monuments within and along survey boundary.
2. Set permanent monument at property corners when monument is not found.
3. Temporarily mark monument locations with stake and flagging.
4. Reconcile differences between legal description and survey.

C. Topographic Survey:

1. Vertical Control: National Geodetic Survey or existing VA Medical Center benchmark.
2. Establish minimum three permanent benchmarks.
3. Determine project site contours at maximum 300 mm (1 foot) interval.

4. Determine spot elevations at specified locations.

D. Utility Survey:

1. Locate piped utilities and utility structures. Identify service type, sizes, depths, and pressures. Establish inverts in and out on gravity sewer manholes. If depth is critical and manholes are not available identify depth with ground-penetrating radar (GPR).
2. Locate fire hydrants.
3. Locate wired utilities and utility structures. Identify service type, rated capacities, and elevations above and below grade.
4. Identify each utility authority including contact person and phone number.

E. Locate permanent structures within survey boundary by perpendicular dimension to property lines.

1. Determine structure plan dimensions, heights, and vertical offsets.
2. Determine projections and overhangs beyond structure perimeter at grade.
3. Determine number of stories and primary building materials.

F. Locate rights-of-way and easements within and adjacent to survey boundary by perpendicular dimension to property line.

1. Locate project site access from rights-of-way by dimension from survey monument. Determine site access width.

3.4 SURVEY DRAWING REQUIREMENTS

A. Consult Contracting Officer's Representative to confirm required survey scale and drawing size.

1. Drawing Size: Maximum 760 by 1070 mm (30 by 42 inches).
2. Boundary Survey Scale: Maximum 1 to 35 (1 inch equals 30 feet).
3. Enlarged Detail Areas: Scale as required to present dimensional data and survey information clearly. Maintain orientation aligned with smaller scale view.
4. Plan Orientation: North at top of drawing sheet.

B. Drawing Notations:

1. Land Surveyor: Name, address, telephone number, signature, seal, and registration number.
2. Survey Dates: Date survey was initially completed and subsequent revision dates.

3. Certification: Certify each drawing adjacent to land surveyor's seal:
   a. "I hereby certify that all information indicated on this drawing was obtained or verified by actual measurements in the field and that every effort has been made to provide complete and accurate information."
   b. Title, number, and total number of drawings on each drawing.
   c. Scale in metric and imperial measurement.
   d. Graphic scale in metric and imperial measurement.
   e. Graphic symbol and abbreviation legends.
   f. North arrow for plan view drawings.
   g. Benchmark locations.
   h. Horizontal and vertical control datum.
   i. Adjacent property owner names.
   j. Zoning classifications.
   k. Building street numbers.
4. Evidence of Possession: Indicate character and location of evidence of possession affecting project site. Notation absence signifies no observable evidence of possession.

C. Vicinity Map: Indicate project site and nearby roadways and intersections.

D. Record Documents Forming Survey Basis: Indicate titles, source, and recording data of documents relied upon to complete survey.

E. Legal Description: Recorded title boundaries.

F. Land Area: Report in sq. m (sf) hectares (acres) as defined by the boundaries of the legal description of the surveyed premises, including legal description of the land.
   1. Accuracy: 0.1 sq. m (1 sq. ft.) 0.005 hectares (0.001 acres).

G. Boundary Lines: Show point of beginning, length and bearing for straight lines, and angle, radius, point of curvature, point of tangency, and length of curved lines.
   1. Include bearing basis and data necessary to mathematically close survey.
   2. When recorded and measured bearings, angles, and distances differ, indicate both recorded and measured data.

a. Indicate when recorded description does not mathematically close survey.

3. Indicate found and installed monuments establishing basis of survey.
4. Contiguity, Gores, and Overlaps: Identify discrepancies within and along survey boundary.

H. Lots and Parcels: Indicate entire lots and parcels included within and intersected by survey boundary.

I. Roadways: Indicate names and widths of rights-of-way and roadways within and abutting survey boundary.

1. Indicate changes in rights-of-way lines either completed or proposed.
2. Indicate accesses to roadways.
3. Indicate abandoned roadways.
4. Indicated unopened dedicated roadways.

J. Setbacks: Indicate recorded setback and building restriction lines.

K. Structures and Site Improvements: Indicate buildings, walls, fences, signs, and other visible improvements.

1. Indicate each building dimensioned to property lines and other structures.
2. Indicate exterior dimensions of buildings at ground level. Show area of building footprint and gross floor area of entire building.
3. Indicate maximum measured height of buildings above grade, point of measurement, and number of stories.
4. Indicate spot elevations at building entrances, first floor, service docks, corners, steps, ramps, and grade slabs.
5. Indicate structures and site improvements within 1500 mm (5 feet) of survey boundary.
6. Indicate encroachments on project site, adjoining property, easements, rights-of-way, and setback lines from fire escapes, bay windows, windows and doors opening out, flue pipes, stoops, eaves, cornices, areaways, stoops, other building projections, and site improvements.
7. Identify setback, height, and floor space area restrictions set by applicable zoning and building codes and recorded subdivision maps. Indicate if no restrictions exist.

L. Easements:

1. Indicate easements evidenced by recorded documents.
   a. Indicate when easements cannot be located.
2. Indicate observable easements created by roadways, rights-of-ways, water courses, drains, telephone, telegraph, electric and other wiring, water, sewer, oil, gas, and other pipelines within project site and on adjoining properties when potentially affecting project site.
3. Indicate observable surface improvements of underground easements.

M. Pavements:
1. Indicate location, alignment, and dimensions for vehicular and pedestrian pavements.
2. Indicate pavement encroachments from adjacent properties onto project site and onto adjacent properties from project site.
   a. Dimension encroachments from survey boundary.
3. Indicate roadway centerlines with true bearings and lengths by 15 m (50 feet) stationing.
   a. Describe curves by designating points of curvature and tangency. Include curve data and location of radius and vertex points.
   b. Indicate elevations at station points along roadway centerlines, roadway edges, and top and bottom of curbs.
4. Indicate parking areas, parking striping, and total parking spaces.
   a. Identify accessible.
5. Indicate curb cuts, driveways, and other accesses to public ways.

N. Indicate cemetery and burial ground boundaries.

O. Waterways:
1. Indicate boundaries of ponds, lakes, springs, and rivers bordering on or running through project site. Note date of measurement and that boundary is subject to change due to natural causes.
2. Indicate flood plain location and elevation.
3. Indicate watershed extent affecting project site.

P. Indicate topographic contours.

Q. Flood Zone: Indicate applicable flood zone from Federal Flood Insurance Rate Maps, by scaled map location and graphic plotting.

R. Public and Private Utilities:
1. Indicate information source and operating authority for each utility.

2. Indicate utilities existing on or serving project site.
3. Indicate fire hydrants on project site and within 150 m (500 feet) of survey boundary.
4. Indicate manholes, catch basins, inlets, vaults, and other surface indications of subgrade services.
5. Indicate depths or invert elevations, sizes, materials, and pressures of utility pipes.
6. Indicate wires and cables serving, crossing, and adjacent to project site.
7. Indicate exterior lighting, traffic control facilities, security, and communications systems.
8. Indicate utility poles on project site and within 3 m (10 feet) of survey boundary.
9. Indicate dimensions of cross-wires or overhangs affecting project site.

S. Observable Evidence:
1. Indicate in-progress and recently completed earth moving work, building construction, and building additions.
2. Indicate in-progress and recently completed pavement construction and repairs.
3. Indicate areas used as solid waste dump, sump, and sanitary landfill.

T. Trees:
1. Indicate individual trees with minimum 150 mm (6 inches) diameter measured at 400 mm (48 inches) above grade.
2. Indicate wooded area perimeter outline and description of predominant vegetation.

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Selective Demolition
Section 02 41 00

PART 1 - GENERAL

1.1 DESCRIPTION:

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

1. The extent of work included in this Section is shown on the Drawings and as specified herein, including but not necessarily limited to the following:
   a. Removal of existing deteriorated concrete as noted on plans or directed by the Architect.
   b. Removal of existing vertical and overhead concrete where directed by the Architect.
   c. Dust and water control.
   d. Removal and disposal of all debris.
   e. Disconnecting and relocating/reinstalling any existing utility lines on the site which interfere with the repairs.
   f. Protection of all existing electrical systems, mechanical equipment, light fixtures, overhead piping, fire protection system etc. scheduled to remain.

B. Contractor must provide barricades with warning lights, enclose the construction area and take all precautions necessary to ensure public and employee safety.

C. All work must be done in accordance with the requirements of all local and State agencies.

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: Section 01 35 26 Safety Requirements Article, ACCIDENT PREVENTION PLAN (APP).

C. Disconnecting utility services prior to demolition: Section 01 00 00, GENERAL REQUIREMENTS.

D. Reserved items that are to remain the property of the Government: Section 01 00 00, GENERAL REQUIREMENTS.

E. Environmental Protection: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.

F. Construction Waste Management: Section 01 74 19 CONSTRUCTION WASTE MANAGEMENT.

G. Infectious Control: Section 01 35 26, SAFETY REQUIREMENTS.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Schedule indicating proposed sequence of operations for selective demolition work to Government's Representative for review prior to start of work. Include coordination for shutoff, capping, and continuation of utility services as required, together with details for dust and noise control protection.

1. Provide detailed sequence of demolition and removal work to ensure uninterrupted progress of Government's on-site operations.
2. Coordinate with Government's continuing use of portions of existing building and/or with Government's partial occupancy of completed new addition.

C. Photographs of existing conditions of structure surfaces, equipment, and adjacent improvements that might be misconstrued as damage related to removal operations. File with Government's Representative prior to start of work.

1.4 QUALITY ASSURANCE

A. Demolition Contractor's Qualifications: Minimum of five (5) years experience on comparable projects.

B. Comply with all pertinent codes and regulations which apply to this type of work and with requirements of insurance carriers providing coverage for this work. Dispose of debris in a legal manner off site daily. Do not allow to accumulate on site.

1.5 JOB CONDITIONS

A. General:

1. Dust and Water Control: Contractor must contain particular debris generated by his work activities from polluting the atmosphere or waterways.

2. On-site burning must not be permitted.
3. Use all means necessary to protect existing facilities, utilities, and appurtenances within the project areas.

B. Occupancy: Conduct selective demolition work in manner that will minimize need for disruption of Government's normal operations. Provide minimum of 72 hours advance notice to Government of demolition activities that will affect Government's normal operations.

C. Condition of Structures: Government assumes no responsibility for actual condition of items or structures to be demolished.
1. Conditions existing at time of inspection for bidding purposes will be maintained by Government insofar as practicable. However, minor variations within structure may occur prior to start of selective demolition work.

D. Partial Demolition and Removal: Items indicated to be removed but of salvageable value to Contractor may be removed from structure as work progresses. Transport salvaged items from site as they are removed.
1. Storage or sale of removed items on site will not be permitted.

1.6 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 must 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 must survey the site and examine the Drawings and Specifications to determine the extent of the work. The Contractor must take necessary precautions to avoid damages to existing items to remain in place, to be reused, or to remain the property of the Medical Center; any damaged items must be repaired or replaced as approved by the COR. The Contractor must coordinate the work of this section with all other work and must construct and maintain shoring, bracing, and supports as required. The Contractor must ensure that structural elements are not overloaded and is 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 must comply with the requirements of Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.

I. The work must comply with the requirements of Section 01 00 00, GENERAL REQUIREMENTS and Section 01 35 26, SAFETY REQUIREMENTS.

J. Provide temporary weather protection during interval between demolition and removal of existing construction on exterior surfaces and installation of new construction to ensure that no water leakage or damage occurs to structure or interior areas of existing building.

K. Remove protections at completion of work.

1.7 DAMAGES

A. Promptly repair damages caused to adjacent facilities by demolition work.

1.8 TRAFFIC

A. Conduct selective demolition operations and debris removal to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities.

B. Do not close, block, or otherwise obstruct streets, walks, or other occupied or used facilities without written permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

1.9 FLAME CUTTING

A. Do not use cutting torches for removal until work area is cleared of flammable materials. At concealed spaces, such as interior of ducts and pipe spaces, verify condition of hidden space before starting flame-cutting operations. Maintain portable fire suppression devices during flame-cutting operations.

1.10 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.

C. Maintain existing utilities to remain in service and protect them against damage during demolition operations.

1. Do not interrupt utilities serving occupied or used facilities, except when authorized in writing by authorities having

jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to governing authorities.

2. Maintain fire protection services during selective demolition operations.

1.11 ENVIRONMENTAL CONTROLS

A. Use water sprinkling, temporary enclosures, and other methods to limit dust and dirt migration. Comply with governing regulations pertaining to environmental protection.

B. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Use appropriate materials and proper equipment to complete the work of this Section. Provide all necessary barricades, warning devices, enclosures, etc. as required to comply with governing safety regulations.

PART 3 - EXECUTION

3.1 PREPARATION

A. General: Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of areas to be demolished and adjacent facilities to remain.

1. Cease operations and notify Owner's Representative immediately if safety of structure appears to be endangered. Take precautions to support structure until determination is made for continuing operations.
2. Cover and protect equipment, and fixtures from soilage or damage when demolition work is performed in areas where such items have not been removed.
3. Erect and maintain dust resistant partitions and closures as required to prevent spread of dust or fumes to occupied portions of the building.
   a. Where selective demolition occurs immediately adjacent to occupied portions of the building, construct dust resistant

partitions of minimum 4-inch studs and ½-inch fire-retardant plywood on demolition side.

b. Provide weatherproof closures for exterior openings resulting from demolition work.

4. Locate, identify, stub off, and disconnect utility services that are not indicated to remain.

a. Provide bypass connections as necessary to maintain continuity of service to occupied areas of building. Provide minimum of 72 hours advance notice to Owner if shutdown of service is necessary during changeover.

3.2 DEMOLITION

A. General: Perform selective demolition work in a systematic manner. Use such methods as required to complete work indicated on Drawings in accordance with demolition schedule and governing regulations.

1. Demolish concrete in small sections. Cut concrete and masonry at junctures with construction to remain using power-driven masonry saw or hand tools; do not use power-driven impact tools.

2. Locate demolition equipment throughout structure and promptly remove debris to avoid imposing excessive loads on supporting walls, floors, or framing.

3. Provide services for effective air and water pollution controls as required by local authorities having jurisdiction.

B. If unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure both nature and extent of the conflict. Submit report to Consultant written, accurate detail. Pending receipt of directive from Owner's Representative, rearrange selective demolition schedule as necessary to continue overall job progress without undue delay.

3.3 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove from building site debris, rubbish, and other materials resulting from demolition operations. Transport and legally dispose off-site.

1. If hazardous materials are encountered during demolition operations, comply with applicable regulations, laws, and ordinances concerning removal, handling, and protection against exposure or environmental pollution.
2. Burning of removed materials is not permitted on project site.

3.4 CLEAN-UP:

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

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DIVISION 03

SECTION 03 10 01
CONCRETE FORMING AND ACCESSORIES FOR REPAIR WORK

PART 1 - GENERAL

1.1 SUMMARY

A. The extent of work included in this Section is specified as follows:

1. Complete and functional concrete formwork system(s) to accommodate the concrete repair work as indicated in the Contract Documents, including all associated formwork design, labor, materials, equipment, services and accessories as specified herein and as required by Project conditions, including, not by way of limitation, the following:
   a. Work includes installation into formwork of items such as anchor bolts, anchorages, inserts and other items to be embedded in concrete.
   b. Work includes shoring and reshoring for placement of concrete repair work.
2. The Contractor is solely responsible for the overall stability of the structure until completion. The requirements of this Section shall not be construed in any way as interfering with the Contractor’s responsibility to provide all necessary supports and braces during construction and during any subsequently determined repair work required by the Architect. See Structural General Notes on the Drawings for additional information.

B. Work not included in this Section is as follows:

1. Concrete Forming Systems intended to replace or relieve any structural members and/or supports of the building framing system during the repair procedure. Such Work must comply with the concrete forming requirements and System Design requirements of Section 03 30 00.

1.2 RELATED REQUIREMENTS

A. Related Sections

1. Section 01 45 00 - Quality Control.
2. Section 03 20 00 - Concrete Reinforcing.
3. Section 03 30 00 - Cast-in-Place Concrete.

4. Division 3 Sections; requirements related to concrete repair.

1.3 RELATED WORK

A. Concrete Formwork System Design: Where the Drawings require that the Contractor’s design documents for a specific formwork and/or shoring location be sealed and signed by the Contractor’s design engineer, comply with System Design and Submittal requirements of Section 03 30 00.

1.4 SUBMITTALS

A. Product Data: Manufacturer's data and installation instructions for proprietary materials used in exposed concrete work, including form liners, form coatings, ties and accessories.
   1. Architect’s review of product data is for general architectural applications and features only.
B. Shop Drawings (For Architectural Intent Review)
   1. Drawings showing details for fabrication and erection of formwork for finished concrete surfaces. Show the general construction of forms including jointing, special formed joints for reveals, location and pattern of form tie placement, and other items which affect the exposed concrete visually.
   2. Design of formwork and shoring for structural stability and sufficiency is the Contractor's responsibility.
C. Quality Control Submittals
   1. Contractor’s Certifications: Provide a written certification letter from the Contractor stating that each proposed forming design and procedure, to the best of the Contractor’s knowledge and belief, is not intended to replace or relieve any structural members and/or supports of the building framing system during the repair procedure.

1.5 QUALITY ASSURANCE

A. Correlation of Performance Requirements: The Work of this Section is subject to the performance requirements indicated in the Contract Documents and as follows:
   1. Requirements of Regulatory Agencies: The Work is subject to all applicable provisions of the Codes and Standards required by the authorities having jurisdiction.

2. Reference Standards: For the purposes of the Work of this Section, the documents listed below are applicable "Reference Standards". Comply with following documents, latest edition except as herein modified:
   a. American Concrete Institute (ACI)
      1) ACI 347, "Guide to Formwork for Concrete."
      2) ACI 347.2R, "Guide for Shoring/Reshoring of Concrete Multistory Buildings".
   b. National Institute of Standards and Technology (NIST)
      1) PS 1, "Structural Plywood".
   c. Any other Standards referenced form a part of this Specification to the extent referenced.
3. Manufacturer's published specifications, installation requirements, and instructions as approved by the Architect.
4. Design Requirements: Where the Contract Documents indicate specific design requirements, any performance criteria included within the design requirements will be subject to the correlation requirements of this Section.
5. Allowable Construction Tolerances: See Part 3 of this Section for additional requirements.
6. Correlation and Intent of the Contract Documents: In the event of conflicts or discrepancies between the Contract Documents, the requirements of regulatory agencies, and the indicated Reference Standards, the most stringent requirements govern.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site at such intervals to ensure uninterrupted progress of work.
B. Store materials to permit easy access for inspection and identification.
C. Handle materials in strict compliance with manufacturer's instructions and recommendations. Protect from all possible damage.

1.7 CONTRACTOR'S QUALITY CONTROL SYSTEM

A. General: In accordance with Division 1 requirements, the Contractor must establish a Quality Control System for the work of this Section. Controls must be adequate to cover all construction operations.

B. Contractor’s system must include, but not be limited to, the following:

1. Review of existing conditions, substrate conditions, requirements of related work, installation instructions, storage and handling procedures, and protection measures.
2. Before concrete placement:
   a. Verify compliance with shoring and reshoring design.
   b. Check supports of forms for vertical and lateral stability.
   c. Verify positioning of shores to ensure concentric alignment at consecutive levels.
   d. Verify arrangement of erected formwork for conformance to shapes, lines and dimensions of members as specified by design Drawings and Specifications. Make corrections and adjustments to ensure proper size and locations of concrete members and stability of formwork System(s).
   e. Verify cleanliness of forms prior to concreting.
3. During concrete placement check formwork and related supports to ensure that forms are not displaced and that completed work will be within specified tolerances.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Form Materials, General

1. Plywood, steel, fiberglass reinforced plastic, or any material that will produce concrete with the required finish and within the specified tolerances. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on the Drawings. Construct formwork to provide continuous, straight, smooth as-cast surfaces.
   a. Use of aluminum form materials in contact with concrete is prohibited.

B. Forms for Exposed Finish Concrete

1. Unless otherwise shown or specified, construct formwork for exposed concrete surfaces with panel-type formwork materials acceptable to the Architect, to provide continuous, straight, smooth as-cast surfaces. Furnish in largest practicable sizes to minimize number of joints. Forms shall be mortar-tight, sufficiently rigid to prevent distortion due to the wet concrete mix and other loads incident to construction operations, including vibration, and so constructed and maintained to prevent warping and opening of the joints due to shrinkage of the form material. Molding strips shall be placed in the corners of forms so as to produce beveled edges on permanently exposed concrete corners.
   a. Plywood Forms: Use overlaid plywood complying with ANSI A 199.1, B-High Density Concrete Form Overlay, Class I.

C. Forms for Concrete Not Exposed
   1. Form concrete surfaces which will not be exposed in the finished structure with plywood, lumber, metal, or other acceptable material. Use lumber that is dressed on at least 2 edges and 1 side for tight fit.

D. Form Ties
   1. Use factory-fabricated, adjustable-length, removable or snap off metal form ties, designed to prevent form deflection, and to prevent spalling concrete surfaces upon removal.
   2. Unless otherwise shown, use ties so that portion remaining within concrete after removal of exterior parts is at least 1 inch from the outer concrete surface. Unless otherwise shown, use form ties which will not leave a hole larger than 1 inch diameter in the concrete surface.
   3. For exposed finish concrete, use plastic cones and coil ties where indicated on the Drawings.

E. Forms Coating
   1. Use commercial formulation form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces, and will not impair subsequent treatment of concrete surfaces requiring bond or adhesion, nor impede the wetting of surfaces to be cured with water or curing compounds.

a. Coat forms for exposed finish concrete with a co-polymer resin compound equal to nox-Crete "Pre-Form" Concrete Form Sealer.

b. Provide a release agent equal to Nox-Crete "Form Coating".

F. Metal Inserts

1. Use metal insets for anchorage of materials or equipment to concrete construction as required for the work.
2. Use threaded inserts of malleable cast iron, furnished complete with full-depth bolts; 3/4 inch bolt size, unless otherwise shown.

G. DESIGN OF FORMWORK

1. Design, erect, support, brace, and maintain formwork so that it will safely support vertical and lateral loads that might be applied, until such loads can be supported by the concrete structure. Carry vertical and lateral loads to ground by formwork system and in place construction that has attained adequate strength for that purpose.
2. Support form facing materials by structural members spaced sufficiently close to prevent deflection. Fit forms placed in successive units for continuous surfaces to accurate alignment, free from irregularities and within allowable tolerances.
3. Design formwork to be readily removable without impact, shock, or damage to cast-in-place concrete surfaces and adjacent materials.
4. Use shores and struts with positive means of adjustment capable of taking up formwork settlement during concrete placing operations, using wedges or jacks or a combination thereof. Use trussed supports when adequate foundations for shores and struts cannot be secured.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, structural support, and conditions under which the work of this Section is to be performed before installation, with formwork erector present, for compliance with requirements for installation tolerances and/or other conditions affecting performance of the Work including, but not limited to the following:

B. Report all deviations from the Contract Documents and/or conditions detrimental to performance of the Work to the Architect in writing.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FORM CONSTRUCTION

A. Construct forms to be the exact sizes, shapes, lines and dimensions shown, and as required to obtain accurate alignment, location, grades, levels, and plumb work in finish structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustifications, reglets, chamfers, blocking screeds, bulkheads, anchorage's and inserts, and other features required. Use selected materials to obtain required finishes.

B. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Use crush plates or wrecking plates where stripping may damage cast concrete surfaces. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and assure ease of removal.

C. Provide temporary openings where interior area of formwork is inaccessible for clean out, for inspection before concrete placement, and for placement of concrete. Brace temporary closures and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings on forms in as inconspicuous location as possible; consistent with project requirements.

D. Construct formwork sufficiently tight to prevent leakage of cement paste during concrete placement. Solidly butt joints and provide backup material at joints as required to prevent leakage and fins.

E. Falsework

1. Erect falsework and support, brace, and maintain it to safely support vertical, lateral, and asymmetrical loads applied until such loads can be supported by in-place concrete structures. Construct falsework so that adjustments can be made for take-up and settlement.

2. Use wedges, jacks or camber strips to facilitate vertical adjustments. Carefully inspect falsework and formwork during and after concrete placement operations to determine abnormal deflection or signs of failure; make necessary adjustments to produce work of required dimensions.

F. Forms for Exposed Concrete

1. Drill forms to suit ties used and to prevent leakage of concrete mortar around tie holes. Do not splinter forms by driving ties through improperly prepared holes.
2. Do not use metal cover plates for patching holes or defects in forms.
3. Provide chamfered corners at intersecting planes, without visible edges or offsets. Back joints with extra studs or girts to maintain true, intersections.
4. Use extra studs, walers, and bracing to prevent bowing of forms between studs and to avoid bowed appearance in concrete.
5. Place ties and spreaders symmetrically in plumb tiers and level rows.
6. Place pouring strips in the forms wherever horizontal construction joints are made.
7. Assemble forms so they may be readily removed without damage to exposed concrete surfaces.
8. Form molding shapes, recesses and projections with smooth-finish materials, and install in forms with sealed joints to prevent displacement.

G. Corner Treatment

1. Form exposed corners to produce smooth, solid, unbroken lines, except as otherwise shown.
2. Form chamfers with 3/4 inch x 3/4 inch strips unless otherwise noted. Extend terminal edges to required limit and miter chamfer strips at changes in direction.
3. Unexposed corners may be formed either square or chamfered.

H. Edge Forms and Screed Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in the finished slab surface. Provide and secure units to support types of screeds required.

I. Provision for Other Trades: Provide openings in concrete formwork to accommodate work of others. Accurately place and securely support items to be built into forms.

J. Cleaning and Tightening

1. Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before concrete is to be placed. Retighten forms immediately after concrete placement as required to eliminate mortar leaks.

3.3 TOLERANCES

A. Construction formwork to provide completed cast-in-place concrete structures complying with the tolerances specified in ACI 347.

B. Before concrete placement check the lines and levels of erected formwork. Make corrections and adjustments to ensure proper size and locations of concrete members and stability of forming systems.

C. During concrete placement check formwork and related supports to ensure that forms are not displaced and that completed work will be within specified tolerances.

3.4 FORM COATINGS

A. Apply coating to form surfaces, for exposed finish concrete, with form coating compound to provide a smooth glossy form surface. Apply material and cure panels in compliance with manufacturer's instructions.

B. Prior to each concrete pour, treat form surfaces with a suitable release agent. Do not allow excess material to accumulate in the forms or to come into contact with surfaces which will be bonded to fresh concrete.

3.5 INSTALLATION OF EMBEDDED ITEMS

A. General: Set and build into the work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of the items to be attached thereto.

3.6 SHORES AND RESHORES

A. Comply with ACI 347 for shoring and reshoring in multistory construction, and as herein specified.

B. Space out shoring in such a manner that no floor or member will be excessively loaded or will induce stress in concrete members where no

reinforcing steel is provided. Extend shores beyond minimums if required to ensure the proper distribution of loads throughout the structure.

C. Remove shores and reshore in a planned sequence to avoid damage to partially cured concrete. Locate and provide adequate reshoring to safely support the work without excessive stress or deflection.

3.7 REMOVAL OF FORMS

A. Formwork not supporting concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 degrees F. for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operation, and provided that curing and protection operations are maintained.

B. Formwork supporting weight of concrete, such as beam soffits, roof slabs and other structural elements shall not be removed until concrete has attained a minimum compressive strength of 4,000 psi or 80% of its design compressive strength.

3.8 REUSE OF FORMS

A. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable. Apply new form coating compound material to concrete contact surfaces as specified for new formwork.

B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close all joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces, except as acceptable to the Architect.

- - E N D - -

Cast-In-Place Concrete
Section 03 30 00

PART 1 - GENERAL

1.1 DESCRIPTION

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

1. Provide all labor, materials, equipment, services and accessories necessary to furnish and install the work of this Section, complete and functional, as indicated in the Contract Documents, as required by Project conditions.

B. The extent of cast-in-place concrete work is shown on the Drawings and is specified as follows:

1. Cast-in-place concrete consisting of Portland cement, supplementary cementitious materials, fine and coarse aggregate, water, and selected admixtures; combined, mixed, transported, placed, finished and cured as herein specified. The work also includes furnishing and installation of items related to concrete construction such as waterstops, vapor retarders, and joint fillers specified herein or under other sections of these Specifications.
2. Concrete mix designs per the requirements of the Contract Documents.
3. Work also included in this Section is as follows:
   a. All other concrete work indicated on the Drawings must be provided and installed, even though not specifically mentioned herein, to complete the Work. Other concrete work includes, but is not limited to, the following:
      1) Anchors: Install anchors furnished under other Sections in accordance with Architect-approved Shop Drawings and/or setting instructions.
      2) Equipment Bases and Curb Islands: Install concrete bases (detailed as curb islands at vehicular traffic areas) for all pumps, boilers, tanks, fans, transformers, floor mounted electrical equipment, etc., including anchor bolts and inserts in accordance with approved Shop Drawings and/or setting instructions furnished by the Contractor responsible for installing the equipment. Finish all bases in a workmanlike

manner with a troweled finish. The bases must be located and sizes determined by the Contractor furnishing the equipment.

3) Joint Accommodation: Provide special concrete edges for work to receive prefabricated expansion joints (as applicable), make provisions in structural concrete for contraction joints, and install water stops for cast-in-place concrete.

C. The work includes designing, furnishing, installing and removing of formwork, shoring and re-shoring for cast-in-place concrete, and installation into formwork embedded items such as anchor bolts, setting plates, bearing plates and bearing pads, anchorages, inserts, etc. Embedded items furnished by others with templates and setting diagrams, must be installed by the general contractor under the Work of this specification Section.

D. The work includes furnishing, fabrication and placement of mild steel reinforcement for concrete as follows:

1. Furnishing, fabricating, and placement of reinforcement for concrete, including bars, welded wire fabric, ties and supports as indicated in the Contract Documents and as required by Project conditions.
2. Surface preparation and application of epoxy coating patching material to repair damaged coatings on epoxy-coated concrete reinforcing.

~~D.~~E. The Contractor is solely responsible for the overall stability of the structure until completion. The requirements of this Section shall not be construed in any way as interfering with the Contractor's responsibility to provide all necessary supports and braces during construction and during any subsequently determined repair work required by the Architect. See Structural General Notes on the Drawings for additional information.

1.2 RELATED WORK

A. Section 01 45 00, QUALITY CONTROL: General requirements pertaining to the Contractor's Quality Control system.

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

C. Section 01 45 35, SPECIAL INSPECTIONS: General requirements pertaining to Special Inspections by the Contractor's Testing Agency.

D. Section 03 10 01, PRECAST STRUCTURAL PRETENSIONED CONCRETE: Superstructure with architectural finishes.

E. Section 03 41 33, CONCRETE FORMING AND ACCESSORIES FOR REPAIR WORK: Formwork and shoring for repair Work (not related to construction of new building superstructure or substructure components).

F. Section 31 63 26, CAISSONS: Concrete-filled deep foundations.

G. Section 32 05 23, CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS: Concrete roads, walks, and similar exterior site work.

1.3 REFERENCES

A. Where this Section references specific New York State Department of Transportation (NYSDOT) "Standard Specifications" (NYSDOT-SS), comply with the latest edition, unless otherwise directed by the Architect.

B. See QUALITY ASSURANCE Article below for additional information pertaining to references.

1.4 TESTING AGENCY FOR CONCRETE MIX DESIGN

A. Testing agency for the trial concrete mix design retained and reimbursed by the Contractor and approved by Contracting Officer's Representative (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 must furnish equipment and qualified technicians to establish proportions of ingredients for concrete mixes.

1.5 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. Embedded items: ACI 117.

D. 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).

E. Slab Finishes, Occupied Spaces: 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).

F. Slab Finishes, Parking Areas: ACI 117, Section 4.8.6, straight edge method with the following maximum tolerances:

1. Trowel finish: 3/16” (5 mm) in 10 ft (3 m).
2. Floated finish: 5/16” (8 mm) in 10 ft (3 m).

1.6 REGULATORY REQUIREMENTS

A. New York State Regulations:

1. By direction of the Government, this Section includes references to New York State Department of Transportation (NYSDOT) Standard Specifications and Approvals however this Project is not affiliated with NYSDOT and NYSDOT has no jurisdictional authority in regards to this Project. NYSDOT Standard Specifications and Approvals form a part of this Specification to the only to the extent referenced by the Contract Documents and are subject to the correlation requirements of this Section.
2. In regards to Project administration, the entities indicated below are applicable in lieu of following entities indicated within referenced NYSDOT Standard Specifications and Approvals:

a. Department: References to "Department" must be construed to mean the Architect, subject to COR review.
b. Department Work: References to "Department work" must be construed to mean this Project.
c. Director: References to "Director" or "Regional Director" must be construed to mean the Architect, subject to COR review.
d. In the event that any of the above responsibilities appear to be in conflict with other Contract requirements or if other entities are referred to due to the NYSDOT Standard Specifications and Approvals referred to herein, notify the Architect in writing and request clarification.

3. All testing and inspection responsibilities for this Project are by Contractor (unless noted otherwise in the Project Manual) including, by reference herein, any testing and/or inspections required within applicable NYSDOT Standard Specifications and Approvals.

B. See QUALITY ASSURANCE Article of this Section for additional requirements.

1.7 FORMWORK SYSTEM DESIGN REQUIREMENTS

A. General Performance

1. Design, General

a. Design Concrete Formwork System to achieve Architectural Intent as indicated on Drawings without exceeding the allowable design working stress of supporting materials involved and without exhibiting permanent deformation in any supporting components of the structure. See Structural Drawings for additional information pertaining to design limits.
b. Concrete Formwork System must be designed to ensure tightness and prevention of leakage for all concrete exposed to view.

2. Shoring of Concrete Members: Concrete members must be adequately shored to safely support loads and lateral pressures outlined in "Guide to Formwork for Concrete" (ACI 347) without distortion, excessive deflection or other damage.
3. Construction Joint Location Planning: Construction joint locations must be planned by Contractor in accordance with requirements

herein, on the Drawings (if indicated) and in keeping with good practice.

B. Design: Design the Concrete Formwork System, including comprehensive engineering analysis by a qualified System Design Engineer, using performance requirements and design criteria indicated and in compliance with the design intent, criteria, and requirements as indicated in the Contract Documents and all governing codes.

1. Concrete Formwork System Design Engineer ("System Design Engineer"): Employ a structural engineer, specializing in design of similar installations and currently licensed to practice in the State where the Work is located, to perform design and prepare a Design Submittal per the requirements of this Section.
   a. Design Submittal must be signed and sealed by the System Design Engineer and submitted per the requirements of this Section.

C. Design Requirements

1. Design formwork in accordance with standards referenced this Section, as modified herein. Forms must be capable of safely supporting vertical and lateral loads that might be applied, until such loads can be supported by the concrete structure. Carry vertical and lateral loads to ground by formwork system and in-place construction that has attained adequate strength and stiffness for that purpose.
2. Locate supports for form facing materials by structural members spaced sufficiently close to prevent deflection.
3. Design formwork to be readily removable without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials.

1.8 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES. All items indicated below are required submittals requiring Contracting Officer's Representative (COR) review and approval.

B. Product Data:

1. Manufacturer's data, recommendations and standard details for all items specified in this Section including accessories and other components of the Work.

a. Include application and installation instructions for proprietary materials and items including, but not limited to, admixtures, patching compounds, epoxies, grouts and sealer.
b. Include surface preparation requirements and application instructions epoxy coating patching materials.
c. Include information described herein, specified in the Contract Documents and/or as required by the Architect.

2. Product Compatibility Data:
   a. Include curing compound product data and verification of its compatibility with other finish materials and surface treatments required.
   b. Include isolation joint filler materials manufacturer’s certification of compatibility with specified sealants.

C. Mix Designs:
1. Include substantiating data for each concrete mix design contemplated for use to the Architect not less than six (6) weeks prior to first concrete placement. Data for each mix must, as a minimum, include the following:
   a. Mix identification designation (unique for each mix submitted), including design compressive strength, corresponding to the Concrete Mix Design Schedule indicated on the Drawings.
   b. Statement of intended use for mix.
   c. Method used to establish a proposed design for each mix (ACI 301). Identify mix proportions with breakdown of all admixtures used and indicate water-to-cementitious-materials ratio.
   d. Manufacturer's data and material certifications signed by the material manufacturer and the Contractor certifying conformance of all materials, including admixtures, with specified requirements.
      1) For all concrete constituents, provide sufficient evaluation and/or classification to prove compliance with Article 2.3 below.
      2) Mix designs composed of admixtures manufactured by more than one producer must require statements of compatibility with other chemicals present in a mix. Ready-mix subcontractor responsible for mix designs must procure all the necessary

statements of compatibility and submit them together with the general mix data required as described herein.

e. Wet and dry unit weight per ASTM C138.

f. Design slump, regular weight concrete per ASTM C143.

g. Tests of proposed mixes for total water-soluble chloride ion content for all above grade structural concrete in accordance with ASTM C1218.

h. Entrained air content. Determine of freshly mixed concrete by pressure method, ASTM C231, or volumetric method, ASTM C173.

i. Average strength qualification data (trial mix data or field test data per ACI 301 4.2.3.4). When field test data for at least 10 consecutive strength tests for one mixture is used to qualify average strength, or trial mixtures are used to establish a design mixture proportions, submit separate qualification data for each production facility, which will supply concrete to the project. Trial mixtures evaluation must be in strict accordance with ACI 301 4.2.3.4.c.

j. Field test data submitted for qualification of average strength under ACI 301 4.2.3.2, 4.2.3.3, and 4.2.3.4 must include copies of the Concrete Testing Agency's reports from which the data was compiled.

k. Submit one copy of a representative concrete batch trip ticket containing information as specified herein.

l. Separate design mixes are required for each strength and class of concrete, each change in type and/or quantity of mix materials including admixtures, each change in slump limits, and each change in entrained air content

m. Submit one copy of a representative concrete batch trip ticket containing information as specified herein.

1) Separate design mixes are required for each strength and class of concrete, each change in type and/or quantity of mix materials including admixtures, each change in slump limits, and each change in entrained air content.

2. Mix designs submitted without the required information outlined above and any associated Certifications required per the Quality

Control Submittals Paragraph below will be rejected. **Concrete must not be placed without an approved mix design.**

D. Shop Drawings:

1. Formed surfaces with reveals, reglets, similar accessories and form tie hole patterns for verification of architectural design intent only.
   a. Location of Joints: Construction joint location plan for each elevated structure level prior to detailing of mild steel reinforcement and post-tensioning tendons.
2. Shop Drawings showing location of control and construction joints, isolation and expansion joints in mats, slabs and walls.
3. Reinforcing steel
   a. Complete placing drawings that detail fabrication, bending, and placement.
      1) Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
      2) Show locations, type and quantities of bolsters, spacers, chairs, support bars and other accessories.
      3) Show concrete clear cover dimension from face of form or finished unformed surface of concrete to reinforcing bars.
   b. Comply with ACI 315, ACI SP-66 Detailing Manual, and follow Standard Practice of ACI 315R and CRSI MSP.

E. Samples: Samples of concrete materials if requested by the Architect, including names, sources, and descriptions.

F. Contractor’s concrete placement and protection plan outlining usage and specific measures in hot and cold weather as defined by ACI 305R and ACI 306R respectively.

G. Prepare a placement schedule and construction joint layout, and submit to the Architect for review and comment prior to start of concrete placement operations.

H. Quality Control Submittals

1. Qualification Data:
   a. 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.

b. All firms and/or persons specified in the QUALITY ASSURANCE Article of this Section; data must demonstrate their capabilities and experience.

2. Mill Test Reports:
   a. Reinforcing Steel.
   b. Cement and binder additives (Fly Ash, Ground Granulated Blast Furnace Slag, Silica Fume, Metakaolin, etc.) where specified or otherwise approved.
3. Manufacturer's Certificates: Manufacturer's statements of material and product properties indicating compliance with requirements of the Contract Documents including compliance with Codes and standards. Provide for each type and size of the following:
   a. Portland Cement.
   b. Concrete aggregates.
   c. Air-entraining admixture.
   d. Chemical admixtures, including chloride ion content.
   e. Curing compounds and finishing aids.
   f. Burlap, polyethylene sheet and/or similar materials for curing of concrete.
   g. Liquid membrane-forming compounds for curing concrete.
   h. Vapor retarder and related components.
   i. Liquid Hardener.
   j. Waterstops.
   k. Pre-molded joint filler and/or isolation joint material.
   l. Neoprene or similar material and/or hard plastic bearing pads if specifically identified on the Drawings.
   m. Polymer/epoxy bonding agent.
   n. Proprietary patching materials.
   o. Proprietary jointing materials (stay-in-place forming, dowel replacements, etc.).
   p. Adhesive binder and concrete repair materials.
   q. Non-shrinking non-metallic grout.

r. Liquid hardener.

s. Expansion joint filler.

t. Adhesive binder.

u. Surface sealers and membrane systems.

v. Steel Reinforcement:

1) Provide manufacturer's records of chemical and physical properties of all heats of billet steel bars.

2) Provide manufacturer’s affidavit for all material stating that the respective material furnished meets the requirements for the steel reinforcement specified. Manufacturer’s records must include certificates of mill analysis, tensile and bend tests.

w. Epoxy-Coated Steel Reinforcement: Fabricator must certify that each lot of coated steel reinforcing bars will receive testing and/or inspection as directed by ASTM A775.

x. Epoxy Coating Patching Material: Where specific epoxy coating patching material requirements from are not included in the submitted concrete reinforcing product data, provide certificates signed by epoxy coating manufacturer certifying that proposed epoxy coating patching material(s) meets or exceeds manufacturer recommendations.

y. Welding Procedure and Equipment

1) Provide written description as required to illustrate each field welding procedure to be performed in the specified work (for procedures not prequalified by AWS only).

2) Include detailed surface preparation requirements.

3) Provide descriptive data for field welding equipment, including type, voltage and amperage.

z. Certified Test Reports: Provide test reports by qualified testing agency indicating that each product complies with performance requirements. Prepare test reports in accordance with reporting procedure described in applicable test standards.

1) Evaluation Reports: Research/Evaluation Reports indicating Code compliance.

2) Testing for Material Properties: For each listed product, test reports indicating compliance with the Quality Assurance requirements of this Section.

4. Field Surveys of Defective Work: Submit to the Architect for information a graphic representation of the location and extent of any defective work for the purposes of evaluation.

1.9 QUALITY ASSURANCE

A. Correlation of Performance Requirements: The Work of this Section is subject to the performance requirements indicated in the Contract Documents and as follows:

1. Requirements of Regulatory Agencies: The Work is subject to all applicable provisions of the Codes and Standards required by the authorities having jurisdiction.
2. Reference Standards: For the purposes of the Work of this Section, the documents listed below are applicable “reference standards”. Comply with following documents, latest edition:
   a. American Concrete Institute (ACI):
      1) Manual of Concrete Practice (MCP) and specifications, standards and recommendations contained therein.
      2) ACI SP-15, "ACI Field Reference Manual", and standards contained therein.
      3) ACI SP-66, "ACI Detailing Manual".
      4) The requirements of this Section directly reference the following ACI documents:
         a) ACI 117, "Specifications for Tolerances for Concrete Construction and Materials and Commentary".
         b) ACI 224.1R, “Causes, Evaluation, and Repair of Cracks”.
         c) ACI 301, "Standard Specifications for Structural Concrete" excluding curing provisions; curing must comply with ACI 308.1. Note: Contractor must make a copy of ACI 301 available at the project field office for the duration of the project.
         d) ACI 302.1R, “Guide for Concrete Floor and Slab Construction”.

e) ACI 304R, “Guide for Measuring, Mixing, Transporting, and Placing Concrete”.
f) ACI 304.2R, “Placing Concrete by Pumping Methods”.
g) ACI 305.1, “Specification for Hot Weather Concreting”.
h) ACI 305R, “Guide to Hot Weather Concreting”.
i) ACI 306.1, "Standard Specification for Cold Weather Concreting".
j) ACI 306R, “Guide to Cold Weather Concreting”.
k) ACI 308.1, “Standard Specification for Curing Concrete”. Note: Contractor must make a copy of ACI 308.1 available at the project field office for the duration of the project.
l) ACI 309R, “Guide for Consolidation of Concrete”.
m) ACI 318, “Building Code Requirements for Structural Concrete”; requirements relating to formwork and shoring design.
n) ACI 347R, “Recommended Practice for Concrete Formwork”.
o) ACI 347.2R, “Guide for Shoring/Reshoring of Concrete Multistory Buildings”.
p) ACI 362.1R, “Guide for the Design of Durable Parking Structures”.
q) ACI 503.2, “Standard Specification for Bonding Plastic Concrete to Hardened Concrete with a Multi-Component Epoxy Adhesive”.

b. American Society for Testing and Materials (ASTM):
1) All applicable standards cited in ACI and CRSI standards indicated herein, and Section 01 45 29 - Testing Laboratory Services.

c. Concrete Reinforcing Steel Institute (CRSI):
1) CRSI, "Manual of Standard Practice”.

d. National Institute of Standards and Technology (NIST)
1) PS 1, “Structural Plywood”.

3. Any other Standards and/or Specifications referenced form a part of this Specification to the extent referenced.
a. See APPLICABLE PUBLICATIONS Article below for additional information.

4. Manufacturer's published specifications, installation requirements, and instructions as approved by the Architect.
5. Correlation and Intent of the Contract Documents: In the event of conflicts or discrepancies between the Contract Documents, the requirements of regulatory agencies, and the indicated reference standards, the most stringent requirements govern.

B. Qualifications

1. Formwork System Design Engineer: Engineer who is legally qualified per the DESIGN REQUIREMENTS Article above and who is experienced in providing engineering services for installations of concrete formwork components and systems that are similar in material, design, and extent to those indicated in the Contract Documents.
2. Ready-Mix Supplier: Submit documentation of annual certification, for all batching facilities proposed for this Project, by NYSDOT or as otherwise acceptable to NYSDOT.
3. Concrete Flatwork Subcontractor: must show record of business in concrete flatwork construction for at least five (5) years on projects of similar or greater complexity.
4. Fabricator of Epoxy-Coated Reinforcement: All fabricators of epoxy-coated reinforcement must be certified as a “Coating Applicator” by the NYSDOT Materials Bureau per NYSDOT-SS Article 709-04.
5. Welders: All welders (welding “operators”) performing approved welding of reinforcing bars must be qualified as follows:
   a. Qualify welding processes and welding operators in accordance with applicable AWS standard(s).
   b. Provide welding certificates indicating the operators to be employed in the work have satisfactorily passed AWS qualification tests within the previous six (6) months. If certificates are older than six (6) months, employer of operator must certify, in writing, that operator is in compliance with applicable AWS provisions pertaining to certification validity.
   c. All welders working on this project will be assigned an identifying symbol or mark. Each welder will be required to mark or stamp his symbol on each weldment completed for identification. Contractor must maintain a record of welders

employed, date of qualification and symbol or identification mark assigned to each.

C. Mock-Ups

1. Prior to casting finished concrete exposed to view, Contractor must form and cast the following mock-ups and receive approval by the Architect:
   a. Parking Area Slabs (Non-Slip Broom Finish): Based on the Contractor's experience of previously accepted work and discussions with the Architect, provide three samples (min. 4' square) to show a range of broom finishes. Provide one each:
      1) Medium Broom/Standard Pressure.
      2) Broom finish using slightly less pressure than Item 1 above.
      3) Broom finish using slightly more pressure than Item 1 above.
      4) Cast concrete supported slab mock-up not less than 10' x 10' to demonstrate typical joints, surface finishes, texture, tolerance, and standard of workmanship.
   b. Cast concrete structural fiber reinforced slab-on-grade slab mock-up not less than 10' x 10' to demonstrate typical joints, surface finish, texture, tolerance, and standard of workmanship.
2. Notify Architect seven (7) days in advance of the dates and times when mock-up will be installed.
3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
4. After Architect acceptance, the sample(s) will become the standard of comparison for completed finish. At completion of project, mock-up(s) must be removed from site by the Contractor.

D. Record of Work: A record must be kept by the General Contractor listing the time and date of placement of all concrete for the structure. Such record must be kept until the completion of the project and must be available to the Architect for examination at any time.

1. All concrete batch trip tickets will be collected and retained by the Contractor. Concrete batch trip tickets must contain information specified in ASTM C94 paragraph entitled "Batch Ticket Information". Batch trip ticket must also show the total amount of water in the mix as batched (including water present in the

aggregate before batching) and the amount of water required by the design mix proportions.

2. Contractor to provide the VA with one original copy of every batch ticket (for every load of concrete delivered and used or rejected) within 3 days of concrete delivery. Failure to produce tickets may result in non-payment for or rejection of completed work.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Follow recommendations and requirements of ACI 304R. Store aggregate separately for each kind or grade, to prevent segregation of sizes and avoid inclusion of dirt and other materials.

B. Deliver cement and cementitious or mineral admixtures 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 other cementitious materials (Fly Ash, Ground Granulated Blast Furnace Slag, Silica Fume, etc.) 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. Store off ground and under cover, protected from damage until used.

D. Forming and Accessories:

1. Deliver materials to site at such intervals to ensure uninterrupted progress of work.
2. Deliver formwork lumber to Project site as far in advance of its use as is practical, and carefully stack it clear of ground in such manner as to facilitate air-drying.
3. Store materials to permit easy access for inspection and identification.
4. Handle materials in strict compliance with manufacturer’s instructions and recommendations. Protect from all possible damage.

E. Concrete:

1. Hauling Time: Discharge all concrete transmitted in a truck mixer, agitator, or other transportation device not later than 1-1/2 hours, or 300 revolutions of the drum after the mixing water has been added, whichever is earliest.

2. Extra Water: Deliver concrete to the job in exact quantities required by the design mix. No water shall be added after batching of concrete, unless noted otherwise herein below.
3. For interior (not subject to moisture and/or freeze-thaw cycles in service) slabs-on-grade/fill only and in order to facilitate slump adjustment, part of the design mix water may be withheld from the concrete load at the batch plant with the respective delivery ticket marked with the quantity of water withheld. The contractor will be responsible for control of adding not more than the withheld quantity per delivery ticket to the respective load in the field. Mixing of this water must be done within the ASTM C94 permitted time frame and with the minimum stipulated number of revolutions of the drum.
   a. Addition of water to control slump for interior (not subject to moisture and/or freeze-thaw cycles in service) slabs-on-grade/fill only beyond that permitted under 1.7.D.3 above may be permitted, provided such addition does not compromise minimum required design strength and the resulting water-to-cementitious materials ratio is not higher than 0.50.
4. Protection: Protect placed concrete work from rain damage in accordance with the Contractor’s program approved by the COR. Protect finished slabs from mortar leakage from pouring of concrete above. Cover masonry walls, glazing, and other finish materials with polyethylene or otherwise protect from damage due to placement of concrete.

F. Reinforcement Materials:
1. Deliver reinforcement to the project site bundled, tagged and marked. Use metal tags indicating bar size, lengths, and other information corresponding to markings shown on placement diagrams.
2. Store concrete reinforcement materials at the site to prevent damage and accumulation of dirt or excessive rust.
   a. Store epoxy-coated steel reinforcing bars on protected cribbing.
3. Handle all reinforcement in accordance with CRSI MSP recommendations.
4. Handle epoxy-coated steel reinforcing bars in accordance with ASTM D3963.

a. Handle epoxy-coated bars with equipment having protected contact areas.
b. Lift bundles of epoxy-coated bars at multiple pick-up points to minimize bar-to-bar abrasion from sags in the bundles.
c. Do not drop or drag bars or bundles.

1.11 PRE-CONCRETE CONFERENCE

A. General: Following the submittal and review of design mixes and at least 15 days prior to placement of the first batch of concrete to be exposed to weather or moisture in service, conduct a meeting to review proposed methods of concrete construction and design-construction team communication to achieve the required results.

B. Agenda: Includes but is not limited to:
1. Review of submittals and requirements to documentation expected to be submitted related to concrete construction.
2. Contractor’s quality control.
3. Testing Agency’s scope of work for concrete construction.
4. Methods of placing, finishing, and curing.
5. Finish criteria required to obtain required flatness and levelness.
6. Timing of floor finish measurements.
7. Material inspection and testing.
8. Construction problems and troubleshooting, deficiencies and remedies.
9. Acceptance criteria.

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 must take minutes and type and distribute the minutes to attendees within five days of the meeting.

1.12 MOCK-UP

A. See QUALITY CONTROL requirements of this Section.

1.13 APPLICABLE PUBLICATIONS

A. Reference Standards: Publications adopted referenced in their entirety subject to the correlation requirements of this Section (See QUALITY ASSURANCE Article above).

B. Standards Referenced in Part: Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.

C. American Concrete Institute (ACI):

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(R2019).....Guide to Evaluation of Strength Test Results of Concrete

308.1-11.....Specification for Curing Concrete

308R-01.....Standard Practice for Curing Concrete

315R-18.....Details and Detailing of Concrete Reinforcement

D. American National Standards Institute and American Hardboard Association (ANSI/AHA):

A135.4-2012.....Basic Hardboard

E. ASTM International (ASTM):

A615/A615M-20.....Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement

A653/A653M-20.....Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc Iron Alloy Coated (Galvannealed) by the Hot Dip Process

A706/A706M-16.....Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement

A767/A767M-19.....Standard Specification for Zinc Coated (Galvanized) Steel Bars for Concrete Reinforcement

A775/A775M-19.....Standard Specification for Epoxy Coated Steel Reinforcing Bars

A820/820M-16.....Standard Specification for Steel Fibers for Fiber Reinforced Concrete

A996/A996M-16.....Standard Specification for Rail Steel and Axle Steel Deformed Bars for Concrete Reinforcement

A1064/A1064M-18a.....Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete

C31/C31M-19a.....Standard Practice for Making and Curing Concrete Test Specimens in the field

C33/C33M-18.....Standard Specification for Concrete Aggregates

C39/C39M-20.....Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens

C94/C94M-19a.....Standard Specification for Ready Mixed Concrete

C143/C143M-20.....Standard Test Method for Slump of Hydraulic Cement Concrete

C150C150M-20.....Standard Specification for Portland Cement

C171-16.....Standard Specification for Sheet Materials for Curing Concrete

C172C172M-17.....Standard Practice for Sampling Freshly Mixed Concrete

C173/C173M-16.....Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method

C192/C192M-19.....Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory

C231/C231M-17a.....Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method

C260/C260M-10a(2016)....Standard Specification for Air Entraining Admixtures for Concrete

C309-19.....Standard Specification for Liquid Membrane Forming Compounds for Curing Concrete

C330/C330M-17a.....Standard Specification for Lightweight Aggregates for Structural Concrete

C494/C494M-19.....Standard Specification for Chemical Admixtures for Concrete

C618-19.....Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete

C666/C666M-15.....Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing

C881/C881M-20.....Standard Specification for Epoxy Resin Base Bonding Systems for Concrete

C1107/1107M-20.....Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink)

C1315-19.....Standard Specification for Liquid Membrane Forming Compounds Having Special Properties for Curing and Sealing Concrete

D6/D6M-95(2018).....Standard Test Method for Loss on Heating of Oil and Asphaltic Compounds

D297-15(2019).....Standard Test Methods for Rubber Products Chemical Analysis

D412—16.....Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension

D1751-18.....Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)

D4263-83(2018).....Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.

D4397-16.....Polyethylene Sheeting for Construction, Industrial and Agricultural Applications

E1155-20.....Standard Test Method for Determining F_F Floor Flatness and F_L Floor Levelness Numbers

F1249-20.....Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor

F1869-16a.....Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

F. American Welding Society (AWS):

D1.4/D1.4M-18.....Structural Welding Code - Steel Reinforcing Bars

G. Concrete Reinforcing Steel Institute (CRSI):

Handbook 2008

H. National Cooperative Highway Research Program (NCHRP):
Report On Concrete Sealers for the Protection of Bridge Structures

I. U. S. Department of Commerce Product Standard (PS):
PS 1-07.....Structural Plywood
PS 20-20.....American Softwood Lumber Standard

J. U. S. Army Corps of Engineers Handbook for Concrete and Cement:
CRD C513.....Rubber Waterstops
CRD C572.....Polyvinyl Chloride Waterstops

1.14 PROJECT CONDITIONS

A. Environmental Requirements

1. Cold Weather Placement: When depositing concrete after the first frost or when the mean daily temperatures are below 40 degrees F., follow requirements of ACI 306.1 and recommendations of ACI 306R as modified herein.
   a. Maintain concrete temperature at a minimum of 55 degrees F. for sections having a minimum dimension of less than 12", or 50 degrees F. for sections having a minimum dimension of 12" or greater, for not less than 72 hours after depositing.
   b. Maintain temperature of concrete record during the required minimum protection period and as described in Section 01 45 29, Testing Laboratory Services, of these specifications.
   c. The specified non-chloride accelerator or high-early strength Type III cement may be used when accepted by the Architect. Site-cured cylinders for verification of early strength and/or the adequacy of the Contractor's protective methods may be required by the Architect.
2. Hot Weather Placement: When depositing concrete in hot weather, follow requirements of ACI 305.1 and recommendations of ACI 305R as modified herein. The temperature of concrete at time of placement must not exceed 90 degrees F. Protect to prevent rapid drying. Start finishing and curing as soon as possible. When the air temperature is expected to exceed 90 degrees F., the Contractor must obtain acceptance from the Architect of the procedures to be used in protecting, depositing, finishing, and curing the concrete. The specified water reducing retarding admixture may be used upon

Architect acceptance. The use of continuous wetting or fog sprays may be required by the Architect for 24 hours after depositing.

B. Protection: Protect newly finished slabs from rain or snow damage in accordance with the Contractor's program approved by the Architect. Protect finished slabs from mortar leakage from pouring of concrete above. Cover masonry walls, glazing, and other finish materials with polyethylene or otherwise protect from damage due to placement of concrete.

1.15 COORDINATION

A. General: Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.
   1. Coordination Shop Drawings: Where adjacent construction interfaces with the work of this Section or otherwise requires specific relationships thereto, provide additional Shop Drawings as required to ensure a coordinated, complete, and functional installation.

B. Forming and Accessories:
   1. Coordinate installation of items furnished under other Sections. See General Notes (Concrete Notes) on the Structural Drawings for additional coordination and related submittal requirements.
   2. Removal of formwork must be scheduled so as not to cause a delay in subsequent Work.

C. The Contractor is responsible for notifying the Architect of any proposed loads and/or attachments to cast-in-place concrete construction that have not been included in the Structural Drawings.
   1. The Contractor is responsible for determining all construction loads including materials storage, support of shoring and staging, vehicles, personnel, environmental loads on incomplete structure, and others, as required. The Contractor's means and methods of construction must recognize and consider these loads and effects during the construction period.

D. Contractor to provide Architect-approved anchors and supports for the accommodation of cladding, interior finishes, equipment, mechanical ductwork, piping and electrical conduit/line supports, etc. as required

to complete the Project. Where post-installed anchors are used, comply with Section 05 05 19.

1.16 CONTRACTOR'S QUALITY CONTROL SYSTEM

A. General

1. In accordance with Division 1 requirements, the Contractor must establish a Quality Control System for the work of this Section.
2. The Contractor’s Quality Control System is the means used by the Contractor to become assured that the construction complies with the requirements of the Contract Documents (including, but not limited to, materials, workmanship, construction, finish, and functional performance) to the satisfaction of the COR, Architect, and authorities having jurisdiction. The Contractor must establish a system of quality control for the Work that includes sufficient inspection and testing of all items of Work, including that of the Contractor’s subcontractors.

B. Contractor’s Quality Control System must include, but not be limited to, the following:

1. General: Review of existing conditions, substrate conditions, requirements of related work, installation instructions, storage and handling procedures, and protection measures.
2. Independent Testing Agency Services: The engaging of qualified independent inspection and testing agency/agencies to perform quality control services above and beyond the minimum inspection and testing requirements indicated in the Contract Documents, as may be necessary to ensure compliance thereto.
   a. The qualifications for all Testing Agencies must meet or exceed the requirements of Section 01 45 29.
3. Field Engineering: The Contractor must employ a Registered Land Surveyor to provide field engineering services required by the Contract Documents.
   a. See Division 1 for requirements applicable Field Engineering.
4. Formwork Systems
   a. Before concrete placement:
      1) Verify compliance with shoring and reshoring design.
      2) Check supports of forms for vertical and lateral stability.

3) Verify positioning of shores to ensure concentric alignment at consecutive levels.
4) Verify arrangement of erected formwork for conformance to shapes, lines and dimensions of members as specified by design Drawings and Specifications. Make corrections and adjustments to ensure proper size and locations of concrete members and stability of formwork System(s).
5) Verify cleanliness of forms prior to concreting.

b. During concrete placement check formwork and related supports to ensure that forms are not displaced and that completed work will be within specified tolerances.

5. Quality-Control-Related Scheduling and Coordination: Include, not by way of limitation, the following:

a. Scheduling and Convening of Contractor’s Quality Control Conferences: Contractor to schedule and conduct conferences for the purposes of coordinating quality control for the Project.

1) The Architect, responsible Engineer and the COR must be invited to attend the conference at their election and must be notified by the Contractor at least fifteen (15) working days prior to the scheduled date of the conference. Unless it is confirmed that the Architect/Engineer will NOT be attending the meeting, all conferences are to be scheduled in conjunction with the scheduled site visits being performed by the Architect or as approved by the Architect.
2) Record minutes of each conference and distribute in typed or printed form to each party in attendance within five (5) working days of the meeting. One copy of these minutes must also be transmitted to the COR and the Architect for information.
3) Contractor’s conference schedule must include, not by way of limitation, the conferences indicated below.

b. Coordination with the authorities having jurisdiction to obtain the necessary approvals for the work of this Section.

C. Pre-Construction Conference: Conference to review Project requirements including all related Quality Control requirements pertaining to the

work of this Section, prior to commencement of the applicable portion of the Work.

1. The following portions of the work must also be included, not by way of limitation:
   a. Excavation bracing, sheeting and/or shoring.
   b. Foundations.
2. The Contractor must require responsible representatives of each party concerned with that portion of the Work to attend the conference, including but not limited to the following:
   a. Contractor's Superintendent and Project Manager.
   b. Ready-mix concrete producer.
   c. Concrete subcontractor.
   d. Concrete pumping contractor.
   e. Concrete finishing foreman.
   f. Rebar installer.
   g. Formwork materials supplier(s) or fabricator.
   h. Formwork installation Subcontractor(s).
   i. MEP/FP Subcontractors if work requires interfaces thereto.
   j. Testing Agency personnel responsible for field quality control.
   k. Prior to the pre-placement conference, Contractor must have submitted the following for review:
      1) All proposed concrete mix designs.
      2) Placement Schedule
      3) Concrete Protection Program
3. Contractor must have a copy of all approved Shop Drawings and Submittals applicable to the Work present at the Pre-Construction Conference.

D. Quality Control Tests and Inspections During Construction: See FIELD QUALITY CONTROL Article in Part 3 of this Section.

E. Quality Control Records: Contractor must maintain accurate records of all inspections and tests performed, instructions received from the Architect, responsible Engineer or Testing Agency, and actions taken as a result of those instructions. These records must include evidence that the required inspections or tests have been performed (including type and number of inspections or tests, nature of defects, causes for

rejection, etc.), proposed or directed remedial action, and corrective action taken.

F. See FIELD QUALITY CONTROL Article in Part 3 of this Section for additional Quality Control requirements.

1.17 INDEPENDENT TESTING AGENCY SERVICES

A. All testing and/or inspections applicable to this Section must comply with Section 01 45 29.

B. See FIELD QUALITY CONTROL Article in Part 3 of this Section for additional Quality Control requirements.

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. 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.

D. Concrete products must comply with following standards for biobased materials:

Material Type	Percent by Weight
Concrete Penetrating Liquid	79 percent biobased material
Concrete Form Release Agent	87 percent biobased material
Concrete Sealer	11 percent biobased material

Note: The minimum-content standards are based on the weight (not the volume) of the material.

E. Form Ties: Develop a minimum working strength of 13.35 kN (3000 pounds) when fully assembled. Ties must 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.

F. Form Coating: Use commercial formulation form-coating compounds with a maximum VOC of 350 grams per liter that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatment of concrete surfaces requiring bond or adhesion, nor impede the wetting of surfaces to be cured with water or curing compounds.

G. Metal Inserts:

1. Use galvanized metal insets for anchorage of materials or equipment to concrete construction as required for the work.
2. Use galvanized threaded inserts for thin slabs, furnished complete with full-depth bolts; 3/4-inch bolt size, unless otherwise shown.

2.2 DESIGN OF FORMWORK

A. Formwork and formwork systems, as well as shoring and re-shoring systems and sequences, must be designed by a Professional Engineer employed by the Contractor. The Professional Engineer must be registered in the State where the work is to be performed. The Contractor must submit written certification indicating conformance with this requirement.

B. Design, erect, support, brace and maintain formwork in accordance with ACI 301 and following recommendations of ACI 347, as modified herein. Forms must be capable of safely supporting vertical and lateral loads that might be applied, until such loads can be supported by the concrete structure. Carry vertical and lateral loads to ground by formwork system and in-place construction that has attained adequate strength for that purpose.

C. The Contractor must be fully aware of the concrete composition and its properties potentially affecting the design of forming components and sequence of form removal and re-shoring. Some such properties include, without being limit to, delayed strength gain, wet concrete unit weight and viscosity of the mix. The Contractor must ascertain that the Professional Engineer designing all aspects of forming and shoring is keenly aware of the properties of concrete placed into the forms.

D. Support form facing materials by structural members spaced sufficiently close to prevent deflection. Fit forms placed in successive units for continuous surfaces to accurate alignment, free from irregularities and within allowable tolerances.

E. Design formwork to be readily removable without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials.

F. Use shores and struts with positive means of adjustment capable of taking up formwork settlement during concrete placing operations, using wedges or jacks or a combination thereof. Use trussed supports when adequate foundations for shores and struts cannot be secured.

G. Formwork for Grade Beams and Footings: Side forms are required for all footings, pile caps and grade beams.

H. Formwork design for post-tensioned structures must consider the stressing sequence and its effect on the loading of forms (and shores/re-shores) during construction.

I. The contractor’s formwork designer must pay special attention to the transfer girders and stage stressing if any, with respect to the actual loads imposed on the formwork sequentially during construction.

2.3 MATERIALS

A. Cementitious Materials

1. General: Provide materials of the same brand or source throughout the project unless otherwise specified.
2. Portland cement: Comply with NYSDOT-SS Article 701-01 requirements and approvals. High-Early Strength Type III cement may be used in lieu of Type I at Contractor's option, providing a written notification is submitted to the Architect prior to use. Type III cement must not be used for hot weather concreting.
3. Fly Ash: Comply with NYSDOT-SS Article 711-10 requirements and approvals.
4. Ground Granulated Blast Furnace Slag (GGBFS): Comply with NYSDOT-SS Article 711-12 requirements and approvals.

B. Aggregates: Comply with NYSDOT-SS Section 703 requirements and approvals and as noted herein below:

1. Provide aggregates from the same source throughout the project unless otherwise specified

2. Fine aggregate: clean, sharp, natural sand free from loam, clay lumps or other deleterious substances.
3. Coarse aggregate: Clean, uncoated, processed aggregate containing no clay lumps, mud, loam, or foreign matter, as follows:
   a. Crushed stone, processed from natural rock deposits (granite, limestone, etc.).
   b. Washed gravel, either natural or crushed. Use of pit or bank run gravel is not permitted.
   c. NYSDOT approved material may have 4% maximum chert content.
   d. Acceptable material must have a maximum lignite content of one-half that permitted by ASTM C33.
   e. Aggregate Size:
      1) Maximum Aggregate Size must be per ACI 301 4.2.2.3 but in no case greater than ASTM C33 #4. Minimum aggregate size must be per the Mix Design Schedule Notes on the Drawings.
      2) No chert allowed for above-grade concrete mixes subject to freeze-thaw cycles in service (includes all slabs-on-grade in open structures and non-conditioned areas).

C. Vapor Barrier: ASTM F1249, 0.38 mm (15 mil) WVT 0.007 foot/hour.

D. Mixing Water: Potable, clean, fresh and free from injurious amounts of oils, acids, alkalis, salts, organic materials, or other substances deleterious to concrete and concrete reinforcing. Comply with NYSDOT-SS Article 712-01 requirements and approvals.

E. Admixtures:
1. General: Unless specified, no admixtures may be used without specific approval of the Architect.
2. Prohibited Products: calcium chloride or admixtures containing more than 0.05% chloride ions or thiocyanates.
3. Air-Entraining Admixture: Comply with NYSDOT-SS Article 711-08 “Air Entraining” requirements and approvals.
4. Water Reducing Admixture: Comply with NYSDOT-SS Article 711-08 “Water-Reducing Admixtures (ASTM TYPE A)” requirements and approvals.
5. Water Reducing, Retarding Admixture: Comply with NYSDOT-SS Article 711-08 “Water-Reducing and Retarding Admixtures (ASTM TYPE D)” requirements and approvals.

6. High-Range Water-Reducing Admixture (Superplasticizer): Comply with NYSDOT-SS Article 711-08 "Water-Reducing (High Range)Admixtures (ASTM TYPE F)" requirements and approvals.
7. Non-Corrosive, Non-Chloride Accelerator: ASTM C494, Type C or E. Admixture manufacturer must have long-term test data confirming non-corrosive nature 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. NYSDOT-SS Approved Material Code "711-0807" Listed.
8. Calcium Nitrite Corrosion Inhibitor: Comply with NYSDOT-SS Article 711-13 requirements and approvals.
9. Structural Fiber (for areas of concrete structure specifically designated): Monofilament polypropylene/polyethylene fibers, 1.5 to 2 inch in length with a minimum tensile strength of 70 ksi and minimum Modulus of Elasticity of 600 ksi. The manufacturer must demonstrate the attainment of average residual strength per ASTM C1399-00 based on the proposed dosage of not less than 140 psi. Not less than 5 samples tested must be 6 in. x 6 in. in cross section and the length of minimum 20 in. and span of 18 in. when placed in the testing apparatus. Samples must be prepared based on the approved mix design. Minimum dosage must not be less than 4.0 lbs/cu. yd. NYSDOT-SS Article 711-01 is NOT applicable to this material.
10. Certification: Written certification of conformance to the requirements above, as well as compatibility with other constituents of the respective proposed mixes, is required from all admixture manufacturers prior to mix design review.

F. Reinforcing Steel: See Paragraph 2.4.

G. Welded Wire Fabric: See Paragraph 2.4.

H. Reinforcing Bars to be Welded: See Paragraph 2.4.

I. Epoxy Coated Reinforcing Bars: See Paragraph 2.4.

J. Expansion Joint Filler: ASTM D1751.

K. Sheet Materials for Curing Concrete: ASTM C171.

L. Liquid Membrane-forming Compounds for Curing Concrete: ASTM C309, Type I, with fugitive dye, and must meet the requirements of ASTM C1315.Compound must be compatible with scheduled surface treatment,

such as paint and resilient tile, and shall not discolor concrete surface.

M. Liquid Hardener and Dustproofer: Fluosilicate solution of magnesium fluosilicate or zinc fluosilicate. Magnesium and zinc may be used separately or in combination as recommended by manufacturer. Use only on exposed slab. Do not use where floor is covered with resilient flooring, paint or other finish coating.

N. Moisture Vapor Emissions & Alkalinity Control Sealer: 100 percent active colorless aqueous siliconate 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 percent solid content, leaving no sheen, volatile organic compound (VOC) content rating as required to suite regulatory requirements. The product must 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 must 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 must cover all labor and materials needed to replace all floor covering that fails due to moisture vapor emission & moisture born contaminates.

O. Penetrating Sealer: See Division 7 requirements. Requires moist (non-membrane) curing of slab.

P. 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 must 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 must achieve 95 percent under an 450 mm x 900 mm (18 inch by 36 inch) base plate.

Q. Adhesive Binder: ASTM C881.

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

S. Fibers:

1. Synthetic Fibers: Monofilament or fibrillated polypropylene fibers for secondary reinforcing of concrete members. Use appropriate length and 0.9 kg/m3 (1.5 lb. per cubic yard). Product must have a UL rating.
2. Steel Fibers: ASTM A820, Type I cold drawn, high tensile steel wire for use as primary reinforcing in slab-on-grade. Minimum dosage rate 18 kg/m3 (30 lb. per cubic yard).

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

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

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

2.4 MILD STEEL REINFORCEMENT MATERIALS AND FABRICATION

A. General

1. Sizes, types, grade or yield strengths as indicated on the Drawings. Use 60,000 psi yield strength if not otherwise indicated. Use reinforcing conforming to ASTM A706 where welding of reinforcing is required, unless otherwise indicated. Provide uncoated finish unless otherwise indicated.
2. Comply with NYSDOT-SS Section 709 requirements and approvals.

B. Deformed Bars: ASTM A615 plus supplementary requirement (S1), Deformed Billet Steel Bars or ASTM A706, Low-Alloy Steel Deformed Bars, unless otherwise indicated.

C. Welded Wire Fabric:

1. Slab-on-Grade: Mesh size and gauge as indicted on the Drawings. Conform to ASTM A1064, plain, in flat sheets. Roll stock is not acceptable.

D. Coated Reinforcement:

1. Epoxy Coated: All epoxy coated bar reinforcement (smooth or deformed) must comply with NYSDOT-SS Article 709-04 requirements and approvals. All epoxy coated wire fabric reinforcement must comply with NYSDOT-SS Article 709-08 requirements and approvals. The coating manufacturer must supply adequate quantity of the NYSDOT-approved Epoxy Patching Compound compatible with the coating and intended for touch-up repairs of damaged hardened coating. Provide epoxy coated reinforcing as defined below:
   a. General:
      1) All reinforcement and welded wire fabric in the upper 3” of the cast-in-place structural slab, slab-on-grade or topping.
      2) All pour strip and stressing pocket reinforcement, if present.
      3) All support steel for all epoxy coated reinforcement.
      4) All epoxy coated rebar tie wire must be epoxy or plastic coated not lighter than 16 gage.
      5) All wall reinforcement located at 2 inches or less from a face of concrete subject to a “splash-on” of de-icing chemicals.
      6) See Section 03 41 33 of these Specifications for precast concrete component reinforcement embedded into cast-in-place concrete topping.
   b. Additional for Parking Structures:
      1) All reinforcement and welded wire fabric in curbs or topping.
   c. Deformed Bar Reinforcement:
   d. Epoxy-Coated Smooth Bar Dowels: ASTM A 615, Grade 60, plain round bars, ASTM A 775 epoxy-coated.

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

1. Use wire bar type supports complying with CRSI recommendations, unless otherwise indicated. Do not use wood, brick, and other unacceptable materials.
2. For slabs on grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
3. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with either hot-dip galvanized,

stainless steel or plastic tip protected legs, at Contractor's option.

a. Chairs and metal accessories supporting epoxy coated rebar must also be epoxy coated.

4. Over waterproof membranes, use concrete chairs to prevent penetration of the membrane.
5. Provide accessories and supports for welded wire fabric and reinforcement in slabs as required to maintain concrete cover and position as shown on the Drawings.

F. Tie Wire: All tie wires must be 16 gauge or heavier, black annealed, unless noted otherwise.

1. Plain-Steel Wire: ASTM A 82, as drawn.
2. Epoxy-Coated Wire: ASTM A 884, Class A, Type 1 coated, as-drawn, plain-steel wire, with less than 2 percent damaged coating in each 12-inch wire length.

G. Fabrication:

1. General: Fabricate reinforcing bars to conform to required shapes and dimensions, with fabrication tolerances complying with CRSI "Manual of Standard Practice". In case of fabricating errors, do not re-bend or straighten reinforcement in a manner that will injure or weaken the material, or damage coating.
2. Fabrication of Epoxy-Coated Steel Reinforcement Bars: Comply with NYSDOT-SS Article 709-04 requirements and approvals.
3. Obtain samples of proper bend radii for various rebar sizes from the fabricator. Adequacy of the radii must be confirmed on-site by the Contractor via measurements and comparison to the requirements for standard hooks in ACI 301 Table 3.3.2.8 or CRSI Manual of Standard Practice. Store and maintain samples on site to be easily accessible for proper bend radii verification by the Testing Agency.
4. Unacceptable Materials: Reinforcement with any of the following defects will not be permitted in the work:
   a. Bar lengths, depths and bends exceeding specified fabrication tolerances.
   b. Bend or kinks not indicated on Drawings or final shop drawings.
   c. Bars with reduced cross-section due to excessive rusting or other cause.

d. Bars heated for bending unless so indicated on the plans.

e. Epoxy coated bars with damaged coating.

2.5 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. A minimum of three trial mixes must be used for the purposes of establishing proportions for any given mix. One set of cylinders for each of minimum 3 trial mixes must be considered a sample.
2. Submit a report of results of each test series, include a detailed listing of the proportions of trial mix or mixes, including cement, and cementitious additives, admixtures, weight of fine and coarse aggregate per cubic meter (cubic yard) measured dry rodded and damp loose, specific gravity, fineness modulus, percentage of moisture, air content, water-binder ratio, and consistency of each cylinder in terms of slump.
3. Prepare a curve showing relationship between water-to-binder 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.
5. A binder consists of all cementitious and pozzolanic materials in a mix (i.e. Portland cement, fly ash, GGBFS, etc.).

B. Fly Ash Testing: Submit certificate verifying conformance with NYSDOT-SS Article 711-10 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 the COR immediately when change in source is anticipated.

1. Testing Laboratory used for fly ash certification/testing must 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 the COR, or as specified. Making and testing of preliminary test cylinders may be carried on pending approval of all binders providing Contractor and manufacturer certify that ingredients used in making test cylinders are the same. The COR may allow Contractor to proceed with depositing concrete for certain portions of work, pending final approval of all binders and approval of design mix.

D. Cementitious Materials Quantities: Maintain minimum quantities of cementitious materials in mixes per the Mix Design Schedule on the Drawings regardless of compressive strength developed above minimums.

E. Chloride Ion Content of design Mix (ASTM C1218):

1. For protection against corrosion for elevated parking structure components, water containment structures (tanks) only, maximum water-soluble chloride ion concentration in hardened concrete at 28 days must be limited to quantities below by weight of cementitious materials (Portland Cement plus Fly Ash or other pozzolans, plus GGBFS) as follows:

   a. In all structural concrete not more than 0.06% chloride ions for prestressed concrete, and not more than 0.15% for reinforced concrete. For the purposes of this paragraph, post-tensioned cast-in-place concrete must be considered as “prestressed”.

F. Cement Factor: See Concrete Mix Design Schedule on the Drawings.

G. Maximum Slump: Maximum slump, as determined by ASTM C143 with tolerances as established by ASTM C94, for concrete to be vibrated must be as shown in the Mix Design Schedule on the Drawings.

H. Air-Entrainment: Air-entrainment of normal weight concrete must conform with the Mix Design Schedule on the Drawings.vConcrete slabs placed at air temperatures below 10 degrees C (50 degrees Fahrenheit) use non-corrosive, non-chloride accelerator. Concrete required to be air entrained use approved air entraining admixture. Pumped concrete, synthetic fiber concrete, architectural concrete, concrete required to be watertight, and concrete with a water/cement ratio below 0.50 use high-range water-reducing admixture (superplasticizer).

I. Durability: Use air entrainment for exterior exposed concrete subjected to freezing and thawing and other concrete shown or specified. See

Concrete Mix Design Schedule on the Drawings for additional information.

J. Performance Requirements:

1. General: The Contractor is responsible for designing the required concrete mixes such that mixing, placing and finishing operations are possible without compromising the performance of the finished product during service life.
2. Durability of Completed Structure:
   a. Follow applicable recommendations of ACI 301, latest edition, based on the following Exposure Classes as delineated therein. This project must be considered located in following Exposure Classes:
      1) Freeze/Thaw: **F3**
      2) Sulfate Exposure: **S0**
      3) Water Contact: **W1**
      4) Corrosion Protection: **C2**
   b. Follow applicable recommendations of ACI 362.1R, latest edition, based on the following Weather Exposure Zone as delineated therein. This project must be considered located in **Weather Exposure Zone III.**

2.6 ENFORCING QUALITY CONTROL REQUIREMENTS

A. Results of field and lab testing as specified in Section 01 45 29, TESTING LABORATORY SERVICES, during the progress of the work must be submitted in a timely manner to the Architect for review.

B. Testing results identifying non-compliant work must be immediately pointed to the contractor with the subsequent notice of the required remedial action. Items of non-compliance include field parameters per ASTM C94, those per ACI 301 or ACI 318 and related standards and recommendations as well as results of laboratory testing.

C. 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 must 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, the 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, the 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, the 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, must be reinforced with additional construction or replaced, if directed by the COR.

2.7 BATCHING AND MIXING

A. General: Concrete must 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 the 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 degrees 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 must 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 must be thoroughly familiar with the structural lightweight aggregate, adjustment and control of mixes to produce concrete of required quality. Representative must assist and advise the COR.

2.8 RELATED MATERIALS

A. Isolation Joint (Compressible) Filler Materials

1. Substructure: For separation joints between concrete building elements and work of other trades as shown in the Structural Drawings, provide molded (expanded) polystyrene foam insulation complying with ASTM C578 Type II (15 psi min. compressive resistance for 10% deformation).
2. Slab-on-grade Within Building Footprint: Closed-cell polyethylene conforming to ASTM D4819 Type II for full depth of joint with pre-scored removable strip to provide a uniform sealing reservoir in the joint, ½-inch thickness, unless indicated otherwise in the Contract Documents.
3. Perimeter Joints at Building Exterior: At locations of adjacent pavements, provide pre-molded asphalt and fiber joint fillers conforming to ASTM D994 or non-extruding and resilient bituminous type conforming to ASTM D1751, ½-inch thickness, provide with removable joint cap or otherwise ensure that width is maintained ½" less than joint depth to allow for sealant unless indicated otherwise in the Contract Documents.
4. Structural Component Isolation Wrap: Cellular rubber insulation having a compression deflection of 25% at 2-5 psi in compliance with ASTM D1056 requirements.
5. Superstructure Separation: For above-ground separation joints between concrete building elements and where concrete building elements are adjacent to dissimilar materials (as shown in the

Drawings or as required), provide compressible filler per Division 7 requirements. Maintain fire-ratings as indicated in the Drawings.

B. Concrete Curing Materials

1. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M182, Class 2.
2. Moisture-Retaining Cover: One of the following, complying with ASTM C171:
   a. Waterproof paper.
   b. Polyethylene film.
   c. Polyethylene-coated burlap.
3. Curing Compound: Liquid Membrane-Forming Curing Compound or Dissipating Resin Compound: ASTM C309, Type 1. Curing compound shall leave no surface residue and must be compatible with concrete sealers, paint and finish floor materials specified in other Sections of these Specifications. For concrete surfaces to receive clear penetrating sealer, liquid membrane-forming curing compound, if not a dissipating resin, must be mechanically removed from the concrete surface by an approved method. The dissipating resin compound film must chemically break down in a two to four-week period. Provide data from an independent laboratory indicating a maximum moisture loss of 0.03 grams per sq. cm. in 72 hours when applied at a coverage rate of 300 sq. ft per gallon. Manufacturer's certification and method of removal, if necessary for sealer application, are required.
   a. Contractor is responsible for providing concrete surface clear of any and all residue of curing compound (regardless of type) as acceptable to the manufacturer of the finish material (sealer, paint, etc.) to be applied to that surface.
4. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete. Applied in accordance with the manufacturer’s instructions, this product must not affect behavior of curing compounds or concrete appearance or texture.

C. Polymer Adhesives: Material suitable for use on dry or damp surface, complying with ASTM C881, for use in all structural concrete repairs.

To the satisfaction of the Architect, Submittals must include sufficient manufacturer's material information for a specific repair, clearly indicate location and the type of repair, and describe the Contractor's proposed methods and procedures (for information only).

D. Epoxy-Resin Bonding Agent: Two-Component, mineral-filled, epoxy-polysulphide polymer complying with FS MMM-G-6506-73, Type I or Type II, Grade A, or ASTM C881, Type II, Grade II, Class B or C.

E. Patching Mortars: See "Concrete Repair Materials" Article below.

F. Post-Installed Anchors

1. General: Comply with Section 05 05 19 requirements.
   a. For fastening to post-tensioned concrete structures, any proposed post-installed anchor design must comply with notes under "Post-Tensioned Concrete" on the Structural Drawings.
2. Expansion Anchors (self-expanding, drop-in or drilled-in): Unless specifically identified on the Drawings, provide submittals for a proposed type of application only on a case-by-case basis. Unless identified on the Drawings for size, capacity and spacing, use of any expansion anchors must be approved by the Architect in writing.
3. Drilled-in Anchors or Rebar Set in Epoxy Adhesive: This product must be specified on the Drawings for type, size and spacing. This product shall not be used without the Architect's approval on a case-by-case basis, unless noted otherwise. This product shall not be used as a substitute for properly cast-in dowels without Architect's approval.

G. Non-Shrink Grout: Non-shrink non-metallic grout must be premixed and must consist of silica aggregates, Portland cement, water reducing and shrinkage compensating agents. Grout must conform to ASTM C1107.

1. For grout requirements under Structural Steel Components and Precast Concrete Components, see Section 03 60 00.

H. Waterstops: Provide in all elevator pit walls and where shown on the Drawings.

1. Non-Metallic Hydrophilic: Swellable strip type compound of polymer modified chloroprene rubber that swells upon contact with water must conform to ASTM D412 as follows: Tensile strength 420 psi minimum; ultimate elongation 600 percent minimum. Hardness must be 50

minimum on the type A durameter and the volumetric expansion ratio in in 70 deg water must be 3 to 1 minimum.

I. Under-slab Vapor Retarder Membrane: Provide only where specifically required by the Drawings as follows: Single or multi-layered plastic extrusion manufactured from virgin polyolefin-based resins.
   1. Minimum Thickness: 15-mil.
   2. Performance Characteristics
      a. Water Vapor Retarder (ASTM E1745): Meets or exceeds Class A, B & C
      b. Water Vapor Permeance (ASTM E-96/ASTM E-154 Section 7): ≤0.01 perms [grains/(ft2*hr*in. Hg)]
      c. Puncture Resistance (ASTM D1709, Meth. B): >3000 Grams (>2,200 Grams)
      d. Tensile Strength (ASTM D882/ASTM E-154 Section 9): >60 lbs. Force/Inch
   3. Accessories as required by manufacturer for complete system.

2.9 CONCRETE REPAIR MATERIALS

A. Cement Patching Mortar: Mixture including Portland cement(s) and aggregate complying with Part 3 of this Section.

B. Polymer Patching Mortar (Proprietary Patching Compound): Packaged, polymer-modified, cementitious dry mix for repair of concrete where specifically required or permitted under Part 3 of this Section. Obtain prior approval of the Architect for any proposed material specifically designed for horizontal, vertical and/or overhead applications. Submittals must include manufacturer’s information together with location and the type of repair. Versatile materials available in free-flowing, flowable or dry-pack form will be preferred.
   1. The following properties are required:
      a. Compressive strength 6,000 psi, minimum.
      b. Freeze-thaw resistance ASTM C666A - 96 rating, or better.
      c. Minimum and maximum thickness within the proposed range being repaired.
      d. Corrosion inhibitive component to be present.

e. Minimum substrate temperature range not narrower than 40 - 80 deg F, but must include the temperature of the proposed substrate at time of application.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

A. Protection of Work In-Place:

1. Do not cut, puncture, or otherwise damage or disrupt vapor retarder installations.
2. In the event of damage or disruption to a vapor retarder installation, repair installation to the satisfaction of the installer responsible for the subject Work and the Testing Agency before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that may serve to reduce bonding to concrete.

C. Comply additionally with Section 03 41 33 requirements.

3.2 FORMWORK

A. General: Design in accordance with ACI 347 is the responsibility of the Contractor. The Contractor must retain a registered Professional Engineer to design the formwork, shores, and reshores.

1. Forms must be capable of safely supporting vertical and lateral loads that might be applied, until such loads can be supported by the hardened concrete of the structure. Carry vertical and lateral loads to ground by formwork system and in-place construction that has attained adequate strength for that purpose. Sequence of construction and formwork/shoring/re-shoring design must be carefully coordinated.
2. Design formwork framing to limit the deflection such that specified tolerances per ACI 117 and as noted herein below, are not compromised.
3. Design formwork to be readily removable without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials and construction.
4. Use shores and struts with positive means of adjustment capable of taking up formwork settlement during concrete placement operations,

using wedges or jacks or a combination thereof. Use trussed supports when adequate foundations for shores and struts cannot be secured.

5. Form boards and plywood forms may be reused for contact surfaces of exposed concrete only if thoroughly cleaned, patched, and repaired and the COR approves their reuse.
6. Provide forms for concrete footings unless the COR determines forms are not necessary.
7. 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. Inspection: Examine the conditions under which concrete formwork is to be erected. Do not proceed with the work until unsatisfactory conditions have been corrected.

C. Form Construction:

1. Construct forms to be the exact sizes, shapes, lines and dimensions shown, and as required to obtain accurate alignment, grades, levels, and plumb work in finish structures. Provide openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking screeds, bulkheads, anchorages and inserts, and other features required. Use proper materials to obtain required finishes.
   a. 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.
   b. Lined Forms: May be used in lieu of unlined plywood forms. Back up form lining solidly with square edge board lumber securely nailed to studs with all edges in close contact to prevent bulging of lining. No joints in lining and backing may coincide. Nail abutted edges of sheets to same backing board. Nail lining at not over 200 mm (8 inches) on center along edges and with at least one nail to each square foot of surface area; nails to be 3d blued shingle or similar nails with thin flatheads.

~~a.~~c. Architectural Liner: Where specifically required, attach liner as recommended by the manufacturer with tight joints to prevent leakage.

2. Construct formwork sufficiently tight to prevent leakage of cement paste during concrete placement. Solidly butt joints and provide backup material at joints required to prevent leakage and fins.
3. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Use crush plates or wrecking plates where stripping may damage cast concrete surfaces. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and assure easy removal.
4. Provide temporary openings where interior area of formwork in inaccessible for cleanout or inspection before concrete placement, and for placement of concrete. Brace temporary closures and set tightly to forms to prevent loss of cement paste. Locate temporary openings on forms in as inconspicuous location as possible, consistent with project requirements.
5. Falsework:
   a. Erect falsework and support, brace and maintain it to safely support all applicable loads until such loads can be supported by in-place hardened concrete structures. Construct falsework so that adjustments can be made for take-up and settlement.
   b. Use wedges, jacks or camber strips to facilitate vertical adjustments. Carefully inspect falsework and formwork during and after concrete placement operations to determine abnormal deflection or signs of failure. Make necessary adjustments to produce work of required dimensions.
6. Forms for Exposed to View Concrete:
   a. Drill forms to suit ties and to prevent leakage of cement paste around tie holes. Do not splinter forms by driving ties through improperly prepared holes. Follow tie pattern approved by the Architect.
   b. Do not use metal cover plates for patching holes or defects in forms.

c. Provide chamfered corners at intersecting planes without visible edges or offsets. Back joints with extra studs or girts to maintain true intersections.

d. Form molding shapes, recesses and projections with smooth-finish materials and install in forms with sealed joints to prevent displacement.

e. All corners must be chamfered with 3/4" x 3/4" strips unless otherwise noted. Extend terminal edges to required limit and miter chamfer strips at changes in direction.

~~0.~~7. 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.

a. 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 must be loosened 24 hours after concrete is placed and must be pulled from least important face when removed.

~~.~~b. Coat surfaces of all metal that is to be removed with paraffin, cup grease or a suitable compound to facilitate removal.

~~3.~~8. Inserts, Sleeves, and Similar Items: Flashing reglets, steel strips, masonry ties, anchors, wood blocks, nailing strips, grounds, inserts, wire hangers, sleeves, drains, guard angles, forms for floor hinge boxes, inserts or bond blocks for elevator guide rails and supports, and other items specified as furnished under this and other sections of specifications and required to be in their final position at time concrete is placed must be properly located, accurately positioned, and built into construction, and maintained securely in place.

~~.~~a. Locate inserts or hanger wires for furred and suspended ceilings only in bottom of concrete joists, or similar concrete member of overhead concrete joist construction.

~~a.~~b. Install sleeves, inserts and similar items for mechanical services in accordance with drawings prepared specially for mechanical services and approved by the Architect. Contractor is responsible for accuracy and completeness of drawings and must coordinate requirements for mechanical services and equipment. Sleeves installed in structural members without expressed approval by the Architect must be subject to review and remedial action up to and including removal and re-construction of affected members at contractor’s sole expense.

~~b.~~c. Coordinate and provide recesses and blockouts in floor slabs for door closers, side coiling grille floor tracks, and other hardware as necessary in accordance with manufacturer's instructions.

~~5.~~9. Edge Forms and Screed strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in the finished slab surface. Provide and secure units to support types of screeds required.

~~6.~~10. Provisions for Other Trades: Provide openings in concrete formwork per the approved shop drawings, to accommodate work of others. Accurately place and securely support items to be built into forms.

~~7.~~11. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt and other debris just before concrete is to be placed. Retighten forms immediately after concrete placement as required to eliminate cement paste leaks.

~~8.~~12. Where required on Drawings, install bearing pads onto substrate and fastened as required.

~~9.~~13. For placement of vapor barriers/retarders and/or slip sheets, see Vapor Barrier Article below.

~~F.~~D. 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.

~~G.~~E. 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 must 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.

3.3 PLACING REINFORCEMENT

A. General: Details of concrete reinforcement in accordance with ACI 318 and ACI 315, unless otherwise shown.

B. Clean reinforcement to remove loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.

C. Repair damaged bar coating with a procedure acceptable to the COR and in accordance with the coating manufacturer’s instructions prior to the reinforcement placement into forms.

1. Epoxy-Coated Reinforcement: Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963. Use epoxy-coated steel wire ties to interconnect or tie together epoxy-coated steel reinforcement.

D. Provide sufficient numbers of supports and of strength to carry reinforcement. Do not place reinforcing bars more than 2 inches beyond the last leg of any continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.

E. Placing: Place reinforcement conforming to CRSI DA4 and to the tolerances per ACI 117, 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 must be made of plastic in areas that will be exposed when building is occupied. Type, number, and spacing of supports conform to ACI 318. Where concrete slabs are placed on ground, use concrete blocks or other non-corrodible material of proper height, for support of reinforcement. Use of brick or stone supports will not be permitted.
2. Lap welded wire fabric at least 1 1/2 mesh panels plus end extension of wires not less than 300 mm (12 inches) in structural slabs. Lap welded wire fabric at least 1/2 mesh panels plus end extension of wires not less than 150 mm (6 inches) in slabs on grade.
3. Splice column steel at no points other than at footings and floor levels unless otherwise shown.
4. Placing Epoxy-Coated Bars
   a. Place epoxy-coated bars in the same general manner as required for uncoated bars. Use only supports, ties, spacers, clips, tie wire, and miscellaneous accessories with epoxy or other protected coating compatible with the epoxy protection.
   b. Tack welding of crossing bars to assemble epoxy-coated reinforcement will not be permitted.
   c. Do not field bend epoxy-coated bars partially embedded in concrete, unless specifically approved for each case. Repair damage to coating of field bent bars with the epoxy-patching compound.
   d. Do not field cut epoxy-coated bars, unless specifically approved. When cutting is allowed, coat the cut ends with the same epoxy patching material used to repair the epoxy coating.
   e. Repair all damage to the epoxy coating with epoxy patching compound.

F. Spacing: Minimum clear distances between parallel bars, except in columns and multiple layers of bars in beams must 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.

G. 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 must test a minimum of three splices, for compliance, locations selected by the 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 the 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.

H. Bending: Bend bars cold, unless otherwise approved. Do not field bend bars partially embedded in concrete, except when approved by the COR.

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

J. Future Bonding: Protect exposed reinforcement bars intended for bonding with future work by wrapping with felt and coating felt with a bituminous compound unless otherwise shown.

3.4 VAPOR BARRIER

A. General
   1. Provide beneath slabs-on-grade per details indicated in the Drawings.
   2. Place vapor retarder over underfloor material specified in Division 31.
   3. Do not cover vapor retarder with sand or aggregate.
   4. Pour concrete slab directly over vapor retarder.

B. Interior Locations: Except where membrane waterproofing is required, interior concrete slab on grade must 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.

C. Verify that sleeves, ties, and other penetrating components which pass through surfaces to receive vapor retarder are rigidly installed.

D. Clean substrates of substances harmful to vapor retarder, including removing projections capable of puncturing vapor retarder.

E. Place, protect, and repair vapor retarder sheets in accordance with manufacturer's instructions and ASTM E1643.
   1. Use the greatest widths and lengths practicable to eliminate joints wherever possible.
   2. Unroll vapor retarder with the longest dimension parallel with the direction of the pour.
   3. Lap vapor retarder over foundation elements and seal to foundation walls.

4. Overlap joints 6 inches and seal with manufacturer's pressure sensitive tape.
5. Seal penetrations (including pipes, conduits, and ducts) per manufacturer's instructions.
6. No penetration of the vapor retarder is allowed except for reinforcing steel and permanent utilities.
7. Terminate vapor retarder at walls with manufacturer's mastic and/or adhesive spray; termination bars may be used if these means prove inadequate.
8. Repair damaged areas by cutting patches of vapor retarder, overlapping damaged area 6 inches and taping all four sides with manufacturer's pressure sensitive tape.

3.5 SLABS RECEIVING RESILIENT COVERING

A. Slab must be allowed to cure for 6 weeks minimum prior to placing resilient covering. After curing, slab must be tested by the Contractor for moisture in accordance with ASTM D4263 or ASTM F1869. Moisture content must 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/she must 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.

3.6 CONSTRUCTION JOINTS

A. Unless otherwise shown or noted herein below, locate and install construction joints in accordance with ACI 318 Article 6.4. Allow 48 hours to elapse between pouring adjacent sections unless this requirement is waived by COR.

B. Locate construction joints in suspended floors near the quarter-point of spans for slabs, beams or girders, unless a beam intersects a girder at center, in which case joint in girder must be offset a distance equal to twice width of beam. Provide keys and inclined dowels as shown. Provide longitudinal keys as shown.

C. Place concrete for columns slowly and in one operation between joints. Install joints in concrete columns at underside of deepest beam or girder framing into column.

D. Allow 2 hours to elapse after column is cast before concrete of supported beam, girder or slab is placed. Place girders, beams, grade beams, column capitals, brackets, and haunches at the same time as slab unless otherwise shown.

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

3.7 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 must 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.

3.8 PLACING CONCRETE

A. Preparation:

1. Remove hardened concrete, wood chips, shavings and other debris from forms.
2. Remove hardened concrete and foreign materials from interior surfaces of mixing and conveying equipment.
3. Have forms and reinforcement inspected and approved by the 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.
5. Prior to Placing Concrete:
   a. Verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
      1) Thoroughly wet wood forms immediately before placing concrete, as required where form coatings are not used.
   b. Coordinate the installation of joint materials and moisture barriers with placement of forms and reinforcing steel.

B. Bonding:

1. General
   a. All bonding of concrete surfaces must be implemented through the use of dampened concrete substrates. No products intended for application to dry substrates will be allowed.
   b. Dampened Concrete Substrate: Where requirements below indicate "dampen" or "dampened", concrete substrates must meet ACI requirements for "Saturated Surface Dry" (SSD) condition. Water must be applied to surface to fill the pores of the substrate (do not saturate) and all free water must be allowed to evaporate or otherwise be removed (no standing water).
   c. For the bonding of cast-in-place concrete to precast concrete surfaces, Contractor must coordinate the requirements below with Section 03 41 00 - Structural Precast Pretensioned Concrete.
   d. The requirements below apply to all bonding of fresh cast-in-place concrete to previously hardened cast-in-place concrete as

indicated in the Contract Documents or as otherwise approved by the Architect. All Contractor-proposed bonding related to repairs must be submitted to the Architect for review.

2. Substrate Preparation
   a. Roughen surfaces of set concrete at all joints and clean surfaces of laitance, coatings, loose particles, and foreign matter. Roughen surfaces in a manner to expose bonded aggregate uniformly (1/4" amplitude).
      1) Substrates that are not fully cured (less than 7-days-old): Utilize wire brushing and/or chipping where practicable otherwise use mechanical preparation as necessary with careful attention to avoid microcracking in accordance with ACI recommendations.
      2) Substrates that are fully cured (7-days-old or more): Utilize mechanical preparation with careful attention to avoid microcracking in accordance with ACI recommendations.
   b. Final Preparation of Roughened Substrate for Bonding: Immediately prior to placement of fresh concrete against partially or fully hardened concrete, provide one of the following final preparations:
      1) "SSD Only" Method Use: At joints between footings and walls, and between walls and slabs they support, and elsewhere as indicated in the Contract Documents, dampen (SSD) the roughened and cleaned surface of set concrete.
         a) Use of "SSD Only" Method outside of the areas indicated above is prohibited without prior approval by the Architect.
      2) Neat Cement Grout Use: At joints in exposed work: At vertical joints in walls, at joints in supported slabs and other structural members dampen (SSD) the roughened and cleaned surface of set concrete and apply a liberal coating of neat cement grout consisting of equal parts Portland cement and fine aggregate by weight and not more than 6 gal. of water per sack of cement. Apply with a stiff broom or brush to a minimum thickness of 1/16 inch. Deposit fresh concrete while cement grout is still tacky.

3) Epoxy Resin Bonding Agent Use:
   a) Use of "Epoxy Resin Bonding Agent" must be only where specifically indicated in the Contract Documents or in locations as approved by the Architect.
   b) Handle and store epoxy-resin adhesive binder in compliance with the manufacturer's printed instructions, including safety precautions.
   c) Follow manufacturer's preparation and installation requirements in accordance with ACI 503.2. Dampen (SSD) substrates unless noted otherwise.
   d) Mix the epoxy-resin adhesive binder in the proportions recommended by the manufacturer, carefully following directions for safety of personnel.
   e) Before depositing fresh concrete, thoroughly roughen and clean hardened concrete surfaces and coat with epoxy-resin grout not less than 1/16" thick. Place fresh concrete while the epoxy-resin material is still tacky, without removing the in-place grout coat, and as directed by the epoxy-resin manufacturer.

C. Place concrete in compliance with the practices and recommendations of ACI 304R and ACI 304.2R, and as herein specified.
   1. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete, which is hardened sufficiently to cause the formation of seams or planes of weakness within the section. If a section cannot be placed continuously, provide construction joints as herein specified. Perform concrete placing at such a rate that concrete, which is being integrated with fresh concrete is still plastic.
      a. Deposit concrete as nearly as practicable to its final location to avoid segregation due to re-handling or flowing. Do not subject concrete to any procedure, which will cause segregation.
   2. Do not use concrete which becomes non-plastic and unworkable, or does not meet the required quality control limits, or which has been contaminated by foreign materials. Do not use re-tempered concrete. Remove rejected concrete from the project site and dispose of it in an acceptable location.

3. Shrinkage cracks must be minimized by following ACI recommended practices for placing, finishing, and curing concrete.

D. Placement Schedule: Place concrete in conformance with the approved placement schedule to ensure an even distribution of loads throughout the entire structure.

E. 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 the COR.

1. Handle concrete from the point of delivery and transfer to the concrete conveying equipment and to the locations of final deposit as rapidly as practicable by methods, which will prevent segregation and loss of concrete mix materials.
2. Provide mechanical equipment for conveying concrete to ensure a continuous flow of concrete at the delivery end. Keep interior surfaces of conveying equipment, including chutes, free of hardened concrete, debris, water, snow, ice and other deleterious materials.

F. 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. Deposit concrete in forms in horizontal layers not deeper than 12 inches unless additional thickness is permitted by the Architect and in a manner to avoid inclined construction joints.
4. 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.
5. 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.

6. Continuously place concrete until an entire unit between construction joints is placed. Rate and method of placing concrete must 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.
7. Floor slabs or toppings on ramps must be placed up-hill.
8. 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.
9. Concrete on metal deck:
   a. Concrete on metal deck must 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 must become familiar with deflection characteristics of structural frame to include proper amount of additional concrete due to beam/deck deflection.

G. 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 must 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 must 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. Use vibrators in size appropriate for the elements, in which concrete is being consolidated.
4. Do not use vibrators to transport concrete inside of forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate the layer of concrete and at least 6 inches into the preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set.

3.9 HOT WEATHER

A. Follow the requirements of ACI 305.1 and the recommendations of ACI 305R or as specified to prevent problems in the batching, mixing, transporting, 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 must be made in advance of concrete placement and approved by COR.
   1. The Contractor must maintain an hourly record of air temperature, wind speed and humidity during and for the first 16 to 24 hours immediately following the concrete placement.
   2. Cool ingredients before mixing to maintain concrete temperature at time of placement at or below 93 degrees F. Mixing water may be chilled, or chopped ice may be used to control the concrete temperature provided the water equivalent of the ice is calculated to the total amount of mixing water.
   3. Wet forms thoroughly before placing concrete.
   4. Use set-control admixtures when required and accepted in mix designs.

3.10 COLD WEATHER

A. Follow the requirements of ACI 306.1 and recommendations of ACI 306R or as specified to prevent freezing of concrete and to permit concrete to gain strength properly. Use only the specified non-corrosive, non-chloride accelerator. Do not use calcium chloride, thiocyantes or admixtures containing more than 0.05 percent chloride ions. Methods proposed for heating materials and arrangements for protecting concrete must be made in advance of concrete placement and approved by COR.

1. When the air temperature has fallen to or is expected to fall below 40 degrees F., provide adequate means to maintain the temperature in the area where concrete is being placed. Concrete temperatures as mixed must comply with Table 3.1 of ACI 306R. The limits of temperature of concrete as placed and maintained must be in accordance with Table 3.2.1 of ACI 306.1. Duration of concrete protection period must be provided in accordance with ACI 306R Chapters 5 and 6. Provide temporary housings or coverings including tarpaulins or plastic film. Keep protection in place and intact at least 24 hours after artificial heat is discontinued. Avoid rapid dry-out of concrete due to overheating, and avoid thermal shock due to sudden cooling or heating.
2. When air temperature has fallen to or is expected to fall below 40 degrees F., uniformly heat all water and/or aggregates before mixing as required to obtain the required concrete mixture temperature per Table 3.1 of ACI 306R. Do not exceed minimum required mixing temperature by more than 20 degrees F.
3. Do not use frozen materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials. Ascertain that forms, reinforcing steel, and adjacent concrete surfaces are entirely free of frost, snow and ice before placing concrete.
4. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators not specified.
5. Use set-control admixtures when required and accepted in mix designs.

3.11 PROTECTION AND CURING

A. Conform to ACI 308.1: Initial curing must 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 the 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 $10m^2/L$ (400 square feet per gallon) on steel troweled surfaces and $7.5m^2/L$ (300 square feet per gallon) on floated or broomed surfaces for the curing/sealing compound.
2. Plastic sheets: Apply as soon as concrete has hardened sufficiently to prevent surface damage. Utilize widest practical width sheet and overlap adjacent sheets 50 mm (2 inches). Tightly seal joints with tape.
3. Paper: Utilize widest practical width paper and overlap adjacent sheets 50 mm (2 inches). Tightly seal joints with sand, wood planks, pressure-sensitive tape, mastic or glue.

B. Curing Formed Surfaces: Cure formed concrete surfaces, including the undersides of girders, beams, supported slabs, and other similar surfaces by moist curing with the forms in place for the full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

C. Protection from Mechanical Injury: During the curing period, protect concrete from damaging mechanical disturbances including load stresses, heavy shock, excessive vibration, and from damage caused by rain or flowing water. Protect all finished concrete surfaces from damage by subsequent construction operations.

3.12 REMOVAL OF FORMS

A. Remove in a manner to assure complete safety of structure after the following conditions have been met.

1. Where structure as a whole is supported on shores, forms for beams and girder sides, columns, and similar vertical structural members may be removed after 24 hours, provided concrete has hardened sufficiently to prevent surface damage and curing is continued without any lapse in time as specified for exposed surfaces.

2. Take particular care in removing forms of architectural exposed concrete to insure surfaces are not marred or gouged, and that corners and arises are true, sharp and unbroken.

B. Control Test: Use to determine if the concrete has attained sufficient strength and curing to permit removal of supporting forms. Cylinders required for control tests taken in accordance with ASTM C172, molded in accordance with ASTM C31, and tested in accordance with ASTM C39. Control cylinders cured and protected in the same manner as the structure they represent. Supporting forms or shoring not removed until strength of control test cylinders have attained at least 70 percent of minimum 28-day compressive strength specified. Exercise care to assure that newly unsupported portions of structure are not subjected to heavy construction or material loading.

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

3.13 CONCRETE SURFACE PREPARATION AND REPAIRS

A. Metal Removal:

1. Unnecessary metal items (other than stainless steel) protruding from concrete surfaces must be cut back 1 inch beyond the respective faces of concrete members by chipping out a conical crater around such items. Coated items cut back as noted herein, must be touched up by compatible touch-up compound and cured per the manufacturer’s instructions. Perform patching as described herein below with patch color matching the surrounding concrete to the greatest extent possible.
2. Unnecessary stainless steel items must be 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.

~~0.~~1. 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.

~~D.~~C. Approved Structural Repairs

1. All structural repairs, including but not limited the use of epoxy adhesives and epoxy mortars, must be made with prior approval of the Architect as to materials and without exception to procedure, using the specified epoxy adhesive and/or epoxy mortar. Where epoxy injection procedures are necessary, an approved low viscosity epoxy made by manufacturers previously specified this Section must be used.

~~E.~~D. Non-Structural Repairs

1. Repairing Surface Irregularities: Remove fins and other surface irregularities in exposed concrete surfaces while concrete is green. Grind smooth and patch with mortar if required, to make surface smooth.
2. Metal Removal

a. Unnecessary metal items (other than stainless steel) protruding from concrete surfaces must be cut back 1 inch beyond the respective faces of concrete members by chipping out a conical crater around such items. Coated items cut back as noted herein, must be touched up by compatible touch-up compound and cured per the manufacturer's instructions. Perform patching as described herein below with patch color matching the surrounding concrete to the greatest extent possible.

b. Unnecessary stainless steel items must be cut back flush with face of concrete members.

3. Repairing Defective Areas of Formed Surfaces

a. Repair and patch defective areas with cement patching mortar immediately after removal of forms, as directed by the Architect.

1) Cut out honeycomb, rock pockets, voids over 1/2-inch diameter, and holes left by tie rods and bolts, down to solid concrete but, in no case, to a depth of less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Before placing the cement patching mortar, thoroughly clean, dampen with water and brush-coat the area to be patched with an approved bonding agent. Cement patching mortar must consist of one-part Portland cement and two and one-half parts fine aggregate passing a No.16 sieve, and just enough water for handling and placing.

a) For exposed to public view surfaces, blend white Portland cement and standard Portland cement so that, when dry, the patching mortar will match the color of the surrounding concrete. Compact mortar in place and strike off slightly higher than the surrounding surface.

b) Proprietary patching compounds may be used in lieu of the cement mortar with prior approval of the Architect and when color match of the adjacent concrete is not required.

2) Follow "Repair Placing, Finishing and Curing" requirements below.

4. Repairing Defective Areas of Unformed Surfaces

a. Slabs with localized low areas and improper slopes to drains must be corrected by the use of an approved polymer patching mortar.

1) Roughen and clean hardened concrete and coat surface with bonding agent.
2) Mix approved material in strict conformance with manufacturer's instructions.
3) Apply fill to the required thickness and feather edge to blend into adjacent areas. Finish surface to match surrounding concrete.

b. Repair unformed surfaces that contain defects, which adversely affect the durability of the concrete; such objectionable conditions include, but are not limited to:
   1) Cracks
      a) Cracks which penetrate to the reinforcement or completely through concrete sections regardless of width
      b) Cracks which leak regardless of width.
      c) Cracks that are wider than the thresholds determined per Subparagraph 3.22.C below.
   2) Crazing.
   3) Spalling.
   4) Pop-outs.
   5) Honeycomb.
   6) Rock pockets.

c. Repairs: The following repairs must be used unless an alternative repair procedure is approved by the Architect:
   a) Crack Repairs: Route a "v" groove in cracks at support slabs and slabs on grade, 1/2-inch wide at the top and 1/2 inch deep. Caulk with sealant specified in Section 07 92 00.
   b) Repairs Other than Cracks: Use approved polymer patching mortar to repair crazing, spalling, pop-outs, honeycomb, rock pockets and other objectionable surface conditions. Follow manufacturer’s written instructions for surface preparation, mixing, conditions of application and placing.
   c) Follow “Repair Placing, Finishing and Curing” requirements below.

5. Repair Placing, Finishing and Curing

a. Perform patching and repairs in compliance with ACI 301 requirements.

b. Apply patching material as follows and in accordance with manufacturer's recommendations.

   1) Saturate the surface dry with water so that it maintains a dark gray color one half hour before placing.

   2) The finished patch must be cured for at least forty-eight hours. Keep damp with water or coat with a water-based curing and sealing compound conforming to ASTM C1315 as recommended by the polymer repair mortar manufacturer.

   3) In hot weather, the surface must be kept cool by shading. Use cold liquid for mixing. Work material rapidly since heat accelerates set. Cure immediately. In cold weather, do not make repair if temperature is expected to fall below freezing within 48 hours of placing. The patches must be kept at a minimum of 60 degrees F. for seventy-two hours for proper curing

c. Finish all patches and repairs to match the texture of adjoining surfaces.

d. Cure all patching and repairs in accordance with manufacturer's recommendations. No vehicular traffic will be permitted on shallow depth repair areas for the first 72 hours after installation.

3.14 CONCRETE FINISHES

A. Vertical and Overhead Surface Finishes:

1. Unfinished areas: Vertical and overhead concrete surfaces exposed in pipe basements, elevator and dumbwaiter shafts, pipe spaces, pipe trenches, above suspended ceilings, manholes, and other unfinished areas will not require additional finishing.

2. Interior and exterior exposed areas to be painted: Remove fins, burrs and similar projections on surfaces flush, and smooth by mechanical means approved by the 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. . Patch "bugholes" larger than 1/2 inch in diameter. Clusters of

"bugholes" with clear spacing of 1/2 inch or less must be considered as a single "bughole" with perimeter defined as a polygon composed of tangents to extreme periphery of the outer "bugholes" in each such cluster.

3. Interior and exterior exposed areas finished: Give a grout finish of uniform color and smooth finish treated as follows:
   a. After concrete has hardened and laitance, fins and burrs removed, scrub concrete with wire brushes. Clean stained concrete surfaces by use of a hone stone.
   b. Apply grout composed of one part of Portland cement, one part fine sand, smaller than a 600 µm (No. 30) sieve. Work grout into surface of concrete with cork floats or fiber brushes until all pits, and honeycombs are filled.
   c. After grout has hardened slightly, but while still plastic, scrape grout off with a sponge rubber float and, about 1 hour later, rub concrete vigorously with burlap to remove any excess grout remaining on surfaces.
   d. In hot, dry weather use a fog spray to keep grout wet during setting period. Complete finish of area in same day. Make limits of finished areas at natural breaks in wall surface. Leave no grout on concrete surface overnight.
4. Textured: Finish as specified. Maximum quantity of patched area 0.2 m2 (2 square feet) in each 93 m2 (1000 square feet) of textured surface.

B. Slab Finishes:
1. Monitoring and Adjustment: Provide continuous cycle of placement, measurement, evaluation and adjustment of procedures to produce slabs within specified tolerances. Monitor elevations of structural steel in key locations before and after concrete placement to establish typical deflection patterns for the structural steel. Determine elevations of cast-in-place slab soffits prior to removal of shores. Provide information to the COR and floor consultant for evaluation and recommendations for subsequent placements.
2. Set perimeter forms to serve as screed using either optical or laser instruments. For slabs on grade, wet screeds may be used to establish initial grade during strike-off, unless the 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 must 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 must 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 must 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 the COR from sample panel.
11. Tolerances:
    a. For slabs-on-grade, slabs and toppings, comply with ACI 117 Section 4.8.6 and table under 4.8.6.1 with classification “flat”.
    b. Embedded items: Unless noted otherwise on Drawings, tolerances must be as follows:
        1) Anchor Bolts:
            a) Adjacent anchor bolts in a group receiving a single fabricated setting piece: ±1/8".
            b) Location and alignment of anchor bolt group from designated location and alignment: ±1/4".
        2) Embedded Plates and Weldments:
            a) Location:
                - Vertical face ±1" vertical, ±2" horizontal
                - Horizontal surface ±¼” vertical, ±1” horizontal
            b) Plumb and Alignment: 1/4" in 12".
12. Measurements

a. For verification of parking structure slabs-on-grade and topping tolerances, follow ACI 117 Paragraph 4.8.6. Testing per ACI 117 may be done just prior to application of sealer on swept and washed surfaces.

b. Department of Veterans Affairs retained testing laboratory will take measurements as directed by the COR, to verify compliance with tolerances and other finish requirements. Measurements will occur within 72 hours after completion of concrete placement (weekends and holidays excluded).

13. Acceptance/ Rejection:

a. If individual slab section measures less than either of specified minimum local FF/FL numbers, that section will be rejected and remedial measures will be required. Sectional boundaries may be set at construction and contraction (control) joints, and not smaller than one-half bay.

b. If composite value of entire slab installation, combination of all local results, measures less than either of specified overall FF/FL numbers, then whole slab will be rejected and remedial measures will 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 the COR, until a slab finish constructed within specified tolerances is accepted.

3.15 SURFACE TREATMENTS:

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

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

C. Non-Slip Finish: Except where safety nosing and tread coverings are shown, apply non-slip abrasive aggregate to treads and platforms of concrete steps and stairs, and to surfaces of exterior concrete ramps and platforms. Broadcast aggregate uniformly over concrete surface at rate of application of 8 percent per 1/10th m2 (7.5 percent per square foot) of area. Trowel concrete surface to smooth dense finish. After

curing, rub treated surface with abrasive brick and water to slightly expose abrasive aggregate.

3.16 APPLIED TOPPING

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

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

3.17 <NOT USED>

3.18 RETAINING WALLS

A. Use air-entrained concrete.

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

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

D. Place porous backfill as shown.

3.19 PRECAST CONCRETE ITEMS

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

3.20 MISCELLANEOUS CONCRETE-RELATED WORK

A. General: Subsequent Attachments to Cast-in-Place Concrete Work: Any attachments made to completed cast-in-place concrete Work in the field must comply with approvals by the Architect to avoid cutting or otherwise damaging the reinforcing steel.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersection, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations, as shown on the Drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of the manufacturer furnishing the machines and equipment.

3.21 FIELD QUALITY CONTROL

A. General

1. Construction Monitoring

a. During progress of the work of this Section, Contractor must monitor construction activities and coordinate all inspection activities required by the Contract Documents to ensure compliance with specified parameters.

1) Comparison with Approved Mock-Ups: Remove and replace work not complying with criteria established at approved mock-ups.

b. The Government reserves the right to additionally sample and test materials being used for the work of this Section.

B. Identified Deficiencies and Review of Proposed Remedial Work: Where Project inspections and/or testing indicate deficiencies in the Work, or non-compliance with this Section and/or the System manufacturer's specifications, the subject Work will be considered defective. For defective work:

1. Contractor must prepare recommendations for additional or remedial work to compensate for deficiencies. Submit all recommendations to the COR, Architect and Geotechnical Engineer (Testing Agency) for review.

2. Once submitted recommendations have been reviewed and found acceptable by the COR, Architect, and Geotechnical Engineer (Testing Agency), proceed with additional or remedial work as required to compensate for deficiencies.

3. Additional testing and inspecting, at Contractor's expense, must be performed to determine compliance of replaced or additional work with specified requirements.
4. Proceed with subsequent construction only after inspection reports are issued and installations comply with requirements.

C. Independent Inspection, Testing, and Test Area Repairs:
1. The Testing Agency must monitor the work of this Section for compliance with project Contract Documents and the approved Submittals.
2. Special Inspections and Tests: Perform all testing and inspections indicated for Concrete Construction in the "Special Inspection and Tests" section of the Building Code and as additionally required by the Authorities Having Jurisdiction. Comply with Section 01 45 35 requirements.
3. Other Inspections and Tests: Perform the following inspections and testing additionally if not otherwise included in Special Inspections and Tests requirements above:
   a. Comply with Section 01 45 29 requirements and as additionally required to ensure compliance with the Contract Documents.
4. Reporting on the Work: Produce reports and digital photographs documenting each inspection and indicate whether subject work complies with or deviates from requirements.
   a. Indicate ambient and substrate surface temperatures, relative humidity and dew point, wind velocity and precipitation during installation.
   b. Reports must be distributed on the same day test/observations are made to COR, Contractor, Installer (as applicable), and Architect.
      1) Comply with Daily Report requirements indicated in Section 01 45 29.
5. Test Area Repairs: Repair materials removed from test area(s) by installing new approved materials by following the same procedures used originally (verify with Contractor). Ensure that original substrates meet requirements of new materials manufacturer(s) and that new materials have sufficient contact with original materials

to allow completed installation to meet or exceed specified requirements.

3.22 CRITERIA FOR EVALUATION AND ACCEPTANCE

A. General

1. COR and Architect must be notified, upon discovery, of any defects in the Cast-in-Place Concrete Work.
2. Evaluation and acceptance of the Cast-in-Place Concrete work will be based upon compliance with the Contract Documents as determined by the Architect. The following categories must be used:
   a. Concrete Quality (as reported by the Testing Agency).
   b. Dimensional Tolerances (includes location of the Work as determined by Field Engineering).
   c. Finishes (includes Aesthetics).
   d. Durability
3. When it is determined that remedial action is required by the Contractor, refer to FIELD QUALITY CONTROL Article above.

B. Criteria for evaluation and acceptance of the Cast-in-Place Concrete work must be in accordance the following: Subject to COR concurrence, the following requirements apply to the work of this Section:

1. ACI 301 Section 1.7 (Acceptance of Structure) except as follows:
   a. Paragraph 1.7.3 (*Finishes*):
      1) Paragraph 1.7.3.1: Add "as modified by the Contract Documents" after "5.3.3" reference. (Note: ACI 301 section 5.3.3 is modified herein by Article 3.7 - FINISH OF FORMED SURFACES above.)
      2) Add Paragraph 1.7.3.2: "Where Smooth Rubbed Finish is specified or otherwise required by the Contract Documents (e.g. Architectural Cast-in-Place Concrete), Architect must determine if texture and color of exposed concrete surfaces matches the approved mock-up satisfactorily."
   b. Paragraph 1.7.5 (*Durability*):
      1) Replace paragraph 1.7.5.1 (c) with the following deficiency statement: "Concrete not conforming to the required entrained air content for concrete (per an approved Mix Design) and/or

the most restrictive durability requirements of 4.2.2.7, ACI 362.1R or the Contract Documents."

2. Additional Requirements for Evaluation of Defects for Structural Repairs:
   a. Unless determined to be unavoidable by the Contractor due to structural stability concerns, no repairs or patching shall be made to the Concrete Work without a determination by the Architect as to whether or not said defect is subject to structural repair requirements. Where the Contractor elects to do repairs for structural stability purposes, the post-repair state of the work will become the defective condition to be reviewed per this Section.
   b. The extent of defective conditions must be documented by a Contractor's Field Survey (see Submittals Paragraph above).
   c. If the Architect determines that a structural defect repair is not required, such determination shall be accompanied by a determination as to the nature of defect repairs required to meet durability and aesthetic requirements.

C. Additional Requirements for Evaluation of Defects for Repairs Related to Durability and/or Aesthetics:
   1. All defects, structural or non-structural, are subject to Architect review for durability and impact to aesthetics.
      a. After the completion of all concrete work, and within one month prior to the scheduled completion of the Project, the Architect will conduct an inspection of all concrete slabs exposed as wearing surfaces. At no cost to the Government, the Contractor must repair all cracks and other unacceptable conditions identified by this inspection in a manner acceptable to the Architect.
   2. Evaluation of concrete cracks and determination of proposed concrete crack repair methods must be per ACI 224.1R and as amended below:
      a. Architect will determine the threshold for acceptable crack widths based on location exposure to deleterious conditions and the impact to aesthetics.
         1) Where the Architect determines a crack to be acceptable (no repair required) in an area that is other than a conditioned

interior space, the area must be treated with a concrete sealer meeting the requirements of Section 07 19 11 to render the crack hydrophobic.

2) If the Architect determines that proposed repairs will have, or if implemented repairs do have, an unacceptable impact to aesthetics, additional finishing shall be required to meet the Design Intent.

3) If the Architect suspects that a concrete crack will be susceptible to leaking, the Contractor must perform water testing that is acceptable to the Architect.

3.23 SUBSEQUENT WORK

A. Where the work of this Section is an integral part of the building superstructure or a fundamental support thereof (i.e., substructure), proceed with installation of subsequent Work only after all required Quality Control Submittals for this Section have been accepted by the Architect.

3.24 CLEANING

A. In accordance with these Specifications, all concrete surfaces must be free of laitance, deleterious substances, metallic projections, concrete paste droppings and/projections rendering surfaces unacceptable to the Architect.

B. Concrete surfaces to receive subsequent coatings or sealants must be free of debris, thoroughly cleaned, and in a general condition acceptable to the coating or sealant manufacturer to receive a product specified elsewhere in these Specifications.

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SECTION 03 31 24.16
CONCRETE REPAIR USING HIGH STRENGTH, FAST-SETTING MATERIALS

PART 1 - GENERAL

1.1 SUMMARY

A. The extent of work included in this Section is shown on the Drawings and is specified as follows:

1. Work consists of the removal of existing delaminated concrete and the installation of a fast-setting, high-strength concrete at locations to be re-opened to traffic the following morning or designated by the Architect. Materials in this specification may also be appropriate when the scope of concrete work is limited and it is not practical to use ready-mixed concrete.

PART 2 - PRODUCTS

2.1 MATERIALS

A. The fast-setting concrete repairs must achieve a compressive strength of 3,500 psi or safely accept vehicular traffic within 3 hours of placement.

B. The concrete must resist freeze/thaw damage and scaling in compliance with ASTM Test Procedures C-666 and C-672. The products approved under this Section are as follows:

1. "MasterEmaco T 1060" as manufactured by BASF Building Systems (www.buildingsystems.basf.com).
2. "SikaQuick 1000" as manufactured by Sika Corporation (www.sikausa.com).
3. Or approved equal.

Note: Products related to those above with extended working times may be acceptable at the discretion of the Architect.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

A. The exact location of spalled concrete to be repaired will be determined in the field by tapping of slab with a sounding rod, chain

drag or hammer. An outline of the area to be repaired will be marked with chalk.

B. The areas of the spalled concrete to be removed will be outlined by making a sawcut around the perimeter of the spalled area. The nominal depth of sawcut must be 1/2 inch. Do not, under any circumstances, cut existing reinforcing bars or post-tensioning strands.

C. All loose unsound concrete must be removed with pneumatic or electric jack hammer weighing no more than 15 lbs. may be used for removing concrete around mild steel reinforcement. Where unsound concrete is below reinforcement, removal to 3/4 inch below reinforcement is required.

D. All deteriorated reinforcing steel bars which have lost more than 20% (or more) of their cross-sectional areas or selected by the Architect must be replaced. New reinforcing steel bars must be furnished and placed in accordance with Section 03 20 00 of the technical specifications and under the directions of the Architect.

E. The deck surface must be blown clean with compressed air to assure that all loose or hollow concrete is removed. The reinforcing steel must be sand blasted to remove all rust.

3.2 PLACING, FINISHING AND CURING

A. Place and properly mixed concrete into the prepared area from one side to the other. Do not place concrete in lifts. Work the material firmly into the bottom and sides of the patch to assure good bond. Do not re-temper or finish material after initial set.

B. For maximum performance and minimal shrinkage, wet curing must be performed for a minimum of 3 hours followed by the application of an approved curing compound.

3.3 METHOD OF MEASUREMENT

A. This work will be measured for payment in square feet. The quantity of repair area will be computed from areas marked by the Contractor and approved by the Architect.

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SECTION 03 37 15.11
CONCRETE REPAIR USING TROWEL APPLIED MORTAR

PART 1 - GENERAL

1.1 SUMMARY

A. The extent of work included in this Section is shown on the Drawings and is specified as follows:

1. Work consists of the removal of existing unsound concrete to required depth and the installation of a trowel applied, fast-setting cement repair material at locations indicated on drawings and/or at other locations designated by the Architect.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. The fast-setting polymer repair mortar must achieve a compressive strength of 5,000 psi in 28 days. The products approved under this Section are as follows:

1. "MasterEmaco S488 CI", as manufactured by BASF Building Systems (www.buildingsystems.basf.com).
2. "SikaRepair 224" as manufactured by Sika Corporation (www.sikausa.com).
3. Or approved equal.

PART 3 - EXECUTION

3.1 SURFACE PREPARATIONS:

A. All loose and unsound concrete must be removed with small chipping hammers. Remove concrete a minimum of 3/4" beyond the reinforcing steel.

B. The surface must be blown clean with compressed air to assure that all loose and hollow concrete is removed. The reinforcing steel must be sandblasted to remove all rust.

3.2 PLACING, FINISHING AND CURING (Trowel Applied Mortar):

A. Apply patching material as follows and in accordance with manufacturer’s recommendations.

B. Saturate the surface with water and allow to dry so that there is no standing water and the surface maintains a dark gray color one half hour before placing.

C. Scratch a base coat firmly into the dampened surface and apply the balance of the patch before base coat is allowed to dry. Consolidate the mortar for density. For deep patches, add recommended filler and apply the material in lifts, allowing it to stiffen enough between lifts to support its own weight. For repairs over 4 inches deep, steel ties must be provided to aid in weight support. Maximum filler addition to be 1 part filler to 2 parts by volume. The surface must be troweled and brushed to match surrounding concrete.

D. The finished patch must be cured for at least forty-eight hours. Keep damp with water or coat with a water-based curing and sealing compound conforming to ASTM C1315 as recommended by the polymer repair mortar manufacturer.

E. In hot weather, the surface must be kept cool by shading. Use cold liquid for mixing. Work material rapidly since heat accelerates set. Cure immediately. In cold weather, do not make repair if temperature is expected to fall below freezing within 48 hours of placing. The patches must be kept at a minimum of 60 degrees F. for seventy-two hours for proper curing.

3.3 TESTING:

A. The patched areas must be sounded with a chain drag and/or hammer after 7 days after concrete placement; any hollowness detected must be corrected by the Contractor by removing and replacing the patch at no extra cost to the Owner.

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SECTION 03 37 16.16
CONCRETE REPAIR USING FORM AND PUMP MATERIALS

PART 1 – GENERAL

1.1 SUMMARY

A. The extent of work included in this Section is shown on the Drawings and is specified as follows:

1. Work consists of the removal of existing unsound concrete to required depth and the installation of a prepackaged pump and pour repair material at locations indicated on drawings and/or at other locations designated by the Architect.

PART 2 – PRODUCTS

2.1 MATERIALS:

A. The pump and pour repair material must achieve a minimum compressive strength of 5,000 psi in 28 days. The products approved under this section are as follows:

1. "MasterEmaco S477 CI, MasterEmaco S440 and S440 CI" as manufactured by BASF Building Systems (www.buildingsystems.basf.com).
2. "Sikacrete 211 SCC Plus or SikaTop 111 Plus" as manufactured by Sika Corporation (www.sikausa.com).
3. "FormFlo P-38 or FormFlo P-51" as manufactured by J.E. Tomes & Associates (www.jetomes.com).

PART 3 – EXECUTION

3.1 SURFACE PREPARATIONS:

A. Saw cut the perimeter of the repair area to a nominal depth of 1/2". Take precautions in areas likely to contain top reinforcing not to cut any reinforcing steel or post-tensioning strands.

B. All loose and unsound concrete must be removed with small chipping hammers to provide a minimum ¼" substrate profile. Remove concrete a minimum of 3/4" beyond the reinforcing steel.

C. The surface must be blown clean with compressed air to assure that all loose and hollow concrete is removed. The reinforcing steel must be

sandblasted to remove all rust. All measures must be taken to prevent flash rusting from occurring to the reinforcing steel.

D. Forms must be watertight. Apply a suitable form release to the forms.

3.2 PLACING, FINISHING, AND CURING:

A. Apply repair material as follows and in accordance with manufacturer's recommendations.

B. Mix the repair material according to manufacturer's recommendations. Follow the manufacturer's guidelines for extending the repair mortar by adding aggregate if required.

C. Saturate the surface with water and allow to dry so that there is no standing water and the surface maintains a dark gray color one half hour before placing.

D. Vibrate form while pumping repair material using a variable pressure pump. Do not overpump so that the forms deflect.

E. Cure the repaired area as recommended by the repair mortar manufacturer.

3.3 TESTING:

A. The patched areas must be sounded with a hammer after 7 days after concrete placement; any hollowness detected must be corrected by the Contractor by removing and replacing the patch at no extra cost to the Owner. The Contractor must provide access, at their expense, for the Architect to sound all repaired areas.

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SECTION 03 41 33
PRECAST STRUCTURAL PRETENSIONED CONCRETE

PART 1 – GENERAL

1.1 DESCRIPTION

A. This section specifies precast prestressed concrete construction including design not shown, fabrication, erection, and other related items including bearing pads and anchorage.

B. The extent of work included in this Section is shown on the Drawings and is specified as follows:

1. Complete Structural Precast Concrete System ("SPCS" or "System") including, but not limited to the following:
   a. Component Types: The following structural precast concrete component types are applicable to this Project:
      1) Long-span double tee units.
      2) Structural framing units including columns, beams and girders.
      3) Exterior spandrels, wall panels, and perimeter columns with Architectural precast finish.
      4) Stairs and solid slab/plank units.
      5) Hollow-Core Slab/Plank Units
      6) Loadbearing "light-wall" or "stitch-wall" units and solid shear wall units.
      7) Walls including fire walls (fire-rated assemblies) and stair walls.
2. Providing System engineering and design for complete structural precast concrete system and any temporary shoring and/or bracing to be used.
3. Providing all labor, material, equipment, accessories, related services, and supervision required for the manufacture and erection of the structural precast and precast, prestressed concrete work of this Section, complete and functional.
4. Providing the services of a qualified technical representative to provide Manufacturer representation on site to ensure installation quality.
5. Providing field engineering services to verify as-built conditions.

1.2 RELATED SECTIONS

A. Section 01 45 00, QUALITY CONTROL: General requirements pertaining to Project Quality Control.

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

C. Section 01 45 35, SPECIAL INSPECTIONS: General requirements pertaining to Special Inspections by the Contractor's Testing Agency.

D. Section 03 30 00, CAST-IN-PLACE CONCRETE: concrete mix requirements and installing connection anchors in concrete and structural topping.

E. Section 03 60 00 - Grouting: grout used below and between structural precast concrete components.

F. Section 05 05 19 - Post-Installed Anchors

G. Section 05 12 00 - Structural Steel: structural steel framing and for furnishing and installing connections attached to structural-steel framing.

H. Section 05 50 00 - Metal Fabrications: furnishing and installing loose hardware items.

I. Section 07 84 00 - Firestopping: joint filler materials for fire-resistance-rated construction.

J. Section 07 92 00, JOINT SEALANTS: Sealants and Caulking.

1.3 RELATED WORK

A. Attachment of System Components to Building: Should any of the component connections provided this Section require special or proprietary inserts or embeds for attachment to preceding Work, these must be furnished under this Section in a timely manner.

1.4 DESIGN REQUIREMENTS

A. Delegated Engineering Responsibility: Design the Structural Precast Concrete System (SPCS), including comprehensive engineering analysis by a qualified SPCS Design Engineer, using performance requirements and design criteria indicated and in compliance with the design intent, criteria, and requirements as indicated in the Contract Documents and all governing codes.

1. SPCS Design Engineer: Employ a Professional engineer, specializing in design of similar installations and currently licensed to

practice in the State where the Work is located, to perform design and prepare a Design Submittal per the requirements of this Section.

a. Design Submittal must be signed and sealed by the SPCS Design Engineer and submitted per the requirements of this Section.

B. General Performance: Tailor all fabrications and installations of Structural Precast Concrete for superior performance in aggressive environment and follow recommendations of Standards referenced this Section.

C. Structural Performance: Precast concrete units and connections must be designed to withstand all applicable loads required by governing codes and erection conditions. In the absence of stricter requirements, provide precast concrete units and connections capable of withstanding the following design loads within limits and under conditions indicated:

1. General

a. Design all ledges, haunches, bearing areas, and connections as recommended in the PCI Design Handbook. Haunches, dapped end bearings and connections without redundant means of load transfer are considered critical.

b. Minimum reinforcing for all precast prestressed concrete and precast reinforced concrete must be in accordance with ACI 318. Analysis of prestressed components will include a check of the shear reinforcing requirement at .1L, .2L, .25L and .3L, where L is the component length.

c. Design members exposed to weather to allow movements of components without damage, failure of joint seals, undue stress on fasteners or other detrimental effects, when subject to seasonal or cyclic day/night temperature ranges.

d. Design System to accommodate construction tolerances, clearance of intended openings and deflection of other building structural members due to thermal, creep and shrinkage.

2. Loads

a. Vehicular Impact Loads

1) See Drawings for extent of vehicle-use areas. Unless noted otherwise, structure will be utilized by passenger vehicles only.
2) All Areas Subject to Use by Passenger Vehicles: At a minimum, design Architectural Precast Concrete members and their attachments to withstand the following vehicular impact loads:
   a) Article 4.5.3 of ASCE 7-10, "Minimum loads for Buildings and other Structures".
   b) Local governing Building Code.

b. Other Loads: As indicated on the Drawings.

3. Durability
   a. Follow applicable recommendations of ACI 301, latest edition, based on the following Exposure Classes as delineated therein. This project must be considered located in following Exposure Classes:
      1) Freeze/Thaw: **F3**
      2) Sulfate Exposure: **S0**
      3) Water Contact: **W1**
      4) Corrosion Protection: **C2**
   b. Follow applicable recommendations of ACI 362.1R, latest edition, based on the following Weather Exposure Zone as delineated therein.
      1) This project must be considered located in **Weather Exposure Zone III.**
4. Maximum Allowable Deflection: Per ACI 318-14 Art. 24.2 - Deflection Due to Service Level Gravity Loads.
   a. Live-load Deflection: Design framing system and connections to maintain clearances at openings, to allow for fabrication and construction tolerances, to accommodate live-load deflection, shrinkage and creep of primary building structure, and other building movements as follows:
      1) Upward and downward movement shall not exceed L/360 for floors and L/200 for roofs, where "L" is the span center-to-center of supports.

b. Dead-load Deflection: Address by providing shop induced camber. Long-term camber shall not exceed L/480 for any precast member where "L" is the span center-to-center of supports.

c. Wind Load Deflection: 0.0025 x Floor to Floor Height.

5. Thermal Movements: System must allow for in-plane thermal movements resulting from the maximum change (range) in ambient and surface temperatures by overstressing of components, failure of connections, and other detrimental effects.

a. Attachment to Open Structure: Where cladding components are utilized, cladding system must accommodate thermal movements of superstructure and/or secondary support framing resulting from an ambient temperature differential.

b. Temperature Change: Accommodate the following:

1) Average Low-to-Mean: 56 deg F

2) Average High-to-Mean: 29 deg F

6. Seismic Design: Design and detail elements and connections to resist seismic force in accordance with code requirements and ACI 318 for the following:

a. As specified by Contract Documents.

7. Fire-Resistance Rating: Select material and minimum thicknesses to provide fire rating as indicated on the Drawings. See Quality Assurance Article this Section for additional information regarding determination of fire-resistance rating.

D. Analysis and Design by SPCS Design Engineer

1. General

a. The Project, as shown on the Drawings, including component dimensions and connections configurations, provides the requirements for the development of the design documents. Design must include consideration for customary stresses incurred in factory precasting, transporting, and erecting. The design, manufacturing, transportation and erection process must be compatible with the requirements of the Contract Documents.

1) Design Modifications: If design modifications are proposed to meet performance requirements and/or field conditions, notify the Architect and include in the Design Calculations and

Construction Drawings required per this Section. Design modifications must not affect the appearance, durability or strength of members when modifying details or materials. Maintain the general design concept when altering size of members and alignment. All proposed design modifications are subject to COR and Architect approval per the SUBMITTALS Article below.

2) Design Standards: Comply with ACI 318 and the design recommendations of PCI MNL 120, "PCI Design Handbook - Precast and Prestressed Concrete," applicable to types of structural precast concrete members indicated.

b. All precast concrete units and precast concrete structural frame must be analyzed and designed by the manufacturer to support self-weight, superimposed dead, live and impact loads, volume change and thermal loads, handling loads and lateral (including but not limited to wind and seismic) loads as required for compliance with the governing Building Code. In addition, the following will be required of the precast concrete manufacturer:

1) For precast concrete structures where stability of the structure and the structural resistance to the lateral loads in accordance with the governing Building Code is to be provided by the precast concrete components, walls, frames, braces, etc., either by themselves or in combination with other structural members, the precast concrete manufacturer must analyze the structure in accordance with the structural system identified in the Contract Documents. The manufacturer must calculate lateral loads as required by the Building Code to be used in such analysis.

2. Calculations: Provide complete structural analysis and design calculations prepared and stamped by the SPCS Design Engineer. The information in the calculations must be paginated, provided with the index page, and must include the following as a minimum:

a. Sketches of structural system(s) which have been analyzed.

b. Calculation of the required gravity and lateral loads.

c. Sketches of models analyzed (with node and member numbering per computer analysis, if used).
d. Summary of material and member properties and boundary conditions assumed.
e. Summary of individual loadings and load combinations.
f. Reactions at supports and connections due to the loading combinations considered.
g. Forces in most critical individual members due to the loading combinations considered.
h. Design calculations of representative connections and member reinforcement.

1.5 QUALITY ASSURANCE

A. Correlation of Performance Requirements: The Work of this Section is subject to the performance requirements indicated in the Contract Documents and as follows:
1. Requirements of Regulatory Agencies: The Work is subject to all applicable provisions of the Codes and Standards required by the authorities having jurisdiction.
2. Reference Standards: For the purposes of the Work of this Section, the documents listed below are applicable "reference standards". Comply with following documents, latest edition:
a. Precast, General:
1) American Concrete Institute (ACI):
a) ACI 301 "Specifications for Structural Concrete".
b) ACI 318 "Building Code Requirements for Structural Concrete".
c) Comply with durability recommendations of ACI 362.1R. "Guide for the design and Construction of Durable Concrete Parking Structures", latest edition, Chapter 6.
2) American Welding Society (AWS):
a) AWS D1.1, "Structural Welding Code - Steel".
b) AWS D1.4 "Structural Welding Code - Reinforcing Steel".
c) AWS D1.6 "Structural Welding Code - Stainless Steel".
d) AWS C5.4, "Recommended Practices for Stud Welding".
3) Concrete Reinforcing Steel Institute (CRSI):

a) CRSI "Manual of Standard Practice".

4) Precast/Prestressed Concrete Institute (PCI):

a) PCI MNL 116, Manual for Quality Control for Plants and Production of Precast Concrete Products".

b) PCI MNL 120, "PCI Design Handbook".

c) PCI MNL 127, "Erectors' Manual Standards and Guideline for the Erection of Precast Concrete".

d) PCI MNL 135, "Tolerance Manual for Precast and Prestressed Concrete Construction".

b. Any other Standards referenced form a part of this Specification to the extent referenced.

3. Manufacturer's published specifications, installation requirements, and instructions as approved by the Architect.

4. Design Requirements: Where the Contract Documents indicate specific design requirements, any performance criteria included within the design requirements will be subject to the correlation requirements of this Section.

5. Correlation and Intent of the Contract Documents: In the event of conflicts or discrepancies between the Contract Documents, the requirements of regulatory agencies, and the indicated reference standards, the most stringent requirements govern.

B. Qualifications:

1. Structural Precast Concrete System (SPCS) Design Engineer: Engineer who is legally qualified per the PERFORMANCE REQUIREMENTS of this Section and who is experienced in providing engineering services for installations of structural precast concrete systems that are similar in material, design, and extent to those indicated in the Contract Documents. Engineer must have a minimum of five (5) years of experience in designing Precast Concrete Parking Structures.

2. Manufacturer ("Precaster" or "Fabricator"): Firm having five (5) years successful experience that demonstrates capability, subject to approval by the COR, to produce and erect type of work specified. The manufacturer must have sufficient production capacity to produce required units without causing delay in work.

a. The precast concrete manufacturing plant(s) must be certified under the Prestressed Concrete Institute (PCI) Certified Plant Program. The manufacturer must be certified at the time of bidding.
   1) In lieu of above qualification, Contractor shall comply with and pay for the following requirements:
      a) Retain an independent testing or consulting firm approved by the Contracting Officer's Representative (COR).
      b) This firm must inspect precast plant at two-week intervals during production and issue a report, certified by a Professional Engineer registered in the State of the Project, verifying that materials, methods, products and quality control meet all requirements of Specifications and Drawings. When report indicates to the contrary, the COR may reject any or all products produced during period of noncompliance with above requirements.
b. Each plant utilized must be certified for the type of product produced.
c. Precast concrete manufacturer must have on staff or must retain a qualified Professional Engineer registered in the state of the project to certify precast concrete conforms in all aspects to requirements of ACI 318.
d. Manufacturer must be capable of providing field service representation during construction, approving an acceptable erector, and recommending appropriate installation methods.

3. Welders: All welders (welding "operators") must be qualified as follows:
   a. Qualify welding processes and welding operators in accordance with applicable AWS standard(s). See "Correlation of Performance Requirements" Paragraph above for additional information.
   b. Provide welding certificates indicating the operators to be employed in the work have satisfactorily passed AWS qualification tests within the previous six (6) months. If certificates are older than six (6) months, employer of operator must certify, in

writing, that operator is in compliance with applicable AWS provisions pertaining to certification validity.

c. All welders working on this project will be assigned an identifying symbol or mark. Each welder will be required to mark or stamp his symbol on each weldment completed for identification. Contractor must maintain a record of welders employed, date of qualification and symbol or identification mark assigned to each.

4. Erector: Firm having five (5) years successful experience in the erection of precast concrete units similar to units required for this project. Submit proof of current erection certification certified for complex structural systems.
   a. The erector must be qualified by the Prestressed Concrete Institute (PCI). The erector must be qualified at the time of bidding.
5. Testing Agency:
   a. Testing Agency must be experienced in the testing and installation of Structural Precast Concrete work.
   b. Testing Agency must be Qualified in accordance with Division 1 requirements as documented according to ASTM E548 and as follows:
      1) ASTM C1077, "Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation".

C. Quality-Control Standard for Fabrication: For manufacturing procedures and testing requirements and quality control recommendations for types of members required, comply with PCI MNL 116, "Manual for Quality Control for Plants and Production of Structural Concrete Products."
   1. Comply with camber and dimensional tolerances of PCI MNL 135, "Tolerance Manual for Precast and Prestressed Concrete Construction."
   2. See SOURCE QUALITY CONTROL Article in Part 2 of this Section for additional information.

D. Fire-Resistance Rated Precast Units: Where the Contract Documents indicate that precast concrete units are to meet a particular fire-resistance rating and/or where additionally required by Code,

provide architectural precast concrete units whose fire resistance satisfy the fire resistance ratings of the Contract Documents and meets the prescriptive requirements of the governing code or has been calculated according to PCI MNL 124, Design for Fire Resistance of Precast Prestressed Concrete or ACI 216.1/TMS 0216.1, Standard Method for Determining Fire Resistance of Concrete and Masonry Construction Assemblies and is acceptable to authorities having jurisdiction.

1. Calculations: Provide complete fire-resistance analysis and design calculations prepared and stamped by the SPCS Design Engineer.
   a. In lieu of calculations, documentation indicating that units have been tested and listed by U.L. in their "Fire-Resistance Directory" may be submitted. Subject units will need to be delivered with each unit bearing the corresponding U.L. label and marking.

E. Mock-Ups: Prior to installation of precast concrete units, erect field-constructed mock-ups to demonstrate aesthetic effects and set quality standards for fabrication, repairs and final cleaning. Build mock-ups to comply with the following requirements, using materials indicated for final work:

1. Locate mock-ups on site in location and of size indicated or, if not indicated, as directed by the Architect.
   a. Large Size Panels: Upon approval of small samples, and before fabrication commences on any other precast concrete work with architectural finishes, construct two large size sample panels. These identical panels must represent all typical details and be of adequate size to demonstrate the finished product (8’-0” long by full height minimum or size as mutually agreed upon by COR and Architect). Deliver the panels to the site at a location designated by the Architect. If the panels are approved by the Architect, one must remain on site and be used as a standard of quality for the architectural finishes required on the Project and one must remain at the fabrication locations to be used as reference and acceptance of fabricated units. Fabrication of the precast work shall not commence until the large size panels has been approved by the COR and Architect.

1) The approved large size panel on-site must be utilized for the repair mock-ups specified in Part 3 of this Section.

2. Repair Mock-ups: On an approved mock-up in a location acceptable to the Architect, damage part of an exposed-face surface for each finish, color, and texture, and demonstrate adequacy of repair techniques proposed for repairs of surface blemishes.
3. Notify Architect seven (7) days in advance of the dates and times when mock-ups will be installed.
4. Obtain Architect's acceptance of mock-ups before starting fabrication.
5. Approval of mockups does not constitute approval of any deviations from the Contract Documents that are contained in mockups unless Architect specifically approves such deviations in writing.
6. Retain sample panels during construction as a standard for judging completed work. Do not alter, move or destroy sample panels until work is completed.
7. Approved mockups may not remain as part of the Work.

1.6 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. All items indicated below are required submittals requiring COR review and approval.

B. Product Data: Manufacturer's data, test reports, specifications, recommendations, use limitations, and standard details for all proposed materials, products, components and accessories.

C. Mix Designs: Submit proposed concrete mix designs and appropriate test data as specified in Part 2 of this Section. Include compressive strength and water-absorption tests.

1. Submit written reports to the Architect of proposed mix for each type of concrete at least fifteen (15) days prior to start of precast unit production.

D. Design Submittal

1. Design Submittal: Submit detailed SPCS design calculations and construction drawings sealed and signed by the SPCS Design Engineer, and prepared specifically for this project.

a. Design Calculations: Provide comprehensive engineering calculations showing how all design loads and performance requirements have been met. Clearly show all resultant loads on structural members due to work of this Section. See Paragraph 1.3.D.2 above for detailed description.

b. Construction Drawings: Detail fabrication, erection, and installation of structural precast concrete members. Indicate member locations, plan views, elevations, dimensions, shapes, cross sections, openings, extent and location of each finish, connections, edge conditions, support conditions, types of reinforcement, including special reinforcement, concrete cover on reinforcement, and sequence of completing connections.

   1) Clearly indicate any proposed design modifications in accordance with the DESIGN REQUIREMENTS Article of this Section.
   2) Indicate separate face and backup mixture locations and thicknesses.
   3) Indicate welded connections by AWS standard symbols and show size, length, and type of each weld. Detail loose and cast-in hardware, lifting and erection inserts, connections, and joints.
   4) Indicate locations, tolerances and details of anchorage devices to be embedded in or attached to structure or other construction.
   5) Indicate plan views and/or elevations showing member locations with all openings 10” x 10” or larger shown and located. Where additional structural support is required for openings include header design.
   6) Coordinate and indicate openings and inserts required by other trades.
   7) Indicate location of each structural precast concrete member by same identification mark placed on unit.
   8) Indicate relationship of structural precast concrete members to adjacent materials.

9) Indicate areas receiving toppings and magnitude of topping thickness.
10) Indicate estimated cambers for structural precast concrete receiving cast-in-place topping.
11) Indicate shim sizes.
12) Indicate joints to be grouted and any critical grouting sequences.
13) Permissible Design Deviations (per Subparagraph 1.4.D.1.a.1 above):
    a) Design connections according to the conceptual details shown in the Contract Documents.
    b) Design deviations will be permitted only after COR's written approval of manufacturer's proposed design supported by complete design calculations and drawings.
    c) Design deviations must provide an installation equivalent to basic intent without incurring additional cost to the COR.

c. Erection Drawings: Use only the final Architect-approved set of Construction Drawings for the purposes of erecting Structural Precast Concrete.
d. Timeliness: Design Submittal must be transmitted to the Architect at least three (3) weeks prior to the commencement of member fabrication.

E. Samples:
1. Design Reference Samples: Submit three (3) sets of samples approximately 12 inches x 12 inches x 2 inches to illustrate the quality, color, and texture of the surface finish for the Architectural Finish precast units; exterior spandrels, wall panels and perimeter columns.
   a. When back face of precast concrete unit is to be exposed, show samples of the workmanship, color, and texture of the concrete.
   b. Two (2) of the approved samples for each specified finish must be returned to the General Contractor for record purposes and distribution to the Precaster.

F. Quality Control Submittals

1. Qualification Data: For firms and/or persons specified in the QUALITY ASSURANCE Article of this Section; data must demonstrate their capabilities and experience.
2. Certifications: Provide certifications indicating compliance with the QUALITY ASSURANCE Article of this Section.
3. Coordination Shop Drawings: Drawings must be sufficient to indicate coordination with adjacent work. See Project Conditions Paragraph below for additional information.
   a. Provide proposed handling/erection procedures, sequence of erection, and bracing plans.
4. Welding Procedure and Equipment
   a. Provide written description as required to illustrate each welding procedure to be performed in the specified work (for procedures not prequalified by AWS only).
   b. Include detailed surface preparation requirements.
   c. Provide descriptive data for field welding equipment, including type, voltage and amperage.
5. Certified Test Reports: Provide test reports by a qualified testing agency indicating that each product complies with performance requirements of this Section. Prepare test reports in accordance with reporting procedure described in applicable test standards.
   a. Testing for Material Properties: For each listed product, test reports indicating compliance with requirements indicated:
      1) Cementitious materials.
      2) Concrete aggregates.
      3) Reinforcing materials and prestressing tendons.
      4) Admixtures.
      5) Bearing pads.
      6) Structural-steel shapes and hollow structural sections.
6. Field Engineering Data, Reports, and As-Built Location Surveys
   a. Surveyors Reports
      1) Submit reports during the construction of the Work that the critical locations and elevations of the Work are in accordance with the Contract Documents. Modification,

correction, or approval required for deviations exceeding tolerances.

2) Include plan drawings of each supported level of the superstructure indicating as-built drainage slopes and ideal drain locations.

3) Submit reports immediately after construction of each supported level of the Work. Mislocated or out-of-tolerance construction must be reconciled or corrected as directed by Architect before such construction is covered or built upon.

7. Field Surveys of Defective Work: Submit to the Architect for information a graphic representation of the location and extent of any defective work for the purposes of evaluation.

a. Closeout Submittals: Upon completion of the work of this Section and prior to final payment, submit the following:

1) Manufacturer's Project Acceptance Documents: Documents must include the following:

a) Final "Field Observation Report" from the SPCS Manufacturer representative indicating that no outstanding action items are known. Refer to FIELD QUALITY CONTROL ARTICLE in Part 3 of this Section for general reporting requirements.

b) SPCS Design Engineer's Inspection Reports: Upon completion of the Work, the engineer responsible for the design of the work in this Section must inspect the work for compliance with design requirements. Provide reports of each site visit until completed Work is in full compliance with the design.

2) SPCS Certification: After the completion of the project, the SPCS Design Engineer must inspect all the precast framing and connections in the field and submit a letter certifying that all members and connections have been observed and the as-built conditions are in full compliance with the approved shop drawings and calculations.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery and Handling:

1. Lift and support precast concrete members during manufacturing, stockpiling, transporting and erection operations only at lifting or supporting points, or both, as shown on contract and shop drawings, and with approved lifting devices. Lifting devices must have a minimum safety factor of 4. Exterior lifting hardware must have a minimum safety factor of 5.
2. Transportation, site handling, and erection must be performed with acceptable equipment and methods, and by qualified personnel.

B. Storage:

1. Store all units off ground.
2. Place stored units so that identification marks are discernible.
3. Separate stacked members by battens across full width of each bearing point.
4. Stack so that lifting devices are accessible and undamaged.
5. Do not use upper members of stacked tier as storage area for shorter member or heavy equipment.

1.8 APPLICABLE PUBLICATIONS

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

B. ASTM International (ASTM):

A36/A36M-19.....Standard Specification for Carbon Structural Steel

A123/A123M-17.....Standard Specifications for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

A153/A153M-16a.....Standard Specifications for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

A307-14e1.....Standard Specifications for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength

A416/A416M-18.....Standard Specification for Low-relation, Seven-Wire Steel Strand for Prestressed Concrete

A615/A615M-20.....Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement

A706/A706M-16.....Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement

A767/A767M-19.....Standard Specification for Zinc Coated (Galvanized) Steel Bars for Concrete Reinforcement

A775/A775M-19.....Standard Specification for Epoxy Coated Steel Reinforcing Bars

A1064/A1064M-18a.....Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete

C33/C33M-18.....Standard Specification for Concrete Aggregates

C88/C88M-18.....Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate

C150/C150M-20.....Standard Specification for Portland Cement

C260/C260M-10a(2016)....Standard Specification for Air Entraining Admixtures for Concrete

C330/C330M-17a.....Standard Specification for Lightweight Aggregates for Structural Concrete

C494/C494M-19.....Standard Specification for Chemical Admixtures for Concrete

F3125/F3125M-19e1.....Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120ksi (830MPa) and 150ksi (1040MPa) Minimum Tensile Strength, Inch and Meter Dimensions

C. American Concrete Institute (ACI):

117-10.....Standard Specifications for Tolerances for Concrete Construction and Materials

318/318R-19.....Building Code Requirements for Structural Concrete and Commentary

D. Prestressed Concrete Institute (PCI):

MNL-116-99.....Manual for Quality Control for Plants and Production of Precast Concrete Products Fourth Edition

MNL-127-99.....Erector's Manual: Standards and Guidelines for the Erection of Precast Concrete Products

E. American Welding Society (AWS):

D1.1/D1.1M-20.....Structural Welding Code - Steel

D1.4-18.....Structural Welding Code - Steel Reinforcing Bars

1.9 PROJECT CONDITIONS

A. Verify dimensions of supporting structures at the Project site and adjust final Shop Drawings to reflect actual field dimensions.

B. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction without delaying the Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

1.10 COORDINATION

A. The Contractor is responsible for notifying the Architect and Manufacturer of any proposed loads and/or attachments to precast components that have not been included in the Design Submittal.

1. The Contractor is responsible for determining all construction loads including materials storage, support of shoring and staging, vehicles, personnel, environmental loads on incomplete structure, and others, as required. The Contractor's means and methods of construction must recognize and consider these loads and effects during the construction period.

B. Contractor to provide Architect-approved anchors and supports for the accommodation of cladding, interior finishes, equipment, mechanical ductwork, piping and electrical conduit/line supports, etc. as required to complete the Project. Where post-installed anchors are used, comply with Section 05 05 19.

1.11 CONTRACTOR'S QUALITY CONTROL SYSTEM

A. General:

1. In accordance with Division 1 requirements, the Contractor must establish a Quality Control System for the work of this Section.

2. The Contractor's Quality Control System is the means used by the Contractor to become assured that the construction complies with the requirements of the Contract Documents (including, but not limited

to, materials, workmanship, construction, finish, and functional performance) to the satisfaction of the COR, Architect, and authorities having jurisdiction. The Contractor must establish a system of quality control for the Work that includes sufficient inspection and testing of all items of Work, including that of the Contractor's subcontractors.

B. Contractor's Quality Control System must include, but not be limited to, the following:
   1. General: Review of existing conditions, substrate conditions, requirements of related work, installation instructions, storage and handling procedures, and protection measures.
   2. Comprehensive Independent Testing Agency Services: Contractor is responsible for providing any independent inspection and testing above and beyond the minimum requirements indicated in the Contract Documents, as may be necessary to ensure compliance thereto.
      a. Contractor's testing agency's qualifications must meet or exceed the requirements of this Section and Division 1.
   3. Field Engineering: The Contractor to provide the following field engineering services for the work of this Section:
      a. Verify as-built finished slab elevations of Structural Precast Concrete prior to locating floor drains and placement of cast-in-place concrete toppings.
         1) Identify all elevations that are out of tolerance per the requirements of this Section relative to the approved Delegated Design submittals.
         2) Identify all drainage slopes and locations of low points for the purposes of final drain placement.
      b. See Division 1 for additional Field Engineering requirements.
   4. Quality-Control-Related Scheduling and Coordination: Include, not by way of limitation, the following:
      a. Scheduling and Convening of Contractor's Quality Control Conferences: Contractor to schedule and conduct conferences for the purposes of coordinating quality control for the Project.
         1) The Architect, responsible Engineer, and the COR must be invited to attend the conference at their election and must be

notified by the Contractor at least fifteen (15) working days prior to the scheduled date of the conference. Unless it is confirmed that the Architect/Engineer will NOT be attending the meeting, all conferences are to be scheduled in conjunction with the scheduled site visits being performed by the Architect or as approved by the Architect.

2) Record minutes of each conference and distribute in typed or printed form to each party in attendance within five (5) working days of the meeting. One copy of these minutes must also be transmitted to the COR and the Architect for information.

3) Contractor's conference schedule must include, not by way of limitation, the conferences indicated below.

b. Coordination with the authorities having jurisdiction to obtain the necessary approvals for the work of this Section.

C. Pre-Construction Conference: Conference to review Project requirements including all related Quality Control requirements, prior to commencement of the applicable portion of the Work.

1. The Contractor must require responsible representatives of each party concerned with that portion of the work to attend the conference, including but not limited to the following:

a. Contractor's Superintendent and Project Manager

b. Materials supplier(s) or Fabricator.

c. Installation Subcontractor(s).

d. MEP/FP Subcontractors if work requires interfaces thereto.

e. Agency responsible for Contractor-furnished testing (as applicable).

f. Testing Agency.

2. Contractor must have a copy of all approved Shop Drawings and Submittals applicable to the Work present at the Pre-Construction Conference.

D. Quality Control Records: Contractor must maintain accurate records of all inspections and tests performed, instructions received from the Architect, responsible Engineer or TESTING AGENCY, and actions taken as a result of those instructions. These records must include evidence

that the required inspections or tests have been performed (including type and number of inspections or tests, nature of defects, causes for rejection, etc.), proposed or directed remedial action, and corrective action taken. At the request of the COR or the Architect, allow access to records pertaining to Contractor's quality control activities.

E. See FIELD QUALITY CONTROL Article in Part 3 of this Section for additional Quality Control requirements.

1.12 INDEPENDENT TESTING AGENCY SERVICES

A. General: Comply with Division 1 requirements for all testing and/or inspections applicable to this Section.

B. The Contractor must employ and pay for the services of an Independent Inspection and Testing Agency (indicated herein as "Testing Agency" or "TESTING AGENCY") to perform the inspections, tests and other services outlined in the Contract Documents. Services must be performed in accordance with requirements of governing authorities and with specified standards.

C. Quality Control Tests and Inspections During Construction: See "Field Quality Control" Article in Part 3 of this Section.

PART 2 – PRODUCTS

2.1 FORMWORK MATERIALS

A. Rigid, dimensionally stable, non-absorptive material, warp and buckle free, that will provide continuous and true precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required finish surfaces.

2.2 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A615, Grade 60 deformed, unless otherwise indicated.

1. Reinforcement to be welded must conform to ASTM A706 Grade 60 deformed.

B. Steel Wire: ASTM A82, plain, cold-drawn, steel.

C. Welded Wire Fabric: ASTM A185.

D. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing, complying with CRSI recommendations and PCI MNL 116.

E. Coated Reinforcement

1. Epoxy Coating: ASTM A775. Fusion bonded coating, apply after fabrication and bending. Film thickness of coating after curing to be 7 to 12 mils, when measured in accordance with Method G12.
2. Epoxy Patching Compound: ASTM A775.
3. Locations:
   a. For all precast concrete work, provide epoxy coated reinforcing as indicated on the Drawings and as defined below:
      1) All reinforcement extending from precast concrete components into the cast-in-place concrete topping.
      2) All reinforcement placed into grouted joints between precast concrete plank units, if those joints are subject to elements or vehicular traffic.
      3) Support steel for all epoxy coated reinforcing steel.

2.3 PRESTRESSING TENDONS

A. Uncoated, 7-wire stress-relieved strand complying with ASTM A416. Use Grade 250 or Grade 270 as necessary to meet or exceed design requirements.

B. Strand similar to above, but having size and ultimate strength of wires increased so that ultimate strength of the strand is increased approximately fifteen (15) percent, or strand with increased strength but with fewer number of wires per strand, may be used at manufacturer's option.

2.4 CONCRETE MATERIALS

A. Cementitious Materials

1. General
   a. Use only one brand and type of any cementitious constituent throughout the project, unless otherwise acceptable to the Architect.
   b. Uniformity of cured concrete appearance resulting from the concrete mix and its constituents, manufacturing or handling practices in the manufacturer’s responsibility.
2. Portland Cement: ASTM C150, Type I or Type III.
3. Fly Ash: ASTM C618, Class C or F.

4. Ground Granulated Blast Furnace Slag (GGBFS): ASTM C989, Grade 100 or higher.
5. Proportion Limits: For limiting provisions on binary and ternary mixes, refer to Concrete Mix Design Schedule indicated on the Drawings.

B. Aggregates: Except as modified by PCI MNL 116, ASTM C 33, as specified this Section. Provide and stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for entire Project.
   1. Aggregates, General: It is the responsibility of the precast manufacturer to select the appropriate sizes and weathering classifications of aggregates used depending on type of member and placement location. Weathering classifications of aggregates used must comply with durability requirements for climate severity and in-service location of concrete (see Paragraph 1.3.C.3.b of this Section).
   2. Face-Mixture Coarse Aggregates: Selected, hard, and durable; free of material that reacts with cement or causes staining; to match selected finish sample.
   3. Face-Mixture Fine Aggregates: Selected, natural or manufactured sand of a material compatible with coarse aggregate to match selected finish sample.

C. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 116.

D. Air Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and to not contain calcium chloride, or more than 0.15 percent chloride ions or other salts by weight of admixture.
   1. Water-Reducing Admixture: ASTM C 494, Type A, or other Type approved for manufacturer's units.
   2. Plasticizing Admixture for Flowable Concrete: ASTM C 1017.

3. Corrosion Inhibiting Admixture: ASTM C 1582. Refer to Section 03 30 00 of these specifications for non-corrosive, non-chloride accelerator and corrosion inhibiting admixture respectively.

2.5 CONNECTION MATERIALS

A. Carbon Steel Shapes and Plates: ASTM A36: All connection plates, bars and shapes must be hot dip galvanized in accordance with ASTM A123 or A153 as applicable, except where stainless steel is specifically required per the Contract Documents.

B. Stainless Steel Shapes and Plates: ASTM A666, AISI Type 304, Grade A or B where indicated and as follows:
   1. Column splices within 2’-0” height above any floor level only.
   2. Plates, angles and clips for hollow core planks.

C. Double-Tee Flange Connections: Plates and bars; stainless steel per ASTM A666, Type 304, Type 201L or Type 201LN.

D. Anchor Bolts: ASTM A307, low-carbon steel bolts, regular hexagon nuts and carbon steel washers.
   1. Galvanized: Provide ASTM F1554, Grade 36, hot-dip zinc coated, with ASTM A563A heavy hex nuts and carbon steel washers, hot-dip galvanized ASTM A153.

E. Carbon-Steel Headed Studs: ASTM A 108, Grades 1010 through 1020, cold finished, AWS D1.1, Type A or B, with arc shields and with the minimum mechanical properties of PCI MNL 116, Table 3.2.3.

F. Carbon-Steel Plate: ASTM A 283, Grade C.

G. Malleable Iron Castings: ASTM A 47. Grade 32510 or 35028.

H. Carbon-Steel Castings: ASTM A 27, Grade 60-30 (Grade 415-205).

I. High-Strength, Low-Alloy Structural Steel: ASTM A 572.

J. Carbon-Steel Structural Tubing: ASTM A 500, Grade B or C.

K. Wrought Carbon-Steel Bars: ASTM A 675, Grade 65.

L. Deformed-Steel Wire or Bar Anchors: ASTM A 496 or ASTM A 706.

M. Threaded Fasteners: ASTM A307 or A325 heavy hexagon structural bolts, heavy hexagon nuts and washers.
   1. Galvanized: ASTM A307, with ASTM A563 heavy hex nuts and carbon steel washers, hot-dip galvanized ASTM A153.

N. Bolts at column splices: For anchoring columns within a 2’-0” height above a respective floor level, stainless steel anchor bolts conforming

to ASTM F593, Group A, Type 304 must be used together with corresponding stainless steel nuts and washers. For column splices outside of the 2'-0" zone above any floor level, comply with Paragraph 2.5.B.1 above.

O. Zinc-Coated Finish: For all steel items for exterior exposure (unless specifically noted otherwise) and items indicated for galvanizing, apply zinc coating by hot-dip process according to ASTM A 123 after fabrication, or ASTM A 153 as applicable (electrodeposition according to ASTM B 633, SC 3, Type 1).
   1. For steel shapes, plates, and tubing to be galvanized, limit silicon content of steel to less than 0.03 percent or to between 0.15 and 0.25 percent or limit sum of silicon content and 2.5 times phosphorous content to 0.09 percent. Zinc coating must be field ground off at weld areas prior to welding.
   2. Zinc rich coating or "Cold Galvanizing" compound, for touch up of hot-dip galvanized components and coating of welded areas requiring corrosion protection. Minimum 95% by weight of dry film of "ultra-pure" zinc dust per ASTM D520 Type III. Provide a minimum dry film thickness of 8 mils.

P. Bearing Pads: Provide bearing pads for precast concrete units as indicated on Drawings.
   1. Elastomeric Pads: AASHTO M 251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size or cut from a molded sheet, 50 to 60 Shore A durometer according to ASTM D 2240, minimum tensile strength 2250 psi per ASTM D 412.
   2. Frictionless Pads: Tetrafluoroethylene (TFE), with glass fiber reinforcing as required for service load bearing stress.
   3. Random Oriented Fiber Reinforced: Must support compressive stress of 3,000 psi with no cracking, splitting or delaminating in internal portions of the pad. One specimen must be tested for every 100 pads used.
   4. Cotton Duck Layer Reinforced: Elastomeric pads with closely spaced layers of fabric meeting AASHTO specification section 18.10.2.

5. Plastic: Multi-monomer plastic strips must be non-leaching and support construction loads with no visible overall expansion. Limit to plank bearing only.
6. Tempered or Untempered Hardboard: Limit use to plank bearing only. Do not use in areas where bearing material in service may remain wet for extended periods of time.

Q. Welding Electrodes: Comply with AWS standards.

R. Caulking and Sealants: Specified under Section 07 92 00 - Joint Sealants, unless noted otherwise.

1. For joint filler materials for fire-resistance-rated construction, refer to Section 07 84 00 - Firestopping.

S. Accessories: Provide clips, hangers, and other accessories required for installation of project units and for support of subsequent construction or finishes.

2.6 GROUT MATERIALS

A. Non-metallic, Shrinkage-Resistant Grout: See Section 03 60 00.

2.7 PROPORTIONING AND DESIGN OF MIXES

A. Prepare design mixes for each type of precast/prestressed concrete required in conformance with the requirements of Section 03 30 00 - Cast-in-Place Concrete.

1. Design mixes may be prepared by independent testing facility or by qualified precast manufacturing plant personnel, at precast manufacturer's option.

B. Produce standard weight concrete consisting of specified Portland cement, permissible cementitious constituents, aggregates, admixtures, and water to produce the following minimum properties:

1. General:
   a. Release strength for all prestressed units must be 3,500 psi.
   b. Cure compression test cylinders using same methods as used for cast-in-place concrete work, and as required by the Section 01 45 29 of these Specifications.
2. Pre-Topped:
   a. 28-Day Compressive Strength (psi): 6,000

b. w/cm. (max):0.38 where "w/cm" refers to water-to-cementitious-materials ratio, where "cm" must include weight of all cementitious materials.

c. Air Entrainment: 6%±1.5%

3. Field Topped:

a. 28-Day Compressive Strength (psi): 5,000

1) Release strength for all prestressed units must be 3,500 psi.

b. w/cm. (max):0.40 where "w/cm" refers to water-to-cementitious-materials ratio, where "cm" must include weight of all cementitious materials.

c. Air Entrainment: 6%±1.5%

C. Submit written reports to Architect of proposed mix for each type of concrete at least fifteen (15) days prior to start of precast unit production. Do not begin concrete production until mixes and evaluations have been reviewed by Architect.

1. Submit results of testing of proposed mixes for water soluble chloride ion content for all precast concrete component subject to weather, vehicular traffic and pedestrian traffic, where chloride ion transfer to concrete via pedestrians' footwear is likely.

D. Adjustment to Concrete Mixes: Mix design adjustments may be requested when characteristics of materials, job conditions, weather, test results, or other circumstances warrant. Laboratory test data for revised mix designs and strength results must be submitted to and accepted by Architect before using in the work.

E. Admixtures:

1. Air-entraining admixture in concrete subject to freeze-thaw cycle and moisture in service must be used in quantities to result in air content limits indicated under Paragraph 2.7.B of this Section herein above.

2. Use water-reducing admixtures in strict compliance with manufacturer's directions. Admixtures to increase cement dispersion, or provide increased workability for low-slump concrete, may be used subject to Architect's acceptance.

3. Use amounts as recommended by admixture manufacturer for climatic conditions prevailing at time of placing. Adjust quantities of admixtures as required to maintain quality control.

2.8 FORMWORK FABRICATION

A. General

1. Accurately construct forms, mortar-tight, of sufficient strength to withstand pressures due to concrete placing operations, vibration operations, temperature changes, and when prestressed, pretensioning and/or detensioning operations.
2. Maintain formwork to provide completed precast concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified in PCI MNL 116.

B. Maintain forms to provide completed structural precast concrete members of shapes, lines, and dimensions indicated, within fabrication tolerances specified.

1. Edge and Corner Treatment: Match existing.
2. Architectural Finish Areas: Form joints are not permitted on faces exposed to view in the finished work.

2.9 FABRICATION

A. General:

1. Plant fabricate all precast concrete units and using a rigid factory-inspected production process.
   a. Comply with manufacturing and testing procedures, and quality control recommendations of PCI MNL-116, and as specified for types of units required and position tolerances for cast-in items.
   b. Comply with the SOURCE QUALITY CONTROL Article below.
2. Long Span Units (Double-Tees): Provide block-outs for openings in accordance with design drawings and precast unit manufacturer's recommendations.
3. Provide "Standard Finish" or “Architectural Finish” units as specified in FINISHES Article of this Section.
   a. Units must be free of voids or honeycomb.
   b. Units must have straight true edges and surfaces.

B. Cast-in Anchorages, Inserts, Plates, Angles, and Other Anchorage Hardware:
   1. General:
      a. Include cast-in weld plates where required for anchorage or lateral bracing to other supporting members.
      b. Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements.
      c. Coordinate with other trades for the installation of items to be cast-in precast concrete structural framing units.
   2. Accurately position built-in anchorage devices and secure to formwork to ensure sufficient anchorage and embedment to comply with design requirements. Locate anchorages where they do not affect position of main reinforcement or placing of concrete. Do not relocate bearing plates in units unless acceptable to Architect.
   3. Weld headed studs and deformed bar anchors used for anchorage according to AWS D1.1 and AWS C5.4, "Recommended Practices for Stud Welding."
   4. Lifting devices must be placed and cast so as not to weaken the unit during manufacturing, handling and erection. Such devices must not interfere with the erection or placing of the unit in its final position in the building. Provide hot-dip galvanized or stainless steel devices as required to meet the patching and visual requirements in Part 3 of this Section.
      a. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing structural precast concrete members to supporting and adjacent construction.
C. Cast-in reglets, slots, and other accessories in structural precast concrete members as indicated on Contract Drawings.
D. Cast-in Holes for openings larger than 10" diameter or 10" square in accordance with final shop drawings. Provide sleeves for horizontal electrical conduit runs and plumbing lines as required. [Holes in precast flanges and other small holes that will be field drilled or cut by trades requiring them will not be allowed without prior approval by

the Architect/Engineer and the Precast Concrete Manufacturer. See Part 3 of this Section for additional information.

E. Coat Surfaces of forms with bond-breaking compound before reinforcement is placed. Provide commercial formulation form-coating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces requiring bond or adhesion. Apply in compliance with manufacturer's instructions.

F. Reinforcement: Reinforce structural precast concrete members to resist handling, transportation, and erection stresses, and specified in-place loads, whichever governs. Comply with recommendations in PCI MNL 116 for fabricating, placing, and supporting reinforcement.

1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete. When damage to epoxy coated reinforcing exceeds limits specified in ASTM A 775, repair with patching material compatible with coating material and epoxy coat bar ends after cutting.
2. Accurately position, support, and secure reinforcement against displacement during concrete placement and consolidation operations. Locate and support reinforcement by metal or plastic chairs, runners, bolsters, spacers, hangers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 116.
3. Place reinforcing steel and prestressing strands to obtain at least the minimum cover for concrete protection per ACI 318. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
4. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh spacing and wire tie laps, where required by design. Offset laps of adjoining widths to prevent continuous laps in either direction.

G. Prestress strands for structural precast concrete members by either pretensioning or post- tensioning methods. Pre-tensioning of tendons

for prestressed concrete may be accomplished either by single strand tensioning method or multiple-strand tensioning method. Comply with PCI MNL-116 requirements.

1. Delay de-tensioning of prestressed units until concrete has attained at least 3500 psi or higher as required by design.
2. If concrete has been heat-cured, perform de-tensioning while concrete is still warm and moist to avoid dimensional changes which may cause cracking or undesirable stresses in concrete.
3. De-tensioning of pre-tensioned tendons may be accomplished either by gradual release of tensioning jacks or by heat cutting tendons, using a sequence and pattern to prevent shock or unbalanced loading.
4. Final Disposition of member Ends: Protect strand ends and anchorage exposed to severe environments with epoxy resin bonding agent.

H. Ready-Mix Concrete: Comply with requirements of ASTM C94 and requirements in this Section for measuring, mixing, transporting, and placing concrete.

1. Delete references for allowing additional water to be added to batch for material with insufficient slump. Addition of water to batch will not be permitted.
2. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C94 may be required when the air temperature is between 85 deg. F and 90 deg F, reduce mixing and delivery time from 1-1/2 hour to 75 minutes and when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

I. Place face mixture to a minimum thickness after consolidation of the greater of 1 inch or 1.5 times the nominal maximum aggregate size, but not less than the minimum reinforcing cover as indicated on Contract Drawings.

1. Use a single design mixture for those members in which more than one major face (edge) is exposed.
2. Where only one face of unit is exposed and at the Fabricator’s option either of the following mixture design/casting techniques may be used:

a. A single design mixture throughout the entire thickness of member.

b. Design mixtures for facing and backup; using cement and aggregates for each type as appropriate, for consecutive placement in the form. Use cement and aggregate specified for facing mixture. Use cement and aggregate for backup mixture complying with specified criteria or as selected by the Fabricator.

J. Place concrete in a continuous operation to prevent formation of seams or planes of weakness in precast units, complying with requirements of ACI 304R. Thoroughly consolidate placed concrete by internal and external vibration without dislocation or damage to reinforcement and built-in items.

1. Place backup concrete to ensure bond with face-mixture concrete.

K. Thoroughly consolidate placed concrete by vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing or entrapped air on surfaces. Use equipment and procedures complying with PCI MNL 116.

1. Place self-consolidating concrete without vibration in accordance with PCI TR-6 "Interim Guidelines for the Use of Self-Consolidating Concrete."

L. Comply with PCI MNL 116 procedures for hot and cold-weather concrete placement.

M. Curing:

1. Cure concrete, according to requirements in PCI MNL 116, by low-pressure steam, steam vapor, radiant heat and moisture, or other similar process to accelerate concrete hardening and to reduce curing time. Cure members until compressive strength is high enough to ensure that stripping does not have an effect on performance or appearance of final product.

2. Delay de-tensioning of prestressed units until concrete has attained at least 3500 psi or higher as required by design.

3. If concrete has been heat-cured, perform de-tensioning while concrete is still warm and moist to avoid dimensional changes which may cause cracking or undesirable stresses in concrete.

N. De-tensioning of pre-tensioned tendons may be accomplished either by gradual release of tensioning jacks or by heat cutting tendons, using a sequence and pattern to prevent shock or unbalanced loading.

O. Identify pickup points of structural precast concrete members and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark the Mark Number and I.D. Number on each precast concrete member on a surface that will not show in finished structure.

2.10 FABRICATION TOLERANCES

A. Fabricate structural precast concrete units of shapes, lines and dimensions indicated, so each finished unit complies with PCI MNL 116 product tolerances, tolerances as specified for types of units required, and position tolerances for cast-in items.

2.11 FINISHES

A. General

1. Finish exposed-to-view architectural finish surfaces of precast concrete members to be uniform in color and appearance.
2. Cure member under similar conditions to develop required concrete quality, and minimized appearance blemishes including non-uniformity, staining, or surface cracking.
3. Patching where required, must be accomplished by skilled craftsmen in such a manner that the structural adequacy is maintained and the appearance and durability are not impaired.

B. Finish of Unformed Surfaces: Apply trowel finish to unformed surfaces unless otherwise indicated. Consolidate concrete, bring to proper level with straightedge, float and trowel to a smooth uniform finish. No surfaces exposed to freeze-thaw cycles in service shall be finished with power equipment, unless evidence acceptable to the Architect/Engineer presented by the manufacturer that such a finishing does not reduce the amount of air entrainment in the top 1/8” of precast concrete.

1. Provide a broom finish on tees parallel with the long direction of the unit or swirl finish as approved by the Architect.
2. Provide an intentionally roughened surface (1/4” amplitude) on tees and beams to receive a concrete topping, where indicated on Drawings

and where required or determined by the Precaster for erection/construction.

C. Finish of Formed Surfaces: Provide finishes for formed surfaces of precast concrete as indicated for each type of unit, and as follows:
   1. Standard Finish: Tees, Beams, Girders and Interior Columns - Normal plant run finish produced in forms that impart a smooth finish to concrete. Small surface holes caused by air bubbles, normal form joint marks, and minor chips and spalls will be tolerated, but no major or unsightly imperfections, honeycomb, or structural defects will be permitted.
   2. Architectural Finish: See Architectural Finish Paragraph below.

D. Architectural Finish: For all exterior precast concrete surfaces exposed to view in finished structure (including but not limited to perimeter columns, wall panels and exterior spandrels), architectural finishes must conform to the following:
   1. General:
      a. Use cement(s) of same type, brand, and mill source throughout the precast concrete production.
      b. Precast concrete units must be uniform in appearance, color and texture to match sample panels prepared by the Precaster and approved by the COR and the Architect.
   2. Preparation: Prior to fabrication of Design Reference Samples required by this Section, Control Area(s) of approximately sixteen (16) square feet of existing building finishes will be selected by the Architect for the purposes of matching colors and surface textures. Controls area(s) must be cleaned via pressurized water-spray and/or other methods acceptable to the COR and the Architect to remove soiling.
   3. Color of Units: Match existing colors.
      a. Provide an architectural mix (blend color aggregate with white and gray cement) with colored admixture as required to match control area(s) as approved by the COR and the Architect.
      b. Other colors are as follows:

1) Standard gray Portland cement may be used for non-exposed backup concrete and interior face(s) of spandrel and wall panels.

4. Surface Finish of Units: Match existing finishes.

2.12 PRECAST BOLLARDS

A. Type: Plant fabricated, precast concrete units, produced under rigid, factory-inspected process.

B. Finish: Provide finish as indicated in the Drawings.

C. Fabrication:

1. Furnish units, which are free of voids or honeycomb, with straight true edges and surfaces.
2. Minimum reinforcement is shown in the Drawings. Adequately reinforce units to resist transporting and handling stresses.
3. All precast bollard exposed surfaces are for light sandblasting to expose aggregate Units must be treated with water repellant sealer in strict accordance with manufacturer’s specifications.

2.13 SOURCE QUALITY CONTROL

A. General: The following requirements supplement the Quality Control requirements of Division 1:

1. Manufacturer must maintain a rigorous quality control program at each manufacturing plant utilized for this Project. Test and inspect precast concrete and keep records related thereto according to the Quality Control provisions of PCI MNL 116. If using self-consolidating concrete also test and inspect according to PCI TR-6 “Interim Guidelines for the Use of Self-Consolidating Concrete” and ASTM C 1611, ASTM C 1712, ASTM C 1610, and ASTM C 1621.
2. The Government may employ a separate testing laboratory to evaluate precast manufacturer's quality control and testing methods.
   a. At the request of the COR, allow access to records pertaining to production quality control activities.
   b. The precast manufacturer must allow Government's Testing Agency access to materials storage areas, concrete production equipment and concrete placement and curing facilities. Cooperate with Government's Testing Agency and provide samples of materials and

concrete mixes as may be requested for additional testing and evaluation.

B. Dimensional Tolerances: Units having dimensions smaller or greater than required, and outside specified tolerance limits of MNL 116, will be subject to additional testing as herein specified.
   1. Precast units having dimensions greater than required will be rejected if appearance or function of the structure is adversely affected, or if larger dimensions interfere with other construction. Repair, or remove and replace rejected units as required to meet construction conditions.
   2. Precast units having dimensions smaller than required will be rejected unless directed otherwise by the Architect.

C. Strength of Units:
   1. The strength of precast concrete units will be considered potentially deficient if the manufacturing processes fail to comply with any of the requirements which may affect the strength of the precast units, including the following conditions.
      a. Failure to meet compressive strength tests requirements.
      b. Reinforcement, and pretensioning and detensioning of tendons of prestressed concrete, not conforming to specified fabrication requirements.
      c. Concrete curing, and protection of precast units against extremes in temperature, not as specified.
      d. Precast units damaged during handling and erection.

D. Testing Precast Units: When there is evidence that strength of precast concrete units does not meet specification requirements, the concrete testing service must take cores drilled from hardened concrete for compressive strength determination, complying with ASTM C42 and as follows.
   1. Take at least three representative cores from precast units of suspect strength, from locations directed by Architect.
   2. Test cores in a saturated surface dry condition per ACI 318 if concrete will be wet during use of completed structure.
   3. Test cores in an air-dry condition per ACI 318 if concrete will be dry during use of completed structure.

4. Strength of concrete for each series of cores will be considered satisfactory if their average compressive strength is at least 85 percent of 28-day design compressive strength.
5. Test results will be made in writing on same day that tests are made, with copies to Architect, Contractor, and precast manufacturer. Include in test reports the project identification name and number, date, name of precast concrete manufacturer, name of concrete testing service, identification letter, name, and type of member or members represented by core tests, design compressive strength compression breaking strength and type of break (corrected for length-diameter ratio), direction of applied load to core with respect to horizontal plan of concrete as placed, and moisture condition of core at time of bearing.

E. Patching: Where core test results are satisfactory and precast units are acceptable for use in work, fill core holes solid with patching mortar, and finish to match adjacent concrete surfaces.

F. Defective Work: Precast concrete units which do not conform to specified requirements, including strength, tolerances, and finishes, must be replaced with precast concrete units that meet requirements of this section. Contractor must also be responsible for cost of corrections to other work affected by or resulting from corrections to precast concrete work.

PART 3 - EXECUTION

3.1 PREPARATION

A. Deliver anchorage devices for structural precast concrete members that are embedded in or attached to the building structural frame or foundation before start of such work. Provide locations, setting diagrams, and templates for the proper installation of each anchorage device.

3.2 EXAMINATION

A. Examine supporting structure or foundation and conditions for compliance with requirements for installation tolerances, true and level bearing surfaces, and other conditions affecting performance.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION, GENERAL

A. Temporary Shoring and Bracing: Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads during erection. All columns to be braced in all directions prior to erecting other members. Remove temporary members and connections when permanent members are in place and final connections are made. Provide temporary guy lines to achieve proper alignment of structures as erection proceeds.

B. Close coordination and cooperation must be maintained between the General Contractor and the Precast Concrete Fabricator to overcome any physical obstructions in the area of the work which would prevent suitable access for trucks and cranes in the delivery, receipt and placing of the precast material.

C. Any attachments made to the precast units in the field must be accepted by the Precast Concrete Fabricator as well as the COR to avoid cutting or otherwise damaging the prestressing tendons or reinforcing steel.

D. If field cut openings are required by the Contractor, the Contractor must coordinate with the Precast Concrete Fabricator. Locations and sizes must be approved by the COR.

3.4 PLANK (SLAB) INSTALLATION

A. Install slabs in accordance with manufacturer's instructions.

B. Before erection of slabs, clean bearing surfaces free from dirt, mortar particles, and trash.

C. Erect slabs to prevent chipping and cracking and to provide a level deck surface.

1. Stagger end joints
2. Locate end joints on centerline of support, where applicable.
3. After erection, fill joints on upper side of flat slabs with Portland cement grout.
4. Install rebar into joints prior to grouting, where applicable.
5. Finish grout joint flush.

D. Erect steel-edged tongue and groove plank so that planks have one structural support.

1. Form tight and closed joints at sides and ends of slabs.
2. Clip slabs to structural support.

3. Welded connections, when required by the Contract Documents, should be done as late in the erection process as possible to permit as much shrinkage and creep deformation in the plank concrete to take place.

E. Do not make cutouts without approval of COR and Architect.
1. Form openings or carefully saw cut; do not punch openings.
2. Locate openings less than 6-inches wide in sections of plank between reinforcing bars.
3. Frame openings larger than 6-inches wide with structural steel headers.

3.5 ERECTION

A. Site Access: Provide suitable access to building, proper drainage, and firm, level bearing for hauling and erection equipment to operate under their own power.

B. Preparation:
1. Provide true, level surfaces on field placed bearing walls and other field placed supporting members.
2. Place and accurate align anchor bolts, plates or dowels in column footings, grade beams and other field placed support members.
3. Shoring required for composite beams and slab must have a minimum load factor of 1.5 times (dead load plus construction loads).

C. Installation: Installation of precast prestressed concrete must be performed by the Fabricator or a competent erector in accordance with PCI MNL-127. Lift members with suitable lifting devices at points provided by manufacturer. Temporary shoring and bracing, when necessary, must comply with manufacturer's recommendations.

D. Alignment: Align and level precast members as required by the approved shop drawings. Level out variations between adjacent members by jacking, loading, or any other feasible method as recommended by the manufacturer and acceptable to COR. Individual pieces are considered plumb, level, and aligned if the error does not exceed 1:500 excluding structural deformation caused by loads.

E. Install loose clips, hangers, bearing pads, and other accessories required for connecting structural precast concrete members to supporting members and backup materials.

1. Install flexible bearing pads where indicated, as precast units are being erected. Set pads on level, uniform bearing surfaces and maintain in correct position until precast units are placed.

F. Erect structural precast concrete level, plumb and square within the specified allowable erection tolerances. Provide temporary structural framing, supports and bracing as required to maintain position, stability, and alignment of members until permanent connections are completed.

1. Install temporary steel or plastic spacing shims or bearing pads as precast concrete members are being erected. Tack weld steel shims to each other to prevent shims from separating.
2. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
3. Remove projecting lifting devices and use sand-cement grout to fill voids within recessed lifting devices flush with surface of adjacent precast concrete surfaces when recess is exposed.
4. Provide and install headers of cast-in-place concrete or structural-steel shapes for openings larger than one slab width according to hollow-core slab fabricator’s written recommendations.

G. Connect structural precast concrete members in position by bolting, welding, grouting, or as otherwise indicated on approved Shop (Erection) Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and/or grouting are completed.

1. Disruption of roof flashing continuity by connections is not permitted; concealment within roof insulation is acceptable.

H. Welded Construction: Comply with AWS “Structural Welding Code” for procedures, appearance and quality of welds, and methods used in correcting welding work.

1. Protect units and bearing pads from damage by field welding or cutting operations and provide non-combustible shield as required.
2. Where connection surfaces to be welded are zinc coated (galvanized), strictly follow any special procedures included in the approved welding procedure Submittal.
   a. In all instances of coating removal/repair on shop galvanized surfaces, any required surface preparation prior to welding

and/or coating application as well the application of the repair coating must be witnessed by the Testing Agency per Section 01 45 29 of these Specifications.

I. Bolted Construction: At bolted connections, use tack welding or other approved means to prevent loosening of nuts after final adjustment.
   1. Unless indicated otherwise, all bolts to be installed to a snug-tight condition in accordance with AISC at a minimum.
   2. For connections utilizing high-strength bolts and slip critical connections verify bolt position and tightness at installation. For sliding connections, properly secure bolt but allow bolt to move within connection slot. For slip critical connection, apply specified bolt torque and check 25 percent of bolts at random by calibrated torque wrench. If inadequate bolt torque is found, test all bolts.

J. Powder-Actuated Fasteners: Do not use powder-actuated fasteners for surface attachment of accessory items in precast, prestressed units unless otherwise accepted by precast manufacturer.

K. Grouting or Dry-Packing Connections and Joints: Grout open spaces and provide reinforcing material at keyways, connections and joints where required or indicated on approved Construction (Erection) Drawings. Use only Architect-approved materials. After precast concrete units have been placed and secured, grout open spaces at connections and joints as follows:
   1. Provide forms or other acceptable method to retain grout in place until sufficiently hard to support itself. Fill joints completely without seepage to other surfaces. Alternatively, pack spaces with stiff dry pack grout material, tamping until voids are completely filled.
   2. Place grout and finish smooth, level, and plumb with adjacent concrete surfaces.
   3. Promptly remove grout material from exposed surfaces before it affects finishes or hardens.
   4. Keep grouted joints damp for at least 24 hours after initial set.

5. At ends of hollow core slabs and at all slab openings (where shown on the Drawings), provide suitable end cap or dam in formed (or extruded) void spaces.

L. Grouting of Lifting Device Locations: Lifting devices must be protected from rusting, or other deterioration or damage by a minimum of 1.5" of approved patching material unless lifting devices are hot-dip galvanized (uncut) or stainless steel. Under no circumstances shall patching material coverage of anchor be less than ½" (no devices shall be visible in the completed work). Unless noted otherwise, fill voids within recessed lifting devices flush with surface of adjacent concrete surfaces.

M. Field cutting or coring of structural precast concrete members is not permitted without approval of the Architect/Structural Engineer of Record.

3.6 FIELD WELDING

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

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

3.7 ERECTION TOLERANCES

A. Install precast units without exceeding tolerance limits specified in PCI MNL-135 "Tolerance Manual for Precast and Prestressed Concrete Construction" and PCI MNL-127 "Recommended Practice for Erection for Erection of Precast Concrete" or PCI MNL-120 Chapter 8.

3.8 CONDITION OF SURFACES RECEIVING WORK OF OTHER TRADES (IF APPLICABLE)

A. Examination

1. Immediately following completion of all precast concrete erection and detailing and prior to observation of the precast concrete components by the Testing Agency, review precast concrete surfaces to receive Work of other trades, including but not limited to cast-in-place concrete toppings, waterproofing, spray-on insulation, and expansion joints, obtain General Contractor's and/or the respective Subcontractor's acceptance of surfaces receiving work of other trades.

2. Due to the construction activities inherent in the fabrication and erection of structural precast concrete structures, precast concrete substrates to receive Work of other trades will have been subjected to construction activities for an extended duration. Prior to commencement of Work over surfaces of precast concrete components so designated, Contractor must examine substrates, for compliance with requirements for cleanliness, surface roughness and other conditions affecting performance of work. Report all deviations from the Contract Documents to the Architect in writing.
   a. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Locations for Cast-in-Place Concrete Topping (if applicable)
   1. Additional surface roughening should not be required if the finish requirements of this Section are met. See Section 03 30 00 for additional cleaning requirements and other preparations required for concrete bonding substrates. Follow "SSD Only" method for final surface preparation an accordance with ACI recommendations.
   2. Refer to Section 03 30 00 of these Specifications for cast-in-place concrete topping requirements.

3.9 PRECAST BOLLARD INSTALLATION

A. Units must be installed on a clean level surface. General Contractor must coordinate finishing of cast-in-place topping areas under bollards as necessary to accommodate detailing indicated on the Drawings and/or the approved Submittals.

B. Units must be set plumb using adhesive as indicated on the Drawings or as otherwise approved by the Architect.

3.10 FIELD QUALITY CONTROL

A. General
   1. Comparison with Approved Mock-Up: Remove and replace work not complying with criteria established at approved mock-up.
   2. Construction Monitoring:
      a. During progress of the Structural Precast Concrete work, Contractor must make visual inspections as necessary and coordinate the other inspection activities as indicated this Section to ensure compliance with specified parameters.

b. Contractor must arrange with the manufacturer to have the services of a manufacturer's field representative at the Project site. Not by way of limitation, the manufacturer's field representative must review the substrate conditions and provide Manufacturer representation on site to ensure installation quality.

c. Refer to Part 2 of this Section for Quality Control related to Structural Precast Concrete component fabrication.

3. The Government may employ a separate testing laboratory to evaluate Contractor's Quality Control System and the field work of this Section.

B. Identified Deficiencies and Review of Proposed Remedial Work: Where Project inspections and/or testing indicate deficiencies in the Work, or non-compliance with this Section and/or the System manufacturer's specifications, the subject Work will be considered defective. For defective work:

1. Contractor must prepare recommendations for additional or remedial work to compensate for deficiencies. Submit all recommendations to the Architect and SPCS Design Engineer for review.
2. Once submitted recommendations have been reviewed and found acceptable by the Architect, proceed with additional or remedial work as required to compensate for deficiencies.
3. Additional testing and inspecting, at Contractor's expense, must be performed to determine compliance of replaced or additional work with specified requirements.
4. At no additional cost to the Government, the Contracting Officer's representative and the Architect reserve the right to require the services of a SPCS Design Engineer, employed by the Manufacturer, at the Project site. Not by way of limitation, the SPCS Design Engineer evaluate must review identified deficiencies in the Work and any subsequent remedial work.

C. Manufacturer's Field Services

1. A qualified technical representative of the Manufacturer must, at a minimum, provide the following:

a. Technical assistance and guidance for installation of the work of this Section.
b. Periodic monitoring of the Work to ensure installation is proceeding in accordance with Manufacturer's designs, recommendations, instructions, and warranty requirements.
c. Field Observation Reports: Representative must submit written reports of each visit indicating observations, findings, and conclusions of inspection. Send reports to the Contractor, Architect and COR. At a minimum, reports must indicate:
   1) Non-complying conditions and locations.
   2) Proposed repair methods for non-complying conditions.
   3) Successful and unsuccessful repair of non-complying conditions noted in previous inspection reports.
   4) Final certification(s).

2. At no additional cost to the Government, the COR and the Architect reserve the right to require the services of a SPCS Design Engineer, employed by the Manufacturer, at the Project site. Not by way of limitation, the SPCS Design Engineer evaluate must review identified deficiencies in the Work and any subsequent remedial work.

D. Independent Inspection:
1. General: Testing Agency must monitor the work of this Section for compliance with project Contract Documents and the approved Submittals.
2. Special Inspections and Tests: Perform all testing and inspections indicated for Concrete Construction and Steel Construction (relating to steel embedments and welded steel connections) in the "Required Special Inspections and Tests" section of the Building Code, as required by the Contract Documents, and as additionally required by the Authorities Having Jurisdiction. Comply with Section 01 45 35 requirements.
3. Other Inspections and Tests: Perform the following inspections and testing additionally if not otherwise included in Special Inspections and Tests requirements above:
   a. Comply with Section 01 45 29 requirements and as additionally required to ensure compliance with the Contract Documents.

4. Reporting on the Work: Produce reports and digital photographs documenting each inspection and indicate whether subject work complies with or deviates from requirements.
   a. Reports must be distributed in timely manner to Owner, Contractor, Manufacturer, and Architect.
      1) Comply with Section Division 1 requirements.

3.11 REPAIRS

A. General:
   1. If repairs are required for any precast concrete member after casting, the Contractor must submit a description of the repair (E.G. crack, spall, etc.) and a detailed description of the proposed fix to be used for Architect's review.
   2. SPCS Engineer direction and/or approval must be obtained for all repairs to structural precast concrete.
   3. Production chips, cracks, and spalls must be repaired at the manufacturer's plant prior to delivery.
   4. For repairs implemented on-site, the Contractor must provide additional measures as necessary to maintain stability of structural precast concrete system during repair work.
   5. Repairs will be acceptable if, in the opinion of the Architect, they do not impair structural adequacy, serviceability and durability of units and/or appearance of any structural precast concrete work.
      a. Obtain Architect's approval of all repairs prior to final joint sealing and cleaning.
   6. Structural precast concrete units that are broken, cracked or chipped must be repaired and/or replaced, as directed by the Architect/Engineer.
   7. Remove and replace damaged structural precast concrete units that cannot be repaired.
   8. See Section 03 30 00 for patching material and bonding agent requirements.

B. Finish Repairs:
   1. Mix patching materials and repair units so that when dry, cured patches blend with color, texture, and uniformity of adjacent

exposed surfaces and show no apparent line of demarcation between original and repaired work.

2. Patch lifting pockets, inserts and other openings with patching mortar blended to match the color of the surrounding concrete. See ERECTION Article above for minimum concrete cover requirements over cut steel lifting devices.
3. Locations of Architectural Finishes: For locations having approved sample panels on-site, each type of repair will be subject to mock-up approval.
   a. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 ft.
   b. Mock-Up: Upon acceptance by the Architect of the Contractor's repair procedure, a single repair must be made to the approved large size panel on-site for Architect review in accordance with the accepted procedure and, upon acceptance, this repair must be maintained as a standard of acceptance for all future repairs of this type.

C. Structural Repairs:
   1. As directed by the Architect/Engineer, it will be acceptable to repair cracks in structural members with low viscosity epoxy, pressure injected or route a "V" groove over cracks and caulk with sealant. See Section 03 30 00 and Section 07 92 00 for materials.

D. Connections:
   1. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A 780.

3.12 PROTECTION AND CLEANING

A. After erection and grouting is completed, be responsible for the protection of slabs and wall panels.

B. Clean mortar, plaster, fireproofing, weld slag, and any other deleterious material from concrete surfaces and adjacent materials immediately.

C. Clean exposed surfaces of precast concrete units after erection and completion of connections to remove weld marks, other markings, dirt, and stains.
   1. Perform cleaning procedures, if necessary, according to Precast Concrete Fabricator's recommendations. Protect other work from staining or damage due to cleaning operations.
   2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

D. Remove rubbish and debris resulting from precast concrete work from premises upon completion.

E. Protect work of this Section from fabrication to the completion of installation.

3.13 INSPECTION AND ACCEPTANCE

A. Final inspection and acceptance of erected precast prestressed concrete must be made by COR to verify conformance with Drawings and Specifications.

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SECTION 03 60 00
GROUTING

PART 1 – GENERAL

1.1 SUMMARY

A. The extent of work included in this Section is specified as follows:
   1. Grouting below and between Structural Precast Concrete components, as indicated in the Contract Documents, and as required by Project conditions.
   2. Grouting below Structural Steel components, at Structural Steel interface joints, as indicated in the Contract Documents, and as required by Project conditions.

1.2 SUBMITTALS

A. Product Data: Manufacturer's data, test reports, specifications, recommendations, and use limitations for all proposed products. Data must also include the following:
   1. Manufacturer’s instructions for installation and curing.

1.3 QUALITY ASSURANCE

A. Correlation of Performance Requirements: The Work of this Section is subject to the performance requirements indicated in the Contract Documents and as follows:
   1. Requirements of Regulatory Agencies: The Work is subject to all applicable provisions of the Codes and Standards required by the authorities having jurisdiction.
   2. Reference Standards: Standards referenced in this Section are commonplace in the industry (unless noted otherwise) and are referred to by basic designation only. Standards form a part of this Specification to the extent referenced.
   3. Manufacturer's published specifications, installation requirements, and instructions as approved by the Architect.
   4. Correlation and Intent of the Contract Documents: In the event of conflicts or discrepancies between the Contract Documents, the requirements of regulatory agencies, and the indicated Reference Standards, the most stringent requirements govern.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Delivery Requirements: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Storage and Handling Requirements:

1. Store and handle materials in accordance with manufacturer's instructions.
2. Keep materials in manufacturer's original, unopened containers and packaging until application.
3. Store materials in clean, dry area indoors.
4. Do not store materials directly on floor.
5. Protect materials during storage, handling, and application to prevent contamination or damage.

1.5 PROJECT CONDITIONS

A. Weather: Perform work only when existing and forecasted weather conditions are within the limits established by manufacturers of the materials and products used. Follow Manufacturer's instructions. Refer to ACI 305 "Hot Weather Concreting" and ACI 306 "Cold Weather Concreting".

1.6 CONTRACTOR'S QUALITY CONTROL SYSTEM

A. General:

1. In accordance with Division 1 requirements, the Contractor must establish a Quality Control System for the work of this Section.
2. The Contractor's Quality Control System is the means used by the Contractor to become assured that the construction complies with the requirements of the Contract Documents (including, but not limited to, materials and workmanship) to the satisfaction of the Owner, Architect, and authorities having jurisdiction. The Contractor must establish a system of quality control for the Work that includes sufficient inspection and testing of all items of Work, including that of the Contractor's subcontractors.

B. Contractor's Quality Control System must include, but not be limited to, the following:

1. General: Review of existing conditions, substrate conditions, requirements of related work, installation instructions, storage and handling procedures, and protection measures.
2. Comprehensive Independent Testing Agency Services: Contractor is responsible for providing any independent inspection and testing above and beyond the minimum requirements indicated in the Contract Documents, as may be necessary to ensure compliance thereto.
   a. Contractor's testing agency's qualifications must meet or exceed the requirements of this Section and Division 1.
3. Quality-Control-Related Scheduling and Coordination: Include, not by way of limitation, the following:
   a. Scheduling and Convening of Contractor's Quality Control Conferences: Contractor to schedule and conduct conferences for the purposes of coordinating quality control for the Project.
      1) The Architect, responsible Engineer, and the COR must be invited to attend the conference at their election and must be notified by the Contractor at least fifteen (15) working days prior to the scheduled date of the conference. Unless it is confirmed that the Architect/Engineer will NOT be attending the meeting, all conferences are to be scheduled in conjunction with the scheduled site visits being performed by the Architect or as approved by the Architect.
      2) Record minutes of each conference and distribute in typed or printed form to each party in attendance within five (5) working days of the meeting. One copy of these minutes must also be transmitted to the Owner and the Architect for information.
      3) Contractor's conference schedule must include, not by way of limitation, the conferences indicated below.
   b. Coordination with the authorities having jurisdiction to obtain the necessary approvals for the work of this Section.

C. Quality Control Conferences: Incorporate the work of this Section in with Section 03 30 00 and 03 41 00 conference requirements.

D. Quality Control Records: Contractor must maintain accurate records of all inspections and tests performed, instructions received from the

Architect, responsible Engineer or Testing Agency, and actions taken as a result of those instructions. These records must include evidence that the required inspections or tests have been performed (including type and number of inspections or tests, nature of defects, causes for rejection, etc.), proposed or directed remedial action, and corrective action taken. At the request of the COR or the Architect, allow access to records pertaining to Contractor's quality control activities.

E. See FIELD QUALITY CONTROL Article in Part 3 of this Section for additional Quality Control requirements.

1.7 INDEPENDENT TESTING AGENCY SERVICES

A. General: See Section 01 45 29 requirements for all testing and/or inspections applicable to this Section.

B. The Contractor must employ and pay for the services of an Independent Inspection and Testing Agency (indicated herein as "Testing Agency" or "TESTING AGENCY") to perform the inspections, tests and other services outlined in the Contract Documents. Services must be performed in accordance with requirements of governing authorities and with specified standards.

C. Quality Control Tests and Inspections During Construction: See "Field Quality Control" Article in Part 3 of this Section.

PART 2 - PRODUCTS

2.1 NON-SHRINK GROUT

A. Pre-mixed, non-metallic, non-corrosive, non-staining, non-gas forming product containing selected silica sands, Portland cement, shrinkage compensating agents, plasticizing and water reducing agents, no chlorides. Grout must conform to ASTM C 1107.

1. Grout exposed to freeze/thaw must provide greater than 95% Durability Factor when tested to ASTM C-666 and/or must comply with the requirements of ASTM C 928.

B. Properties

1. Consistency: Dry-pack to plastic as required for application.
2. Compressive Strength: 6,000 psi @ 7days, unless noted otherwise.

C. Mixing Water: Potable or ASTM C 1602-compliant water.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of work. Notify Architect of conditions that would adversely affect surface preparation or application.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

A. Prepare surfaces in accordance with manufacturer’s instructions.

B. Remove all foreign and loose materials from concrete and surfaces to receive grout. Remove cement paste and laitance to expose sound aggregate.

C. Clean steel surfaces to be free of dirt, dust, oil, grease, and other contaminants. Clean rust from base plates and other metal surfaces to be grouted to obtain satisfactory adhesion.

D. Maintain substrate in a saturated condition for 24 hours prior to grouting. Surface should be saturated, surface dry (SSD) at time of grout installation.

E. Remove freestanding water from foundation and bolt holes immediately before grouting.

3.3 FORMING

A. Build forms for grout in accordance with manufacturer’s instructions.

B. Build forms to be liquid tight and nonabsorbent.

3.4 MIXING

A. Add water to grout and mix in accordance with manufacturer’s instructions.

B. Use minimum amount of water required to achieve necessary placement consistency.

C. Do not use mixing water in amount or at temperature that will produce flow of less than 25 seconds in accordance with ASTM C 939 or cause mixed grout to bleed or segregate.

D. Do not retemper grout by adding water.

E. Do not add plasticizers, accelerators, retarders, or other additives to grout, unless approved by manufacturer.

F. Store and mix grout to produce mixed-grout temperature in accordance with manufacturer's instructions.

3.5 PLACING

A. Place grout in accordance with manufacturer's instructions at locations indicated on the Drawings.

B. Place grout in continuous pour unless dry pack is shown on the Drawings or is permitted by the Engineer of Record.

C. Place grout to prevent entrapment of air or water beneath equipment.

D. Ensure grout fills entire space being grouted and remains in contact with plate throughout entire grouting process.

E. Do not vibrate grout.

F. Trim grout surfaces immediately after placement and cover exposed grout with clean wet rags. Keep rags wet for 5 to 6 hours.

G. Placement Depth:

1. Minimum: 1 inch.
2. Lifts Over 6 Inches: In accordance with manufacturer's instructions.

3.6 CURING

A. Cure grout in accordance with manufacturer's instructions.

B. Cure exposed grout with membrane curing compound immediately after wet rags are removed, to minimize potential moisture loss within grout.

C. Shade foundation from sunlight for 24 hours after grouting.

D. Ensure foundation, plate, and grout temperatures do not fall below 50 degrees F until after final set, when grouting at minimum temperatures.

E. Protect grout from freezing until it has attained compressive strength of 3,000 psi in accordance with ASTM C 109.

3.7 FIELD QUALITY CONTROL

A. Construction Monitoring: During progress of Grouting work, Contractor must make visual inspections as necessary and coordinate the other inspection activities as indicated this Section to ensure compliance with specified parameters.

B. Identified Deficiencies and Review of Proposed Remedial Work:

1. Where Project inspections and/or testing indicate deficiencies in the Work, or non-compliance with this Section and/or the System manufacturer's specifications, the installation will be considered defective. For defective work:
   a. Contractor must prepare recommendations for additional or remedial work to compensate for deficiencies. Submit all recommendations to the Architect for review.
   b. Once submitted recommendations have been reviewed and found acceptable by the Architect, proceed with additional or remedial work as required to compensate for deficiencies.
   c. Additional testing and inspecting, at Contractor's expense, must be performed to determine compliance of replaced or additional work with specified requirements.
   d. Proceed with enclosing Grouting installations with other construction only after inspection reports are issued and installations comply with requirements.
2. Remedial action deemed necessary by the Architect and resulting from non-compliance with the Contract requirements must be addressed as described for "Corrective Measures" in Division 1 of these Specifications.
3. Where remedial action was deemed necessary based on Quality Control Testing, retest all remedial work until test results prove subject Work complies with indicated requirements.

C. Independent Inspection and Testing:
   1. General: An independent testing agency engaged per Part 1 of this Section must monitor the work of this Section for compliance with project Contract Documents and the approved Submittals.
   2. Special Inspections and Tests: Perform all testing and inspections indicated in the "Required Special Inspections and Tests" section of the Building Code, as required by the Contract Documents, and as additionally required by the Authorities Having Jurisdiction.
      a. See Schedule of Special Inspections in Section 01 45 35 for additional information.

3. Other Tests and Inspections During Construction: Perform the following testing and inspections additionally if not otherwise included in Special Inspections and Tests requirements above:
   a. Grouting Related to Structural Precast Concrete Work: Comply with Section 01 45 29, Part 3, ERECTION OF STRUCTURAL PRECAST CONCRETE Article requirements, and as additionally required to ensure compliance with the Contract Documents.
   b. Grouting Related to Structural Steel Work: See Section 01 45 29, Part 3, STRUCTURAL STEEL Article requirements, and as additionally required to ensure compliance with the Contract Documents.
4. Coordination: Coordinate independent inspection and testing of Grouting work with related Section 03 41 00 and 05 12 00 requirements.
5. Reporting on the Work: Produce reports and digital photographs documenting each inspection and indicate whether subject work complies with or deviates from requirements.
   a. Reports must be distributed in timely manner to Owner, Contractor, and Architect. Comply with Division 1 requirements.

3.8 PROTECTION

A. Protect placed grout from damage during construction.

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SECTION 03 64 33
PRESSURE CHEMICAL GROUT INJECTION

PART 1 - GENERAL

1.1 SUMMARY

A. The extent of work included in this Section is shown on the Drawings and is specified as follows:

1. The Contractor must provide all necessary materials, equipment, and labor required to seal all leaking cracks or joints at locations shown on plans or as designated by the Architect.

1.2 APPLICATOR QUALIFICATIONS

A. The Contractor must have a minimum of three years of experience performing work similar to that shown in the drawings and specifications.

B. The Contractor must submit a list of five projects in which similar work to that specified was successfully completed. The list must contain the following for each of the five projects:

1. Project Name
2. Owner of Project
3. Owner's Representative, Address and Telephone Number
4. Brief Description of Work
5. Cost of Portion of Work Similar to that Specified in this Section
6. Total Restoration Cost of Project
7. Date of Completion of Work

C. The sum of the costs of the five projects provided in B.5 above must be a minimum of $50,000.

D. A full-time on-site supervisor must be provided by the Contractor for the entire duration of the chemical grouting work. The supervisor must have had a minimum of 2 years of documented supervisory experience with the products to be used. If the supervisor does not have that experience, the supplier or manufacturer of the materials must provide a full-time qualified, certified by the manufacturer, field inspector on jobsite during the entire period of material application. The Installation Contractor must submit with his bid to the Architect a proof of obtaining licenses or permits as required.

1.3 SUBMITTALS

A. The Contractor must submit the following to the Architect:

1. Documentation showing compliance with the Applicator Qualifications as specified herein before.
2. Technical data sheets published by the material manufacturers for each chemical grout product or formulation to be used showing that his products meet the requirements of the specifications. Technical data must include the following:
   a. Intended use
   b. Pot life (neat)
   c. Initial cure time (1000 psi)
   d. Tack free (thin film)
   e. Final cure (75% ultimate strength)
3. Submit safety data sheets for each product.

1.4 PRODUCT DELIVERY

A. The product must be delivered and handled strictly according to the manufacturer's recommendations. Any containers of the material to be used which have been opened previously will not be accepted.

1.5 JOB CONDITIONS

A. Existing and environmental conditions: The Installation Contractor must examine the condition of surfaces into which the chemical grout is to be injected and must follow the recommendations of the manufacturer with regard to limitations of the materials in various moisture and temperature levels.

PART 2 - PRODUCTS

2.1 MATERIALS

A. "Mountain Grout” (polyurethane product dependent on project details) as manufactured by Green Mountain International LLC, 235 Pigeon Street, Waynesville, NC (www.polyurethanegrouts.com).

B. "Scotch-Seal Chemical Grout 5600" as manufactured by Avanti, Webster, Texas (www.avantigrout.com).

C. "Hydroactive Grouts" as manufactured by DeNeef America, Inc., 5610 Brystone Drive, Houston, Texas (www.deneef.com).

D. Products to be used must be one-component polyurethane and have low viscosity (180cps maximum at 570F.) for a hairline crack application, and regular viscosity (600 SPX maximum at 570F.) for a wide crack application as required by the Architect.

E. It is the responsibility of the Contractor to develop the correct mix proportions to achieve full depth injection of the cracks. The mix proportions must be approved by the Architect.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

A. The Installation Contractor must thoroughly review the entire surface around the cracks or joints to be chemical grout injected to determine the applicability of grout materials in respect to the thickness of cracks/joints, existence of any foreign materials harmful to the application of the chemical grout used and deterioration of concrete surface which must be repaired and cleaned prior to the application.

B. If the Installation Contractor finds any cracks/joints being too wide to receive an application of the grout material to be used, a complete written report regarding the locations must be submitted to the Architect, indicating existing minimum and maximum thickness and length of the cracks/joints. The Architect must verify the non-applicability of the material to be used in the cracks/joints reported with the material manufacturer or supplier and direct the contractor with a proper repair method of wide cracks prior to application of the grout material.

C. Where any detrimental foreign materials exists, the Contractor must follow the recommendations of the chemical grout material manufacturer (subject to the Architect's approval) in respect to the materials and methods of cleaning or removing the foreign materials.

D. "Packers" must be inserted into pre-drilled holes at strategic locations on surfaces. The Installation Contractor must drill holes strictly according to the recommendations by the material manufacturer or supplier in respect to the locations, sizes and angle of the holes to be drilled.

3.2 APPLICATION

A. Chemical grout must be pumped and pressure injected into the packers which have been inserted into pre-drilled holes. Packers compatible with the grout material to be used must be installed.

B. The applicator must allow the grout material with sufficient time to flow into all of the cracks/joints on its own.

C. The Contractor must clean surfaces of excess chemical grout used by proper means recommended by the material manufacturer and/or supplier so that only the edge thickness of completed grouted cracks is noticeable. Packers must not extend beyond the plane of the surface of the existing concrete.

D. The Contractor is responsible for performing test injections at a minimum of three selected locations to finalize material selections, injection procedures and testing procedures prior to the start of work. The Contractor must extract two full depth cores for every 500 lineal foot of injection of cracks to demonstrate that the cracks are fully filled with chemical grout. If injection is incomplete (less than 90% of the injected crack filled), re-injection and additional cores may be required at the direction of the Architect at no extra cost to the Owner.

3.3 FIELD QUALITY ASSURANCE

A. A warranty must be submitted to the Architect which guarantees that in the event of any water leak through the repaired cracks/joints, the material manufacturer/supplier and the Installation Contractor will jointly repair the cracks/joints which have failed any time during the warranty period of five (5) years with no cost to the Owner.

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DIVISION 04

SECTION 04 05 13
MASONRY MORTARING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Masonry mortar installed by other concrete and masonry sections.

1.2 RELATED REQUIREMENTS

A. Mortar used in Section:

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

B. Mortar Color: See finish legend.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. ASTM International (ASTM):

1. C40/C40M-11 - Organic Impurities in Fine Aggregates for Concrete.
2. C91/C91M-12 - Masonry Cement.
3. C144-11 -Aggregate for Masonry Mortar.
4. C150/C150M-15 - Portland Cement.
5. C207-06(2011) - Hydrated Lime for Masonry Purposes.
6. C270-14a - Mortar of Unit Masonry.
7. C595/C595M-15e1 - Blended Hydraulic Cements.
8. C780-15 - Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
9. C979/C979M-10 - Pigments for Integrally Colored Concrete.
10. C1329/C1329M-15 - Mortar Cement.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:

1. Description of each product.

C. Test Reports: Certify each product complies with specifications.

1. Mortar.
2. Admixtures.

D. Certificates: Certify each product complies with specifications.

1. Portland cement.
2. Masonry cement.
3. Mortar cement.
4. Hydrated lime.
5. Fine aggregate.
6. Color admixture.

E. Qualifications: Substantiate qualifications comply with specifications.
1. Testing laboratory.

1.5 QUALITY ASSURANCE

A. Preconstruction Testing:
1. Engage independent testing laboratory to tests and submit reports.
a. Deliver samples to laboratory in number and quantity required for testing.
2. Test mortar and materials specified.
3. Mortar:
a. Test for compressive strength and water retention according to ASTM C270.
b. Minimum Mortar compressive strengths 28 days:
1) Type M: 17.2 MPa (2,500 psi).
2) Type S: 12.4 MPa (1,800 psi).
3) Type N: 5.1 MPa (750 psi).
4. Non Staining Cement: Test for water soluble alkali.
a. Water Soluble Alkali: Maximum 0.03 percent.
5. Sand: Test for deleterious substances, organic impurities, soundness and grading.

1.6 DELIVERY

A. Deliver products in manufacturer's original sealed packaging.
B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, production run number, and manufacture date.
C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.7 STORAGE AND HANDLING

A. Store masonry materials under waterproof covers on planking clear of ground.

1. Protect loose, bulk materials from contamination.

B. Protect products from damage during handling and construction operations.

1.8 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Hydrated Lime: ASTM C207, Type S.

B. Aggregate for Masonry Mortar: ASTM C144 and as follows:

1. Test sand for color value according to ASTM C40/C40M. Sand producing color darker than specified standard is unacceptable.

C. Blended Hydraulic Cement: ASTM C595/C595M, Type IS, IP.

D. Masonry Cement: ASTM C91/C91M. Type N, S, Or M.

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

E. Mortar Cement: ASTM C1329/C1329M, Type N, S or M.

F. Portland Cement: ASTM C150/C150M, Type I.

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

G. Pigments: ASTM C979/C979M; inorganic, inert, mineral pigments only, unaffected by atmospheric conditions, nonfading, alkali resistant, and water insoluble.

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

2.2 PRODUCTS - GENERAL

A. Provide each product from one manufacturer.

2.3 MIXES

A. Pointing Mortar for New Work:

1. For Precast Concrete: Proportion by volume; one part white Portland cement, two parts white sand, and 1/5 part hydrated lime.

B. Masonry Mortar: ASTM C270.

1. Admixtures:

a. Do not use mortar admixtures, and color admixtures unless approved by Contracting Officer's Representative.

b. Do not use antifreeze compounds.

C. Colored Mortar:

1. Maintain uniform mortar color for exposed work, throughout.
2. Match mortar color in approved sample or sample panel specified in Section 04 20 00, UNIT MASONRY.
3. Alteration Work Mortar Color: Match existing mortar.

D. Color Admixtures:

1. Proportion as specified by manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.

B. Protect existing construction and completed work from damage.

3.2 MIXING

A. Measure ingredients by volume using known capacity container.

B. Mix for 3 to 5 minutes in a mechanically operated mortar mixer.

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 Stiffened Because of Water Loss Through Evaporation:

1. Re-temper by adding water to restore to proper consistency and workability.
2. Discard mortar reaching initial set or unused within two hours of mixing.

E. Pointing Mortar:

1. Mix dry ingredients with enough water to produce damp mixture of workable consistency retaining shape when formed into ball.
2. Allow mortar to stand in dampened condition for 60 to 90 minutes.
3. Add water to bring mortar to a workable consistency before use.

3.3 MORTARING

A. Type M Mortar: Use for precast concrete panels.

B. Type S Mortar: Use for masonry containing vertical reinforcing bars (non-engineered) and engineered reinforced unit masonry work.

C. Type N Mortar: Use for other masonry work.

D. Type N Mortar: Use for pointing items and tuck pointing specified.

3.4 FIELD QUALITY CONTROL

A. Field Tests: Performed by testing laboratory specified in Section 01 45 29, TESTING LABORATORY SERVICES.

1. Take and test samples during progress of work according to ASTM C780.

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SECTION 04 05 16
MASONRY GROUTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Grout for filling hollow concrete masonry cores.

1.2 RELATED WORK

A. Section 03 45 00, PRECAST ARCHITECTURAL CONCRETE: Grout

B. Section 04 20 00, UNIT MASONRY: Grout

C. Section 09 91 00, PAINTING

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section

American National Standards Institute (ANSI):

A118.6-19 - .....Standard Cement Grouts for Tile Installation.

B. ASTM International (ASTM):

C40/C40M-20 - .....Organic Impurities in Fine Aggregates for Concrete.

C150/C150M-20 - .....Portland Cement.

C207-18 - .....Hydrated Lime for Masonry Purposes.

C404-18 - .....Aggregates for Masonry Grout.

C476-20 - .....Grout for Masonry.

C595/C595M-20 - .....Blended Hydraulic Cement.

C979/C979M-16 - .....Pigments for Integrally Colored Concrete.

C1019-19 - .....Sampling and Testing Grout.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. All items indicated below are required submittals requiring Contracting Officer’s Representative (COR) review and approval.

B. Manufacturer's Literature and Data:

1. Description of each product.

C. Sustainable Construction Submittals:

1. Recycled Content: Identify pre-consumer recycled content percentage by weight.

D. Test Reports: Certify each product complies with specifications.

1. Grout, each type.
2. Cement.

3. Aggregate.

E. Certificates: Certify each product complies with specifications.

1. Blended hydraulic cement.
2. Portland cement.
3. Grout.
4. Hydrated lime.
5. Aggregate.
6. Color admixture.

1.5 QUALITY ASSURANCE

A. Preconstruction Testing:

1. Engage independent testing laboratory to perform tests and submit reports.
   a. Deliver samples to laboratory in number and quantity required for testing.
2. Grout:
   a. Test compressive strength according to ASTM C1019 standard.
3. Cement:
   a. Test for water soluble alkali (nonstaining) when nonstaining cement is specified.
   b. Nonstaining cement containing more than 0.03 percent water soluble alkali.
4. Aggregate:
   a. Test for deleterious substances, organic impurities, soundness and grading.

1.6 DELIVERY

A. Deliver products in manufacturer's original sealed packaging.

B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, production run number, and manufacture date.

1.7 STORAGE AND HANDLING

A. Store masonry materials under waterproof covers on planking clear of ground, and protect damage from handling, dirt, stain, water and wind.

B. Protect products from damage during handling and construction operations.

1.8 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Grout Components:

1. Hydrated Lime: ASTM C207, Type S.
2. Aggregate For Masonry Grout: ASTM C404, Size 8.
3. Blended Hydraulic Cement: ASTM C595, Type IS, IP.
4. Portland Cement: ASTM C150, Type I.
5. Liquid Acrylic Resin:
   a. A formulation of acrylic polymers and modifiers in liquid form designed for use as an additive for mortar to improve physical properties.
6. Water: Potable, free of substances that are detrimental to grout, masonry, and metal.

2.2 PRODUCTS - GENERAL

A. Provide each product from one manufacturer.

B. Sustainable Construction Requirements:

2.3 MIXES

A. Grout: ASTM C476; fine grout and coarse grout.

B. Ready-Mixed Grout: ANSI A118.8.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.

B. Protect existing construction and completed work from damage.

C. Clean mortar from masonry cells protruding more than 13 mm (1/2 inch) to permit grout flow.

D. Remove debris from grout spaces.

E. Verify reinforcement is correctly placed before placing grout.

3.2 MIXING

A. Mix grout in mechanically operated mixer.

1. Mix grout for five minutes, minimum.

B. Measure ingredients by volume using container of known capacity.

C. Mix water with grout dry ingredients.

1. Slump Range: 200 to 275 mm (8 to 11 inches).

3.3 GROUTING

A. Install grout according to Section 04 20 00, UNIT MASONRY.

B. Use fine grout for filling wall cavities and hollow concrete masonry units where smallest cell dimension is 50 mm (2 inches) or less.

C. Use either fine grout or coarse grout for filling wall cavities and hollow concrete masonry units where smallest cell dimension is greater than 50 mm (2 inches).

D. Use grout for filling bond beam or lintel units.

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SECTION 04 20 00
UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Concrete masonry unit (CMU) assemblies for:
   1. Exterior walls.
   2. Interior walls.

1.2 RELATED REQUIREMENTS

A. Sealants and Sealant Installation: Section 07 92 00, JOINT SEALANTS.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.
B. American Concrete Institute (ACI):
   1. 315-99 - Details and Detailing of Concrete Reinforcement.
   2. 530.1/ASCE 6/TMS 602-13 - Specification for Masonry Structures.
C. ASTM International (ASTM):
   1. A615/A615M-15ae1 - Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
   2. A951/A951M-14 - Steel Wire for Masonry Joint Reinforcement.
   3. A1064/A1064M-15 - Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
   4. C90-14 - Load-Bearing Concrete Masonry Units.
   5. C612-14 - Mineral Fiber Block and Board Thermal Insulation.
   6. D1056-14 - Flexible Cellular Materials - Sponge or Expanded Rubber.
   7. D2240-05(2010) - Rubber Property-Durometer Hardness.
   8. F1667-15 - Driven Fasteners: Nails, Spikes, and Staples.
D. American Welding Society (AWS):
   1. D1.4/D1.4M-11 - Structural Welding Code - Reinforcing Steel.
E. Federal Specifications (Fed. Spec.):
   1. FF-S-107C(2) - Screws, Tapping and Drive.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
B. Submittal Drawings:

1. 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.
2. Special masonry shapes, profiles, and placement.
3. Masonry units for typical window and door openings, and, for special conditions as affected by structural conditions.

C. Manufacturer's Literature and Data:
1. Description of each product.
2. Installation instructions.

D. Samples:
1. Concrete masonry units, when exposed in finish work.
2. Anchors and Ties: Each type.
3. Joint Reinforcing: 1200 mm (48 inches) long each type.

E. Sustainable Construction Submittals:
1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.

F. Test reports: Certify products comply with specifications.
1. Ceramic glazed facing brick.

G. Certificates: Certify products comply with specifications.

H. Delegated Design Drawings and Calculations: Signed and sealed by responsible design professional.

1.5 QUALITY ASSURANCE

A. Welders and Welding Procedures Qualifications: AWS D1.4/D1.4M.

B. Mockups:
1. Before starting masonry, build a mockup panel minimum 1800 mm by 1800 mm (6 feet by 6 feet) with 600 mm (24 inch) 90 degree return for outside corner.
   a. Use masonry units from random cubes of units delivered on site.
   b. Include structural backup, reinforcing, ties, and anchors.
2. Mockup panel approved by Contracting Officer's Representative set workmanship and aesthetic quality for masonry work.
3. Clean sample panel to test cleaning methods.
4. Remove mockup panel when directed by Contracting Officer's Representative.

1.6 DELIVERY

A. Deliver products in manufacturer's original sealed packaging.

B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, production run number, and manufacture date.

C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.7 STORAGE AND HANDLING

A. Store products above grade, protected from contamination.

B. Protect products from damage during handling and construction operations.

1.8 FIELD CONDITIONS

A. Hot and Cold Weather Requirements: Comply with ACI 530.1/ASCE 6/TMS 602.

1.9 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

A. Delegated Design: Prepare submittal documents including design calculations and drawings signed and sealed by registered design professional, licensed in state where work is located.

2.2 PRODUCTS - GENERAL

A. Provide each product from one manufacturer .

B. Sustainable Construction Requirements:

1. Concrete Masonry Unit Recycled Content: 30 total recycled content, minimum.
   a. Post-Consumer Recycled Content: 30 minimum.
   b. Pre-Consumer Recycled Content: 30 minimum.
2. Steel Recycled Content: 30 percent total recycled content, minimum.

2.3 UNIT MASONRY PRODUCTS

A. Concrete Masonry Units (CMU):

1. Hollow and Solid Load-Bearing Concrete Masonry Units: ASTM C90.
   a. Unit Weight: Normal weight

2. For molded faces used as a finished surface, use concrete masonry units with uniform fine to medium surface texture unless specified otherwise.
3. Use bullnose concrete masonry units at corners exposed in finished work with 25 mm (1 inch) minimum radius rounded vertical exterior corners (bullnose units).
4. Customized Units:
   a. Sound-Absorbing Units:
      1) Vertical slots in face to core areas.
      2) Acoustical absorption insert: Mineral fiber and metal septum, providing unit with NRC rating of 0.70.
   b. Split-Face Units:
      1) Split-Rib Units: Rib shapes as indicated on drawings on exposed faces.
      2) Ground Face Units: Ground finish on exposed faces.
   c. Glazed Face Units: Facing conform to ASTM C744.

2.4 ANCHORS, TIES, AND REINFORCEMENT

A. Steel Reinforcing Bars: ASTM A615/A615M; Grade 60, deformed bars.

B. Joint Reinforcement:
   1. Form from wire complying with ASTM A951/A951M.
   2. Hot dipped galvanized after fabrication.
   3. Width of joint reinforcement 40 mm (1.6 inches) less than nominal thickness of masonry wall or partition.
   4. Cross wires welded to longitudinal wires.
   5. Joint reinforcement minimum 3000 mm (10 feet) long, factory cut.
   6. Joint reinforcement with crimp formed drip is not acceptable.
   7. Maximum spacing of cross wires 400 mm (16 inch) to longitudinal wires.
   8. Ladder Design:
      a. Longitudinal wires deformed 4 mm (0.16 inch).
      b. Cross wires 2.6 mm (0.10 inch).
   9. Trussed Design:
      a. Longitudinal and cross wires minimum 4 mm (0.16 inch nominal) diameter.
      b. Longitudinal wires deformed.

10. 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 minimum 75 mm (3 inches) spaced 400 mm on center (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. Dovetail Anchors:
1. Corrugated steel dovetail anchors formed of 1.5 mm (0.06 inch) thick by 25 mm (1 inch) wide galvanized steel, 90 mm (3-1/2 inches) long where used to anchor 100 mm (4 inch) nominal thick masonry units, 140 mm (5-1/2 inches) long for masonry units more than 100 mm (4 inches) thick.
2. Triangular wire dovetail anchor 100 mm (4 inch) wide formed of 4 mm (9 gage) steel wire with galvanized steel dovetail insert. Anchor length to extend minimum 75 mm (3 inches) into masonry, 25 mm (1 inch) into 40 mm (1-1/2 inch) thick units.
3. Form dovetail anchor slots from 0.6 mm (0.02 inch) thick galvanized steel (with felt or fiber filler).

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

E. Wall Ties, (Mesh or Wire):
   1. Mesh wall ties formed of ASTM A1064/A1064M, W0.5, 2 mm, (0.08 inch) galvanized steel wire 13 mm by 13 mm (1/2 inch by 1/2 inch) mesh, 75 mm (3 inches) wide by 200 mm (8 inches) long.
   2. Rectangular wire wall ties formed of W1.4, 3 mm, (0.12 inch) galvanized steel wire 50 mm (2 inches) wide by 200 mm (8 inches) long.

F. Corrugated Wall Tie:
   1. Form from 1.5 mm (0.06 inch) thick corrugated, galvanized steel 30 mm (1-1/4 inches) wide by lengths to extend minimum 100 mm (4 inches) into joints of masonry plus 38 mm (1-1/2 inch) turn-up.
   2. Provide 5 mm (3/16 inch) hole in turn-up for fastener attachment.

G. 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 minimum 75 mm (3 inches) into joints of masonry.

H. Adjustable Steel Beam Anchor:
   1. Z or C type steel strap, 30 mm (1 1/4 inches) wide, 3 mm (1/8 inch) thick.
   2. Flange hook minimum 38 mm (1 1/2 inches) long.
   3. Length to embed in masonry minimum 50 mm (2 inches) in 100 mm (4 inch) nominal thick masonry and 100 mm (4 inches) in thicker masonry.
   4. Bend masonry end minimum 40 mm (1 1/2 inches).

I. Ridge Wall Anchors:
   1. Form from galvanized steel minimum 25 mm (1 inch) wide by 5 mm (3/16 inch) thick by 600 mm (24 inches) long, plus 50 mm (2 inch) bends.
   2. Other lengths as indicated on drawings.

2.5 ACCESSORIES

A. Shear Keys:

1. Solid extruded cross-shaped section of rubber, neoprene, or polyvinyl chloride, with durometer hardness of approximately 80 when tested according to ASTM D2240, and minimum shear strength of 3.5 MPa (500 psi).
2. Shear Key Dimensions: Nominal 70 mm by 8 mm for long flange and 38 mm by 16 mm for short flange (2-3/4 inches by 5/16 inch for long flange, and 1-1/2 inches by 5/8 inch for short flange).

B. Weeps:
1. Weep Hole: Flexible PVC louvered configuration with rectangular closure strip at top.

C. Cavity Drain Material: Open mesh polyester sheets or strips to prevent mortar droppings from clogging the cavity.

D. Preformed Compressible Joint Filler:
1. Thickness and depth to fill joint.
2. Closed Cell Neoprene: ASTM D1056, Type 2, Class A, Grade 1, B2F1.
3. Non-Combustible Type: ASTM C612, Type 5, Max. Temp.1800 degrees F.

E. Box Board:
1. Mineral Fiber Board: ASTM C612, Type 1.
2. 25 mm (1 inch) thickness.
3. Other spacing material having similar characteristics is acceptable subject to Contracting Officer's Representative's approval.

F. Masonry Cleaner:
1. Detergent type cleaner selected for each type masonry.
2. Acid cleaners are not acceptable.
3. Use soapless type specially prepared for cleaning brick or concrete masonry as appropriate.

G. 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.

H. Welding Materials: AWS D1.4/D1.4M, type to suit application.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

A. Install products according to manufacturer's instructions and approved submittal drawings.
   1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

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

C. Wall Openings:
   1. Fill hollow metal frames built into masonry walls and partitions solid with mortar as laying of masonry progresses.
   2. When 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 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 minimum 100 mm (4 inches) above suspended ceiling or to overhead construction where no ceiling occurs.
   2. Extend following partitions to overhead construction.
      a. Full height partitions, and fire partitions and smoke partitions indicated 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 finished masonry partitions minimum 100 mm (4 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 (40 inches) wide that have hollow metal frames.
2. Openings 1025 mm (41 inches) wide to 1600 m (63 inches) wide without structural steel lintel or frames, require lintel formed of concrete masonry lintel or bond beam units filled with grout and reinforced with one No. 16 (No. 5) rod top and bottom for each 100 mm (4 inches) of nominal thickness unless shown otherwise.
3. Precast concrete lintels of 25 MPa (3,000 psi) concrete, same thickness as partition, and with one No. 16 (No. 5) deformed bar top and bottom for each 100 mm (4 inches) of nominal thickness, is acceptable in lieu of reinforced CMU masonry lintels.
4. Use steel lintels, for openings greater than 1600 m (63 inches) wide, brick masonry openings, and elevator openings unless shown otherwise.
5. Doors having overhead concealed door closers require steel lintel, and pocket for closer box.
6. Lintel Bearing Length: Minimum 100 mm (4 inches) at both 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 one-half running bond, unless indicated 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. Minimum Masonry Unit Length: 100 mm (4 inches).
5. On interior partitions provide 6 mm (1/4 inch) open joint for caulking between existing construction, exterior walls, concrete work, and abutting masonry partitions.
6. Use minimum 100 mm (4 inches) nominal thick masonry for free standing furring, unless indicated otherwise.

7. Do not abut existing plastered surfaces except suspended ceilings with new masonry partitions.

H. Use minimum 100 mm (4 inches) nominal thick masonry for fireproofing steel columns unless indicated otherwise.

I. Before connecting new masonry with previously laid masonry, 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 voids between steel and masonry are filled with mortar, provide minimum 25 mm (1 inch) mortar free expansion space between masonry and steel by applying box board material to steel before masonry is laid.
2. Do not install 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. Fill 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 minimum one web of hollow masonry units.

M. Wetting and Wetting Test:

1. Test and wet brick and clay tile according to BIA TN 11B.
2. Do not wet concrete masonry units or glazed structural facing tile before laying.

N. Temporary Formwork: Provide formwork and shores as required for temporary support of reinforced masonry elements.

O. Construct formwork to conform to shape, line and dimensions indicated on drawings. Make sufficiently tight to prevent mortar, grout, or concrete leakage. Brace, tie and support formwork as required to

maintain position and shape during construction and curing of reinforced masonry.

P. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other reasonable temporary construction loads.

Q. Minimum Curing Times Before Removing Shores and Forms:
   1. Girders and Beams: 10 days.
   2. Slabs: 7 days.
   3. Reinforced Masonry Soffits: 7 days.

3.2 INSTALLATION - ANCHORAGE

A. Veneer to Concrete Walls:
   1. Install dovetail slots in concrete vertically at 400 mm (16 inches) on centers.
   2. Locate dovetail anchors at 400 mm (16 inch) maximum vertical intervals.
   3. Anchor new masonry facing to existing concrete with adjustable cavity wall ties spaced at 400 mm, (16 inches) maximum vertical intervals, and at 400 mm (16 inches) maximum horizontal intervals. Fasten ties to concrete with power actuated fasteners or concrete nails.

B. Masonry Facing to Backup and Cavity Wall Ties:
   1. Use individual ties for new work.
   2. Stagger ties in alternate courses, and space at 400 mm (16 inches) maximum vertically, and 400 mm (16 inches) horizontally.
   3. At openings, provide additional ties spaced maximum 900 mm (36 inches) apart vertically around perimeter of opening, and within 300 mm (12 inches) from edge of opening.
   4. Anchor new masonry facing to existing masonry with adjustable cavity wall ties spaced at 400 mm (16 inch) maximum vertical intervals and at every second masonry unit horizontally. Fasten ties to masonry with masonry nails.
   5. Option: Install joint reinforcing for multiple wythes and cavity wall ties spaced maximum 400 mm (16 inches) vertically.
   6. Tie interior and exterior wythes of reinforced masonry walls together with individual ties. Provide ties at intervals maximum

400 mm (16 inches) on center horizontally, and 400 mm (16 inches) on center vertically. Lay ties in the same line vertically in order to facilitate vibrating of the grout pours.

C. Anchorage of Abutting Masonry:
   1. Anchor interior 100 mm (4 inch) thick masonry partitions to exterior masonry walls with wall ties. Space ties at 600 mm (24 inches) maximum vertical intervals. Extend ties 100 mm (4 inches) minimum into masonry.
   2. Anchor interior masonry bearing walls or interior masonry partitions over 100 mm (4 inches) thick to masonry walls with rigid wall anchors spaced at 400 mm (16 inch) maximum vertical intervals.
   3. Anchor abutting masonry walls and partitions to concrete with dovetail anchors. Install dovetail slots vertically in concrete at centerline of abutting wall or partition. Locate dovetail anchors at 400 mm (16 inch) maximum vertical intervals. Secure anchors to existing wall with two 9 mm (3/8 inch) by 75 mm (3 inch) expansion bolts or two power-driven fasteners.
   4. Anchor abutting interior masonry partitions to existing concrete and existing masonry construction, with adjustable wall ties. Extend ties minimum 100 mm (4 inches) into joints of new masonry. Fasten ties to existing concrete and masonry construction, with powder actuated drive pins, nail or other means that provides rigid anchorage. Install anchors at 400 mm (16 inch) maximum vertical intervals.

D. Masonry Furring:
   1. Anchor masonry furring less than 100 mm (4 inches) nominal thick to masonry walls or to concrete with adjustable wall ties or dovetail anchors.
   2. Space at maximum 400 mm (16 inches) on center in both directions.

E. Anchorage to Steel Beams or Columns:
   1. Use adjustable beam anchors on each flange.
   2. At columns weld 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.

3.3 INSTALLATION - REINFORCEMENT

A. Joint Reinforcement:
   1. Install joint reinforcement in CMU wythe of combination brick and CMU, cavity walls, and single wythe concrete masonry unit walls or partitions.
   2. Reinforcing is acceptable 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.

B. Steel Reinforcing Bars:
   1. Install reinforcing bars in cells of hollow masonry units where required for vertical reinforcement and in bond beam units for horizontal reinforcement. Install in wall cavities of reinforced masonry walls where indicated on drawings.
   2. Bond Beams:
      a. Form Bond beams of load-bearing concrete masonry units filled with grout and reinforced with two No. 15m (No. 5) reinforcing bars unless shown otherwise. Do not cut reinforcement.
      b. Brake bond beams only at expansion joints and at control joints, if shown.
   3. Grout openings:
      a. Leave cleanout holes in double wythe walls during construction by omitting units at base of one side of wall.
      b. Locate 75 mm by 75 mm (3 inches. by 3 inches.) min. cleanout holes at location of vertical reinforcement.
      c. Keep grout space clean of mortar accumulation and debris. Clean as work progresses and immediately before grouting.

3.4 INSTALLATION - CMU CONTROL JOINTS

A. CMU control joints (CJ) where indicated on drawings.

B. Keep joint free of mortar and other debris.

C. Joints Occur In Masonry Walls:
   1. Install preformed compressible joint filler in brick wythe.

2. Install cross shaped shear keys in concrete masonry unit wythe with preformed compressible joint filler on both sides of shear key.

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 joint reinforcement at expansion and control joints.

F. Fill opening in exposed face of expansion and control joints with sealant as specified in Section 07 92 00, JOINT SEALANTS.

3.5 INSTALLATION - BUILDING EXPANSION AND SEISMIC JOINTS

A. Keep expansion and seismic joints open and free of mortar. Remove mortar and other debris.

B. Install non-combustible, compressible type joint filler to fill space completely except where sealant is shown on joints in exposed finish work.

C. Fill opening in exposed face of expansion and seismic joints with sealant as specified in Section 07 92 00, JOINT SEALANTS.

3.6 INSTALLATION - ISOLATION JOINT

A. Where full height walls and partitions lie parallel or perpendicular to and under structural beams and shelf angles, provide minimum 9 mm (3/8 inch) separation between walls and partitions and bottom of beams and shelf angles.

B. Insert continuous full width strip of non-combustible type compressible joint filler.

C. Fill opening in exposed face of isolation joints with sealant as specified in Section 07 92 00, JOINT SEALANTS.

3.7 INSTALLATION – BRICKWORK (NOT USED)

3.8 INSTALLATION - CONCRETE MASONRY UNITS

A. Types and Uses:

1. Provide special concrete masonry shapes as required, including lintel and bond beam units, sash units, and corner units. Provide solid concrete masonry units, where full units cannot be installed, or where needed for anchorage of accessories.

2. Provide solid load-bearing concrete masonry units or grout cell of hollow units at jambs of openings in walls, where structural members impose loads directly on concrete masonry, and where shown.
3. Provide rounded corner (bullnose) shapes at opening jambs in exposed work and at exterior corners.
4. Do not install brick jambs in exposed finish work.
5. Install concrete building brick only as filler in backup material where not exposed.
6. Construct fire resistance in fire rated partitions meeting fire ratings indicated on drawings.

B. Laying:

1. Lay concrete masonry units with 9 mm (3/8 inch) joints, with a bond overlap of minimum 1/4 of unit length, except where stack bond is indicated on drawings.
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 voids with mortar or grout.
7. Provide 6 mm (1/4 inch) open joint for sealant between existing construction, exterior walls, concrete work, and abutting masonry partitions.
8. Lay concrete masonry units with full face shell mortar beds and fill head joint beds for depth equivalent to face shell thickness.
9. Lay concrete masonry units so 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 minimum 50 mm (2 inches) by 75 mm (3 inches).
10. Do not wedge masonry against steel reinforcing. Minimum 13 mm (1/2 inch) clear distance between reinforcing and masonry units.
11. Install deformed reinforcing bars of sizes indicated on drawings.
12. At time of placement, ensure steel reinforcement is free of loose rust, mud, oil, and other contamination capable of affecting bond.

13. Place steel reinforcement at spacing indicated on drawings before grouting.
14. Minimum clear distance between parallel bars: One bar diameter.
15. Hold vertical steel reinforcement in place vertically by centering clips, caging devices, tie wire, or other approved methods.
16. Support vertical bars near each end and at maximum 192 bar diameter on center.
17. Splice reinforcement or attach reinforcement to dowels by placing in contact and securing with wire ties.
18. Stagger splices in adjacent horizontal reinforcing bars. Lap reinforcing bars at splices a minimum of 40 bar diameters.
19. Grout cells of concrete masonry units, containing reinforcing bars, solid as specified.
20. Install cavity and joint reinforcement as masonry work progresses.
21. Rake joints 6 to 10 mm (1/4 to 3/8 inch) deep for pointing with colored mortar when colored mortar is not full depth.

C. Waterproofing Parging:
1. Parge earth side of concrete masonry unit basement walls with mortar applied in two coats, each coat 6 mm (1/4 inch) thick.
2. Clean wall surfaces to receive parging of dirt, oil, or grease, and moisten before application of first coat.
3. Roughen first coat when partially set, permit to hardened for 24 hours, and moisten before application of second coat.
4. Keep second coat damp for minimum 48 hours.
5. Thicken parging and round to form a cove at the junction of outside wall face and footing.

3.9 INSTALLATION - GLAZED STRUCTURAL FACING TILE (NOT USED)

3.10 POINTING

A. Fill joints with pointing mortar using rubber float trowel to apply mortar solidly into raked joints.
B. Wipe off excess mortar from joints of glazed masonry units with dry cloth.
C. Tool exposed joints to smooth concave joint.
D. At joints with existing work, match existing joint.

3.11 GROUTING

A. Preparation:
   1. Clean grout space of mortar droppings before placing grout.
   2. Close cleanouts.
   3. Install vertical solid masonry dams across grout space for full height of wall at intervals of maximum 9000 mm (30 feet). Do not bond dam units into wythes as masonry headers.
   4. Verify reinforcing bars are installed as indicated on drawings.

B. Placing:
   1. Place grout in grout space in lifts as specified.
   2. Consolidate each grout lift 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 inches) below top of last masonry course.
      b. Grout from dam to dam on high lift method.
      c. Longitudinal run of masonry may be stopped off only by raking back one-half masonry unit length in each course and stopping grout 100 mm (4 inches) back of rake on low lift method.

C. Puddling Method:
   1. Consolidate by puddling with grout stick during and immediately after placing.
   2. Grout cores of concrete masonry units containing reinforcing bars solid as masonry work progresses.

D. Low Lift Method:
   1. Construct masonry to 1.5 m (5 feet) maximum height 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 cured minimum of 4 hours.
   2. Place grout in 1.5 m (5 feet) maximum lifts.
   3. Exception:
      a. Where following conditions are met, place grout in 3.86 m (12.67 feet) maximum lifts.

b. Masonry has cured minimum of 4 hours.

c. Grout slump is maintained between 250 and 275 mm (10 and 11 inches).

d. No intermediate reinforced bond beams are placed between top and bottom of grout lift.

4. When vibrating succeeding lifts, extend vibrator 300 to 450 mm (12 to 18 inches) into preceding lift.

3.12 PLACING REINFORCEMENT

A. General: Clean reinforcement of loose rust, mill scale, earth, ice or other materials which will reduce bond to mortar or grout. Do not use reinforcement bars with kinks or bends not shown on drawings or approved submittal drawings, or bars with reduced cross-section due to excessive rusting or other causes.

B. Position reinforcement accurately at spacing indicated on drawings. Support and secure vertical bars against displacement. Install horizontal reinforcement as masonry work progresses. Where vertical bars are shown in close proximity, provide clear distance between bars of minimum one bar diameter or 25 mm (1 inch), whichever is greater.

C. For columns, piers and pilasters, maintain clear distance between vertical bars as indicated on drawings, minimum 1.5 bar diameters or 38 mm (1-1/2 inches), whichever is greater. Provide lateral ties as indicated on drawings.

D. Splice reinforcement bars only where indicated on drawings, unless approved by Contracting Officer's Representative. Provide lapped splices. In splicing vertical bars or attaching to dowels, lap ends, place in contact and wire tie.

E. Provide minimum lap as indicated on approved submittal drawings, or if not indicated, minimum 48 bar diameters.

F. Weld splices where indicated on drawings according to AWS D1.4/D1.4M.

G. Embed metal ties in mortar joints as work progresses, with minimum mortar cover of 15 mm (5/8 inch) on exterior face of walls and 13 mm (1/2 inch) at other locations.

H. Embed prefabricated horizontal joint reinforcement as work progresses, with 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 minimum

150 mm (6 inches) at ends. Use prefabricated "L" and "T" sections to provide continuity at corners and intersections. Cut and bend joint reinforcement for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.

I. Anchoring: Anchor reinforced masonry work to supporting structure as indicated on drawings.

J. Anchor reinforced masonry walls at intersections with non-reinforced masonry.

3.13 INSTALLATION OF REINFORCED BRICK MASONRY (NOT USED)

3.14 INSTALLATION OF REINFORCED CONCRETE UNIT MASONRY

A. Do not wet concrete masonry units (CMU).

B. Lay CMU units with full-face shell mortar beds. Fill vertical head joints (end joints between units) solidly with mortar from face of unit to distance behind face equal to thickness of longitudinal face shells. Solidly bed cross-webs of starting courses in mortar. Maintain head and bed 9 mm (3/8 inch) joint widths.

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 horizontally reinforced beams (bond beams) are indicated on drawings, 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 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 grout pour height specified.

F. Grouting:

1. Use fine grout for filling spaces less than 100 mm (4 inches) in one or both horizontal directions.
2. Use coarse grout for filling 100 mm (4 inch) spaces or larger in both horizontal directions.
3. Grouting Technique: At Contractor’s option, use either low-lift or high-lift grouting techniques.

G. Low-Lift Grouting:

1. Provide minimum clear dimension of 50 mm (2 inches) and clear area of 5160 sq. mm (8 sq. inches) in vertical cores to be grouted.
2. Place vertical reinforcement before 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 feet) height, or if bond beam occurs below 1.5 m (5 feet) height, stop pour 38 mm (1-1/2 inches) below top of bond beam.
4. 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 indicated on drawings. 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 sq. mm (10 sq. inches), respectively.
2. Provide cleanout holes in first course at 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 before placing grout.
5. Limit grout lifts to maximum height of 1.5 m (5 feet) and grout pour to 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, to suit application. 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 loosen 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 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 indicated on drawings, or if not shown, provide as required to prevent grout blowout or rupture of CMU face shells, but provide minimum 4.1 mm diameter (0.16 inch) wire ties spaced 400 mm (16 inches) on center for members with 500 mm (20 inches) or less side dimensions, and 200 mm (8 inches) on center for members with side dimensions exceeding 500 mm (20 inches).

12. Preparation of Grout Spaces: Before 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. Limit grout pours to sections which can be completed in one working day with maximum one hour interruption of pouring operation. Place grout in lifts which do not exceed 1.5 m (5 feet). Allow minimum 30 minutes and maximum one hour between lifts. Mechanically consolidate each lift.
15. Place grout in lintels or beams over openings in one continuous pour.
16. 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.
17. 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.

3.15 CONSTRUCTION TOLERANCES

A. Lay masonry units plumb, level and true to line within tolerances according to ACI 530.1/ASCE 6/TMS 602 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) - 9 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).

3.16 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.

3.17 FIELD QUALITY CONTROL

A. Water Penetration Testing:
1. Seven days before plastering or painting, in presence of Contracting Officer's Representative, test solid exterior masonry walls for water penetration.
2. Direct water on masonry for a period of one hour when wind velocity is less than five miles per hour.
3. Should moisture appear on inside of walls tested, make additional tests at other areas as directed by Contracting Officer's Representative.

4. Correct areas showing moisture on inside of walls, and repeat test at repaired areas, to ensure moisture penetration has been stopped.
5. Make water test at following locations:
   a. Sixteen places.

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DIVISION 05

SECTION 05 05 15
HOT DIP GALVANIZING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes:

1. Requirements for hot dip galvanizing iron and steel items as shown on the Drawings and/or as required in other Division 5 Sections.

1.2 DEFINITIONS

A. Hot Dip Galvanizing: A shop-applied zinc coating applied by means of dipping metal items into molten zinc for the purposes of long-term corrosion protection.

1.3 SUBMITTALS

A. Product Data

1. Manufacturer’s Specifications and Application Instructions: Submit manufacturer's specifications for coating system including description of materials. Include cautions and limitations, if any, for proper use of proposed finishes plus recommendations for handling.
2. Submit manufacturer’s product data and applications instructions for touch-up paint.

B. Quality Control Submittals

1. Qualification Data
   a. Manufacturer.
2. Material Certificates: Manufacturer's statements of material properties indicating compliance with requirements of the Contract Documents including compliance with Codes, Standards, and type designations within Standards.
   a. Indicate the following items meet Specification requirements:
      1) Certify that the hot dip galvanized coating for each lot meets or exceeds the specified requirements of ASTM A 123 or A 153 (as applicable).

1.4 QUALITY ASSURANCE

A. Correlation of Performance Requirements: The Work of this Section is subject to the performance requirements indicated in the Contract Documents and as follows:

1. Requirements of Regulatory Agencies: The Work is subject to all applicable provisions of the Codes and Standards required by the authorities having jurisdiction.
2. Reference Standards: For the purposes of the Work of this Section, the documents listed below are applicable "Reference Standards". Provide only materials complying with referenced standards, and which are certified for such compliance. Comply with following documents, latest edition:
   a. American Galvanizers Association (AGA):
      - Quality Assurance Manual.
      - Inspection of Hot Dip Galvanized Products.
      - The Design of Products to be Hot Dip Galvanized after Fabrication.
      - Recommended Details of Galvanizing Structures.
   b. American Society for Testing and Materials (ASTM):
      - A 123 Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
      - A 143 Practice for Safeguarding against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.
      - A 153 Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
      - A 384 Practice for Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies.
      - A 385 Specification for Practice for Providing High-Quality Zinc Coatings (Hot-Dip).
      - A 780 Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
      - B 6 Specification for Zinc.

- E 376 Practice for Measuring Coating Thickness by Magnetic-Field or Eddy-Current (Electromagnetic) Test Methods.

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

- Metal Finishes Manual.

d. Any other Standards referenced form a part of this Specification to the extent referenced.

3. Manufacturer's published specifications, installation requirements, and instructions as approved by the Architect.
4. Correlation and Intent of the Contract Documents: In the event of conflicts or discrepancies between the Contract Documents, the requirements of regulatory agencies, and the indicated Reference Standards, the most stringent requirements govern.

B. Qualifications

1. Galvanizer:
   a. A firm specializing in hot dip galvanizing after fabrication and with not less than five (5) years of successful experience in hot dip galvanizing.
   b. Member of AGA.

1.5 DELIVERY, STORAGE AND HANDLING

A. Handle all items to be galvanized in such a manner as to avoid any mechanical damage and to minimize distortion.

B. Store and handle in strict compliance with manufacturers' instructions and recommendations.

1. Load and store galvanized items in a manner that prevents formation of wet storage film.
2. Stack or bundle galvanized items to allow air between galvanized surfaces.
3. Do not store galvanized items directly on building or ground surface.

1.6 COORDINATION AND SCHEDULING

A. The Contractor must consult with the Fabricator and Galvanizer regarding potential problems or potential handling problems during the galvanizing process which may require modification of design before

fabrication proceeds. Contractor to notify the Architect in a timely manner of any proposed design modifications.

B. Prior to fabrication, Contractor must submit approved fabrication Shop Drawings to the Galvanizer. The Galvanizer must review fabricator's shop drawings for suitability of materials for galvanizing and coatings and coordinate any required fabrication modifications.

C. Determination of Special Processing: For steel to be hot-dip galvanized, provide steel chemically suitable for metal coatings complying with the following requirements: carbon below 0.25%, phosphorous below 0.04%, manganese below 1.3%, and silicon below 0.04%. Notify the Galvanizer if steel does not meet these requirements so that suitability for galvanizing may be determined and whether special processing techniques are required.

1.7 GALVANIZER'S QUALITY CONTROL SYSTEM

A. Inspection and testing of hot dip galvanized coatings must be done per the guidelines of Inspection of Hot Dip Galvanized Products by AGA.

1. Include visual examination and tests in accordance with ASTM A 123 or A 153 as applicable to determine acceptable adhesion and thickness of the zinc coating on the metal surface.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Base material for galvanizing must be geometrically suitable for galvanizing as described in ASTM A 384 and A 385. Steel materials suitable for galvanizing include structural shapes, pipe, sheet, fabrications and assemblies.

B. Base materials must be chemically suitable for galvanizing.

C. Zinc for galvanizing must conform to ASTM B6, Prime Western grade.

2.2 FABRICATION REQUIREMENTS

A. Fabrication practices for products to be in accordance with the applicable portions of ASTM A 143, A 384, and A 385, except as specified herein. Avoid fabrication techniques which could cause distortion or embrittlement of the steel.

1. Fabricate structural steel in accordance with Class II guidelines as described in Recommended Details of Galvanizing Structures by AGA.

B. Remove all flux, welding slag, splatter, anti-splatter compounds and burrs using mechanical methods prior to galvanizing. When welding material to be galvanized, avoid the use of a high silicon welding rod.

C. Provide holes and/or lifting lugs at positions acceptable to the Architect in order to facilitate handling during the galvanizing process. Close holes after galvanizing where holes allow entry of water in completed work.

D. Avoid unsuitable marking paints. Use only water-soluble markers. Consult with the galvanizer about removal of grease, oil paint and other deleterious material prior to fabrication.

E. Remove by blast cleaning or other methods surface contaminants and coatings which would not be removable by the normal chemical cleaning process in the galvanizing operation.

F. Whenever possible, slip joints should be used to minimize field welding of materials.

2.3 SPECIAL FABRICATION REQUIREMENTS

A. For all hot dip galvanized components, comply with ASTM A143 recommendations for embrittlement avoidance.

B. Comply with ASTM A384 to avoid warpage and distortion. Notify Architect of potential issues.

C. Comply with ASTM A385 for recommended venting/drainage designs and sizing.

PART 3 - EXECUTION

3.1 PREPARATION

A. Inspection: Inspect substrates to which coating work of this section is applied for conditions which may impair or be detrimental to the performance of the system. No coating work shall be installed until corrections to substrates have been performed.

B. Metal Preparation: Pre-clean steel work in accordance with accepted methods to produce an acceptable surface for quality hot dip galvanizing.

3.2 GALVANIZING

A. Hot Dip Galvanize steel members, fabrications, and assemblies after fabrication by the hot dip process in accordance with ASTM A 123.

B. Hot Dip Galvanize bolts, nuts and washers and iron and steel hardware components in accordance with ASTM A 153.

C. Safeguard products against steel embrittlement in conformance with ASTM A 143.

D. Handle all articles to be galvanized in such a manner as to avoid any mechanical damage and to minimize distortion.

E. To minimize surface imperfections, use of the galvanizing process involving a flux blanket on the kettle (wet method) is prohibited.

F. Coat any steel item less than 44 feet in length and 8 feet in depth in a single dip to minimize potential distortion.

G. Tumble small parts during galvanizing to prevent build-up of galvanized coating.

H. Coating Requirements

1. Coating Weight: Conform with the minimum shown in paragraph 5.1 of ASTM A 123 or Table 1 of ASTM A 153, as appropriate.
2. Surface Finish: Continuous, adherent, as smooth and evenly distributed as possible and free from any defect detrimental to the stated end use of the coated article.
3. Adhesion: Withstand normal handling consistent with the nature and thickness of the coating and normal use of the article.

I. Post-Galvanizing Treatments

1. For architecturally exposed galvanized surfaces, provide passivation treatments as required to prevent wet storage staining.

3.3 REPAIRS

A. Galvanized Coatings

1. Touch-up damaged and abraded galvanized surfaces in strict compliance with ASTM A780. Prepare surfaces in compliance with SSPC AP-10 near white metal.
2. Shop Repair: The maximum area to be repaired is defined in accordance with ASTM A 123 Section 6.2 “Finish”.
3. Field Repair: For field touch up of hot-dip galvanized components and field coating of welded areas requiring corrosion protection,

repair using zinc rich coating or "cold galvanizing" compound. Provide factory mixed and prepared organic binder, zinc-rich paint specifically formulated for use on steel surfaces and for repair of hot dip galvanized steel. Minimum 95% by weight of dry film of "ultra-pure" zinc dust per ASTM D520 Type III. Provide a minimum dry film thickness of 8 mils.

3.4 PROTECTION

A. Protect galvanized items from all possible damage. Protection must be as recommended by manufacturer.

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SECTION 05 05 19
POST-INSTALLED ANCHORS IN CONCRETE AND MASONRY (BRICK OR CMU)

PART 1 - GENERAL

1.1 SUMMARY

A. The extent of work included in this Section is shown on the Contract Drawings and is specified as follows:

1. Furnish all work, labor, materials, equipment and supervision necessary to provide and install post-installed (drilled-in) anchors in previously placed concrete and/or in concrete masonry unit (brick or CMU) construction as indicated on the Contract Drawings, as specified herein, or as otherwise required to anchor or support materials and equipment from structure.
2. This Section includes requirements for the following types of anchors:
   a. Mechanical Anchors
      1) Expansion Anchors (self-expanding, drop-in or drilled-in)
      2) Screw Anchors
   b. Adhesive Anchors (bonded via grouts, epoxies, polymers or hybrids)
3. For adhesive anchors, include any required protection of anchors with approved fire-resistive materials, or spray-on fireproofing to meet Code requirements when anchors are attached to fire-resistive construction.

B. Work not included in this Section is as follows:

1. Anchors, embeds, and other materials placed prior to concrete pour and cast into concrete - See Section 03 30 00.
2. Concrete reinforcing steel - See Section 03 30 00.

1.2 DEFINITIONS

A. Post-installed anchors are those installed in the hardened medium (concrete, masonry) after that medium has gained the specified design strength and has cured for the minimum specified time period, unless noted otherwise in the Contract Drawings.

B. Post-installed anchors typically involve mechanical drilling into hardened medium. Drilling equipment maybe of common construction type

or specific to the manufactured anchor as instructed by the anchor manufacturer.

C. Delegated Design: When design of an anchorage is noted in the Contract Drawings to be provided by others, it includes, not by way of limitation, the selection of anchors, their dimensional and installation parameters and cluster geometry by the Contractor's professional engineer licensed in the State where the Work is to be performed. Such design must be based on information provided in the Contractor Documents including but not limited to architectural, civil, structural, mechanical, plumbing, and fire protection drawings and respective specifications and equipment or component manufacturer's published data.

1.3 PERFORMANCE REQUIREMENTS

A. General

1. All proposed anchors, anchoring locations, and any design loadings utilized must be approved by the Architect for each instance prior to installation.
2. Design of anchorage may either be provided directly in the Contract Drawings or referred to a Delegated Design by others with the loading information and other requirements indicated on the same drawings.
3. Completed anchor installation shall not compromise the design fire-resistance of a substrate.
4. Delegated Designs:
   a. Delegated Design, as defined this Section, must be based on the loading information provided in the Contract Drawings. In the event such information is not provided, the Contractor must obtain the necessary information from the respective subcontractor whose components are to be anchored to the structure. The loading thus obtained must be submitted to the Architect for review and approval prior to initiating the Delegated Design.
   b. Products proposed for use in the Delegated Design must conform to this Specification Section. Design and manufacturing information on products proposed for use under this Section and not

specifically listed herein below must be submitted to the Architect for review and approval in accordance with the Submittals article of this Section. Such information must contain proof of equivalency to the specified products with the applicable ICC ES report or testing information in accordance with ACI 355.2 or ACI 355.4 as applicable.

c. If anchoring substrate is subject to Delegated Design requirement, the Delegated Design Engineer for the substrate must additionally approve of the attachment.

B. Structural Performance

1. If a specific type of anchor is not indicated in the Contract Drawings or otherwise by the Architect, or where anchors are subject to layouts and/or other product selections being proposed by the Contractor, the anchorage design must be considered a part of Delegated Design and must comply with the following:

a. Select anchor type(s) appropriate to conditions and item being fastened to the structure. Submit all selections per the Submittals article of this Section.

1) For large areas of the floors, the allowance for suspended loads has been provided in the Contract Drawings under "Design Criteria". This loading is intended for large groups of anchors generally used to support ceilings and ceiling mounted ductwork and conduit systems. The service load carrying capacity of such anchors should not exceed 400 lbs, unless noted otherwise in the Contract Drawings for hanging loads.

2) The Contractor must submit operating weight and lateral load information on any mechanical or other equipment units intended to be supported by the structure to the Architect so that appropriate anchorage could be designed. Design of such anchorage performed by the Architect in the form of a drawing or a sketch must be considered an integral part of the Contract Documents.

a) Delegated Design of anchorage to the structure supporting mechanical or other equipment units performed by the Contractor's professional engineer, must be submitted to

the Architect with all supporting information not limited to calculations and drawings, in accordance with the Submittals article of this Section.

b. Use recommended and appropriate safety factors and strength reduction factors.

c. Confirm applicability of the proposed anchor(s) for cracked and uncracked concrete substrates, or type of masonry where the anchor(s) are intended to be used.

C. Noted Restrictions

1. Post-installed anchors covered by this Specification Section must be 1/4-inch or larger in diameter.
2. Post-installed anchors may only be installed in sound and fully cured concrete, unless permitted otherwise in writing by the Architect. Surfaces showing obvious distress by way of porosity or honeycombing, disintegration, carbonation, and cracks over 0.02-inch in width and 8 inches or longer and/or with evidence of propagation the distance of the embedment length must be reported to the Architect for evaluation.
3. Post-installed anchors may only be installed in fully cured (28 days or longer) brick or concrete (CMU) masonry.
4. Post-installed anchors shall not be used with lightweight concrete unless specifically tested per ICC-ES AC193, ICC-ES AC308, or ACI 355.2/355.4 as applicable.
5. Adhesive Anchors

   a. Adhesive anchors shall not be used in overhead applications or connections where anchors must be capable of resisting sustained tension.

   b. Adhesive anchors shall not be used where they will be exposed to sustained temperatures above 110-degrees Fahrenheit or short-term temperatures above 180-degrees Fahrenheit unless tested per ICC-ES AC308 for higher temperature.

   c. Adhesive anchors shall not be installed if substrate temperature is below 40-degrees Fahrenheit unless tested per ICC-ES AC308 for lower installation temperature.

1.4 SUBMITTALS

A. Product Data

1. Manufacturer's data sheets on each product to be used, including:
   a. Structural design criteria.
   b. Preparation instructions and recommendations.
   c. Installation methods not limited to equipment and technique.
   d. Storage and handling requirements and recommendations.

B. Code Compliance Report by ICC Evaluation Service or other agency recognized by the authority having jurisdiction. Code Compliance Reports must be submitted for anchors that will be considered for use on this project.

1. Anchors specifically referenced by the Contract Documents must have the Evaluation Service Reports provided with a cover letter indicating the applicable notes and/or details for each anchor (unless noted otherwise). Report to the Architect if the anchors referenced on the Drawings have not been adequately tested or whose evaluation reports do not exist. Proposed alternative anchors will then be considered in lieu of those referenced.
2. Anchors not specifically referenced by the plans or specifications must have the Evaluation Service Reports submitted with the associated justification.

C. Loading information for Delegated Design. This information must include operating weights and generated lateral loads of any equipment proposed to be fastened to the structure. Vibrating equipment must include manufacturer’s recommendations on accounting for effect(s) of dynamic forces on the anchorage.

D. Samples

1. Representative length and diameters of each type anchor shown on the Contract Drawings.
2. Submit three (3) samples of all materials.

E. Quality Control Submittals

1. Design Calculations
   a. Design Calculations for post-installed anchorages are generally required to be submitted for all Delegated Design unless noted otherwise. This includes the following:

1) Where design loads are shown on structural documents in lieu of completely detailed anchor information.
2) Where design loads are provided by the Contractor as a separate submittal to the Architect and copied to the professional engineer performing Delegated Design.
3) Upon request, when determined by the Architect that the submitted information is insufficient to complete review.

b. Calculations are not required to be submitted:
1) Where anchor size, length or embedment length, spacing, and a proprietary trade name are specifically shown on the Structural Drawings.
2) For individual anchors not shown on the Structural Drawings anchors (not anchor clusters) with manufacturer's information submitted and approved as specified, by the Architect and used by other trades and spaced greater than 18 inches in any direction and away from the structure edges. Those are typically used but not limited to hangers for ceilings, piping, mechanical equipment, electrical raceways, etc. The equipment supplier remains responsible for the proper anchor design.

1.5 SUBSTITUTIONS

A. Anchors included in this Section, but not shown in specific detail on the Contract Drawings, may be considered a substitution anchor for that detail.

B. Other post-installed anchors will be considered in lieu of specified anchors provided they meet the requirements of this Specification. Submittals to the Architect must demonstrate anchor equivalency or superiority based on manufacturer's published data and accompanying calculations, and must be approved in writing by the Architect prior to anchor installation.

C. The Architect may reject proposed substitutions for aesthetics, interference, inappropriate materials, fire ratings, or any other reason.

D. The contractor proposing substitutions is responsible for all additional costs incurred related to that substitution, including those

of other trades and design professionals. The contractor proposing substitutions is responsible for coordination with all other trades.

1.6 QUALITY ASSURANCE

A. Correlation of Performance Requirements: The Work of this Section is subject to the performance requirements indicated in the Contract Documents and as follows:

1. Requirements of Regulatory Agencies: The Work is subject to all applicable provisions of the Codes and Standards required by the authorities having jurisdiction.
2. Reference Standards: For the purposes of the Work of this Section, the documents listed below are applicable "Reference Standards". Provide only materials complying with referenced standards, and which are certified for such compliance. Comply with following documents, latest edition except as herein modified:
   a. American Concrete Institute (ACI):
      1) ACI 318-11, Appendix D ACI 318-19, Chapter 17.
      2) ACI 355.2, "Qualification of Post-Installed Mechanical Anchors in Concrete".
      3) ACI 355.4, "Qualification of Post-Installed Adhesive Anchors in Concrete".
   b. Any other Standards referenced form a part of this Specification to the extent referenced.
3. Special Code Requirements
   a. Mechanical Anchors:
      1) Expansion, Drop-in, and Screw Anchors (Concrete): ICC-ES AC193.
      2) Expansion Anchors (Masonry): ICC-ES AC01.
      3) Screw Anchors (Masonry): ICC-ES AC106.
   b. Adhesive Anchors:
      1) Adhesive Anchors (Concrete): ICC-ES AC308.
      2) Adhesive Anchors (Masonry): ICC-ES AC58.
4. Manufacturer's published specifications and installation requirements and instructions. Manufacturer's Anchor Selection Guide identifying proposed anchor as suitable for intended use/material.

5. Design Requirements: Where the Contract Documents indicate specific design requirements, any performance criteria included within the design requirements will be subject to the correlation requirements of this Section.
6. Correlation and Intent of the Contract Documents: In the event of conflicts or discrepancies between the Contract Documents, the requirements of regulatory agencies, and the indicated Reference Standards, the most stringent requirements govern.

B. No post-installed concrete anchors shall be permitted without anchor manufacturer having obtained ICC-ES Evaluation Report for a specific anchor indicating its approval for use in cracked concrete.

C. Where material or equipment must be supported from the structure, the installer of that material or equipment support is responsible for supplying the anchors and meeting the requirements of this specification unless specifically noted otherwise on the plans.

D. Mock-Ups: When the Architect is requested to review a Substitution, a field-constructed mock-up may be requested. Upon request, build mock-ups to comply with the following requirements, using materials indicated for final work:
   1. Locate mock-ups on site in location and of size indicated or, if not indicated, as directed by the Architect.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents unless such deviations are specifically approved by the Architect in writing.
   3. Approved mockups may not remain as part of the Work.

E. Tests and Inspections
   1. The Owner will engage, at his/her expense, an independent Testing Agency to observe anchor installation as outlined in Section 01 45 29 of these specifications under “Drilled-In Inserts”.
      a. If visual inspection reveals that the installed anchor does not meet the specified requirements, the anchor must be removed, replaced, or relocated with the written approval of the Architect.
   2. Tests and Inspections During Construction: See “Field Quality Control” Article in Part 3 of this Section.

1.7 CONTRACTOR'S QUALITY CONTROL SYSTEM

A. General:

1. In accordance with Division 1 requirements, the Contractor must establish a Quality Control System for the work of this Section.
2. The Contractor’s Quality Control System is the means used by the Contractor to become assured that the construction complies with the requirements of the Contract Documents (including, but not limited to, materials, workmanship, construction, and finish) to the satisfaction of the Owner, Architect, and authorities having jurisdiction. The Contractor must establish a system of quality control for the Work that includes sufficient inspection and testing of all items of Work, including that of the Contractor’s subcontractors.

B. Contractor’s Quality Control System must include, but not be limited to, the following:

1. General: Review of existing conditions, substrate conditions, requirements of related work, installation instructions, storage and handling procedures, and protection measures.
2. Comprehensive Independent Testing Agency Services: Contractor is responsible for providing any independent inspection and testing above and beyond the minimum requirements indicated in the Contract Documents, as may be necessary to ensure compliance thereto. Contractor is also responsible for the following:
   a. Coordination of any testing and inspections as required by the authorities having jurisdiction to obtain the necessary approvals for the work of this Section.
3. Quality-Control-Related Scheduling and Coordination: Include, not by way of limitation, the following:
   a. Coordination with the authorities having jurisdiction to obtain the necessary approvals for the work of this Section.

C. Quality Control During Construction: See FIELD QUALITY CONTROL Article in Part 3 of this Section.

D. Quality Control Records: Contractor must maintain accurate records of all inspections and tests performed, instructions received from the Architect, responsible Engineer or Testing Agency, and actions taken as

a result of those instructions. These records must include evidence that the required inspections or tests have been performed (including type and number of inspections or tests, nature of defects, causes for rejection, etc.), proposed or directed remedial action, and corrective action taken. At the request of the Architect, allow access to records pertaining to Contractor's quality control activities.

1.8 INDEPENDENT TESTING AGENCY SERVICES

A. General:
   1. Comply with Division 1 requirements for all testing and/or inspections applicable to this Section.
   2. The Contractor must employ and pay for the services of an Independent Inspection and Testing Agency (indicated herein as "Testing Agency" or "TESTING AGENCY") to perform the inspections, tests and other services outlined in the Contract Documents. Services must be performed in accordance with requirements of governing authorities and with specified standards.

B. Quality Control Tests and Inspections During Construction: See FIELD QUALITY CONTROL Article in Part 3 of this Section.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Interior Use (unless noted otherwise): Provide carbon steel anchors with zinc plating in accordance with ASTM B633 (Class SC1, Type I) for use in conditioned environments free from potential moisture. For interior uses where anchor is in contact with preservative treated wood anchors must be mechanically galvanized, hot dip galvanized or 300 series stainless steel.

B. Exposed Use (unless noted otherwise): Provide hot dip galvanized anchors with hot dip galvanized nuts and washers or stainless steel anchors using Series 300 stainless steel bolts with Series 304/316 or Type 18-8 stainless steel nuts and washers unless noted otherwise for the following conditions:
   1. Exterior environments.
   2. Potentially moist environments including exterior wall construction.

3. Corrosive environments including parking areas.
4. All exterior wall cladding support and anchorage.
5. Where anchor is in contact with preservative treated wood.
6. As noted on the Drawings.

2.2 PRODUCTS

A. Expansion Anchors

1. Concrete Wedge Anchors (expansion bolt) and Drop-in Anchors:
   a. Carbon steel anchors (where noted): ASTM B633, Class SC1, Type I or III.
   b. Stainless steel anchors (where noted): ASTM F593, Type 303, 304 or 316.
   c. Tested and qualified for performance in cracked and uncracked concrete in accordance with ACI 355.2 and ICC-ES AC193 for all mandatory tests.
2. Masonry Wedge Anchors (expansion bolt):
   a. Federal Specification A-A-1923A, Type 4.
   b. Mechanically galvanized (where noted): ASTM B695, Class 55, Type 1.
   c. Stainless steel anchors (where noted): ASTM F593, Type 303, 304 or 316.
   d. Tested in accordance with ICC-ES AC01 for all mandatory tests.

B. Screw Anchors

1. Concrete Screw Anchors:
   a. Carbon steel heat-treated or hardened.
   b. Zinc-plated in accordance with ASTM B633, Class SC1, Type I or equivalent coating.
   c. Tested and qualified for use per ICC-ES AC193 for all mandatory tests.
2. Masonry Screw Anchors: (Grouted Masonry Only):
   a. Carbon steel heat-treated or hardened.
   b. Zinc-plated per ASTM B633, Class SC1, Type I, mechanically galvanized per ASTM B695, or equivalent coating.
   c. Tested per ICC-ES AC106 for all mandatory tests (and seismic tests).

C. Adhesive Anchors

1. Adhesive anchors consist of an insert and an adhesive.
2. Inserts:
   a. Threaded Rod Inserts: Provide preparation or configuration as recommended by manufacturer.
      1) All Exposures (unless noted otherwise): Zinc coated; hot-dipped per ASTM A123 or ASTM A153 Class C or D, or mechanically deposited per ASTM B695, Class 65, Type I.
3. Adhesives for Concrete:
   a. Epoxy: ASTM C881 Type IV, Grade 3, Class B and C.
   b. Acrylic: Cartridge type, two-component, acrylic based system dispensed and mixed through a static mixing nozzle supplied by the manufacturer. Minimum physical requirements of ASTM C881 Type IV, Grade 3, Class A, B and C.
   c. Tested and qualified for use in cracked and uncracked concrete in accordance with ICC- ES AC308 for all mandatory and optional seismic tests including creep tests.
      1) Post-installed adhesive anchors must be tested for installation in water-saturated concrete per ICC-ES AC308.
      2) Post-installed adhesive anchors must be tested for standing water in holes per ICC-ES AC308.
4. Adhesives for Solid Concrete and Brick Masonry:
   a. Epoxy: ASTM C881 Type IV, Grade 3, Class B and C.
   b. Acrylic: Cartridge type, two-component, acrylic based system dispensed and mixed through a static mixing nozzle supplied by the manufacturer. Minimum physical requirements of ASTM C881 Type IV, Grade 3, Class A, B and C.
   c. Tested in accordance with ICC-ES AC58 for all mandatory tests and the following optional tests:
      1) Seismic tests
      2) Creep tests
      3) Dampness tests
      4) Freeze-thaw tests
5. Adhesives for Hollow Concrete Masonry:
   a. Epoxy: ASTM C881 Type IV, Grade 3, Class B and C.

b. Tested in accordance with ICC-ES AC58 for all mandatory tests and the following optional tests.
   1) Seismic tests
   2) Creep tests
   3) Dampness tests
   4) Freeze-thaw tests

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work. Report all deviations from the Contract Documents to the Architect in writing.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ASSESSMENT OF EMBEDDED ITEMS

A. **Identify location of embedded items such as reinforcing steel, stressing tendons, conduit, heating tubes, etc. prior to drilling holes.** Coordinate with respective trades if any apparent conflict exists.

B. The Contractor is responsible for the cost of any required repairs including engineering costs.

3.3 INSTALLATION

A. Install in strict accordance with manufacturer's instructions and recommendations and as required by applicable Code including, but not limited to, applicable requirements of ICC-ES evaluation reports.
   1. Use special tools when recommended by manufacturer for installation of anchors unless otherwise permitted specifically by the Architect.

B. Apply anchor items neatly, with anchor mounted plumb and level unless otherwise indicated.

C. Anchors must be installed perpendicular to the concrete surface within a plus or minus 5-degree tolerance. Post-installation verification of this criterion may be satisfied by visual inspection to verify proper seating of the nut and washer.

D. In areas where concrete has been removed, the minimum anchor embedment must be measured from the surface of sound concrete.

E. Drill holes of proper diameter and depth in accordance with manufacturer's published design information for that specific anchor. Use only equipment approved by anchor manufacturer. All holes must be perpendicular to the concrete surface unless shown otherwise on structural plans.

1. Do not drill holes until base material has cured for a minimum of 28 days and achieved full design strength.
2. Depth of drilled holes must be limited where required by the Contract Documents and any drilling into manufactured components must be approved by the component manufacturer.
3. Exercise care in drilling to avoid damaging any existing embedded items. If embedded items are encountered, stop drilling and contact the Architect immediately. Any offsets or relocations of anchors must be approved by the Architect.

F. Clean out holes, properly prepare substrate, and install anchors in accordance with manufacturer's written instructions. Proper tools must be on job site.

G. For adhesive anchors, maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer. Verify that base material temperature is within manufacturer's stated limits. Do not install adhesive anchors if any criteria do not fall within manufacturer's limits. Ensure that bore holes and anchors are free of dust, standing water, ice, debris, grease, oil, dirt and other foreign matter.

H. For adhesive anchors, protect anchors with approved fire-resistive materials, or spray-on fireproofing when anchors are attached to fire-resistive construction. Refer to ICC-ES Evaluation Service Reports (ESR's) Conditions of Use for applicability.

I. Bending and welding of post-installed anchors is not permitted.

3.4 FIELD QUALITY CONTROL

A. General:

1. During progress of the Post-Installed Anchors work, Contractor must monitor construction activities and coordinate all inspection

activities required by the Contract Documents to ensure compliance with specified parameters.

2. The Government may employ a separate testing agency to evaluate Contractor's Quality Control System and the field work of this Section. Additionally, the Government reserves the right to additionally sample and test materials being used for the work of this Section.

B. Identified Deficiencies and Review of Proposed Remedial Work:

1. Where Project inspections and/or testing indicate deficiencies in the Work, or non-compliance with this Section and/or the reference standards, the subject Work will be considered defective. For defective work:
   a. Contractor must prepare recommendations for additional or remedial work to compensate for deficiencies. Submit all recommendations to the Architect for review.
   b. Once submitted recommendations have been reviewed and found acceptable by the Architect, proceed with additional or remedial work as required to compensate for deficiencies.
   c. Additional testing and inspecting, at Contractor's expense, must be performed to determine compliance of replaced or additional work with specified requirements.
   d. Proceed with enclosing Structural Steel with other construction only after inspection reports are issued and installations comply with requirements.
2. Remedial action deemed necessary by the Architect and resulting from non-compliance with the Contract requirements must be addressed as described for "Corrective Measures" in Division 1 of these Specifications.
3. Where remedial action was deemed necessary based on Quality Control Testing, retest all remedial work until test results prove subject Work complies with indicated requirements.

C. Independent Inspection and Testing:

1. General: An independent testing agency engaged per Part 1 of this Section must monitor the work of this Section for compliance with project Contract Documents and the approved Submittals.

2. Special Inspections and Tests: Perform all testing and inspections indicated for Steel Construction in the "Required Special Inspections and Tests" section of the Building Code, as required by the Contract Documents, and as additionally required by the Authorities Having Jurisdiction.
   a. See Schedule of Special Inspections in Section 01 45 35 for additional information.
3. Other Tests and Inspections During Construction: Perform the following testing and inspections additionally if not otherwise included in Special Inspections and Tests requirements above:
   a. The Architect reserves the right to require the anchor manufacturer's representative to demonstrate proper installation procedures for post-installed anchors and to observe Contractor's installation procedures, at no extra cost to Government. See Mock-Up requirements in Part I of this Section.
   b. The Architect reserves the right to require pullout or shear tests to determine adequacy of anchors, at no extra cost to Government.
   c. Comply with Section 01 45 29 requirements and as additionally required to ensure compliance with the Contract Documents.
4. Reporting on the Work: Produce reports and digital photographs documenting each inspection and indicate whether subject work complies with or deviates from requirements.
   a. Reports must be distributed in timely manner to Owner, Contractor, Manufacturer, and Architect.
   b. Prepare and distribute required reports as specified in Division 1.

3.5 REPAIR AND RESTORATION OF DEFECTIVE WORK

A. Remove and replace misplaced or malfunctioning anchors. Fill empty anchor holes and patch failed anchor locations with high-strength non-shrink, nonmetallic grout. Anchors that fail to meet installation torque requirements will be regarded as malfunctioning.
B. All anchor repairs involving anchor relocation and re-installation must be reviewed by the Architect prior to commencement of this Work.

C. Abandoned holes must be grouted with non-shrink grout. When post-installed anchors fail to meet with requirements as determined by inspection and testing, the following repairs may be undertaken:

1. When failure is due to excessive anchorage pullout, the Contractor must evaluate the damage, develop a repair method, and document that method in writing. If approved, the anchor may be reset once prior to re-drilling the hole and installing an anchor of equal size. Use the minimum spacing embedment depth, and installation torque required for the original anchor.
2. When failure is due to breaking of the anchor, slippage or loosening, bending, improper installation or poor attachment, remove the defective anchor, re-drill the hole, and install the same diameter anchor if the integrity of surrounding concrete has not been disturbed.
3. For cases where excessive slippage upon torquing is experienced, or usage of the same hole is not possible, fill the existing hole with non-shrink grout and relocate the anchor location.
4. When failure is due to breakout of concrete around the anchor, the Contractor’s engineer must evaluate the damage, develop a repair method, and document that method in writing. Local spalling of the concrete around the anchor, up to a maximum depth of 1/4-inch, is not considered a concrete breakout failure.

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SECTION 05 12 00
STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. The extent of work included in this Section is specified as follows:

1. All labor, materials, equipment and services necessary for and incidental to the furnishing and installation of Structural Steel, as defined in the AISC "Code of Standard Practice" and as shown on the Drawings and as required by Project conditions.
2. Embedments into work of other trades, which will receive structural steel components via connections as detailed and described in the Contract Documents, will be considered a part of structural steel work, fabricated and furnished by the structural steel fabricator and installed by the General Contractor.
3. Provide structural analysis and design for structural steel components and/or connections as required this Section.

1.2 RELATED REQUIREMENTS

A. Materials Testing and Inspection During Construction: Section 01 45 29, TESTING LABORATORY SERVICES.

B. General requirements pertaining to Special Inspections by the Contractor’s Testing Agency: Section 01 45 35, SPECIAL INSPECTIONS.

C. Painting: Section 09 91 00, PAINTING.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. American Institute of Steel Construction (AISC):

1. AISC Manual - Steel Construction Manual, 14th Ed.
2. 303-10 - Code of Structural Steel Buildings and Bridges.
3. 360-10: Specification for Structural Steel Buildings.
4. AISC "Code of Standard Practice for Steel Buildings and Bridges".
5. AISC "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings" and including the "Commentary" and supplements thereto as issued.

6. AISC "Specifications for Structural Joints using ASTM A325 OR A490 Bolts" approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation.

C. The American Society of Mechanical Engineers (ASME):

1. B18.22.1-09 - Washers: Helical Spring-Lock, Tooth Lock, and Plain Washers.

D. American Welding Society (AWS):

1. D1.1/D1.1M-15 - Structural Welding Code - Steel.

E. ASTM International (ASTM):

1. A6/A6M-14 - General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling.
2. A36/A36M-14 - Carbon Structural Steel.
3. A53/A53M-12 - Pipe, Steel, Black and Hot-Dip, Zinc-Coated, Welded and Seamless.
4. A123/A123M-15 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
5. A242/A242M-13 - High-Strength Low-Alloy Structural Steel.
6. A283/A283M-13 - Low and Intermediate Tensile Strength Carbon Steel Plates.
7. A307-14 - Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength.
8. A500/A500M-13 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing and Rounds and Shapes.
9. A501/A501M-14 - Hot-Formed Welded and Seamless Carbon Steel Structural Tubing and Rounds and Shapes.
10. A572/A572M-15 - High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
11. A992/A992M-15 - Structural Shapes.
12. F2329/F2329M-15 - Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy steel Bolts, Screws, washers, Nuts, and Special Threaded Fasteners.
13. F3125/F3125M-15 - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830

MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions

F. Master Painters Institute (MPI):
   1. No. 18 - Primer, Zinc Rich, Organic.
G. Military Specifications (Mil. Spec.):
   1. MIL-P-21035 - Paint, High Zinc Dust Content, Galvanizing, Repair.
H. Occupational Safety and Health Administration (OSHA):
   1. 29 CFR 1926.752(e) - Guidelines For Establishing The Components Of A Site-Specific Erection Plan.
   2. 29 CFR 1926-2001 - Safety Standards for Steel Erection.
I. Research Council on Structural Connections (RCSC) of The Engineering Foundation:
   1. Specification for Structural Joints Using ASTM F3125 Bolts.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Delegated design requirements of this Section are applicable to the following:
   1. Any components proposed in lieu of components required by the Contract Documents.
   2. Any connections proposed in lieu of connections detailed in the Drawings.
B. Delegated Design Includes: Comprehensive engineering analysis by a qualified Delegated Design Engineer, using performance requirements and design criteria indicated and in compliance with the design intent, criteria, and requirements as indicated in the Contract Documents and all governing Codes.
   1. Delegated Design Engineer: Employ a professional engineer, specializing in design of similar installations and currently licensed to practice in the State where the Work is located, to perform design and prepare a Design Submittal per the requirements of this Section.
      a. Design Submittal must be signed and sealed by the Delegated Design Engineer and submitted per the requirements of this Section.
   2. Design of Components and/or Connections

a. Design of components and/or connections based on forces indicated on Drawings must be the Delegated Design Engineer's responsibility unless an individual connection has been fully detailed by the Architect/Structural Engineer.
b. All details shown are typical, similar details apply to similar conditions, unless otherwise indicated. Verify dimensions at the site whenever possible without causing delay in the work.
c. Promptly notify the Architect whenever design of members and connections for any portion of the structure appears not to be clearly indicated in the Contract Documents.

C. Structural Performance: Without exceeding the allowable design working stress of materials involved, and without exhibiting permanent deformation in any components, provide metal fabrications and connections capable of withstanding the following design loads within limits and under conditions indicated:
1. Design Loads: Components and connections must withstand design loads including, but not limited to, gravity, wind, seismic, and erection design loads and thermal movements established by applicable local building codes, and as indicated.
a. Design Limits and Conditions, General: Comply with limits and conditions indicated in the Structural General Notes/Drawings and this Section. In compliance with Code and ASCE/SEI 7 load combinations, design components and connections using applicable design criteria, including but not limited to, the following:
1) Specific Loads: As indicated.
2) Design Wind Pressure: See Structural Drawings for design criteria.
3) Seismic Forces: See Structural Drawings for design criteria.
2. Movement Accommodation: Metal fabrications (components), connections, anchorages, and attachments must withstand and accommodate, without maintenance or repairs, the effects of the following without exceeding performance criteria limits (including approved physical properties data), or failure due to defective

manufacture, fabrication, installation, or other defects in construction:

a. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

b. Temperature Change: Accommodate the following:

1) Average Low-to-Mean: 56 deg F

2) Average High-to-Mean: 29 deg F

c. Movements Due to Superstructure Creep and Shrinkage: See Structural Drawings for nature and magnitude of anticipated creep and shrinkage of the superstructure; components, connections, anchorages, and attachments must accommodate relative displacements of System supports.

d. Attachment to Open Structure: Components, connections, anchorages, and attachments must accommodate thermal movements of superstructure resulting from seasonal temperature differential. See the Drawings for additional information.

1.5 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data:

1. Manufacturer's data, specifications, and installation instructions for the following materials and products:

a. Structural steel (each type).

b. High-strength bolts (each type), including nuts and washers.

c. Unfinished bolts and nuts.

d. Proprietary fasteners.

e. Paint products.

f. Shrinkage-resistant grout.

g. Description of each type of welding stud and arc shield.

h. Welding materials.

2. Include certifications, laboratory test reports and other data as required to show compliance with these specifications (See Quality Control Submittals paragraph below).

C. Shop Drawings: Drawings including complete details and schedules for fabrication and shop assembly of members, and details, schedules, procedures and diagrams showing the sequence of erection.

1. Indicate profiles, sizes, spacing and locations of structural members, connections, attachments, anchorages, framed openings, size and type of fasteners, cambers, and clearances.
   a. Include details of cuts, connections, holes, and other pertinent data.
   b. Indicate welds by standard AWS symbols, and show size, net length, type of each weld and welding sequences.
   c. Identify all high-strength bolts not required to be tensioned (installed "snug tight" as defined by AISC).
2. Provide setting drawings, templates, and directions for the installation of anchor bolts and other anchorages to be installed by others.
3. Include complete details of all painting work to be performed.

Note: Review of Shop Drawings will be for Design Intent only. Compliance with requirements for material fabrication, assembly, and erection of structural steel is the Contractor's responsibility.

D. Quality Control Submittals:

1. Qualification Data:
   a. Delegated Design Engineer(s).
   b. Welding Personnel (Operators): Provide welding certificates indicating the operators to be employed in the work have satisfactorily passed AWS qualification tests within the previous six (6) months. If certificates are older than six (6) months, employer of operator must certify, in writing, that operator is in compliance with applicable AWS provisions pertaining to certification validity.
   c. Fabricator.
   d. Erector.

2. Welding Procedure and Equipment:
   a. Provide written description as required to illustrate each welding procedure to be performed in the specified work (for procedures not prequalified by AWS only).
   b. Include detailed surface preparation requirements.
   c. Provide descriptive data for field welding equipment, including type, voltage and amperage.
3. Mill Certificates: Signed by manufacturers of steel products certifying that products furnished comply with the specified chemical and physical properties.
4. Certified Test Reports: Provide test reports by a qualified testing agency indicating compliance with performance requirements of this Section. Prepare test reports in accordance with reporting procedure described in applicable test standards.
   a. Evaluation Reports: Research/Evaluation Reports indicating Code compliance.
5. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.
6. Coordination Shop Drawings: Drawings must be sufficient to indicate coordination with adjacent work.
7. Erection Procedure: Submit data, illustrative and written to describe the structural steel erection procedure, including the sequence of erection and temporary staying and bracing. Contractor must provide sufficient bracing, etc. so that the erected steel is stable during construction or until all the concrete slabs are poured.

E. Delegated Design Submittal(s): Where the Delegated Design requirements of this Section are applicable to proposed structural steel components and connections, submit detailed Design Calculations signed by the Delegated Design Engineer, and prepared specifically for this project.
   1. Design Calculations: Provide calculations showing how all design loads and performance requirements have been met. Include detail drawings of each proposed component and/or connection. Clearly show

all resultant loads on building structure due to work of this Section. Submit design calculations for the following:

a. Connections not completely detailed on the Structural Drawings.

b. Request for substitution of member sizes or material grades.

c. Modification of the strength or configuration of structural framing requested for the Contractor's convenience, erection sequence or construction equipment and/or materials.

Note: Such calculations must be in conformance with the reference standards cited herein and must clearly demonstrate applicability for the intended use.

2. Design Submittal(s) must be transmitted to the Architect at least three (3) weeks prior to the commencement of construction.

F. Record Surveys: Signed and sealed by responsible surveyor or engineer.

1.6 QUALITY ASSURANCE

A. General: The Quality requirements of this Section are intended to be complimentary to the requirements of Division 1. In the event of an apparent conflict, the Architect must be notified in a timely manner.

B. Source Quality Control: Materials and fabrication procedures are subject to inspection and tests in the mill, shop, and field by the Architect and/or the Owner’s testing Agency. Such inspections and tests will not relieve the Contractor of responsibility for providing materials and fabrication procedures in compliance with specified requirements.

C. Correlation of Performance Requirements: The Work of this Section is subject to the performance requirements indicated in the Contract Documents and as follows:

1. Requirements of Regulatory Agencies: The Work is subject to all applicable provisions of the Codes and Standards required by the authorities having jurisdiction.

2. Reference Standards: For the purposes of the Work of this Section, the documents listed below are applicable “Reference Standards”. Comply with following documents, latest edition:

a. American Institute of Steel Construction (AISC):

1) AISC "Code of Standard Practice for Steel Buildings and Bridges".
2) AISC "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings" and including the "Commentary" and supplements thereto as issued.
3) AISC "Specifications for Structural Joints using ASTM A325 OR A490 Bolts" approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation.

b. American Welding Society (AWS):
1) AWS D1.1, "Structural Welding Code - Steel".

c. ASTM International (ASTM):
1) ASTM A6 "General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use".

d. Any other Standards referenced form a part of this Specification to the extent referenced.

3. Manufacturer's published specifications, installation requirements, and instructions as approved by the Architect.
4. Design Requirements: Where the Contract Documents indicate specific design requirements, any performance criteria included within the design requirements will be subject to the correlation requirements of this Section.
5. Correlation and Intent of the Contract Documents: In the event of conflicts or discrepancies between the Contract Documents, the requirements of regulatory agencies, and the indicated Reference Standards, the most stringent requirements govern.

D. Qualifications:
1. Delegated Design Engineer: An engineer who is legally qualified per the PERFORMANCE REQUIREMENTS of this Section and who is experienced in providing engineering services for installations of structural steel components and assemblies that are similar in material, design, and extent to those indicated in the Contract Documents.
~~0.~~2. Fabricator Qualifications: AISC Quality Certification participant designated as AISC Certified Plant, Category STD.
~~.~~a. Regularly fabricates specified products.

~~.~~b. Fabricated specified products with satisfactory service on five similar installations for minimum five years.

3. Installer (Erector) Qualifications: AISC Quality Certification Program participant designated as AISC-Certified Erector, Category ACSE.

~~.~~a. Regularly installs specified products.

~~.~~b. Installed specified products with satisfactory service on five similar installations for minimum five years.

~~a.~~c. Before commencement of Work, ensure steel erector provides written notification required by OSHA 29 CFR 1926.752(e). Submit a copy of the notification to Contracting Officer's Representative.

~~6.~~4. Welders and Welding Procedures Qualifications: AWS D1.1/D1.1M.

a. All welders working on this project will be assigned an identifying symbol or mark. Each welder will be required to mark or stamp his symbol on each weldment completed for identification. Contractor must maintain a record of welders employed, date of qualification and symbol or identification mark assigned to each.

~~F.~~E. Project Quality Control: See CONTRACTOR'S QUALITY CONTROL SYSTEM and INDEPENDENT TESTING AGENCY SERVICES Articles below.

~~G.~~F. Record of the Work: A record of the Work of this Section, including all Quality Control Submittals required this Section, must be kept by the Contractor. Such record must be kept until the completion of the Project and must be available to the Architect for examination at any time.

1. See CONTRACTOR'S QUALITY CONTROL SYSTEM Article, "Quality Control Records" Paragraph below for additional requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the site at such intervals to insure uninterrupted progress of the Work.

1. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete or masonry, in ample time to not delay that work.

B. Store materials to permit easy access for inspection and identification. Keep steel members off the ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.
   1. Do not store materials on the structure in a manner that might cause distortion or damage to the members of the supporting structures. Repair or replace damaged materials or structures as directed.

C. Handling, shipping, and erecting of painted steel shall not be performed until thoroughly dry. Special care must be exercised to avoid abrasion or other damage to the coated surfaces. Stacking and storing of painted members in the shop, in transit, and at the job site must be done using softeners and timbers to keep individual members free from contact with the ground, and with each other; and must be protected from soiling by adjacent fabrication of construction operations.

1.8 PROJECT CONDITIONS

A. Field Measurements: Check actual locations of walls and other construction to which structural steel components and assemblies must fit, by accurate field measurements before fabrication; show recorded measurements on final Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delay of work.
   1. Where field measurements cannot be made without delaying the work, guarantee dimensions and proceed with fabrication of products without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to guaranteed dimensions. Allow for trimming and fitting.

B. Protection: Protect any adjacent materials or areas below from damage due to weld splatter or sparks during field welding.

1.9 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages, steel weld plates and angles. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry.

1.10 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

1.11 CONTRACTOR'S QUALITY CONTROL SYSTEM

A. General:

1. In accordance with Division 1 requirements, the Contractor must establish a Quality Control System for the work of this Section.
2. The Contractor’s Quality Control System is the means used by the Contractor to become assured that the construction complies with the requirements of the Contract Documents (including, but not limited to, materials, workmanship, construction, and finish) to the satisfaction of the Owner, Architect, and authorities having jurisdiction. The Contractor must establish a system of quality control for the Work that includes sufficient inspection and testing of all items of Work, including that of the Contractor’s subcontractors.

B. Contractor’s Quality Control System must include, but not be limited to, the following:

1. General: Review of existing conditions, substrate conditions, requirements of related work, installation instructions, storage and handling procedures, and protection measures.
2. Comprehensive Independent Testing Agency Services: Contractor is responsible for providing any independent inspection and testing above and beyond the minimum requirements indicated in the Contract Documents, as may be necessary to ensure compliance thereto. Contractor is also responsible for the following:

a. Coordination of any testing and inspections as required by the authorities having jurisdiction to obtain the necessary approvals for the work of this Section.

3. Quality-Control-Related Scheduling and Coordination: Include, not by way of limitation, the following:
   a. Providing access for the COR, Architect, and Testing Agency to places where structural steel work is being fabricated or produced.
   b. Scheduling and Convening of Contractor's Quality Control Conferences: Contractor to schedule and conduct conferences for the purposes of coordinating quality control for the Project.
      1) The Architect, responsible Engineer, and the Owner must be invited to attend the conference at their election and must be notified by the Contractor at least fifteen (15) working days prior to the scheduled date of the conference. Unless it is confirmed that the Architect/Engineer will NOT be attending the meeting, all conferences are to be scheduled in conjunction with the scheduled site visits being performed by the Architect or as approved by the Architect.
      2) Record minutes of each conference and distribute in typed or printed form to each party in attendance within five (5) working days of the meeting. One copy of these minutes must also be transmitted to the Owner and the Architect for information.
      3) Contractor's conference schedule must include, not by way of limitation, the conferences indicated below.
   c. Coordination with the authorities having jurisdiction to obtain the necessary approvals for the work of this Section.

C. Pre-Construction Conference: Conference to review Project requirements including all related Quality Control requirements, prior to commencement of the applicable portion of the Work.
   1. The Contractor must require responsible representatives of each party concerned with that portion of the work to attend the conference, including but not limited to the following:

a. Contractor's Superintendent and Project Manager
b. Materials supplier(s) or fabricator.
c. Installation Subcontractor(s).
d. Subcontractors of subsequent Work if work requires interfaces thereto.
e. Testing Agency.

2. Contractor must have a copy of all approved Shop Drawings and Submittals applicable to the Work present at the Pre-Construction Conference.

D. Painted Coatings: A pre-production conference must be arranged by the Contractor with the Fabricator and a representative of the paint manufacturer in attendance, to discuss all details relevant to performing the work in accordance with the requirements.

E. Quality Control During Construction: See FIELD QUALITY CONTROL Article in Part 3 of this Section.

F. Quality Control Records: Contractor must maintain accurate records of all inspections and tests performed, instructions received from the Architect, responsible Engineer or Testing Agency, and actions taken as a result of those instructions. These records must include evidence that the required inspections or tests have been performed (including type and number of inspections or tests, nature of defects, causes for rejection, etc.), proposed or directed remedial action, and corrective action taken. At the request of the Architect, allow access to records pertaining to Contractor's quality control activities.

1.12 INDEPENDENT TESTING AGENCY SERVICES

A. All testing and/or inspections applicable to this Section must comply with Section 01 45 29.

B. See FIELD QUALITY CONTROL Article in Part 3 of this Section for additional Quality Control requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. W and S-Shapes:

1. ASTM A572/A572M; Grade 50, unless otherwise noted on the Drawings.

B. Channel and Angles:

1. ASTM A36/A36M.

C. Plates and Bars:

1. ASTM A36/A36M.

D. Hollow Structural Sections:

1. ASTM A500/A500M.

E. Structural Pipe:

1. ASTM A53/A53M, Type E or S, Grade B, double extra strong.

F. Carbon Steel Castings: ASTM A27, Grade 65-35, medium-strength carbon steel.

G. Anchor Bolts: ASTM F1554 rods with ASTM A563 Grade A nuts and ASTM F436 washers, unless otherwise indicated.

H. High-Strength Bolts, Nuts, and Washers: Heavy hexagonal structural bolts, heavy hexagon nuts, and hardened washers, all galvanized and complying with ASTM A325 or ASTM A490.

I. Welding Materials: AWS D1.1, type to suit application.

J. Filler Material for Welding

1. Shielded metal-arc welding AWS A5.1
2. Welded joints designed using E70xx low hydrogen electrodes.
3. Fabricator or Erector may substitute filler material in accordance with Section 1.17.2 of AISC Specification for Structural Steel for Buildings after obtaining Architect's approval.

2.2 PRODUCTS - GENERAL

A. Metallic Non-Shrink Grout: See Section 03 60 00.

2.3 FABRICATION TOLERANCES

A. Unless noted otherwise, fabrication tolerances for structural steel must be held within limits established by ASTM A6 and by Article 6.4 AISC 303, Code of Standard Practice for Steel Buildings and Bridges, and by Standard Mill Practice - General Information (AISC Steel Construction Manual).

2.4 FABRICATION

A. Fabricate structural steel according to Chapter M, AISC 360.

B. Shop Fabrication and Assembly:

1. Fabricate and assemble structural assemblies in the shop to the greatest extent possible. Fabricate items of structural steel in accordance with the governing specifications and as indicated on the final shop drawings. Provide camber in structural members as shown, and fabricate so that the natural camber of the beams is turned upward.
2. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence, which will expedite erection and minimize field handling of materials.
3. Where finishing is required, complete the assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in the final structure free of markings, burrs, and other defects.
4. Fabricate Structural Steel in accordance with the latest AISC Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.

C. Shop and Field Connections:

1. Bolt field connections, except where welded connections or other connections are indicated.
   a. Provide high-strength threaded fasteners for all principal bolted connections, except where otherwise shown.
2. High-Strength Bolted Construction: Install high-strength threaded fasteners in accordance with AISC "Specifications for Structural Joints using ASTM A325 or A490 Bolts".
   a. All high strength bolts must be tightened by standard impact wrench using the turn-of-the-nut method.
   b. Other tightening methods, conforming to specifications for structural steel joints may be used only with approval of the Architect.
3. Bolted connections with approved proprietary fasteners: Install fasteners in specifically identified connections in strict accordance with submitted Research/Evaluation Reports and fastener manufacturer’s instructions. In the event of discrepancies between

the two respective documents notify the Architect immediately, who will issue Supplementary Instructions.

4. Welded Construction: Comply with AWS Code for procedures, appearance and quality of welds, and methods used in correcting welding work.
   a. Protect adjacent materials from damage by field welding operations and provide non-combustible shield as required.
   b. Where surfaces to be welded are zinc coated (galvanized), strictly follow any special procedures included in the approved welding procedure Submittal.
   c. In all instances of coating removal/repair on shop galvanized surfaces, any required surface preparation prior to welding and/or coating application as well the application of the repair coating must be witnessed by the Testing Agency per Section 01 45 29 of these Specifications.
   d. Assemble and weld built-up sections by methods which will produce true alignment of axes without warp.
5. Shear Connectors: Prepare steel surfaces as recommended by the manufacturer of the shear connectors.
   a. Provide headed stud type shear connectors welded to beams, girders, and other areas as detailed. Spacing as indicated on the drawings or, if not so indicated, studs to be uniformly spaced in a zigzag pattern along the length of the member.
   b. Headed type shear connectors must be automatically end-welded in accordance with Article 431 and 432 of AWS Building Code.
6. Bearing Plates:
   a. Bearing plates must be provided under beams and girders resting on footings, piers and walls.
   b. Where not specifically indicated in the Contract Documents, bearing plates shall be either loose or attached.
7. Base Plates:
   a. Column base plates must be rolled, pressed and milled as per AISC Specification, Sect. 1.21.3 and furnished attached to the column.

D. Holes for Other Work:

1. Provide holes required for securing other work to structural steel framing, and for the passage of other work through steel framing members, as shown on the final shop drawings. Provide threaded nuts welded to framing, and other specialty items as shown to receive other work.
2. Cut, drill or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.

2.5 FINISHES

A. General:
   1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
   2. Finish metal fabrications after assembly.
   3. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

B. Shop Priming:
   1. Prime paint structural steel according to AISC 303, Section 6.
      a. Interstitial Space Structural Steel: Prime paint, unless indicated to receive sprayed on fireproofing.

C. Shop Finish Painting: Apply primer and finish paint as specified in Section 09 91 00, PAINTING.

D. Do not paint:
   1. Surfaces within 50 mm (2 inches) of field welded joints.
   2. Surfaces indicated to be encased in concrete.
   3. Surfaces receiving sprayed on fireproofing.
   4. Beam top flanges receiving shear connector studs applied.

E. Structural Steel Galvanizing: ASTM A123/A123M, hot dipped, 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.
   1. Galvanize structural steel framing installed at exterior locations.

F. Bolts, Nuts, and Washers Galvanizing: ASTM F2329, hot-dipped.

2.6 ACCESSORIES

A. General: Shop paint steel according to AISC 303, Section 6.

B. Finish Paint System: Primer and finish as specified in Section 09 91 00, PAINTING.

C. Galvanizing Repair Paint: Comply with Section 05 05 15.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine substrates, structural support, and conditions under which the work of this Section is to be performed before installation, with Installer present, for compliance with requirements for installation tolerances and/or other conditions affecting performance of the Work including, but not limited to the following:

1. Prior to start of erection, the steel erector must check elevations of all bearing surfaces and locations of all embedded anchor bolts and connection plates.

B. Report all deviations from the Contract Documents and/or conditions detrimental to performance of the Work to the Architect in writing.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Field Measurements: Take measurements on-site per Part 1 requirements of this Section. Fabricator will be held responsible for any errors in fabrication and for correct fit of Structural Steel work.

3.3 ERECTION TOLERANCES

A. Unless noted otherwise, Erection tolerances must be in accordance with the AISC 303, Code of Standard Practice for Steel Buildings and Bridges, Article 7.13, except as follows:

1. Elevation tolerance for column splice points at time member is erected is 10 mm (3/8 inch).
2. Elevation tolerance for top surface of steel beams and girders at connections to columns at time floor is erected is 13 mm (1/2 inch).

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

B. Individual pieces must be erected so that deviation from plumb, level and alignment shall not exceed 1 to 500.

3.4 ERECTION

A. Erect structural steel according to AISC 303 and AISC 360. Comply with the governing reference Standards and as herein specified.

B. Temporary Shoring and Bracing: Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads during erection. Remove temporary members and connections when permanent members are in place and final connections are made.

C. Temporary Planking: Provide temporary planking and working platforms as necessary to effectively complete the work. Comply with all City, State, and OSHA regulations as required.

D. Anchor Bolts: Furnish anchor bolts and other connectors as necessary for securing structural steel to foundations and other in-place work.

1. Furnish templates and other devices as necessary for presetting bolts and other anchors to accurate locations.
   a. Refer to Division 3 of these specifications for anchor bolt installation requirements in concrete, and Division 4 for masonry installation.

E. Setting Bases and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean the bottom surface of base and bearing plates.

1. Set loose and attached base plates and bearing plates for structural members on wedges or other adjusting devices.
2. Tighten the anchor bolts after the supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with the edge of the base or bearing plate prior to packing with grout.
3. Pack grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure in strict compliance with the manufacturer's instructions, or as otherwise required.

4. See Section 03 60 00 for requirements related to Grouting.

F. Field Assembly: Set structural frames accurately to the lines and elevations indicated. Align and adjust the various members forming a part of a complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces, which will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
   1. Level and plumb individual members of the structure within specified AISC tolerances.
   2. Fasten splices of compression members only after the abutting surfaces have been brought completely into contact.
   3. Splices will be permitted only where indicated.
   4. Field connections, including high strength bolted construction, welded construction and shear connectors must comply with "Fabrication" requirements of this Section and any approved Delegated Design Submittals.

G. Erection Bolts: On exposed welded construction, remove erection bolts, fill holes with plug welds and grind smooth at exposed surfaces.

H. Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment, and the preparation of steel substrate at and adjacent to field welds.

I. Enlarge unfair holes to admit bolts by reaming only, unless otherwise noted. Do not enlarge unfair holes in members by burning or by the use of drift pins, except in secondary bracing members.

J. Gas Cutting: Do not use gas-cutting torches in the field for correcting fabrication errors in the structural framing. Cutting will be permitted only on secondary members, which are not under stress, as acceptable to the Architect. Finish gas-cut sections equal to a sheared appearance when permitted.

3.5 FIELD PAINTING

A. After welding, clean and prime weld areas to match adjacent finish.

B. Touch-up primer damaged by construction operations.

C. Apply galvanizing repair paint to galvanized coatings damaged by construction operations.

D. Finish Painting: As specified in Section 09 91 00, PAINTING.

3.6 FIELD QUALITY CONTROL

A. General:

1. During progress of the Structural Steel work, Contractor must monitor construction activities and coordinate all inspection activities required by the Contract Documents to ensure compliance with specified parameters.
2. The COR reserves the right, at any time before final acceptance, to reject material not complying with specified requirements.
3. The Government may employ a separate testing agency to evaluate Contractor's Quality Control System and the field work of this Section. Additionally, the Government reserves the right to additionally sample and test materials being used for the work of this Section.

B. Record Survey:

1. Engage Professional Land Surveyor or Registered Civil Engineer as specified in Section 01 00 00, GENERAL REQUIREMENTS to supervise surveys during erection as follows:
   a. Measure and record structural steel framing plumbness, level, and alignment after completing bolting and welding and before installation of work supported by structural steel.
   b. Check elevations of bearing surfaces.
   c. Check locations of anchor bolts.
   d. Identify deviations from the most stringent specified erection tolerances as indicated in the Contract Documents and/or the AISC "Code of Standard Practice for Steel Buildings and Bridges".

C. Identified Deficiencies and Review of Proposed Remedial Work:

1. Where Project inspections and/or testing indicate deficiencies in the Work, or non-compliance with this Section and/or the reference standards, the subject Work will be considered defective. For defective work:
   a. Contractor must prepare recommendations for additional or remedial work to compensate for deficiencies. Submit all recommendations to the Architect for review.

b. Once submitted recommendations have been reviewed and found acceptable by the Architect, proceed with additional or remedial work as required to compensate for deficiencies.

c. Additional testing and inspecting, at Contractor's expense, must be performed to determine compliance of replaced or additional work with specified requirements.

d. Proceed with enclosing Structural Steel with other construction only after inspection reports are issued and installations comply with requirements.

2. Remedial action deemed necessary by the Architect and resulting from non-compliance with the Contract requirements must be addressed as described for "Corrective Measures" in Division 1 of these Specifications.

3. Where remedial action was deemed necessary based on Quality Control Testing, retest all remedial work until test results prove subject Work complies with indicated requirements.

D. Independent Inspection and Testing:

1. General:

a. An independent testing agency engaged per Part 1 of this Section must monitor the work of this Section for compliance with project Contract Documents and the approved Submittals.

b. Testing Agency's inspector must perform required duties in such a way that neither fabrication nor erection is unnecessarily delayed or impeded. In no case shall the inspector recommend or prescribe the method of repair of a defect.

c. Testing Agency must perform shop inspections for a minimum of 20% of the beams, struts and similar members; this must include examination of steel for straightness and alignment, conformance to length tolerances, fissures, mill scale, and other defects and deformities, as described in ASTM A6, and examination of aforementioned fabricated pieces for conformity with approved shop drawings. Testing of welding must be performed as required herein.

d. Field inspection by the Testing Agency of erected steel must be such as to assure that the Work conforms to specified requirements and must include the following:
   1) Inspection of field welding as required herein.
   2) Ascertainment of proper fit and alignment.
   3) Ascertainment of proper installation and tensioning of bolts.
   4) Ascertainment that Contractor's erection procedures adequately correct for distortion and shrinkage in field welded assemblies and connections. The Testing Agency must measure weld shrinkage at all groove welds. Reports of such measurements must be submitted to the Architect within two (2) days of completion of welding.

2. Special Inspections and Tests: Perform all testing and inspections indicated for Steel Construction in the "Required Special Inspections and Tests" section of the Building Code, as required by the Contract Documents, and as additionally required by the Authorities Having Jurisdiction.
   a. See Schedule of Special Inspections is Section 01 45 35 for additional information.
3. Other Tests and Inspections During Construction: Perform the following testing and inspections additionally if not otherwise included in Special Inspections and Tests requirements above:
   a. Comply with Section 01 45 29 requirements and as additionally required to ensure compliance with the Contract Documents.
4. Reporting on the Work: Produce reports and digital photographs documenting each inspection and indicate whether subject work complies with or deviates from requirements.
   a. Reports must be distributed in timely manner to Owner, Contractor, Manufacturer, and Architect.
   b. Prepare and distribute required reports as specified in Division 1.

E. Post-Installation Quality Control Review: The Architect reserves the right to require the manufacturer's Delegated Design Engineer to

approve installations per designs submitted, at no extra cost to Government.

3.7 REPAIRS

A. Touch-up after erection must consist of smoothing all damaged painted areas, and building back each coat to achieve initial condition.

1. Where galvanized surfaces are damaged, prepare surfaces and repair in accordance with procedures specified in ASTM A780.
2. Touch-up painted surfaces with same type of shop paint used on adjacent surfaces. Where abraded to bare metal, and all other bare surfaces such as on field welds, bolts, washers and nuts - the surfaces must be cleaned to the standard of the shop-applied system.

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SECTION 05 50 00
Metal Fabrications

PART 1 - GENERAL

1.1 DESCRIPTION

A. The extent of work included in this Section is specified as follows:

1. All labor, materials, equipment and services necessary for and incidental to the furnishing and installation of Metal Fabrications as shown on the Drawings, as required by Project conditions, and as follows:
   a. Miscellaneous Hangers, Framing, Supports and Pipe Sleeves
   b. Loose Bearing and Leveling Plates
   c. Rough Hardware and Anchorages for Miscellaneous Metal
   d. Frames
   e. Gratings and Supports
   f. Abrasive Metal Stair Nosings
   g. Ladders
   h. Railings
   i. Steel Pipe Guards
   j. Steel Pipe Bollards
   k. Elevator Beams and Subsill Supports
   l. Corrosion Protection of Metals

B. Work includes Providing structural analysis and design for steel components and/or connections as required this Section.

C. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

1.2 RELATED REQUIREMENTS

A. Materials Testing and Inspection During Construction: Section 01 45 29, TESTING LABORATORY SERVICES.

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

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

1.3 DEFINITIONS

A. Society for Protective Coatings (SSPC) Environmental Zones:

1. 1A: Interior, normally dry (or temporary protection). Very mild.
2. 1B: Exterior, normally dry. Coatings may be subject to exposure to sunlight.
3. 2A: Frequently wet by fresh water. Coating may be subject to condensation, splash, spray or frequent immersion.
4. 2B: Frequently wet by salt water. Coating may be subject to condensation, splash, spray, or frequent immersion.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Delegated design requirements of this Section are applicable to the following:

1. Any components proposed in lieu of components required by the Contract Documents.
2. Any connections proposed in lieu of connections detailed in the Drawings.
3. All ladders and railings.

B. Delegated Design Includes: Comprehensive engineering analysis by a qualified Delegated Design Engineer, using performance requirements and design criteria indicated and in compliance with the design intent, criteria, and requirements as indicated in the Contract Documents and all governing Codes.

1. Delegated Design Engineer: Employ a Professional Engineer, specializing in design of similar installations and currently licensed to practice in the State where the Work is located, to perform design and prepare a Design Submittal per the requirements of this Section.
   a. Design Submittal must be signed and sealed by the Delegated Design Engineer and submitted per the requirements of this Section.
2. Design of Components and/or Connections

a. Design of components and/or connections based on forces indicated on Drawings must be the Delegated Design Engineer's responsibility unless an individual connection has been fully detailed by the Architect/Structural Engineer of Record.

b. All details shown are typical, similar details apply to similar conditions, unless otherwise indicated. Verify dimensions at the site whenever possible without causing delay in the work.

C. Structural Performance: Without exceeding the allowable design working stress of materials involved, and without exhibiting permanent deformation in any components, provide metal fabrications and connections capable of withstanding the following design loads within limits and under conditions indicated:

1. Design Loads: Components and connections must withstand design loads including, but not limited to, gravity, wind, seismic, and erection design loads and thermal movements established by applicable local building codes, and as indicated.

a. Design Limits and Conditions, General: Comply with limits and conditions indicated in the Structural General Notes/Drawings and this Section. In compliance with Code and ASCE/SEI 7 load combinations, design components and connections using applicable design criteria.

b. Railing Loads: Railings must withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1) Handrails and Top Rails of Guards:

a) Uniform load of 50 lbf/ ft. applied in any direction.

b) Concentrated load of 200 lbf applied in any direction.

c) Uniform and concentrated loads need not be assumed to act concurrently.

2) Infill Area of Guards:

a) Horizontal concentrated load of 50 lbf applied to 1 sq. ft. at any point in system, including panels, intermediate rails, balusters, or other elements composing infill area.

b) Load on infill area need not be assumed to act concurrently with loads on top rails.

c) Impact loads as required by governing codes.

c. Ladder Loads: Ladders must withstand the effects of loads as indicated in ASME A17.1; all parts and appurtenances necessary to meet these performance requirements ladder must be considered integral parts of the design.

2. Working Stresses: Determine allowable design working stresses of railing materials based on the following:

a. Aluminum: The lesser of minimum yield strength divided by 1.65 or minimum ultimate tensile strength divided by 1.95.

b. Stainless Steel: 60 percent of minimum yield strength.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

1.5 SUBMITTALS

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

B. Product Data: Manufacturer's data, specifications, anchor details, and installation instruction for products to be used in the fabrication of miscellaneous metal work, including painting products.

C. Shop Drawings:

1. Each item specified, showing complete detail, location in the project, material and size of components, method of joining various components and assemblies, finish, and location, size and type of anchors.

2. Mark items requiring field assembly for erection identification and furnish erection drawings and instructions.

3. Provide templates and rough-in measurements as required.

D. Delegated Design Submittal(s): Where the Delegated Design requirements of this Section are applicable to proposed steel components and connections, submit detailed Design Calculations signed by the Delegated Design Engineer, and prepared specifically for this project.

1. Design Calculations: Provide calculations showing how all design loads and performance requirements have been met. Include detail drawings of each proposed component and/or connection. Clearly show all resultant loads on building structure due to work of this Section. Submit design calculations for the following:
   a. Connections not completely detailed on the Structural Drawings.
   b. Request for substitution of member sizes or material grades.
   c. Modification of the strength or configuration of structural framing requested for the Contractor's convenience, erection sequence or construction equipment and/or materials.

   Note: Such calculations must be in conformance with the reference standards cited herein and must clearly demonstrate applicability for the intended use.

E. Quality Control Submittals
   1. Qualification Data
      a. Delegated Design Engineer(s).
      b. Welding Personnel (Operators): Provide welding certificates indicating the operators to be employed in the work have satisfactorily passed AWS qualification tests within the previous six (6) months. If certificates are older than six (6) months, employer of operator must certify, in writing, that operator is in compliance with applicable AWS provisions pertaining to certification validity.
   2. Welding Procedure and Equipment
      a. Provide written description as required to illustrate each welding procedure to be performed in the specified work (for procedures not prequalified by AWS only).
      b. Include detailed surface preparation requirements.
      c. Provide descriptive data for field welding equipment, including type, voltage and amperage.
   3. Mill Certificates: Signed by manufacturers of steel products certifying that products furnished comply with requirements.
   4. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

F. Furnish setting drawings and instructions for installation of anchors to be preset into concrete and masonry work, and for the positioning of items having anchors to be built into concrete or masonry construction.

1.6 QUALITY ASSURANCE

A. GENERAL

~~0.~~1. Each manufactured product must meet, as a minimum, the requirements specified, and must be a standard commercial product of a manufacturer regularly presently manufacturing items of type specified.

~~0.~~2. Each product type must be the same and be made by the same manufacturer.

~~0.~~3. Assembled product to the greatest extent possible before delivery to the site.

~~0.~~4. Include additional features, which are not specifically prohibited by this specification, but which are a part of the manufacturer's standard commercial product.

~~F.~~B. Correlation of Performance Requirements: The Work of this Section is subject to the performance requirements indicated in the Contract Documents and as follows:

1. Requirements of Regulatory Agencies: The Work is subject to all applicable provisions of the Codes and Standards required by the authorities having jurisdiction.
2. Accessibility Guidelines: Work of this Section must be in full compliance with all applicable accessibility requirements for buildings capable of accommodating the public as required by the authorities having jurisdiction. See Code Summary on the Drawings for additional information.
3. Reference Standards: Standards referenced in this Section are commonplace in the industry (unless noted otherwise) and are referred to by basic designation only. Standards form a part of this Specification to the extent referenced.
4. Manufacturer's published specifications, installation requirements, and instructions as approved by the Architect.
5. Design Requirements: Where the Contract Documents indicate specific design requirements, any performance criteria included within the

design requirements will be subject to the correlation requirements of this Section.

6. Correlation and Intent of the Contract Documents: In the event of conflicts or discrepancies between the Contract Documents, the requirements of regulatory agencies, and the indicated Reference Standards, the most stringent requirements govern.

~~G.~~C. Qualifications

1. Delegated Design Engineer: An engineer who is legally qualified per the PERFORMANCE REQUIREMENTS of this Section and who is experienced in providing engineering services for installations of steel components and assemblies that are similar in material, design, and extent to those indicated in the Contract Documents.
2. Welding Personnel: Operators must be qualified for each welding procedure according to the following (as applicable to the Work):
   a. AWS D1.1, "Structural Welding Code - Steel."
   b. AWS D1.2, "Structural Welding Code - Aluminum."
   c. AWS D1.6, "Structural Welding Code - Stainless Steel."

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 of Mechanical Engineers (ASME):
B18.2.2-87(R2010).....Square and Hex Nuts

C. American Society for Testing and Materials (ASTM):
A36/A36M-14.....Structural Steel
A47-99(R2014).....Malleable Iron Castings
A48-03(R2012).....Gray Iron Castings
A53-12.....Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
A123-15.....Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
A307-14.....Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
C1107-13.....Packaged Dry, Hydraulic-Cement Grout (Nonshrink)

F436-16.....Hardened Steel Washers

F468-06(R2015).....Nonferrous Bolts, Hex Cap Screws, Socket Head Cap Screws and Studs for General Use

F593-13.....Stainless Steel Bolts, Hex Cap Screws, and Studs

D. American Welding Society (AWS):

D1.1-15.....Structural Welding Code Steel

D1.2-14.....Structural Welding Code Aluminum

D1.3-18.....Structural Welding Code Sheet Steel

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

AMP 521-01(R2012).....Pipe Railing Manual

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

MBG 531-09(R2017).....Metal Bar Grating Manual

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

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

SP 1-15.....No. 1, Solvent Cleaning

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

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

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver materials unopened and in their original packaging, clearly labelled for identification. Sequence deliveries to avoid delays, but minimize on-site storage.

1. Deliver anchor bolts and other anchorage devices which are embedded in cast-in-place concrete or masonry construction to the project site in time to be installed before the start of cast-in-place concrete operations or masonry work.

B. Store materials in compliance with the manufacturers' written instructions and recommendations and as follows:

1. Store packaged materials in their original, unbroken package or container.
2. Store materials in a neat manner without exceeding the structural capacity of the storage substrates and in a manner to avoid permanent deflections.

3. Metals which are stored at the project site must be placed above ground on platforms, skids, or other supports. Protect steel from corrosion. Store other materials in a weathertight and dry place until ready for use.

C. Handle materials in strict compliance with manufacturer's instructions and recommendations. Protect from all possible damage. Only remove from storage area material quantities that can be installed in a day's work.

1.9 PROJECT CONDITIONS

A. Field Measurements: Check actual locations of walls and other construction to which metal fabrications must fit, by accurate field measurements before fabrication; show recorded measurements on final Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delay of Work.

1. Where field measurements cannot be made without delaying the work, guarantee dimensions and proceed with fabrication of products without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to guaranteed dimensions. Allow for trimming and fitting.

B. Protection: Protect any adjacent materials or areas below from damage due to weld splatter or sparks during field welding.

1.10 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages, steel weld plates and angles. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry.

1.11 CONTRACTOR'S QUALITY CONTROL SYSTEM

A. General:

1. In accordance with Division 1 requirements, the Contractor must establish a Quality Control System for the work of this Section.
2. The Contractor's Quality Control System is the means used by the Contractor to become assured that the construction complies with the requirements of the Contract Documents (including, but not limited to, materials, workmanship, construction, and finish) to the satisfaction of the Owner, Architect, and authorities having jurisdiction. The Contractor must establish a system of quality control for the Work that includes sufficient inspection and testing of all items of Work, including that of the Contractor's subcontractors.

B. Contractor's Quality Control System must include, but not be limited to, the following:
   1. General: Review of existing conditions, substrate conditions, requirements of related work, installation instructions, storage and handling procedures, and protection measures.
   2. Comprehensive Independent Testing Agency Services: Contractor is responsible for providing any independent inspection and testing above and beyond the minimum requirements indicated in the Contract Documents, as may be necessary to ensure compliance thereto.
   3. Quality-Control-Related Scheduling and Coordination: Include, not by way of limitation, the following:
      a. Coordination with the authorities having jurisdiction to obtain the necessary approvals for the work of this Section.

C. Painted Coatings: A pre-production conference must be arranged by the Contractor with the Fabricator and a representative of the paint manufacturer in attendance, to discuss all details relevant to performing the work in accordance with the requirements.

D. Quality Control During Construction: See FIELD QUALITY CONTROL Article in Part 3 of this Section.

E. Quality Control Records: Contractor must maintain accurate records of all inspections and tests performed, instructions received from the Architect, responsible Engineer or Testing Agency, and actions taken as a result of those instructions. These records must include evidence that the required inspections or tests have been performed (including

type and number of inspections or tests, nature of defects, causes for rejection, etc.), proposed or directed remedial action, and corrective action taken. At the request of the Architect, allow access to records pertaining to Contractor's quality control activities.

1.12 INDEPENDENT TESTING AGENCY SERVICES

A. General:
   1. Comply with Division 1 requirements for all testing and/or inspections applicable to this Section.
   2. The Contractor must employ and pay for the services of an Independent Inspection and Testing Agency (indicated herein as "Testing Agency" or "TESTING AGENCY") to perform the inspections, tests and other services outlined in the Contract Documents. Services must be performed in accordance with requirements of governing authorities and with specified standards.
B. Quality Control Tests and Inspections During Construction: See FIELD QUALITY CONTROL Article in Part 3 of this Section.

PART 2 – PRODUCTS

2.1 MATERIALS AND COMPONENTS

A. Metal Surfaces, General: For fabrication of miscellaneous metal work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness.
B. Structural Steel: ASTM A36.
C. Stainless Steel: ASTM A240, Type 302 or 304.
D. Aluminum, Extruded: ASTM B221, Alloy 6063-T5 unless otherwise specified. For structural shapes use alloy 6061-T6 and alloy 6061-T4511.
E. Steel Pipe (Bollard): ASTM A53.
   1. Galvanized for exterior locations.
   2. Type S, Grade A unless specified otherwise.
   3. NPS (inside diameter) as shown.
F. Cast-Iron: ASTM A48, Class 30, commercial pattern.
G. Malleable Iron Castings: A47.

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

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

J. Grout: ASTM C1107, pourable type.

K. Steel Plates and Shapes: ASTM A123.

L. Steel Plates to be Bent or Cold Formed: ASTM A283, Grade C.

M. Steel Bars and Bar-Size Shapes: ASTM A663 or A675, Grade 65, or ASTM A36.

N. Steel Tubing: ASTM A500 or 501, hot or cold rolled.

O. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.

1. Painted Commercial Steel: Cold-rolled steel, ASTM A 1008, structural steel, Grade 33 (unless noted otherwise). Provide manufacturer's standard protective coating.
2. Galvanized steel, ASTM A 653, structural steel, Grade 33 (unless noted otherwise). Repair any damaged galvanized coating in accordance with Part 3 of this Section.
3. Stainless Steel, ASTM A1011 SS GR 33 or ASTM A653 GR 33.

P. Gray Iron Castings: ASTM A48, Class 30.

Q. Malleable Iron Castings: ASTM A47, grade as selected.

R. Concrete Inserts: Threaded type, galvanized ferrous castings, either malleable iron ASTM A47 or cast steel ASTM A27. Provide bolts, washers and shims as required, hot-dip galvanized, ASTM A153.

2.2 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. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at

exterior walls. Select fasteners for type, grade, and class required.

a. Provide stainless-steel fasteners for fastening aluminum.

b. Provide stainless-steel fasteners for fastening stainless steel.

c. Provide stainless-steel fasteners for fastening nickel silver.

2. Bolts and Nuts: Regular hexagon head type, ASTM A307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

3. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593 (ASTM F 738M); with hex nuts, ASTM F 594; and, where indicated, flat washers; Alloy Group 1.

4. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.

   a. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

5. Eyebolts: ASTM A489.

6. Machine Screws: ASME B18.6.3.

7. Lag Screws: ASME B18.2.1.

8. Wood Screws: Flat head, ASME B18.6.1.

9. Plain Washers: Round, ASME B18.22.1.

10. Lock Washers: Helical, spring type, ASME B18.21.1.

11. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

12. Cast-in-Place Anchors in Concrete

   a. Provide either threaded type or wedge type anchors unless otherwise indicated; galvanized ferrous castings, either ASTM A 47 malleable iron or ASTM A 27 cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.

   b. Slotted-Channel Inserts: Cold-formed, box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-

head bolts, complete with washers and nuts as needed for fastening to inserts.

1) Accessories: Provide complete assemblies including, but not limited to, the following accessories:
   a) End caps.
   b) Filler strips.
   c) Heavy duty channel nuts.
2) Unless otherwise noted or otherwise required for the attachment of engineered units, slotted-channel inserts must be provided as follows:
   a) Grade = 33, regardless of material used.
   b) Minimum Length = 8 inches
   c) Required Mechanical Properties:
   d) Minimum Pull-out Capacity = 1,500 Lbs.
   e) Minimum Shear Capacity (perpendicular to direction of slot) = 1,500 Lbs.
3) Finishes: Provide units fabricated from hot-dip galvanized steel or stainless steel as indicated in the Drawings. All hardware must match base unit material. For hot-dip galvanized units, all hardware must be zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.

13. Post-Installed Anchors: Comply with Section 05 05 19 requirements.

2.3 PAINT

A. Metal Primer Paint: Comply with paint requirements specified in Division 9.

B. Galvanizing Repair and Primer Paint: Comply with Section 05 05 15 requirements.

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.4 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Concrete: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 4000 psi.

2.5 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 must 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 must 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 AMP 500 Metal Finishes Manual.
2. Steel and Iron: NAAMM AMP 504.
   a. Zinc coated (Galvanized): ASTM A123, G90 unless noted otherwise.
   b. Surfaces exposed in the finished work:
      1) Finish smooth rough surfaces and remove projections.
      2) Fill holes, dents and similar voids and depressions with epoxy type patching compound.
   c. Shop Prime Painting:
      1) Surfaces of Ferrous metal:
         a) Items not specified to have other coatings.
      ~~1)~~2) Galvanized surfaces specified to have prime paint.
         ~~c)~~a) Remove all loose mill scale, rust, and paint, by hand or power tool cleaning as defined in SSPC-SP2 and SP3.
      ~~1)~~3) Clean of oil, grease, soil and other detrimental matter by use of solvents or cleaning compounds as defined in SSPC-SP1.
      ~~1)~~4) After cleaning and finishing apply one coat of primer as specified in Section 09 91 00, PAINTING.
      ~~2)~~5) Non-ferrous metals: Comply with MAAMM-500 series.
3. Stainless Steel: NAAMM AMP-504 Finish No. 4.

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.

2.6 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.

2.7 FRAMES

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

2.8 GRATINGS

A. Fabricate gratings to support live loads specified and a concentrated load as specified.
B. Provide clearance at all sides to permit easy removal of grating.
C. Make cutouts in gratings with 6 mm (1/4 inch) minimum to 25 mm (one inch) maximum clearance for penetrations or passage of pipes and ducts. Edge band cutouts.
D. Fabricate in sections not to exceed 2.3 m2 (25 square feet) in area and 90 kg (200 pounds) in weight.
E. Fabricate sections of grating with end-banding bars.
F. Fabricate angle frames and supports, including anchorage as shown.
1. Fabricate intermediate supporting members from "T's" or angles.
2. Locate intermediate supports to support grating section edges.
3. Fabricate frame to finish flush with top of grating.
4. Locate anchors at ends and not over 600 mm (24 inches) o.c.
5. Butt or miter, and weld angle frame at corners.

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

2.9 LOOSE LINTELS

A. Furnish lintels of sizes shown. Where size of lintels is not shown, provide the sizes specified.

B. Fabricate lintels with not less than 150 mm (6 inch) bearing at each end for nonbearing masonry walls, and 200 mm (8 inch) bearing at each end for bearing walls.

C. Provide one angle lintel for each 100 mm (4 inches) of masonry thickness as follows except as otherwise specified or shown.

1. Openings 750 mm to 1800 mm (2-1/2 feet to 6 feet) - 100 x 90 x 8 mm (4 x 3-1/2 x 5/16 inch).
2. Openings 1800 mm to 3000 mm (6 feet to 10 feet) - 150 x 90 x 9 mm (6 x 3-1/2 x 3/8 inch).

D. For 150 mm (6 inch) thick masonry openings 750 mm to 3000 mm (2-1/2 feet to 10 feet) use one angle 150 x 90 x 9 mm (6 x 3-1/2 x 3/8 inch).

E. Provide bearing plates for lintels where shown.

F. Weld or bolt upstanding legs of double angle lintels together with 19 mm (3/4-inch bolts) spaced at 300 mm (12 inches) on centers.

G. Insert spreaders at bolt points to separate the angles for insertion of metal windows, louver, and other anchorage.

H. Where shown or specified, punch upstanding legs of single lintels to suit size and spacing of anchor bolts.

I. Elevator Entrance:

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

2.10 ABRASIVE METAL STAIR NOSINGS

A. Extruded Units: Aluminum, with abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder. Fabricate units in lengths necessary to accurately fit openings or conditions.

1. Provide ribbed units, with abrasive filler strips projecting 1/16 inch above aluminum extrusion.
2. Nosings: Two-piece units, 3 inches wide, with subchannel for casting into concrete steps.

B. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.

C. Apply bituminous paint to concealed surfaces of cast-metal units.

D. Apply clear lacquer to concealed surfaces of extruded units.

2.11 LADDERS

A. Steel Ladders:

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

B. Ladder Rungs:

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

2.12 RAILINGS

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

B. Fabrication General:

1. Provide continuous welded joints, dressed smooth and flush.
2. Standard flush fittings, designed to be welded, may be used.
3. Exposed threads will not be approved.
4. Form handrail brackets to size and design shown.

C. Handrails:

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

D. Steel Pipe Railings:
1. Fabricate of steel pipe with welded joints.
2. Number and space of rails as shown.
3. Space posts for railings not over 1800 mm (6 feet) on centers between end posts.
4. Form handrail brackets from malleable iron.
5. Fabricate removable sections with posts at end of section.
6. Removable Rails:
   a. Provide "U" shape brackets at each end to hold removable rail as shown. Use for top and bottom horizontal rail when rails are joined together with vertical members.
   b. Secure rail to brackets with 9 mm (3/8 inch) stainless steel through bolts and nuts at top rail only when rails joined with vertical members.
   c. Continuously weld brackets to post.
   d. Provide slotted bolt holes in rail bracket.
   e. Weld bolt heads flush with top of rail.
   f. Weld flanged fitting to post where posts are installed in sleeves.
7. Opening Guard Rails:
   a. Fabricate rails with flanged fitting at each end to fit between wall opening jambs.
   b. Design flange fittings for fastening with machine screws to steel plate anchored to jambs.
   c. Fabricate rails for floor openings for anchorage in sleeves.

2.13 STEEL PIPE GUARDS

A. Pipe Guards: Provide bent steel plate pipe guards as shown in the Drawings and as follows:
1. Provide bent steel plate pipe guards at all pipes exposed to vehicular traffic. Provide minimum of 2” clearance between inside face of guard and pipe.

2. Provide openings or cutouts as required for required access to pipe cleanouts, etc.
3. Provide steel channel leg support to set on slab if bent steel plate pipe guard extends more than 1'-0" beyond face of structure in either direction. Contractor to coordinate.
4. Finish: Bent steel plate pipe guards must be hot dip galvanized per requirements this Section.

2.14 STEEL PIPE BOLLARDS

A. Fabricate steel pipe bollards to dimensions and details shown in the Drawings.
   1. If approved for use at certain locations by the Architect, pipe bollards expansion bolted to concrete must be provided with acorn cap nuts, where nuts are left exposed.
   2. Fabricate metal bollards from Schedule 40 steel pipe, unless noted otherwise.

B. Finish: Hot dip galvanized.

2.15 ELEVATOR BEAMS

A. Fabricate elevator beams from standard ASTM A36 rolled wide flange shapes to support all loads as directed by elevator manufacturer.

B. Finish: Shop primed and field painted.

2.16 ELEVATOR SUBSILL SUPPORTS

A. Provide continuous, concealed support angle for elevator sill. Coordinate requirements for size, load and anchorage with Elevator Supplier. Provide anchors spaced not more than 2 feet on center.

B. Finish: Shop primed and field painted.

2.17 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Finish: Hot dip galvanized.

2.18 STEEL WELD (EMBED) PLATES, ANGLES AND ASSEMBLIES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete

the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

B. Finish: Hot dip galvanized.

2.19 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly to the highest extent possible.

C. Prior to finishing operations, verify exposed surfaces have had tool and die marks, stretch lines have been blended into surrounding surface and sharp edges have been eased in accordance with the Fabrication requirements of this Section.

2.20 STEEL AND IRON FINISHES

A. All exposed steel and iron items are for protective coatings. Steel and Iron items without galvanized finish or other protective coating must be for paint unless noted otherwise.

B. Galvanizing

1. Hot-dip galvanize items as indicated to comply with the requirements of Section 05 05 15 - Hot Dip Galvanizing.
2. Where painting of galvanized items is required by the Contract Documents, do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

C. Painting:

1. Finish Painting, General:
   a. Provide shop-applied finish coats of paints/protective coating systems where required by the Contract Documents. Provide field-applied finish coats of paints/protective coating systems where shop-applied field coats are not otherwise specified or provided.
   b. Omit painted finishes at locations as follows:
      1) Surfaces with galvanized finishes unless otherwise required by the Contract Documents.
      2) Surfaces embedded in concrete.
      3) Surfaces to receive sprayed-on fireproofing.

4) Contact surfaces in high-strength bolted friction-type connections unless otherwise permitted by the AISC Manual of Construction.
5) Shop Painted Items Requiring Field Welding: Surfaces to receive welding within 3 inches on each side of weld. Finish to be completed in the field.

c. All painting work must comply with comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel" unless noted otherwise.

d. The manufacturer's printed label instructions for all handling, applying, and re-coat intervals for the coatings system must be followed. No work shall be performed when temperature and humidity conditions are outside the limitations stated by the coatings manufacturer.

e. See Division 9 for requirements related to finish coats.

2. Shop Priming:

a. Surface Preparation: After fabrication and shop assembly, clean off all loose rust, loose mill scale, and weld spatter, slag or flux deposits in accordance with SSPC procedures as follows:

1) Solvent Cleaning (SSPC Spec. No. SP-1): Remove all oil and grease prior to performing mechanical cleaning operations and afterwards as necessary.
2) Interior Items (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning".
3) Items Exposed to Weather (SSPC Zones 1B, 2A and 2B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning".
   a) Surface profile must not exceed 1.5 mils.
   b) Surfaces inaccessible to blast cleaning after assembly must be blast cleaned and coated beforehand.

b. Immediately after surface preparation, apply primer paint in accordance with the manufacturer's instructions. Use painting methods, which will result in full coverage of joints, corners, edges and all exposed surfaces.

c. Stripe paint primer into corners, crevices, bolts, welds, and sharp edges.

3. Shop Painting:
   a. Surface preparation: Remove oil, grease and similar contaminants in accordance with SSPC SP-1 "Solvent Cleaning".
   b. Shop paint application must be by spray to thoroughly cleaned surfaces only, in accordance with all provisions of SSPC PA-1 Paint Application, with specified dry film thicknesses maintained on edges and corners.
4. Field Painting:
   a. Surface Preparation: After installation, prepare surfaces to be painted in accordance with SSPC procedures as follows:
      1) Solvent Cleaning (SSPC Spec. No. SP-1): Remove all oil and grease prior to performing mechanical cleaning operations and afterwards as necessary.
      2) Bare Metal Areas: SSPC-SP 11, "Power Tool Cleaning to Bare Metal".
      3) Touch up with the same primer as the shop coat.
   b. Apply protective finishes in accordance with Division 9 requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, structural support, and conditions under which the work of this Section is to be performed before installation, with Installer present, for compliance with requirements for installation tolerances and/or other conditions affecting performance of the Work.
   1. Check elevations of all bearing surfaces and locations of all embedded anchor bolts and connection plates.
B. Report all deviations from the Contract Documents and/or conditions detrimental to performance of the Work to the Architect in writing.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Field Measurements: Take measurements on-site per Part 1 requirements of this Section. Fabricator will be held responsible for any errors in fabrication and for correct fit of miscellaneous metal work.

3.3 INSTALLATION, GENERAL

A. Set work accurately, in alignment and where shown, plumb, level, free of rack and twist, and set parallel or perpendicular as required to line and plane of surface.

B. Items set into concrete or masonry.

1. Provide temporary bracing for such items until concrete or masonry is set.
2. Place in accordance with setting drawings and instructions.
3. Build strap anchors, into masonry as work progresses.

C. Set frames of gratings, covers, corner guards, trap doors and similar items flush with finish floor or wall surface and, where applicable, flush with side of opening.

D. Field weld in accordance with AWS.

1. Design and finish as specified for shop welding.
2. Use continuous weld unless specified otherwise.

E. Install anchoring devices and fasteners as shown and as necessary for securing metal fabrications to building construction as specified. Power actuated drive pins may be used except for removable items and where members would be deformed or substrate damaged by their use.

F. Spot prime all abraded and damaged areas of zinc coating as specified and all abraded and damaged areas of shop prime coat with same kind of paint used for shop priming.

G. Isolate aluminum from dissimilar metals and from contact with concrete and masonry materials as required to prevent electrolysis and corrosion.

H. Secure escutcheon plate with set screw.

3.4 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.

3.5 DOOR FRAMES

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

3.6 OTHER FRAMES

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

3.7 GRATINGS

A. Set grating flush with finish floor; top of curb, or areaway wall. Set frame so that horizontal leg of angle frame is flush with face of wall except when frame is installed on face of wall.
B. Set frame in formwork before concrete is placed.
C. Where grating terminates at a wall bolt frame to concrete or masonry with expansion bolts unless shown otherwise.
D. Secure removable supporting members in place with stainless steel bolts.
E. Bolt gratings to supports.

3.8 STEEL LINTELS

A. Use lintel sizes and combinations shown or specified.

B. Install lintels with longest leg upstanding, except for openings in 150 mm (6 inch) masonry walls install lintels with longest leg horizontal.

C. Install lintels to have not less than 150 mm (6 inch) bearing at each end for nonbearing walls, and 200 mm (8 inch) bearing at each end for bearing walls.

3.9 STAIR NOSINGS

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

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

B. Install flush with horizontal and vertical surfaces.

C. Install nosing to within 100 mm (4 inches) of ends of concrete stair treads, except where shown to extend full width. Center nosings on tread widths unless otherwise indicated.

D. Extend nosings full width of door openings.

E. Extend nosings, full width between stringers of metal stairs, and terminate at point of curvature of steps having short radius curved ends.

3.10 LADDERS

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

B. In elevator pits, set ladders to clear all elevator equipment where shown on the Drawings.

1. Where ladders are interrupted by division beams, anchor ladders to beams by welding, and to floors with expansion bolts.
2. Where ladders are adjacent to division beams, anchor ladders to beams with bent steel plates, and to floor with expansion bolts.

C. Ladder Rungs:

1. Set ladder rungs into formwork before concrete is placed.
2. Set step portion of rung 150 mm (6 inches) from wall.

3. Space rungs approximately 300 mm (12 inches) on centers.
4. Where only one rung is required, locate it 400 mm (16 inches) above the floor.

3.11 RAILINGS

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

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

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

3.12 STEEL PIPE GUARDS

A. Support legs, if required, shall not be anchored to concrete slabs unless approved by the Architect.

B. Anchors shall not be placed less than 4” from edges of columns, wall, etc.

3.13 STEEL PIPE BOLLARDS

A. Slab-on-grade Locations:

1. Install pipe bollards plumb and at height indicated in the Drawings.
2. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches above bottom of excavation. Wrap base of pipe bollard below finished floor with closed-cell polyethylene expansion joint filler (1/2” min. thickness).
3. Place concrete around bollard and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.
4. Finish concrete work to match surrounding concrete surfaces. Tool edge of edge of concrete placement to receive sealant.
5. Once concrete is cured, provide cove sealant all around base of pipe bollard. Tool to a neat surface.

B. Supported Slab Locations:

1. Anchor and/or attach pipe bollards to elevated slabs as shown on the Drawings.
   a. Any gaps between pipe bollard base plates and concrete slabs must be grouted per Section 03 60 00 requirements. Tool to a neat surface.

C. All Locations (unless noted otherwise):

1. Fill pipe solid with air-entrained Portland cement or grout, having a 28-day minimum compressive strength of 3000 psi. Mound top surface to shed water and tool for neat appearance.

3.14 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for operable partitions securely to and rigidly brace from building structure.

C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.
   1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in BEARING AND LEVELING PLATES Article.

3.15 BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
   1. Use non-shrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use non-shrink, nonmetallic grout in exposed locations unless otherwise indicated.
   2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.16 FIELD QUALITY CONTROL

A. General:
   1. During progress of the Metal Fabrications work, Contractor must monitor construction activities and coordinate all inspection activities required by the Contract Documents to ensure compliance with specified parameters.
   2. The Government may employ a separate testing agency to evaluate Contractor’s Quality Control System and the field work of this Section. Additionally, the Government reserves the right to additionally sample and test materials being used for the work of this Section.
B. Identified Deficiencies and Review of Proposed Remedial Work:
   1. Where Project inspections and/or testing indicate deficiencies in the Work, or non-compliance with this Section and/or the

manufacturer's specifications, the subject Work will be considered defective. For defective work:

a. Contractor must prepare recommendations for additional or remedial work to compensate for deficiencies. Submit all recommendations to the Architect for review.

b. Once submitted recommendations have been reviewed and found acceptable by the Architect, proceed with additional or remedial work as required to compensate for deficiencies.

c. Additional testing and inspecting, at Contractor's expense, must be performed to determine compliance of replaced or additional work with specified requirements.

2. Remedial action deemed necessary by the Architect and resulting from non-compliance with the Contract requirements must be addressed as described for "Corrective Measures" in Division 1 of these Specifications.

3. Where remedial action was deemed necessary based on Quality Control Testing, retest all remedial work until test results prove subject Work complies with indicated requirements.

C. Independent Inspection and Testing:

1. General:

a. An independent testing agency engaged per Part 1 of this Section must monitor the work of this Section for compliance with project Contract Documents and the approved Submittals.

b. Field inspection by the Testing Agency of installed Metal Fabrications must be such as to assure that the Work conforms to specified requirements.

2. Tests and Inspections During Construction: Perform the following testing and inspections:

a. Comply with Section 01 45 29 requirements and as additionally required to ensure compliance with the Contract Documents.

3. Reporting on the Work: Produce reports and digital photographs documenting each inspection and indicate whether subject work complies with or deviates from requirements.

a. Reports must be distributed in timely manner to Owner, Contractor, Manufacturer, and Architect.

b. Prepare and distribute required reports as specified in Section Division 1.

D. Post-Installation Quality Control Review: The Architect reserves the right to require the manufacturer's Delegated Design Engineer to approve installations per designs submitted, at no extra cost to Government.

3.17 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 manufacturer and protect from damage until completion of the project.

C. Touch-up Painting: Cleaning and touch-up painting of field welds, bolted connections and abraded areas of the shop paint on miscellaneous metal is specified in Division 9 of these Specifications.

D. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780.

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SECTION 05 70 00
DECORATIVE METAL

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes Decorative Metal as shown on drawings and schedules

B. Drawings and general provisions of the Contract Documents apply to work of this section.

1.2 RELATED REQUIREMENTS

A. Materials Testing and Inspection During Construction: Section 01 45 29, TESTING LABORATORY SERVICES.

1.3 SUBMITTALS

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

B. Shop drawings indicating quantities, dimensions, finishes, and attachment details.

C. Product literature and samples for each color, pattern, and finish as indicated.

1.4 QUALITY ASSURANCE

A. Manufacturer shall have a minimum of 5 years experience in manufacturing decorative metals for commercial use.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the project site in manufacturer's original packaging, properly labeled for identification and installation purposes.

B. Store in location to avoid damage from job-site traffic, direct sunlight, moisture, stacking or other job-site contaminates. Store in a completely supported flat position. Edge storage is not recommended.

C. Handle components to avoid denting or scratching of finished surfaces.

D. DO NOT use markers on protective PVC film. Some types of ink will permeate the film and mark the material surface.

1.6 PROJECT CONDITIONS

A. Maintain a constant temperature range of 65°F to 85°F (18°C to 24°C), with stable relative humidity, for at least 48 hours prior to, throughout the installation period and maintained consistently thereafter.

B. Installation locations must be enclosed, weatherproofed and climate controlled prior to commencing installation.

C. Do not install if relative humidity is greater than 80%.

1.7 WARRANTY

A. Provide manufacturers warranty against defects in material and workmanship.

PART 2 – PRODUCTS

2.1 METALS

A. Perforated Aluminum

1. 0.1875″ Aluminum: Type 5052 alloy complying with ASTM B209
2. Size: 4′ x 8′
3. Lazer cut Panels: Harvest Pattern
4. Color Collection Name Black Matte
5. Finish: Powder coat
6. Custom Options
   a. Double Side Finish: Yes

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine product, substrates and installation conditions.

B. Notify the contractor and architect in writing of any conditions detrimental to the proper and timely completion of the installation.

C. Do not proceed with work until conditions have been corrected.

3.2 SURFACE PREPARATION

A. Prior to installation, clean surface to remove dirt, debris and loose particles. Perform additional preparation procedures as required per the manufacturer’s instructions.

B. Protection: Take all necessary precautions to prevent damage to materials during installation.

3.3 INSTALLATION

A. Install the work of this section in strict accordance with manufactures written Technical Information and workability guidelines

3.4 CLEANING

A. Remove protective coverings and clean decorative metal to remove adhesives and tape residue. Test all solvents on non-exposed surfaces prior to use.

1. For painted surfaces, use a mild detergent solution on a soft cloth.
2. For stainless steel, use a glass cleaner and a soft cloth.
3. For other surfaces, contact manufacturer for proper cleaning procedures.
4. For HEAVY CLEANING and removal of grease, use oil based mineral spirits or naphtha. Low concentration ammonia based cleaning agents such as glass cleaners may also be used.
5. Minor scuffs can be polished out by hand with a #6 to #9 type finishing polish or wax.
6. DO NOT treat with rubbing compounds or lacquer thinner as this may dissolve or etch the coating.

B. Visually inspect all exposed surfaces for scratches or blemishes.

C. Protect Decorative Metal from damage during remainder of construction period.

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SECTION 05 70 10
DECORATIVE FORMED METAL

PART 1 GENERAL

1.1 SUMMARY

A. Furnish screenwall/vision barrier, structural supports and attachment brackets as shown on the drawings, as specified, and as needed for a complete and proper installation.

B. The screenwall/vision barrier to be furnished include the following:

1. Fixed extruded screenwall/vision barrier.

1.2 REFRENCE

A. The Aluminum Association Incorporated

1. Aluminum Standards and Data
2. Specifications and Guidelines for Aluminum Structures

B. American Society of Civil Engineers

1. Minimum Design Loads for Buildings and Other Structures

C. American Society for Testing and Materials

1. ASTM B209
2. ASTM B211
3. ASTM B221
4. ASTM E90-90

D. Architectural Aluminum Manufacturers Association

1. AAMA 800 Voluntary Specifications and Test Methods for Sealants
2. AAMA 605.2 Voluntary Specification for High Performance Organic Coatings on Aluminum Extrusions and Panels.
3. AAMA TIR Metal Curtain Wall Fasteners
4. AAMA 2605-98 Superior Performing Organic Coatings on Aluminum Extrusions and Panels

E. Canadian Standards Association

1. CAN3-S157-M83 Strength Design in Aluminum
2. S136 94 Cold Formed Steel Structural Members

1.3 SUBMITTALS

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

B. Product Data

1. Material types and thickness.

C. Shop Drawings

2. Include elevations, sections, and specific details for each louver.
3. Show anchorage details and connections for all component parts.
4. Include signed and sealed structural calculations.

D. Samples

1. Submit color chips for approval.

1.4 QUALITY ASSURANCE

A. Single subcontract responsibility: Subcontract the work to a single firm that has had not less than six years' experience in the design and manufacturing of work similar to that shown and required.

B. Structural Requirements: Design all materials to withstand wind and snow loads as required by the applicable building code. Maximum allowable deflection for the louver structural members to be l/180 or 0.75 inch, whichever is less. Maximum allowable deflection for the louver blades to be l/120 or 0.50 inch across the weak axis, whichever is less.

C. Professional Engineer Requirements: Drawings and structural calculations to be signed and sealed by a professional engineer licensed to practice in the state where the project is located.

D. Warranty: Provide written warranty to the owner that all products will be free of defective materials or workmanship for a period of one year from date of installation.

1.5 DELIVERY AND STORAGE

A. Delivery: At the time of delivery all materials shall be visually inspected for damage. Any damaged boxes, crates, louver sections, etc. shall be noted on the receiving ticket and immediately reported to the shipping company and the material manufacturer.

B. Storage:

1. Material may be stored flat on end or on its side.
2. Material may be stored either indoors or outdoors.
3. If stored outdoors the material must be raised sufficiently off the ground to prevent it being flooded.
4. If stored outdoors the material must be covered with a weatherproof flame-resistant sheeting or tarpaulin.

C. Handling:

1. Material shall be handled in accordance with sound material handling practices and in such a way as to minimize racking.

PART 2 - PRODUCTS:

2.1 MANUFACTURERS

A. Basis of Design – Construction Specialties Vision Barrier Screen Vert-A-Cade 304 or VA approved equal.

2.2 MATERIALS

A. Aluminum Extrusions: ASTM B211, Alloy 6063-T52.

2.3 FABRICATIONS

A. Provide screen wall models, structural supports and accessories as shown on the drawings. Materials, sizes, depths, arrangements, and material thickness to be as indicated or as required for optimal performance with respect to strength; durability; and uniform appearance.

B. Screenwall to be mechanically assembled using stainless steel or aluminum fasteners.

C. Include supports, anchorage, and accessories required for complete assembly.

2.4 VISION BARRIER MODELS

A. Aluminum Screen Blades to be fabricated from extruded aluminum sections in 6063-T52 alloy and spaced approximately 4 3/4" on center. Blades to be nominal 6" deep and mechanically secured to continuous extruded aluminum supports. Aluminum supports fixed directly to horizontal steel supports or to spandrel beams with extruded aluminum clip angles. All fasteners to be stainless steel or aluminum. Material shipped knocked down for field assembly by the installer. Support braces and mounting clips to painted standard Kynar to coat black.

2.5 FINISHES

A. General: Comply with NAAMM "Metal Finishes Manual" for finish designations and application recommendations, except as otherwise indicated. Apply finishes in factory. Protect finishes on exposed surfaces prior to shipment. Remove scratches and blemishes from exposed surfaces that will be visible after completing the finishing process. Provide Matte Black finish to match existing screenwall.

B. 100% Fluoropolymer Resin Powder Coat System complying with AAMA-2605-5 standards for gloss and color retention. Finish thickness to be 1.5 to 3.0 mils.

1. Finish to allow zero VOCs to be emitted into facility of application or at job site.

2. Finish to adhere to a 4H Hardness rating.
3. Furnish manufacturer's twenty (20) year warranty for finish for gloss and color retention.

PART 3 EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's instructions and recommendations for installation of the work.

B. Verify dimensions of supporting structure at the site by accurate field measurements so that the work will be accurately designed, fabricated, and fitted to the structure.

C. Anchor sunshades to the building substructure as indicated on architectural drawings.

D. Erection Tolerances:

1. Maximum variation from plane or location shown on the approved shop drawings: 1/8" per 12 feet of length, but not exceeding 1/2" in any total building length or portion thereof (non-cumulative).
2. Maximum offset from true alignment between two members abutting end to end, edge-to-edge in line or separated by less than 3": 1/16" (shop or field joints). This limiting condition shall prevail under both load and no-load conditions.

E. Cut and trim component parts during erection only with the approval of the manufacturer or fabricator, and in accordance with his recommendations. Restore finish completely. Remove and replace members where cutting and trimming has impaired the strength or appearance of the assembly.

F. Do not erect warped, bowed, deformed, or otherwise damaged or defaced members. Remove and replace any members damaged in the erection process as directed.

G. Set units level, plumb and true to line, with uniform joints.

3.2 PROTECTION

A. Protect installed materials to prevent damage by other trades. Use materials that may be easily removed without leaving residue or permanent stains.

3.3 ADJUSTING AND CLEANING

A. Immediately clean exposed surfaces of the louvers to remove fingerprints and dirt accumulation during the installation process. Do not let soiling remain until the final cleaning.

B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to the material finishes. Thoroughly rinse surfaces and dry.

C. Restore louvers and accessory components damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by the Architect, remove damaged materials, and replace with new materials.

   1. Touch up minor abrasions in finishes with a compatible air-dried coating that matches the color and gloss of the factory applied coating.

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DIVISION 06

SECTION 06 10 00
ROUGH CARPENTRY

PART 1 - GENERAL

1.1 DESCRIPTION:

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

1.2 RELATED WORK:

A. Sustainable design requirements: Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

1.3 SUBMITTALS:

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

B. Sustainable Design Submittals, as described below:

1. Postconsumer and preconsumer recycled content as specified in PART 2 - PRODUCTS.
2. Volatile organic compounds per volume as specified in PART 2 - PRODUCTS.
3. For composite wood products, submit documentation indicating that product contains no added urea formaldehyde.

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

D. Manufacturer’s Literature and Data:

1. Submit data for lumber, panels, hardware and adhesives.
2. Submit data for wood-preservative treatment from chemical treatment manufacturer and certification from treating plants that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
3. Submit data for fire retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
4. For products receiving a waterborne treatment, submit statement that moisture content of treated materials was reduced to levels specified before shipment to project site.

E. Manufacturer’s certificate for unmarked lumber.

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 152 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 QUALITY ASSURANCE:

A. Installer: A firm with a minimum of three (3) years' experience in the type of work required by this section.

1.6 GRADING AND MARKINGS:

A. Any unmarked lumber or plywood panel for its grade and species will not be allowed on VA Construction sites for lumber and material not normally grade marked, provide manufacturer's certificates (approved by an American Lumber Standards approved agency) attesting that lumber and material meet the specified the specified requirements.

1.7 APPLICABLE PUBLICATIONS:

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

B. American Forest and Paper Association (AFPA):

NDS-15.....National Design Specification for Wood Construction

WCD1-01.....Details for Conventional Wood Frame Construction

C. American Institute of Timber Construction (AITC):

A190.1-07.....Structural Glued Laminated Timber

D. American Society of Mechanical Engineers (ASME):

B18.2.1-12(R2013).....Square and Hex Bolts and Screws

B18.2.2-10.....Square and Hex Nuts

B18.6.1-81(R2008).....Wood Screws

E. American Plywood Association (APA):

E30-11.....Engineered Wood Construction Guide

F. ASTM International (ASTM):

A653/A653M-13.....Steel Sheet Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot Dip Process

C954-11.....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

C1002-14.....Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Metal Studs

D198-14.....Test Methods of Static Tests of Lumber in Structural Sizes

D2344/D2344M-13.....Test Method for Short-Beam Strength of Polymer Matrix Composite Materials and Their Laminates

D2559-12a.....Adhesives for Structural Laminated Wood Products for Use Under Exterior (Wet Use) Exposure Conditions

D3498-03(R2011).....Adhesives for Field-Gluing Plywood to Lumber Framing for Floor Systems

D6108-13.....Test Method for Compressive Properties of Plastic Lumber and Shapes

D6109-13.....Test Methods for Flexural Properties of Unreinforced and Reinforced Plastic Lumber and Related Products

D6111-13a.....Test Method for Bulk Density and Specific Gravity of Plastic Lumber and Shapes by Displacement

D6112-13.....Test Methods for Compressive and Flexural Creep and Creep-Rupture of Plastic Lumber and Shapes

F844-07a(R2013).....Washers, Steel, Plan (Flat) Unhardened for General Use

F1667-13.....Nails, Spikes, and Staples

G. American Wood Protection Association (AWPA):

AWPA Book of Standards

H. Commercial Item Description (CID):

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

I. Forest Stewardship Council (FSC):

FSC-STD-01-001(Ver. 4-0)FSC Principles and Criteria for Forest Stewardship

J. Military Specification (Mil. Spec.):

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

K. Environmental Protection Agency (EPA):

40 CFR 59(2014).....National Volatile Organic Compound Emission Standards for Consumer and Commercial Products

L. Truss Plate Institute (TPI):

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

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

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

PS 20-10.....American Softwood Lumber Standard

N. ICC Evaluation Service (ICC ES):

AC09.....Quality Control of Wood Shakes and Shingles

AC174.....Deck Board Span Ratings and Guardrail Systems (Guards and Handrails)

PART 2 - PRODUCTS

2.1 LUMBER:

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

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

B. Lumber Other Than Structural:

1. Unless otherwise specified, species graded under the grading rules of an inspection agency approved by Board of Review, American Lumber Standards Committee.

2. Furring, blocking, nailers and similar items 101 mm (4 inches) and narrower Standard Grade; and, members 152 mm (6 inches) and wider, Number 2 Grade.

D. Sizes:

1. Conforming to PS 20.
2. Size references are nominal sizes, unless otherwise specified, actual sizes within manufacturing tolerances allowed by standard under which produced.

E. Moisture Content:

1. Maximum moisture content of wood products is to be as follows at the time of delivery to site.
   a. Boards and lumber 50 mm (2 inches) and less in thickness: 19 percent or less.
   b. Lumber over 50 mm (2 inches) thick: 25 percent or less.

F. Fire Retardant Treatment:

1. Comply with Mil Spec. MIL-L-19140.
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 610 mm (24 inches) from ground; nailers, edge strips, blocking, crickets, curbs, cant, vent strips and other members provided 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 AWPA Book use category system standards U1 and T1, except any process involving the use of Chromated Copper Arsenate (CCA) or other agents classified as carcinogenic for pressure treating wood is not permitted.

2.3 PLYWOOD:

A. Comply with 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 406 mm (16 inches) on center and 12 mm (15/32 inch) thick with supports 610 mm (24 inches) on center unless specified otherwise.
   b. Minimum 1200 mm (48 inches) wide at corners without corner bracing of framing.
3. Roof sheathing:
   a. Minimum 9 mm (11/32 inch) thick with span rating 24/0 or 12 mm (15/32 inch) thick with span rating for supports 406 mm (16 inches) on center unless specified otherwise.
   b. Minimum 15 mm (19/32 inch) thick or span rating of 40/20 or 18 mm (23/32 inch) thick or span rating of 48/24 for supports 610 mm (24 inches) on center.

2.4 STRUCTURAL-USE PANELS (NOT USED)

PART 3 - EXECUTION

3.1 INSTALLATION OF MISCELLANEOUS WOOD MEMBERS:

A. Conform to applicable requirements of the following:

1. AFPA WCD1 for nailing and framing unless specified otherwise.
2. APA for installation of plywood.

B. Fasteners:

1. Nails.
   a. Nail in accordance with the Recommended Nailing Schedule as specified in AFPA WCD1 where detailed nailing requirements are not specified in nailing schedule. Select nail size and nail spacing sufficient to develop adequate strength for the connection without splitting the members.
   b. Use special nails with framing connectors.
   c. For sheathing, select length of nails sufficient to extend 25 mm (1 inch) into supports.
   d. Use 8d or larger nails for nailing through 25 mm (1 inch) thick lumber and for toe nailing 50 mm (2 inch) thick lumber.

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

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

g. Nailing Schedule; Using Common Nails:

1) Sheathing:

a) 152 mm (6 inch) wide or less to each joist face nail two (2) 8d nails.

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 provide expansion bolts. Special bolts or screws designed for anchor to solid masonry or concrete in drilled holes may be used.

d. Provide toggle bolts to hollow masonry or sheet metal.

e. Provide 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 610 mm (24 inch) intervals between end bolts. Provide 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 C954 for steel over 0.84 mm (0.033 inch) thick.

4. Power actuated drive pins may be provided where practical to anchor to solid masonry, concrete, or steel.

5. Do not anchor to wood plugs or nailing blocks in masonry or concrete. Provide metal plugs, inserts or similar fastening.

6. Screws to Join Wood:

a. Where shown or option to nails.

b. ASTM C1002, sized to provide not less than 25 mm (1 inch) penetration into anchorage member.

c. Spaced same as nails.

C. Set sills or plates level in full bed of mortar on masonry or concrete walls.

1. Space anchor bolts 1219 mm (4 feet) on centers between ends and within 152 mm (6 inches) of end. Stagger bolts from side to side on plates over 178 mm (7 inches) in width.
2. Provide shims of slate, tile or similar approved material to level wood members resting on concrete or masonry. Do not use wood shims or wedges.
3. Closely fit, and set to required lines.

D. Cut notch, or bore in accordance with AFPA WCD1 passage of ducts wires, bolts, pipes, conduits and to accommodate other work. Repair or replace miscut, misfit or damaged work.

E. Blocking Nailers, and Furring:
1. Install furring, blocking, nailers, and grounds where shown.
2. Provide longest lengths practicable.
3. Provide 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 610 mm (24 inches) between ends.
   c. Stagger nails from side to side of wood member over 127 mm (5 inches) in width.

M. Sheathing:
1. Provide plywood for sheathing.
2. Lay panels with joints staggered, with edge and ends 3 mm (1/8 inch) apart and nailed over bearings as specified.
3. Set nails not less than 9 mm (3/8 inch) from edges.
4. Install 50 mm by 101 mm (2 inch by 4 inch) blocking spiked between joists, rafters and studs to support edge or end joints of panels.

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DIVISION 07

SECTION 07 11 13
BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Bituminous dampproofing on concrete surfaces.
2. Backfill protection barriers (protection course).

B. Unless noted otherwise, bituminous dampproofing must applied to the following concrete surfaces:

1. Exterior, below-grade surfaces of foundation walls.
2. Back side of retaining walls, below floor slab.
3. Back side of elevator pit retaining walls, below floor slab, if no other waterproofing is provided.
4. Provide bituminous dampproofing in any other areas as recommended by the Geotech Report.

1.2 RELATED WORK

A. Section 03 00 00, CAST-IN-PLACE CONCRETE: Concrete.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this Section.

B. ASTM International (ASTM):

C578-19.....Rigid, Cellular Polystyrene Thermal insulation.
D226/D226M-17.....Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
D449/D449M-03(2014)e1...Asphalt Used in Dampproofing and Waterproofing.
D1227-13(2019)e1.....Emulsified Asphalt Used as a Protective Coating for Roofing.
D6380/D6380M-03(2018)...Asphalt Roll Roofing (Organic Felt).
D6506/D6506M-01(2018)e1.Asphalt Based Protection Board for Below-Grade Waterproofing.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:

1. Description of each product.
2. Application instructions.

a. Include standard details for spanning building joints if applicable.

1.5 QUALITY ASSURANCE

A. Source Quality Control

1. Provide primary dampproofing materials and primers which are the products of one manufacturer.
2. Provide protection course and auxiliary materials recommended in writing by manufacturer of primary materials.

B. Correlation of Performance Requirements: The Work of this Section is subject to the performance requirements indicated in the Contract Documents and as follows:

1. Requirements of Regulatory Agencies: The Work is subject to all applicable provisions of the Codes and Standards required by the authorities having jurisdiction.
2. Reference Standards: Standards referenced in this Section are commonplace in the industry (unless noted otherwise) and are referred to by basic designation only. Standards form a part of this Specification to the extent referenced. Provide only materials complying with referenced standards, and which are certified for such compliance.
3. Correlation and Intent of the Contract Documents: In the event of conflicts or discrepancies between the Contract Documents, the requirements of regulatory agencies, and the indicated Reference Standards, the most stringent requirements govern.

1.6 DELIVERY

A. Deliver products in manufacturer's original sealed packaging.

B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, production run number, and manufacture date.

C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.7 STORAGE AND HANDLING

A. Deliver products in unopened factory labeled packages. Store and handle in strict compliance with manufacturers’ instructions and recommendations. Protect from all possible damage. Sequence deliveries to avoid delays, but minimize on-site storage.

1.8 PROJECT CONDITIONS

A. Substrate: Proceed with dampproofing only after substrate construction and penetrating work have been completed.

B. Weather Limitations: Proceed with dampproofing only when existing and forecasted weather conditions will permit work to be performed according to manufacturer's recommendations and warranty requirements.

C. Ventilation: Provide adequate ventilation during application of dampproofing in enclosed spaces. Maintain ventilation until dampproofing has cured.

1.9 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

A. Control moisture migration through concrete or masonry exterior walls where no hydrostatic head occurs or is anticipated.

2.2 PRODUCTS - GENERAL

A. Provide each product from one manufacturer and from one production run.

B. Hot Applied Bituminous Dampproofing:

1. Asphalt: ASTM D449/D449M, Type I.

C. Cold Applied Bituminous Dampproofing:

1. Asphalt: ASTM D1227, Type III (spray grade).

2.3 ACCESSORIES

A. Asphalt Saturated Felt: ASTM D226/D226M, Type I, 7 kg (15 pound).

B. Protection Course: Extruded-polystyrene board insulation, unfaced, ASTM C 578, Type X, 13 mm (1/2 inch) thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for surface smoothness, surface moisture, and other conditions affecting performance of Bituminous Dampproofing work.

1. Any cracks in the substrate deemed too large to be spanned by fabric reinforced dampproofing system must be repaired to the satisfaction of the Architect.

2. Test for surface moisture according to ASTM D 4263.

B. Proceed with application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect existing construction and completed work from damage.

B. Clean substrates. Remove contaminants capable of affecting subsequently installed product's performance.

C. Remove free water; surfaces may remain damp.

D. Apply patching compound to patch and fill tie holes, honeycombs, reveals, and other imperfections; cover with asphalt-coated glass fabric.

3.3 INSTALLATION - GENERAL

A. Install products according to manufacturer's instructions and approved submittal drawings.

1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer’s Representative consideration.

3.4 DAMPPROOFING INSTALLATION

A. Applications:

1. Apply to surfaces where indicated on drawings.

B. Apply dampproofing at 1 liter/square meter (2-1/2 gallon per 100 square feet), minimum, each coat.

1. Allow 24 hours drying time between coats.

C. Adhere protection course to conceal foundation dampproofing before backfilling.

3.5 BACKFILLING

A. Backfilling: Install protection board as specified above. Place backfill not sooner than 24 hours, nor later than seven days, after application of asphalt dampproofing materials. Do not rupture or damage the film or displace the coating or membranes.

3.6 PROTECTION

A. Protect dampproofing and protection course from construction operations.

B. Repair damage.

- - E N D - -

Vehicular Traffic Coatings
Section 07 18 16

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies a surface applied elastomeric and composition waterproofing type membrane suitable for vehicular traffic, but not intended for heavy industrial use.

B. The extent of traffic bearing waterproofing membrane system and related components required to provide waterproof traffic decks is shown on the Drawings and includes but not limited to the following:

1. Surface preparation.
2. Installation of complete liquid applied traffic bearing waterproofing membrane system (the "System") to provide a waterproof, chemical and abrasion resistant non-skid traffic bearing topping.
3. Providing the services of a qualified technical representative to provide manufacturer representation on site to ensure installation quality.

1.2 RELATED WORK

A. Section 07 60 00, FLASHING AND SHEET METAL: Metal flashing.

B. Section 09 06 00, SCHEDULE FOR FINISHES: Color and Texture of Finish Coat.

1.3 APPLICABLE PUBLICATIONS

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

B. ASTM International (ASTM):

C794-18.....Adhesion-in-Peel of Elastomeric Joint Sealants
D412-16.....Vulcanized Rubber and Thermoplastic Elastomers-Tension
D2240-15e1.....Rubber Property - Durometer Hardness
E96/E96M-16.....Water Vapor Transmission of Materials

1.4 TEST AREA

A. Before start of general application, apply the elastomeric coating as specified in a representative test area. Provide a test area not less

than 9.29 square meters (100 square feet). The area to be covered by the coating to include all site conditions such as flashings bases, corners and projections through the coating. Provide test area in location determined by the Contracting Officer Representative (COR). After COR approval, area will serve as an example for the remaining work.

1.5 SUBMITTALS

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

B. Manufacturers Literature and Data: Manufacturer’s detailed illustrated product data, specifications, installation instructions, use limitations, and general recommendations for each material and product used.

1. Include manufacturer's certified test data showing compliance with the requirements.

C. Shop Drawings

1. Show large scale details of all edge terminations, joint treatments, penetration or projections and flashing conditions.
2. Include schematic detail drawings of each membrane type which clearly identify the successive coats or layers of the membrane System.

D. Application Schedule: Indicate number of coatings for each proposed system and indicate the design coverage rate for each coating. Indicate design film thicknesses for testing purposes.

1. Notify Architect in writing if manufacturer's instructions vary from the system installation summaries indicated in Part II of this Section.

E. Samples: Each finish color on 101 by 203 mm (4 by 8 inch) substrate, layered to show each coat and finish.

F. Operation and Maintenance Instructions: See Closeout Submittals below.

G. Quality Control Submittals

1. Qualification Data: For firms and/or persons specified in the QUALITY ASSURANCE Article of this Section; data must demonstrate their capabilities and experience. Include list of completed projects.

2. Manufacturer’s Certifications: Provide a written certification letter from the System manufacturer stating that the all materials are suitable for site conditions, applications indicated and specified in the Contract Documents.
3. Warranty
   a. Sample warranty form.
   b. Provide copy of license agreement between manufacturer and installer indicating division of warranty responsibility.

H. Closeout Submittals: Upon completion of the work of this Section and prior to final payment, submit the following:
1. Manufacturer's Project Acceptance Documents: Documents must include the following:
   a. Final Field Quality Control Report indicating final inspections are complete and all work of this Section in in compliance with applicable standards.
   b. Certification by the manufacturer that its products and systems are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.
   c. The above documents must be attached to final warranty.
2. Operation and Maintenance Instructions
   a. Maintenance Manuals: Include the following content for inclusion in the Project Maintenance Manuals:
      1) Identify types of coating systems applied and include drawings indicating the types of coating systems and their location in the structure.
      2) Include schematic detail drawings of each membrane type which clearly identify the successive coats or layers of the membrane System. Identify each coat or layer by dry film thickness or application rate and by manufacturer's reference number or name which specifically identifies the product used for each coat.
      3) Include recommendations for routine care and maintenance. Identify common causes of damage and include instructions for temporary patching until permanent repairs can be made by qualified personnel. Include precautions against any known

materials and methods which may be detrimental to finishes and/or performance.

4) Name, address, and contact information of contractors nearest the Project location who are qualified to perform repairs to the membrane.

3. See Division 1 for additional requirements for Operating and Maintenance Documents.

1.6 QUALITY ASSURANCE

A. General: Provide all Work of this Section, including the following components, so that there will be undivided responsibility for the performance of the entire system installed:
   1. System accessories.
   2. Flashings in connection with system.
   3. Expansion joints in the system (as applicable).
   4. Fluid applied waterproofing membrane materials.
   5. Traffic bearing wear coat.
   6. Substrate repair materials.

B. Source Quality Control: Provide System components which are the products of one manufacturer.

C. Correlation of Performance Requirements: The Work of this Section is subject to the performance requirements indicated in the Contract Documents and as follows:
   1. Requirements of Regulatory Agencies: The Work is subject to all applicable provisions of the Codes and Standards required by the authorities having jurisdiction.
   2. Reference Standards: Standards referenced in this Section are commonplace in the industry (unless noted otherwise) and are referred to by basic designation only. Standards form a part of this Specification to the extent referenced.
   3. Correlation and Intent of the Contract Documents: In the event of conflicts or discrepancies between the Contract Documents, the requirements of regulatory agencies, and the indicated Reference Standards, the most stringent requirements govern.

D. Qualifications
   1. General: Work specified herein must be performed by and be the responsibility of the Installation Contractor authorized, trained,

approved and qualified by the manufacturer of materials used; having necessary equipment and facilities to fulfill requirements of the manufacturer and this section.

2. Manufacturer: Manufacturer must provide evidence showing that the specified materials have been manufactured by the same source and successfully installed on a yearly basis for a minimum of ten (10) years on projects of similar scope and complexity.
3. Installer: Waterproofing installer (applicator) must demonstrate qualifications to perform the work of this Section by submitting the following documentation:
   a. Certification or licensing by the waterproofing manufacturer as an applicator of the product to be used in order to provide a warranty as described this Section.
   b. List of at least five (5) projects (with reference names and phone numbers) satisfactorily completed under the current company name within the last three (3) years, of similar scope and complexity to this project. Previous experience submittal must correspond to specific membrane system proposed for use by applicator.
   c. A minimum of five (5) years in business under the same name.

E. Pre-Installation Conference
1. A pre-installation conference must be held prior to commencement of field installation to establish procedures, to maintain required working conditions, and to coordinate the Work of this Section with related and adjacent Work.
2. Contractor must require responsible representatives of each party concerned with that portion of the work to attend the conference, including but not limited to the following:
   a. Contractor’s Superintendent and Project Manager
   b. Manufacturer's technical representative.
   c. Installation Subcontractor representative.
   d. MEP/FP Subcontractors if work requires interfaces thereto.
   e. Agency responsible for Contractor-furnished testing (as applicable).
   f. Owner’s Testing Agency (as applicable).
3. Comply with Division 1 requirements.

F. Field Observations and Inspections

1. Record of Work: A record of the Work of this Section, complying with the Quality Control Submittal requirements of this Section, must be kept by the General Contractor. Such record must be kept until the completion of the Project and must be available to the Architect for examination at any time.
2. See FIELD QUALITY CONTROL requirements in Part 3 of this Section for additional requirements.

1.7 DELIVERY AND STORAGE

A. Deliver materials to the site in original sealed containers, clearly marked with manufacturer's name and brand, and type of material.

B. Store materials in weathertight and dry storage facility. Protect from damage from handling, weather and construction operations before, during and after installation. Store materials at temperatures and under conditions recommended by the manufacturer.

1.8 PROJECT CONDITIONS

A. Specified coating must not be applied if weather is too cold, raining, snowing or if any other conditions exist that will not permit proper application or curing of coating. Follow manufacturer's written directions. Humidity should not deviate from acceptable ranges during application and curing. Protection required for proper installation and curing must be the responsibility of the Contractor and must comply with the manufacturer’s recommendations.

1. Weather: Perform work only when existing and forecasted weather conditions are within the limits established by manufacturers of the materials and products used.

B. Protect adjacent surfaces and materials with covering, duct tape and drop cloths as required to keep adjacent surfaces free of coating. Upon completing, remove protection and clean. Surfaces soiled or damaged by special coating must be cleaned or replaced at no extra cost to Owner.

C. Proceed with the installation of waterproofing only after the substrate construction has been completed and cured and after penetrating components have been installed, so that the membrane will not be penetrated or damaged by subsequent work.

D. When payment for elastomeric deck coating is based on area of application, the area used in calculations must be horizontal surfaces only. Verify dimensions as no extras will be allowed for inconsistency in dimensions.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Do not proceed with application of materials when ambient temperature is less or greater than that recommended by the coating material manufacturer. Do not apply traffic coatings to damp or wet substrates, when relative humidity exceeds 85 percent, or when temperatures are less than 3 degrees C (5 degrees F) above dew point.

1.10 SAFETY REQUIREMENTS

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

1.11 WARRANTY

A. Construction Warranty: Comply with FAR clause 52.246-21 "Warranty of Construction".

B. Special Project Warranty

1. Special warranty requirements specified in this Article shall in no way deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and must be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.
2. Materials manufacturer and approved installer must be jointly and severally responsible and must submit an affidavit signed by both parties warrantying the installed system for a minimum period of five (5) years from the date of substantial completion of the Work provided under this Section. Warranty must also include the following:
   a. Installer must repair or replace membrane which leaks water, deteriorates excessively, wears prematurely or otherwise fails to perform as required within the warranty period, due to failure of materials and/or workmanship under normal traffic and/or exposure conditions. Any type of failure of the membrane which occurs within the specified warranty period must be repaired by the Contractor at no cost to the Owner.

b. An agreement to remove and reinstall other work which has been superimposed on the Work as required to repair or replace the Traffic Coating System; such other work is limited to work shown in the Contract Documents.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Traffic coating system, after installation, must be monolithic, watertight, chemical and abrasion resistant, non-skid and consistent in thickness and color. Coating system must be resistant to excessive deterioration under normal exterior exposure and normal traffic in applications indicated, and withstand deterioration from manufacturer recommended cleaning procedures for period of warranty. In addition, it is required that traffic coatings be resistant to deterioration from contact with motor oil, transmission fluids, and other motor vehicle operating compounds, and exposure to normal ice/snow melting substances not specifically excluded by manufacturer's warranty.

B. VOC Requirements: Manufacturers must ensure that all components of specified products do not exceed volatile organic compound (VOC) limits of 400 g/l.

2.2 MATERIALS, GENERAL

A. General: The waterproofing membrane system must be a complete system of compatible materials, designed by the manufacturer to produce a waterproofing, traffic-bearing and chemical resistance surface.

B. WATERPROOFING MEMBRANE (Base Coat)

1. The base coat (membrane) must meet the following minimum performance criteria:

a. Minimum Tensile Strength (ASTM D412)

1) Base Coat - 1,000 psi

2) Top Coat - 2,000 psi

b. Minimum Elongation (ASTM D412)

1) Base Coat - 350%

c. Minimum Adhesion - one of the following:

1) ASTM D903:Base Coat - 20 psi

2) ASTM C794: Base Coat - 25 pli

3) ASTM D4541: Base Coat - 250 psi

4) ACI 503: Failure occurs in concrete when fc<6000 psi

d. A light application of primer compatible with the elastomeric seal coat must be applied onto the clean, dry concrete surface. The elastomeric coating must be applied uniformly to the primed surface. The elastomeric base coat must be applied in strict accordance with manufacturer's requirements for the system and verified by wet mil thickness testing (minimum one test per 500 square feet). The coating must be allowed to cure adequately. Special treatment must be provided at all construction joints, cove joints and at all cracks over 1/16" in width. This special treatment must be included in the bid price for the waterproofing membrane installation. The coating must also be applied at base of columns, walls and curbs to produce a 4" minimum high base.

2. Minimum System Thickness (Dry Mils): 20 mils

C. WEARING COURSE

1. A compatible wearing course must be applied over the base coat in accordance with the manufacturer's instructions. A selected aggregate must be broadcast evenly over the surface and fall on the surface in vertical direction so as not to displace uncovered coating.
2. Aggregates should be spread to an excess thickness until surface appears dry. After the coating has sufficiently cured, the excess aggregates must be removed and the tie coat must be applied to the surface.

D. LEVELING COURSE (IF REQUIRED)

1. A compatible leveling course must be applied directly onto the concrete surface after cleaning and prior to application of the primer. The leveling course is intended to fill and smooth pop-outs, scaling, depressions and pitting in the concrete surface due to abrasion, finishing problems or other existing conditions.

E. TOTAL SYSTEM REQUIREMENTS

1. Minimum System Thickness without Aggregate (Dry mils) in parking areas: 40 mils
2. Minimum System Thickness without Aggregate (Dry mils) in heavy wear areas: 50 mils
3. All systems must be wear-balanced for parking stall and drive aisle applications according to the manufacturer's recommendations.

4. Color of Wearing Course/Wearing Surface must be as selected by the Consultant/Owner.

2.3 AGGREGATE

A. Thoroughly washed, clean, medium-grained sharp indigenous stone granules, graded between 1 mm (.04 inch) and 4 mm (.16 inch) in size, and having a hardness of 6.5 or greater on the Moh's scale.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions under which the work of this Section is to be performed before installation, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance and timely completion of the Work including, but not limited to the following:
   1. Verify that substrates are free defects that may adversely affect proper execution of coating.
   2. Verify that substrates are free of curing agents or sealers that would inhibit bond.
   3. Verify that substrates have cured minimum of 28 days and are free of ridges and sharp projections, loose particles, cracks, pits, or other matter detrimental to adhesion and application of coating.
   4. Verify that substrates are visibly dry and free of moisture.
      a. Test for moisture content by method recommended in writing by coating manufacturer.
      b. Begin work of this Section only after minimum concrete-curing and -drying period recommended in writing by coating manufacturer has passed and after substrates are dry.
   5. Verify all penetrating (sleeves) work has been completed.

B. Report all deviations from the Contract Documents and/or conditions detrimental to performance of the Work to the Architect in writing.

C. Proceed with installation only after unsatisfactory conditions have been corrected and approved by the manufacturer's representative. Upon determination of acceptable concrete surfaces, notify the General Contractor and the Architect in writing.

3.2 SURFACE PREPARATION

A. Apply to clean, dry surfaces. Smooth rough spots and tool marks.

1. Clean the substrate of protrusions, dust, debris, oily materials and other substances detrimental to the work, as recommended by the coating system's manufacturer.
   a. Shot blast horizontal surfaces to remove contaminants and to provide a clean uniform textured surface as recommended by the manufacturer. Any other proposed cleaning methods must be submitted and approved by the Architect.
   b. Clean vertical surfaces of column bases, spandrels, walls, protrusions, etc., to provide a clean uniform textured surface.

B. Fill holes, depressions and cracks with fillers compatible with the coating material and recommended by the coating manufacturer.

C. Install cant strips and similar accessories as shown and as recommended by the waterproofing manufacturer (even though not shown) in the manner recommended by the manufacturer.

D. Subsurface imperfections that telegraph through the finish coating surface are not acceptable.

3.3 WORK COORDINATION

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

3.4 FLASHINGS, PRIMERS AND JOINT CONTROL

A. Install sheet-type flashings and joint covers where shown and as recommended by the fluid applied waterproofing manufacturer (even though not shown); using the type of sheet material and installation methods recommended by the manufacturer. Embed flashing in fluid applied waterproofing.

B. Cracks/Construction Joints: At locations of possible movement in the substrate construction, including cracks which have developed and construction joints, prepare the substrate to increase the fluid applied waterproofing capability for bridging the movement without failure. Use only products which have been determined to be compatible with the elastomeric waterproofing.

C. Fill voids and non-moving cracks and joints in the substrate with sealant or other compounds as recommended by the waterproofing manufacturer for compatibility. Fill rough areas of substrate (rough within limitations specified by the manufacturer) with a feathered-out

coating of elastomeric waterproofing, squeegee-applied to form a smooth top surface.

D. Prime substrate as recommended by the waterproofing system's manufacturer.

E. Mask off adjoining surfaces not to receive fluid applied waterproofing, to effectively prevent the spillage or migration of materials outside the membrane area.

3.5 APPLICATION

A. General

1. Comply with manufacturer's instruction, except where more stringent requirements are shown or specified, and except where project conditions require extra precautions or provisions to ensure satisfactory performance of the work.
2. Mix separately packaged components in accordance with manufacturer's instructions.
3. Apply coatings in accordance with manufacturer's instructions. Allow sufficient curing time in-between coatings.
4. Manufacturer's Technical Representative: Start the installation of elastomeric waterproofing membrane, only in the presence and with the advice of the manufacturer's technical representative.
   a. A series of four (4) wet mill gauge tests must be conducted for every 1000 sq. ft. on the first day of installation in the presence of the representative to ensure proper coverage rate.

B. Prime surfaces to receive elastomeric waterproofing materials as recommended by the product manufacturer.

1. Install leveling courses where required by substrates.

C. Where horizontal surfaces intersect vertical surfaces, provide a sealant type fillet as recommended by the manufacturer.

D. Install system coatings per approved Application Schedule.

1. Apply the elastomeric membrane to the primed deck within the time specified by the manufacturer.
2. Apply a uniform coating of cold applied elastomeric waterproofing to the substrate and adjoining surfaces indicated to receive the membrane.
   a. Apply coating by hand, complying with manufacturer's recommendations regarding horizontal and vertical surfaces.

b. Provide waterproof membrane at base of columns, spandrels, to produce a 4" minimum high base. Curb surfaces must be considered floors and waterproofed unless otherwise noted.

3. Wearing Surface: Apply top coat in one or two applications to achieve the specified dry film thicknesses.
   a. While coating is still fluid, uniformly broadcast aggregate over the surface at the rate specified.
   b. After top coat has cured, remove all excess aggregate from the deck surface.
   c. Apply a tie coat to the cured surface to encapsulate the top layer of aggregate.

E. Complete the base to a uniform established line as shown.

F. Permit cold applied membrane to cure without delay, and under conditions which will not contaminate or deteriorate the fluid applied waterproofing material. Block-off traffic and protect membrane from physical damage.

3.6 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: A qualified technical representative of the manufacturer must inspect the surfaces and job conditions before and during installation to assure that surfaces and conditions are adequate and that the materials and installation is proper. Certification must be sent to the General Contractor, Architect and Owner.
   1. Notify manufacturer in timely manner to arrange for manufacturer’s technical representative’s site visits to ensure proper installation, verify work is in accordance with manufacturer’s requirements, and warranty requirements have been met.
   2. Inspect during installation of insulation, application of base coat, and application of finish coat.
   3. Inspect after completion of finish coat application.
   4. Prepare report indicating:
      a. Non-complying conditions and locations.
      b. Repair methods for non-complying conditions.
      c. Successful and unsuccessful repair of non-complying conditions noted in previous inspection reports.

B. Testing: After installation of coating system, the system must be tested by flooding designated areas for a minimum of 24 hours by the Contractor in the presence of the Owner's Testing Agency to verify watertightness. If leaks are observed, the areas must be repaired by the Contractor to the satisfaction of the Architect and the area must be retested until satisfactory performance is obtained.

3.7 CLEANING

A. Clean exposed surfaces using materials and methods recommended by manufacturer of material or product being cleaned.
   1. Immediately upon completion of work:
      a. Remove all surplus materials, cartons, rubbish and debris resulting from these operations and legally dispose of off-site.
      b. Clean all exposed surfaces, remove excess materials and equipment, and repair any damage to other work.
   2. Re-clean all exposed surfaces one day prior to Date of Substantial Completion.
   3. Remove and replace work that cannot be successfully repaired or cleaned to the satisfaction of the Architect.

3.8 PROTECTION

A. Protect the finished coating from traffic until the coating cures and afterward until final acceptance.

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Clear Penetrating Concrete Sealers
Section 07 19 11

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes requirements for a Clear Penetrating Concrete Sealer System ("System") consisting of vapor permeable water repellant treatments to provide a coating that protects cementitious substrates from weather exposure, soiling and other agents.

B. The extent of work included in this Section is shown on the Drawings and is specified as follows:

1. Sealers for Newly-Constructed Horizontal Concrete Deck Surfaces and Surrounds: For newly-constructed portions of the building (not including repair work), provide concrete penetrating sealer system on slabs on grade, supported horizontal concrete deck surfaces, and 6" of all vertical concrete surfaces adjacent to horizontal deck surfaces as herein specified, unless otherwise noted.
2. Sealers for Masonry Walls (CMU): Provide concrete penetrating sealer system on the following exterior faces of CMU walls not otherwise coated or clad:
   a. Full height of all new masonry surfaces adjacent to horizontal deck surfaces as herein specified.
3. Providing the services of a qualified technical representative] to provide manufacturer representation on site to ensure installation quality.

C. Work not included in the Section: Sealers for existing concrete surfaces and restoration-related repairs thereto. See Section 07 19 33 for additional information.

1.2 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data: Manufacturer's data, test reports, specifications, recommendations, use limitations, and standard details for all proposed products and accessory materials. Include recommendations for application and surface preparation.

1. A qualified independent testing laboratory must perform all testing.

C. Application Schedule: Include proposed application rates for each component used for each condition.

D. Quality Control Submittals (Informational Submittals):

1. Qualification Data: For firms and/or persons specified in the QUALITY ASSURANCE Article of this Section; data must demonstrate their capabilities and experience. Include list of completed projects.
2. Warranty: Sample warranty form.
3. Documents Required for Payment
   a. When payment for sealer application is based on square foot area of application, the area used in calculations must be horizontal surfaces only.
   b. As a condition for payment of the sealer application, the Contractor must submit an invoice indicating the delivery and site receipt of the quantity of material calculated and designated for this project. In addition to the calculated quantity, the invoice must also reflect the project address, or be designated for use on this project, if delivered to the Contractor’s address.

1.3 QUALITY ASSURANCE

A. Source Quality Control

1. Provide sealer materials, with a proven record of performance, from one source which are products of one manufacturer.
   a. Qualification Data to Include list of no less than five (5) projects, similar to this Project, where the proposed sealer system has demonstrated satisfactory in-service performance.
2. Obtain accessory materials from the System manufacturer or from manufacturers which are acceptable to the System manufacturer.
3. No leftover material from previous projects will be permitted for use on Project.

B. Correlation of Performance Requirements: The Work of this Section is subject to the performance requirements indicated in the Contract Documents and as follows:

1. Requirements of Regulatory Agencies: The Work is subject to all applicable provisions of the Codes and Standards required by the authorities having jurisdiction.
2. Reference Standards: Standards referenced in this Section are commonplace in the industry (unless noted otherwise) and are referred to by basic designation only. Standards form a part of this Specification to the extent referenced. Provide only materials complying with referenced standards, and which are certified for such compliance.
3. Correlation and Intent of the Contract Documents: In the event of conflicts or discrepancies between the Contract Documents, the requirements of regulatory agencies, and the indicated Reference Standards, the most stringent requirements govern.

C. Qualifications
1. Manufacturer: Manufacturer must be capable of providing field service representation during construction, approving an acceptable installer, and recommending appropriate installation methods.
2. Installer (Applicator): Sealers must be installed by a Contractor who has a minimum of three (3) years' experience using the specified product.

D. Pre-Installation Conference
1. A pre-installation conference must be held prior to commencement of field installation to establish procedures, to maintain required working conditions, and to coordinate the Work of this Section with related and adjacent Work.
2. Contractor must require responsible representatives of each party concerned with that portion of the work to attend the conference, including but not limited to the following:
   a. Contractor's Superintendent and Project Manager.
   b. Representative of sealer manufacturer to establish procedures.
   c. Installation Subcontractor(s).
   d. Government's Testing Agency.
3. Comply with Section Division 1 requirements.

E. Field Testing Acceptance Criteria

1. Meet or exceed the following requirements for Project based on testing performed on a minimum of three, 3-inch diameter (or larger) core samples removed from the treated area.
   a. Repellency Rating (Waterproofing Performance): 85% or better, based on comparison of untreated versus treated samples. Test procedure for waterproofing performance must be according to ASTM D 6489, "Standard Test Method for Determining the Water Absorption of Hardened Concrete Treated with a Water Repellent Coating".
   b. Penetration (1 application): 1/8 inch minimum, based on the average of a series of measurements on the split face of core samples.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer. Sequence deliveries to avoid delays, but minimize on-site storage.

B. Store and handle materials in accordance with manufacturers written instructions and as follows:
   1. Store containers upright in a cool, dry, well-ventilated place, out of the sun. Store away from all other chemicals and potential sources of contamination.
   2. Keep lights, fire, sparks, and heat away from containers.
   3. Do not drop containers or slide across sharp objects.
   4. Keep containers tightly closed when not in use and protect from all possible damage.

1.5 PROJECT CONDITIONS

A. Protection
   1. Contractor must provide, at all times, covered access to premises and necessary utilities, space for storage of material and equipment, etc.
   2. Do not permit spray mist or liquid to drift onto adjacent materials, areas below, and/or surrounding properties.

B. Environmental Requirements: Perform work only when existing and forecasted weather conditions are within the limits established by manufacturers of the materials and products used, and as follows:
   1. Do not proceed with application of materials if ambient temperature is below 20 degrees F. or if ice or frost are covering the substrate.
   2. Do not proceed with application if ambient temperature of surface temperature exceeds 100 degrees F.
   3. Do not proceed with application of materials in rainy conditions or if rain is anticipated within 8 hours after application. Materials must not be applied to damp substrates. The surface should be sufficiently dry to observe the spray pattern during application.
   4. Do not apply materials in high or gusty winds.

1.6 COORDINATION

A. Sealer Coordination: Review other sections of these Specifications in which curing compounds or paints, are to be provided on concrete surfaces to be sealed to ensure compatibility with the concrete sealer.

1.7 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

B. Special warranty requirements specified in this Article shall in no way deprive the Government of other rights the Government may have under other provisions of the Contract Documents and must be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

C. The system manufacturer must furnish the Government a written single-source performance warranty that the Clear Penetrating Concrete Sealer System will be free of defects related to workmanship or material deficiency and meet or exceed the requirements of Paragraph 2.2 (above) for a ten (10) year period from the date of substantial completion of the work provided under this section of the Specification.
   1. Any required repairs under the warranty must be made by the system manufacturer. The required written warranty must be provided by the system manufacturer.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Provide a clear liquid "silane" type sealing (water repellent) compound, 100 percent solids content, which will penetrate the concrete to provide a surface which is resistant to salts, de-icer chemicals, moisture, gasoline, oil and acids. Sealer material must not permanently alter the appearance or surface texture of concrete surfaces.

2.2 PERFORMANCE REQUIREMENTS

A. CI Systems must comply with the following:
   1. NCHRP 244 procedure - Series II & IV.
   2. Scaling Resistance of Concrete (ASTM C-672) - No Scaling.
   3. Alberta Department of Transportation and Utilities B388 Penetrating Sealer for Traffic Bearing Surfaces Type 1B - Water Repellency after Abrasion (minimum) 86.0%.
   4. VOC Requirements: Where applicable, the manufacturers must ensure that all components of specified products do not exceed volatile organic compound (VOC) limits of 400 g/l.

B. Accessory Materials
   1. Fugitive Dye: For horizontal deck surfaces, all penetrating sealers applied must contain fugitive dye to demonstrate complete and thorough application to surface.

C. Application Rate: Application rates for this project must meet or exceed documented application rates in approved test data.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to receive sealer and conditions under which the work of this Section is to be performed before installation, with Installer (Applicator) present, for defects or conditions adversely affecting quality, and/or execution of the installation.
   1. All new construction must be cured a minimum of 28 days.

B. Report all deviations from the Contract Documents and/or conditions detrimental to performance of the Work to the Architect in writing.

C. Proceed with installation only after unsatisfactory conditions have been corrected. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 PREPARATION

A. Remove dirt, dust and materials that will interfere with the proper and effective application of the System. Protect all surrounding areas and landscape during cleaning operations. Allow surfaces to dry prior to application.

B. All caulking, patching and joint sealants should be installed a minimum of 24 hours prior to application, or as required by product manufacturer, whichever is greater, before application of water repellent.

C. Protect all surrounding areas as recommended by the manufacturer or as directed by the Architect.

1. Windows must be protected from contact with materials by masking with polyethylene or other approved techniques.
2. All adjacent cladding surfaces (other than concrete) and metallic items must be protected from contact with the sealer materials by masking with polyethylene.
3. Protect adjacent landscaping from exposure to sealer materials.

3.3 INITIAL TEST APPLICATION AND TESTING

A. Horizontal Deck Surfaces

1. Prior to full scale surface preparation and application of selected material, a trial application must be conducted. The locations must be 11 feet by 11 feet in size for products applied at 125 square feet per gallon, 12 feet 3 inches by 12 feet 3 inches for products applied at 150 square feet per gallon, 13 feet 3 inches by 13 feet 3 inches for products applied at 175 square feet per gallon and 14 feet by 14 feet for products applied at 200 square feet per gallon, at a location determined by the Architect. The preferred location will be on a sloping ramp.
2. The trial area must be cleaned according to manufacturer's recommendations in the same manner as planned for the entire project. This may include sweeping and cleaning with compressed air, water cleaning under pressure or shotblasting. For the

purposes of this test only, sandblasting is an acceptable substitute for shotblasting.

3. Upon completion of surface preparation, a core will be removed from the cleaned surface and tested for water absorption. This is the Untreated Water Absorption value. The test area will then be treated with one gallon of the selected material. From the treated area, two core samples must be removed. Both cores are to be tested for Treated Water Absorption and split with a chisel and dye tested for depth of sealer penetration. The repellency rating is calculated on the basis of untreated and treated water absorption values.
4. Once field test results are obtained, which meets or exceeds requirements of Paragraph 2.2 above, the Contractor will be authorized to perform full scale surface preparation and application of the selected material. Do not proceed with application unless directed in writing by the Architect and Material Manufacturer.
5. Cost of trial area application and testing must be included in the Contractor's price for sealer installation. Additional quality control testing, if desired by the Government in other areas or subsequent to the installation to determine warranty performance, will be paid for by the Government.

B. Vertical Applications

1. Sealer test application not required.

3.4 APPLICATION

A. Horizontal Deck Surfaces

1. Product must be applied at a rate as specified above. Do not dilute or alter the material.
   a. Preferred method of application is with low pressure (15 PSI) airless spray equipment or with a heavily-saturated brush or roller. Spray equipment should be equipped with solvent resistant gaskets and hoses.
   b. When applying by brush or roller, care will be taken to ensure that sufficient material is being applied to thoroughly saturate the treatment surfaces maintaining the appropriate square foot coverage rate required.

1) Product must be applied to horizontal surfaces in a single saturating application.
2) Sufficient material must be applied so that treated surfaces remain wet for a few minutes before penetration into the surface.
3) Surface residues, pools and puddles must be broomed out thoroughly until they completely penetrate into the surface.
4) Treated surfaces must be protected from rain and other surface water for a period of not less than eight (8) hours after application.
5) Treated surfaces must be protected from excessive foot and vehicular traffic for a period of not less than eight (8) hours after application.

B. Vertical Applications
   1. Product must be applied at a rate as recommended by the manufacturer for the surface condition/substrate. Do not dilute or alter the material.
      a. Preferred method of application is with low pressure (15 PSI) airless spray equipment. Spray equipment should be equipped with solvent resistant gaskets and hoses.
   2. Protect adjacent surfaces not scheduled to receive the System. If applied on unscheduled surfaces, remove immediately, by manufacturer approved method.

3.5 CRITERIA FOR ACCEPTANCE

A. Verification: Acceptance of the Work is to be based on Government's Testing Agency's verification of compliance with specified acceptance criteria (see Quality Assurance Article above).

B. Remedies: Remedial action deemed necessary by the Architect and resulting from non-compliance with the Contract requirements must be addressed as described for "Corrective Measures" in Division 1 of these Specifications.

3.6 FIELD QUALITY CONTROL

A. Manufacturer's Field Services
   1. A qualified technical representative of the manufacturer must:

a. Verify specified products are used.

b. Provide technical assistance and guidance for installation of the System.

c. Inspect the surfaces and job conditions before and during installation to ensure that surfaces, conditions, and protections are adequate and that the materials and installation is in accordance with the manufacturer's written instructions and the test panel results approved by the Architect. Representative must submit written reports of each visit indicating observations, findings, and conclusions of inspection.

d. Send reports to the Contractor, Architect and Contracting Officer's Representative. At a minimum, reports must indicate:

1) Non-complying conditions and locations.

2) Proposed repair methods for non-complying conditions.

3) Successful and unsuccessful repair of non-complying conditions noted in previous inspection reports.

4) Final certification(s).

2. Scheduling: Contractor must notify manufacturer in timely manner to arrange for manufacturer's technical representative's site visits to verify System work is in accordance with manufacturer's requirements, and warranty requirements have been met.

B. Testing

1. After System has cured for 24 hours at low humidity and temperature between 70- and 90-degrees F or 48 hours at high humidity and low temperature between 50- and 69-degrees F, all surfaces must be tested with a water spray. Re-coat any area that indicates water absorption.

2. See Quality Assurance Article herein for additional testing requirements.

3.7 CLEANING

A. Remove and dispose of necessary masking materials following completion of System application.

B. Clean-up any over spray from adjacent surfaces with cleaner as recommended by the System manufacturer which will not damage surfaces.

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Penetrating Concrete Sealers with Corrosion Inhibitor
Section 07 19 33

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes requirements for a Penetrating Concrete Sealer with Corrosion Inhibitor System ("CI System") consisting of vapor permeable water repellant treatments to:
   1. Provide a coating that protects cementitious substrates from weather exposure, soiling and other agents.
   2. Provide a penetrating component that forms a protective, molecular barrier on embedded reinforcement to reduce the rate of corrosion.

B. The extent of work included in this Section is shown on the Drawings and is specified as follows:
   1. Sealers for Existing Horizontal Concrete Deck Surfaces and Surrounds: For newly-constructed portions of the building provide CI System on all existing slabs on grade, all existing supported horizontal concrete deck surfaces, and 6" of all existing vertical concrete surfaces adjacent to horizontal deck surfaces as herein specified, unless otherwise noted.
      a. Concrete surfaces with an Existing Traffic Membrane System do not receive this application.
      b. Concrete surfaces (without an existing traffic membrane system) that are scheduled to receive a new traffic membrane system, must receive CI System application before the new traffic membrane system is installed.
   2. Other surfaces as noted in the Restoration Drawings.
   3. All locations must receive two (2) applications (2-coats).
   4. Providing the services of a qualified technical representative] to provide manufacturer representation on site to ensure installation quality.
   5.

C. Work not included in the Section: Sealers for new concrete surfaces not related to restoration of existing surfaces. See Section 07 19 11 for additional information.

1.2 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data: Manufacturer's data, test reports, specifications, recommendations, use limitations, and standard details for all proposed products and accessory materials. Include recommendations for application and surface preparation.

1. A qualified independent testing laboratory must perform all testing.

C. Application Schedule: Include proposed application rates for each component used for each condition.

D. Quality Control Submittals (Informational Submittals):

1. Qualification Data: For firms and/or persons specified in the QUALITY ASSURANCE Article of this Section; data must demonstrate their capabilities and experience. Include list of completed projects.
2. Warranty: Sample warranty form.
3. Documents Required for Payment
   a. When payment for sealer application is based on square foot area of application, the area used in calculations must be horizontal surfaces only.
   b. As a condition for payment of the sealer application, the Contractor must submit an invoice indicating the delivery and site receipt of the quantity of material calculated and designated for this project. In addition to the calculated quantity, the invoice must also reflect the project address, or be designated for use on this project, if delivered to the Contractor’s address.

1.3 QUALITY ASSURANCE

A. Source Quality Control

1. Provide sealer materials, with a proven record of performance, from one source which are products of one manufacturer.
   a. Qualification Data to Include list of no less than five (5) projects, similar to this Project, where the proposed sealer system has demonstrated satisfactory in-service performance.

2. Obtain accessory materials from the System manufacturer or from manufacturers which are acceptable to the System manufacturer.
3. No leftover material from previous projects will be permitted for use on Project.

B. Correlation of Performance Requirements: The Work of this Section is subject to the performance requirements indicated in the Contract Documents and as follows:
1. Requirements of Regulatory Agencies: The Work is subject to all applicable provisions of the Codes and Standards required by the authorities having jurisdiction.
2. Reference Standards: Standards referenced in this Section are commonplace in the industry (unless noted otherwise) and are referred to by basic designation only. Standards form a part of this Specification to the extent referenced. Provide only materials complying with referenced standards, and which are certified for such compliance.
3. Correlation and Intent of the Contract Documents: In the event of conflicts or discrepancies between the Contract Documents, the requirements of regulatory agencies, and the indicated Reference Standards, the most stringent requirements govern.

C. Qualifications
1. Manufacturer: Manufacturer must be capable of providing field service representation during construction, approving an acceptable installer, and recommending appropriate installation methods.
2. Installer (Applicator): Sealers must be installed by a Contractor who has a minimum of three (3) years' experience using the specified product.

D. Pre-Installation Conference
1. A pre-installation conference must be held prior to commencement of field installation to establish procedures, to maintain required working conditions, and to coordinate the Work of this Section with related and adjacent Work.
2. Contractor must require responsible representatives of each party concerned with that portion of the work to attend the conference, including but not limited to the following:
   a. Contractor's Superintendent and Project Manager.

b. Representative of sealer manufacturer to establish procedures.

c. Installation Subcontractor(s).

d. Government's Testing Agency.

3. Comply with Section Division 1 requirements.

E. Field Testing Acceptance Criteria

1. Meet or exceed the following requirements for Project based on testing performed on a minimum of three, 3-inch diameter (or larger) core samples removed from the treated area.

a. Repellency Rating (Waterproofing Performance): 85% or better, based on comparison of untreated versus treated samples. Test procedure for waterproofing performance must be according to ASTM D 6489, "Standard Test Method for Determining the Water Absorption of Hardened Concrete Treated with a Water Repellent Coating".

b. Penetration (1 application): 1/4 inch minimum (6 mm), based on the average of a series of measurements on the split face of core samples.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer. Sequence deliveries to avoid delays, but minimize on-site storage.

B. Store and handle materials in accordance with manufacturers written instructions and as follows:

1. Store containers upright in a cool, dry, well-ventilated place, out of the sun. Store away from all other chemicals and potential sources of contamination.

2. Keep lights, fire, sparks, and heat away from containers.

3. Do not drop containers or slide across sharp objects.

4. Keep containers tightly closed when not in use and protect from all possible damage.

1.5 PROJECT CONDITIONS

A. Protection

1. Contractor must provide, at all times, covered access to premises and necessary utilities, space for storage of material and equipment, etc.
2. Do not permit spray mist or liquid to drift onto adjacent materials, areas below, and/or surrounding properties.

B. Environmental Requirements: Perform work only when existing and forecasted weather conditions are within the limits established by manufacturers of the materials and products used, and as follows:
1. Do not proceed with application of materials if ambient temperature is below 20 degrees F. or if ice or frost are covering the substrate.
2. Do not proceed with application if ambient temperature of surface temperature exceeds 100 degrees F.
3. Do not proceed with application of materials in rainy conditions or if rain is anticipated within 8 hours after application. Materials must not be applied to damp substrates. The surface should be sufficiently dry to observe the spray pattern during application.
4. Do not apply materials in high or gusty winds.

1.6 COORDINATION

A. Sealer Coordination: Review other sections of these Specifications in which curing compounds or paints, are to be provided on concrete surfaces to be sealed to ensure compatibility with the concrete sealer.

1.7 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

B. Special warranty requirements specified in this Article shall in no way deprive the Government of other rights the Government may have under other provisions of the Contract Documents and must be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

C. The system manufacturer must furnish the Government a written single-source performance warranty that the Clear Penetrating Concrete Sealer System will be free of defects related to workmanship or material deficiency and meet or exceed the requirements of Paragraph 2.2 (above)

for a ten (10) year period from the date of substantial completion of the work provided under this section of the Specification.

1. Any required repairs under the warranty must be made by the system manufacturer. The required written warranty must be provided by the system manufacturer.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Provide a clear liquid "silane" type sealing (water repellent) compound, 100 percent solids content, which will penetrate the concrete to provide a surface which is resistant to salts, de-icer chemicals, moisture, gasoline, oil and acids. Sealer material must not permanently alter the appearance or surface texture of concrete surfaces.

2.2 PERFORMANCE REQUIREMENTS

A. CI Systems must comply with the following:
   1. NCHRP 244 procedure - Series II & IV.
   2. Scaling Resistance of Concrete (ASTM C-672) - No Scaling.
   3. Alberta Department of Transportation and Utilities B388 Penetrating Sealer for Traffic Bearing Surfaces Type 1B - Water Repellency after Abrasion (minimum) 86.0%.
   4. VOC Requirements: Where applicable, the manufacturers must ensure that all components of specified products do not exceed volatile organic compound (VOC) limits of 400 g/l.
   5. Corrosion Protection: CI System must comply with one or more of the following:
      a. U. S. Department of the Interior Bureau of Reclamation: USBR M-82 Test Protocol.
      b. U.S. DOT, Federal Highway Administration: FHWA RD-98-153 Test Protocol; must reduce corrosion by 90% or greater.
      c. Other Architect-approved test protocol prior to bidding.

B. Accessory Materials
   1. Fugitive Dye: For horizontal deck surfaces, all penetrating sealers applied must contain fugitive dye to demonstrate complete and thorough application to surface.

C. Application Rate: Application rates for this project must meet or exceed documented application rates in approved test data.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine surfaces to receive sealer and conditions under which the work of this Section is to be performed before installation, with Installer (Applicator) present, for defects or conditions adversely affecting quality, and/or execution of the installation.
   1. All new construction must be cured a minimum of 28 days.

B. Report all deviations from the Contract Documents and/or conditions detrimental to performance of the Work to the Architect in writing.

C. Proceed with installation only after unsatisfactory conditions have been corrected. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 PREPARATION

A. Remove dirt, dust and materials that will interfere with the proper and effective application of the System. Protect all surrounding areas and landscape during cleaning operations. Allow surfaces to dry prior to application.

B. All caulking, patching and joint sealants should be installed a minimum of 24 hours prior to application, or as required by product manufacturer, whichever is greater, before application of water repellent.

C. Protect all surrounding areas as recommended by the manufacturer or as directed by the Architect.
   1. Windows must be protected from contact with materials by masking with polyethylene or other approved techniques.
   2. All adjacent cladding surfaces (other than concrete) and metallic items must be protected from contact with the sealer materials by masking with polyethylene.
   3. Protect adjacent landscaping from exposure to sealer materials.

3.3 INITIAL TEST APPLICATION AND TESTING

A. Horizontal Deck Surfaces

1. Prior to full scale surface preparation and application of selected material, a trial application must be conducted. The locations must be 11 feet by 11 feet in size for products applied at 125 square feet per gallon, 12 feet 3 inches by 12 feet 3 inches for products applied at 150 square feet per gallon, 13 feet 3 inches by 13 feet 3 inches for products applied at 175 square feet per gallon and 14 feet by 14 feet for products applied at 200 square feet per gallon, at a location determined by the Architect. The preferred location will be on a sloping ramp.
2. The trial area must be cleaned according to manufacturer's recommendations in the same manner as planned for the entire project. This may include sweeping and cleaning with compressed air, water cleaning under pressure or shotblasting. For the purposes of this test only, sandblasting is an acceptable substitute for shotblasting.
3. Upon completion of surface preparation, a core will be removed from the cleaned surface and tested for water absorption. This is the Untreated Water Absorption value. The test area will then be treated with one gallon of the selected material. From the treated area, two core samples must be removed. Both cores are to be tested for Treated Water Absorption and split with a chisel and dye tested for depth of sealer penetration. The repellency rating is calculated on the basis of untreated and treated water absorption values.
4. Once field test results are obtained, which meets or exceeds requirements of Paragraph 2.2 above, the Contractor will be authorized to perform full scale surface preparation and application of the selected material. Do not proceed with application unless directed in writing by the Architect and Material Manufacturer.
5. Cost of trial area application and testing must be included in the Contractor's price for sealer installation. Additional quality control testing, if desired by the Government in other areas or subsequent to the installation to determine warranty performance, will be paid for by the Government.

B. Vertical Applications

1. Sealer test application not required.

3.4 APPLICATION

A. Horizontal Deck Surfaces

1. Product must be applied at a rate as specified above. Do not dilute or alter the material.
   a. Preferred method of application is with low pressure (15 PSI) airless spray equipment or with a heavily-saturated brush or roller. Spray equipment should be equipped with solvent resistant gaskets and hoses.
   b. When applying by brush or roller, care will be taken to ensure that sufficient material is being applied to thoroughly saturate the treatment surfaces maintaining the appropriate square foot coverage rate required.
      1) Product must be applied to horizontal surfaces in a single saturating application.
      2) Sufficient material must be applied so that treated surfaces remain wet for a few minutes before penetration into the surface.
      3) Surface residues, pools and puddles must be broomed out thoroughly until they completely penetrate into the surface.
      4) Treated surfaces must be protected from rain and other surface water for a period of not less than eight (8) hours after application.
      5) Treated surfaces must be protected from excessive foot and vehicular traffic for a period of not less than eight (8) hours after application.

B. Vertical Applications

1. Product must be applied at a rate as recommended by the manufacturer for the surface condition/substrate. Do not dilute or alter the material.
   a. Preferred method of application is with low pressure (15 PSI) airless spray equipment. Spray equipment should be equipped with solvent resistant gaskets and hoses.
2. Protect adjacent surfaces not scheduled to receive the System. If applied on unscheduled surfaces, remove immediately, by manufacturer approved method.

3.5 CRITERIA FOR ACCEPTANCE

A. Verification: Acceptance of the Work is to be based on Government's Testing Agency's verification of compliance with specified acceptance criteria (see Quality Assurance Article above).

B. Remedies: Remedial action deemed necessary by the Architect and resulting from non-compliance with the Contract requirements must be addressed as described for "Corrective Measures" in Division 1 of these Specifications.

3.6 FIELD QUALITY CONTROL

A. Manufacturer's Field Services

1. A qualified technical representative of the manufacturer must:
   a. Verify specified products are used.
   b. Provide technical assistance and guidance for installation of the System.
   c. Inspect the surfaces and job conditions before and during installation to ensure that surfaces, conditions, and protections are adequate and that the materials and installation is in accordance with the manufacturer's written instructions and the test panel results approved by the Architect. Representative must submit written reports of each visit indicating observations, findings, and conclusions of inspection.
   d. Send reports to the Contractor, Architect and Contracting Officer's Representative. At a minimum, reports must indicate:
      1) Non-complying conditions and locations.
      2) Proposed repair methods for non-complying conditions.
      3) Successful and unsuccessful repair of non-complying conditions noted in previous inspection reports.
      4) Final certification(s).
2. Scheduling: Contractor must notify manufacturer in timely manner to arrange for manufacturer's technical representative's site visits to verify System work is in accordance with manufacturer's requirements, and warranty requirements have been met.

B. Testing

1. After System has cured for 24 hours at low humidity and temperature between 70- and 90-degrees F or 48 hours at high humidity and low temperature between 50- and 69-degrees F, all surfaces must be tested with a water spray. Re-coat any area that indicates water absorption.
2. See Quality Assurance Article herein for additional testing requirements.

3.7 CLEANING

A. Remove and dispose of necessary masking materials following completion of System application.

B. Clean-up any over spray from adjacent surfaces with cleaner as recommended by the System manufacturer which will not damage surfaces.

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SECTION 07 22 00
ROOF AND DECK INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof and deck insulation, substrate board, vapor retarder, and cover board on new concrete substrates ready to receive roofing or waterproofing membrane.
2. Repairs and alteration work to existing roof insulation.

1.2 RELATED WORK

A. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS: Non-Flooring Adhesives and Sealants VOC Limits.

B. Section 06 10 00, ROUGH CARPENTRY: Wood Cants, Blocking, and Edge Strips.

C. Sheet metal components: Section 07-60-00, FLASHING AND SHEET METAL.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. American Society of Civil Engineers

ASCE 7-16.....Minimum Design Loads and Associated Criteria for Buildings and Other Structures

C. American Society of Heating, Refrigeration and Air Conditioning (ASHRAE):

Standard 90.1-13.....Energy Standard for Buildings Except Low-Rise Residential Buildings.

D. ASTM International (ASTM):

C208-12(2017)e2.....Cellulosic Fiber Insulating Board.

C552-17e1.....Cellular Glass Thermal Insulation.

C726-17.....Mineral Fiber Roof Insulation Board.

C728-17a.....Perlite Thermal Insulation Board.

C1177/C1177M-17.....Glass Mat Gypsum Substrate for Use as Sheathing.

C1278/C1278M-17.....Fiber-Reinforced Gypsum Panel.

C1289-19.....Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.

C1396/C1396M-17.....Gypsum Board.

D41/D41M-11 (2016).....Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.

D312/D312M-16a.....Asphalt Used in Roofing.

D1970/D1970M-20.....Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.

D2178/D2178M-15a.....Asphalt Glass Felt Used in Roofing and Waterproofing.

D2822/D2822M-05(2011)e1.Asphalt Roof Cement, Asbestos Containing.

D4586/D4586M-07(2018)...Asphalt Roof Cement, Asbestos-Free.

E84-20.....Surface Burning Characteristics of Building Materials.

F1667-18a.....Driven Fasteners: Nails, Spikes, and Staples.

E. Factory Mutual Global (FM):

1-28 Wind Loads to Roof Systems and Roof Deck Securement.

P7825-05 Approval Guide

F. National Roofing Contractors Association (NRCA):

Manual-15.....The NRCA Roofing Manual: Membrane Roof Systems-2019.

G. UL LLC (UL):

Listed Online Certifications Directory.

Fire Resistance Directory (2009)

H. U.S. Department of Agriculture (USDA):

USDA BioPreferred Program Catalog.

I. U.S. Department of Commerce National Institute of Standards and Technology (NIST):

DOC PS 1-19.....Structural Plywood.

DOC PS 2-18.....Performance Standard for Wood-Based Structural-Use Panels.

1.4 QUALTIY CONTROL

A. Supervision of work by persons that are knowledgeable and experienced in roofing. See submittals for documentation of supervisor’s qualification.

B. Unless specified otherwise, comply with the recommendations of the NRCA “Roofing and Waterproofing Manual” applicable to insulation for storage, handling, and application.

1.5 PERFORMANCE REQUIREMENTS

A. FM Approvals Listing: Membrane roofing, base flashings, tapered insulation and component materials must comply with requirements in FM Approvals 4450 and 4470 as part of a membrane roofing system.
   1. Fire/Windstorm Classification: Class 1A-90

1.6 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
B. Submittal Drawings:
   1. Show size, configuration, and installation details.
      a. Nailers, cants, and terminations.
      b. Layout of insulation showing slopes, tapers, penetrations, and edge conditions.
C. Manufacturer's Literature and Data:
   1. Description of each product.
   2. Fastening requirements.
   3. Insulation span data for flutes of metal decks.
D. Samples:
   1. Roof insulation, each type.
   2. Fasteners, each type.
E. Certificates:
   1. Indicating type, thickness and thermal conductance of insulation. (Average thickness for tapered insulation).

2. Indicating materials and method of application of insulation system on metal decks meet the requirements of Factory Mutual Research Corporation for Class 1 Insulated Steel Deck Roofs.

F. Layout of tapered roof system showing units required.
G. Documentation of supervisors training and experience showing knowledge of roofing procedures.
H. Sustainable Construction Submittals:
   1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.
   2. Biobased Content:
      a. Show type and quantity for each product.
   3. Low Pollutant-Emitting Materials:
      a. Show volatile organic compound types and quantities.

b. Certify each composite wood product contain no added urea formaldehyde.

I. Qualifications: Substantiate qualifications meet specifications.

1. Installer.

1.7 QUALITY ASSURANCE

A. Roof insulation on combustible or steel decks shall have a flame spread rating not greater than 75 and a smoke developed rating not greater than 150, exclusive covering, when tested in accordance with ASTM 84. Insulation bearing the UL label and listed in the UL Building Materials Directory as meeting the flame spread and smoke developed ratings will be accepted in-lieu-of copies of test reports. Compliance with flame spread and smoke developed ratings will not be required when insulation has been tested as part of a roof construction assembly of the type used for this project and the construction is listed as fire-classified in the UL Building Materials Directory or listed as Class I roof deck construction in the FM P7825. Insulation tested as part of a roof construction assembly shall bear UL or FM labels attesting to the ratings specified herein.

1.8 DELIVERY

A. Comply with recommendations of NRCA Manual.

B. Deliver products in manufacturer's original sealed packaging.

C. Mark packaging, legibly. Indicate manufacturer's name or brand, type, and manufacture date.

D. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.9 STORAGE AND HANDLING

A. Comply with recommendations of NRCA Manual.

B. Store products indoors in dry, weathertight facility.

C. Protect products from damage during handling and construction operations.

1.10 FIELD CONDITIONS

A. Environment: Install products when existing and forecasted weather permit installation according to manufacturer's instructions.

1.11 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

B. Manufacturer's Warranty: Warrant substrate board, vapor retarder, insulation, and cover board against material and manufacturing defects as part of Division 07 roofing system warranty.

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

A. Insulation Thermal Performance:
   1. Minimum one inch (1”) thickness.

B. Fire and Wind Uplift Resistance: Provide roof insulation complying with requirements specified in Division 07 roofing section.

2.2 PRODUCTS - GENERAL

A. Provide each product from one manufacturer.

B. Sustainable Construction Requirements:
   1. Insulation Recycled Content:
      a. Mineral Fiber: 75 percent total recycled content, minimum.
      b. Fiberglass: 20 percent total recycled content, minimum.
      c. Cellulose: 75 percent post-consumer recycled content, minimum.
      d. Perlite Composite Board: 23 percent post-consumer recycled content, minimum.
      e. Rigid Foam: 9 percent total recycled content, minimum.
      f. Glass Fiber Reinforced Rigid Foam: 6 percent total recycled content, minimum.
   2. Low Pollutant-Emitting Materials: Comply with VOC limits specified in Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for the following products:
      a. Non-flooring adhesives and sealants.
      b. Composite wood and agrifiber.
   3. Bio-Based Materials: Where applicable, provide products designated by USDA and meeting or exceeding USDA recommendations for bio-based content, and products meeting Rapidly Renewable Materials and certified sustainable wood content definitions; refer to www.biopreferred.gov./98

2.3 ADHESIVES

A. Primer: ASTM D41/D41M.

B. Asphalt: ASTM D312, Type III or IV for vapor retarders and insulation.

C. Modified Asphaltic Insulation Adhesive: Insulation manufacturer's recommended modified asphaltic, asbestos-free, cold-applied adhesive

formulated to adhere roof insulation to substrate or to another insulation layer.

D. Bead-Applied Urethane Insulation Adhesive: Insulation manufacturer's recommended bead-applied, low-rise, one- or multicomponent urethane adhesive formulated to adhere roof insulation to substrate or to another insulation layer.

E. Full-Spread Applied Urethane Insulation Adhesive: Insulation manufacturer's recommended spray-applied, low-rise, two-component urethane adhesive formulated to adhere roof insulation to substrate or to another insulation layer.

F. Roof Cement: Asbestos free, ASTM D2822/D2822M, Type I or Type II; or, ASTM D4586/D4586M, Type I or Type II.

2.4 ROOF AND DECK INSULATION

A. Roof and Deck Insulation, General: Preformed roof insulation boards approved by roofing manufacturer.

B. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 1, Grade 2, faced with glass fiber reinforced cellulosic felt facers on both major surfaces of the core foam.

C. Isocyanurate Board: ASTM C1289, Type I, Class 2, or Type III.

D. Cellular Glass Board Insulation: ASTM C552, Type IV, kraft-paper sheet faced, roof board.

E. Perlite Board Insulation: ASTM C728, expanded perlite particles, selected binders, and cellulosic fibers with surface treated to reduce bitumen absorption.

F. Perlite Board: ASTM C726

G. Cellulosic Fiber Board Insulation: ASTM C208, Type II, Grade 2 for single-ply roofing.

H. Mineral Fiberboard: ASTM C726.

I. Tapered Roof Insulation System:

1. Fabricate of polyisocyanurate board. 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; 25 mm (1-1/2 inch), unless otherwise noted.
4. Minimum slope 1/48 (1/4 inch per 12 inches).

J. Composite Nail Base Insulated Roof Sheathing:

1. Oriented-Strand-Board-Surfaced, Polyisocyanurate-Foam Sheathing: Polyisocyanurate thermal insulation ASTM C1289, Type V, insulation thickness as shown, with oriented strand board laminated to top surface.
2. Oriented Strand Board: NIST DOC PS 1, Exposure 1, 11 mm (7/16 inch) thick.
3. Bottom surface faced with felt facers.

2.5 RECOVERED MATERIALS

A. Comply with following minimum content standards for recovered materials:

Material Type	Percent by Weight
Perlite composite board	23 percent post consumer recovered paper
Plastic rigid foams: Polyisocyanurate/polyurethane	
Rigid foam	9 percent recovered material
Foam-in-place	5 percent recovered material
Glass fiber reinforced	6 percent recovered material
Rock wool material	75 percent recovered material

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

2.6 INSULATION ACCESSORIES

A. Glass (Felt): ASTM D2178/D2178M, Type VI, heavy duty ply sheet.

B. Cants and Tapered Edge Strips:

1. Wood Cant Strips: Refer to Section 06 10 00, ROUGH CARPENTRY.
2. Insulation Cant Strips: ASTM C208, Type II, Grade 1, cellulosic-fiber insulation board.
3. Tapered Edge Strips: 1/12 (1 inch per 12 inches), from 0 mm (0 inches), 300 mm to 450 mm (12 inches to 18 inches) wide.
   a. Cellulosic Fiberboard: ASTM C208.
   b. Mineral Fiberboard: ASTM C726.
   c. Perlite Board: ASTM C728.

C. Vapor Retarder:

1. Glass-Fiber Felts: ASTM D2178/D2178M, Type IV, asphalt impregnated.
2. Self-Adhering Sheet Vapor Retarder: ASTM D1970/D1970M, minimum 1.0 mm (40 mils) thick membrane of HDPE film fully coated with

asphalt adhesive, or 0.76 to 1.0 mm (30 to 40 mils) thick membrane of butyl rubber based adhesive backed by a layer of high density cross-laminated polyethylene; maximum permeance rating of 6 ng/Pa/s/sq. m (0.1 perms).

D. Cover Board:

1. Oriented Strand Board: DOC PS 2, Exposure 1, 11 mm (7/16 inch) thick.

2.7 ACCESSORIES

A. Fasteners: Corrosion-resistant carbon steel fasteners and galvalume-coated steel or plastic round plates for fastening substrate board and insulation to roof deck.

B. Fasteners for securing insulation to precast concrete decks:

1. Conform to requirements of Factory Manual Research Corporation for wind uplift.
2. Self-drilling factory coated steel fasteners with 50 mm (2 inch) diameter disk, complying with corrosion resistance provision in FM approvals A470.
3. Fasteners designed for fastening roof insulation to concrete deck and acceptable to roofing system manufacturer.

C. Fasteners for securing insulation to steel decks:

1. Conform to requirements of Factory Mutual Research Corporation for wind uplift.
2. Self-drilling galvanized screws with 50mm (2 inch) diameter disk.
3. Antibackout thread design.
4. Have a pullout resistance of 14 kg (30 pounds) minimum.

D. Nails: ASTM F1667; type to suit application.

PART 3 - EXECUTION

3.1 GENERAL

A. Do not apply roof insulation if deck will be used for subsequent work platform, storage of materials, or staging or scaffolding will be erected thereon.

B. Entire roof deck construction of any section of the building shall be completed before insulation system work is begun. Curbs, blocking, edge strips, and other components which insulation, roofing and base flashing is attached to shall be in place ready to receive insulation and roofing. Coordinate roof insulation operations with roofing and

sheet metal work so that insulation is installed to permit continuous roofing operations.

C. Insulation system materials shall be dry and damage free when applied. Do not use broken insulation or insulation with damaged facings. Remove damaged insulation from the site immediately.

D. Dry out surfaces, including the flutes of metal deck, that become wet from any cause during progress of the work before roofing work is resumed. Apply materials only to dry substrates.

E. Except for temporary protection specified, do not apply materials during damp or rainy weather, during excessive wind conditions, nor while moisture (dew, fog, snow, ice) or frost is present in any amount in or on the materials when temperature is below 10 degrees C (50 degrees F). Do not apply materials to substrate having temperature of 10 degrees C (50 degrees F) or less.

F. Phased construction is not permitted. The complete installation of all flashing, insulation, and roofing shall be completed in the same day except for the area where temporary protection is required when work is stopped.

3.2 EXAMINATION

A. Comply with requirements of Division 07 roofing section.

3.3 GENERAL PREPARATION

A. Examine and verify substrate suitability for product installation.

B. Protect existing construction and completed work from damage.

3.4 SURFACE PREPARATION

A. Sweep decks to broom clean condition. Remove all dust, dirt or debris.

B. Remove projections that might damage materials.

C. Concrete Decks, Except Insulating Concrete:

1. Test concrete decks for moisture prior to application of materials. Heat bitumen as specified and pour approximately 0.5 liters (one pint) of bitumen on surface to which roofing materials are to be applied. If bitumen foams upon contact with deck or after bitumen has cooled and bitumen is stripped clean from deck leaving no residue, the deck is not dry enough for application of prime coat and subsequent work.

2. Prime concrete decks, including precast unit, with primer and allow to dry before application of bitumen. Keep primer back 100 mm (four inches) from joints in precast unit.

D. Insulating Concrete:

1. Allow to dry for at least five days after installation before the placement of subsequent materials or insulation.
2. If rain occurs during or at end of drying period or during installation, allow additional drying time before continuing the placement of the subsequent materials or insulation.

E. Poured gypsum shall be dried out in accordance with manufacturer's printed instructions prior to application of subsequent materials.

F. Cover wood sheathing, poured gypsum, gypsum plank, and cement wood fiber plank with a layer of building paper (red rosin).

G. Existing Roofs:

1. At areas to be altered or repaired, remove loose insulation and wet insulation.
2. Cut and remove existing insulation and vapor retarder for new work to be installed. Clean cut edges and install a temporary seal to cut surfaces. Use roof cement and one layer of 7 kg (15 pound) felt strip cut to extend 150 mm (6 inches) on each side of cut surface. Bed strip in roof cement and cover strip with roof cement to completely embed the felt.

3.5 SELECTION OF RIGID INSULATION

A. Insulation Type:

1. Use either cellular glass, mineral fiberboard, perlite board, phenolic board, isocyanurate board or urethane board or a combination thereof.
2. Use no less than two layers of insulation unless specified otherwise.
3. Use either 25 mm (one inch) thick mineral fiberboard, cellular glass, or perlite board as first layer over steel decks. Do not use phenolic, isocyanurate, or urethane board type insulation directly on steel roof decks.
4. Use 6 mm (1/4 inch) thick glass-mat faced gypsum sheathing cover board. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows.

Offset joints of insulation below a minimum of 6 inches (150 mm) in each direction. Loosely butt cover boards together and fasten roof deck.

5. Where tapered insulation is used, all insulation shall be factory tapered.

B. Insulation Thickness:

1. Thickness of roof insulation shown on drawings is nominal. Actual thickness shall be not less than 1 inch at low points and slope at 1/4 inch per foot as indicated on drawings, to facilitate drainage.
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, gravel stops, 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 25 mm (1 inch).
4. Use not less than two layers of insulation when insulation is 25 mm (1 inch) or more in thickness unless specified otherwise.

3.6 INSTALLATION - GENERAL

A. Install products according to manufacturer's instructions.

1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

B. Comply with requirements of UL for insulated steel roof deck.

C. Attach substrate board and other products to meet requirements of Division 07 roofing section.

3.7 SUBSTRATE BOARD INSTALLATION

A. Fasten substrate board to top flanges of steel decking to resist uplift pressures according requirements for specified roofing system.

1. Locate the long dimension edge joints solidly bearing on top of decking ribs.

3.8 VAPOR RETARDER INSTALLATION

A. Vapor Retarder Installation, General:

1. Install continuous vapor retarder on roof decks where indicated.

2. At vertical surfaces, turn up vapor retarder to top of insulation or base flashing.
3. Seal penetrations through vapor retarder with roof cement to prevent moisture entry from below.

B. Cast in Place Concrete Decks, Except Insulating Concrete:
1. Prime deck as specified.
2. Apply two plies of asphalt saturated felt mopped down to deck.

C. Precast Concrete Unit Decks Without Concrete Topping:
1. Prime deck as specified.
2. Apply two plies of asphalt saturated felt.
3. Mop to deck, keeping bitumen 100 mm (4 inches) away from joints of precast units. Bridge joints with felt. Mop between plies as specified.

3.9 INSULATION INSTALLATION

A. Insulation Installation, General:
1. Base Sheet: Where required by roofing system, install one lapped base sheet specified in Division 07 roofing section by mechanically fastening to roofing substrate before installation of insulation.
2. Cant Strips: Install wood cant strips specified in Section 06 10 00 ROUGH CARPENTRY at junctures of roofing system with vertical construction.
3. Use same insulation as existing for roof repair and alterations unless specified otherwise.

B. Insulation Thickness:
1. Thickness of roof insulation shown on drawings is nominal. Provide thickness required to comply with specified thermal performance.

2. Insulation on Metal Decks: Provide insulation in minimum thickness recommended by insulation manufacturer to span deck flutes. Support edges of insulation on metal deck ribs.
3. When actual insulation thickness differs from drawings, coordinate alignment and location of roof drains, flashing, gravel stops, fascias and similar items.
4. Where tapered insulation is used, maintain insulation thickness at high points and roof edges shown on drawings.
   a. Low Point Thickness: Minimum 38 mm (1-1/2 inches).

5. Use minimum two layers of insulation when required thickness is 68 mm (2.7 inch) or greater.

C. Lay insulating units with close joints, in regular courses and with end joints staggered. When laid in more than one layer, break joints of succeeding layers of roof insulation with those in preceding layer.
   1. Stagger joints between layers minimum 150 mm (6 inches).

D. Lay units with long dimension perpendicular to the rolled (longitudinal) direction of the roofing felt.

E. Seal cut edges at penetrations and at edges against blocking with roof cement.

F. Cut to fit tightly against blocking or penetrations.

G. Cover all insulation installed on the same day; comply with temporary protection requirements of Division 07 roofing section. Do so by either:
   1. The roofing membrane as specified.
2. Temporary protection as specified.

H. Installation Method:
   1. Adhered Insulation:
      a. Prime substrate as required.
      b. Set each layer of insulation firmly in solid mopping of hot asphalt.
      c. Set each layer of insulation firmly in ribbons of bead-applied insulation adhesive.
      d. Set each layer of insulation firmly in uniform application of full-spread insulation adhesive.
   2. Mechanically Fastened Insulation:
      a. Fasten insulation according to requirements in Division 07 roofing section.
      b. Fasten insulation to resist uplift pressures specified in Division 07 roofing section and ASCE-7.
   3. Mechanically Fastened and Adhered Insulation:
      a. Fasten first layer of insulation according to "Mechanically Fastened Insulation" requirements.

I. Fasten each subsequent layer of insulation according to "Adhered Insulation" requirements.Over Precast Concrete Unit Decks:

1. Mechanically fasten first layer of insulation to precast concrete deck to conform to FM Class 1-90.
2. Set each subsequent layer of insulation in place, in accordance with roofing system manufacturer's instructions.

J. Steel Deck:

1. Material and method of application of insulation systems used on metal decks shall meet the requirements of Underwriters laboratories for Class A or Factory Mutual Research Corporation for Class I Insulated Steel Roof Deck.
2. Use 6 mm (1/4 inch) thick glass-mat faced gypsum sheathing cover board. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches (150 mm) in each direction. Loosely butt cover boards together and fasten to roof deck.
3. Mechanically fasten first layer of insulation to steel deck to conform to FM Class 1-90, Insulated Steel Roof Deck. Fasten only to upper surface of deck flutes so that fasteners are not visible from below.
4. Set each subsequent layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place, in accordance with roofing system manufacturer's instructions.

3.10 COVER BOARD INSTALLATION

A. Install cover boards over insulation with long joints in continuous straight lines with staggered end joints.

B. Offset cover board joints from insulation joints 150 mm (6 inches), minimum.

C. Secure cover boards according to "Adhered Insulation" requirements.

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SECTION 07 53 23
ETHYLENE-PROPYLENE-DIENE-MONOMER ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ethylene Propylene Diene Monomer (EPDM) sheet roofing fully adhered to insulation.

1.2 RELATED WORK

A. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS: Non-Flooring Adhesives and Sealants VOC Limits.

B. Section 07 22 00, ROOF AND DECK INSULATION: Substrate Board, Vapor Retarder, Roof Insulation, and Cover Board.

C. Treated wood framing, blocking, and nailers: Section 06-10-00, ROUGH CARPENTRY.

D. Roof Insulation: Section 07-22-00, ROOF AND DECK INSULATION.

E. Roof hatches, equipment supports, dome type skylights, and gravity ventilators: Section 07-72-00, ROOF ACCESSORIES.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. American National Standards Institute/Single-Ply Roofing Institute (ANSI/SPRI):

FX-1-16.....Standard Field Test Procedure for Determining the Withdrawal Resistance of Roofing Fasteners.

RP-4 2019.....Wind Design Standard for Ballasted Single-ply Roofing Systems.

C. American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI):

7-16.....Minimum Design Loads For Buildings and Other Structures.

D. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE):

90.1-13.....Energy Standard for Buildings Except Low-Rise Residential Buildings.

E. ASTM International (ASTM):

A276/A276M-17.....Stainless Steel Bars and Shapes.

B209-14.....Aluminum and Aluminum-Alloy Sheet and Plate.

B209M-14.....Aluminum and Aluminum-Alloy Sheet and Plate (Metric).

C67-20.....Sampling and Testing Brick and Structural Clay Tile.

C140/C140M-20a.....Sampling and Testing Concrete Masonry Units and Related Units.

C936/C936M-20.....Solid Concrete Interlocking Paving Units.

C1371-15.....Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers.

C1549-16.....Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer.

D751-19.....Standard Test Methods for Coated Fabrics.

D1248-16.....Polyethylene Plastics Extrusion Materials for Wire and Cable.

D1876-08(2015)e1.....Peel Resistance of Adhesives (T-Peel Test).

D2103-15.....Polyethylene Film and Sheeting.

D2240-15e1.....Rubber Property-Durometer Hardness.

D3884-09(2017).....Abrasion Resistance of Textile Fabrics (Rotary Platform, Double-Head Method).

D4263-83(2018).....Indicating Moisture in Concrete by the Plastic Sheet Method.

D4586/D4586M-07(2018)...Asphalt Roof Cement, Asbestos-Free.

D4637/D4637M-15.....EPDM Sheet Used In Single-Ply Roof Membrane.

E96/E96M-16.....Water Vapor Transmission of Materials.

E108-07.....Fire Tests of Roof Coverings.

E408-13(2019).....Total Normal Emittance of Surfaces Using Inspection-Meter Techniques.

E1918-16.....Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field.

E1980-11(2019).....Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field.

G21-15.....Resistance of Synthetic Polymeric Materials to Fungi.

F. National Roofing Contractors Association (NRCA):

Fifth Edition - 05..... The NRCA Roofing and Waterproofing Manual.

G. Federal Specification (Fed. Spec.)
FF-S-107C (2).....Screws, Tapping and Drive
FF-S-111D (1).....Screw, Wood
UU-B-790A.....Building Paper, Vegetable Fiber (Kraft, Waterproofed, Water Repellent and Fire Resistance

H. Factory Mutual Engineering and research Corporation (FM):
Annual Issue.....Approval Guide Building Materials

I. Cool Roof Rating Council (CRRC):
1-20.....Product Rating Program.

J. Federal Specifications (Fed. Spec.):
UU-B-790A.....Building Paper, Vegetable Fiber: (Kraft, Waterproofed, Water Repellent and Fire Resistant).

K. Florida Department of Business and Professional Regulation (FL):
Approved Product Approval.

L. National Roofing Contractors Association (NRCA):
Manual-19.....The NRCA Roofing Manual: Membrane Roof Systems.

M. U.S. Department of Agriculture (USDA): USDA BioPreferred Catalog.

N. Warnock Hersey (WH):
Annual Issue.....Certification Listings

O. Underwriters Laboratories, Inc (UL):
Annual Issue.....Building Materials Directory
Annual Issue.....Fire Resistance Directory

P. UL LLC (UL):
580-06..... Tests for Uplift Resistance of Roof Assemblies.
1897-20.....Uplift Tests for Roof Covering Systems.

Q. U.S. Department of Commerce National Institute of Standards and Technology (NIST):
DOC PS 1-19.....Structural Plywood.
DOC PS 2-18.....Performance Standard for Wood-Based Structural-Use Panels.

R. U.S. Environmental Protection Agency (EPA):
Energy Star.....ENERGY STAR Program Requirements for Roof Products Version 3.0.

1.4 PREINSTALLATION MEETINGS

A. Conduct preinstallation meeting at the Project site minimum 30 days before beginning Work of this section.

1. Required Participants:
   a. Contracting Officer's Representative.
   b. Contractor.
   c. Installer.
   d. Other installers responsible for adjacent and intersecting work, including roof deck, flashings, roof specialties, roof accessories, utility penetrations, rooftop curbs and equipment, lightning protection.
2. Meeting Agenda: Distribute agenda to participants minimum 3 days before meeting.
   a. Installation schedule.
   b. Installation sequence.
   c. Preparatory work.
   d. Protection before, during, and after installation.
   e. Installation.
   f. Terminations.
   g. Transitions and connections to other work.
   h. Inspecting and testing.
   i. Other items affecting successful completion.
   j. Pull out test of fasteners.
   k. Material storage, including roof deck load limitations.
3. Document and distribute meeting minutes to participants to record decisions affecting installation.

1.5 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Applicators approval certification by manufacturer.

C. Submittal Drawings:

1. Roofing membrane layout.
2. Roofing membrane seaming and joint details.
3. Roof membrane penetration details.
4. Base flashing and termination details.
5. Paver anchoring locations and details.

D. Manufacturers installation instruction revised for project.

E. Manufacturer's Literature and Data:

1. Description of each product.
2. Minimum fastener pull out resistance.
3. Installation instructions.
4. Warranty.
5. Product Data for Federally-Mandated Bio-Based Materials: For roof materials, indicating USDA designation and compliance with definitions for bio-based products, Rapidly Renewable Materials, and certified sustainable wood content.

F. Sustainable Construction Submittals:

1. Solar Reflectance Index (SRI) for roofing membrane.
2. Low Pollutant-Emitting Materials:
   a. Show volatile organic compound types and quantities.
3. Energy Star label for roofing membrane.

G. Samples:

1. Roofing Membrane: 150 mm (6 inch) square.
2. Base Flashing: 150 mm (6 inch) square.
3. Fasteners: Two, each type.
4. Roofing Membrane Seam: Two 300 mm (12 inches) square samples of welded seams to represent quality of field welded seams.

H. Certificates: Certify products comply with specifications.

1. Fire and windstorm classification.
2. High wind zone design requirements.
3. Energy performance requirements.

I. Qualifications: Substantiate qualifications comply with specifications.

1. Installer, including supervisors.
2. Manufacturer's field representative.

J. Field quality control reports.

K. Temporary protection plan. Include list of proposed temporary materials.

L. Operation and Maintenance Data:

1. Maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:

1. Approved by roofing system manufacturer as installer for roofing system with specified warranty.
2. Regularly installs specified products.
3. Installed specified products with satisfactory service on five similar installations for minimum five years.
4. Employs full-time supervisors experienced installing specified system and able to communicate with Contracting Officer's Representative and installer's personnel.

B. Manufacturer's Field Representative:

1. Manufacturer's full-time technical employee or independent roofing inspector.
2. Individual certified by Roof Consultants Institute as Registered Roof Observer.

C. 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 Roof Inspector, Material Manufacturers Technical Representative, Roofing Applicator, Contractor, and Resident Engineer.
2. Discuss specific expectations and responsibilities, construction procedures, specification requirements, application, environmental conditions, job and surface readiness, material storage, and protection.
3. Inspect roof deck at this time to:

   a. Verify that work of other trades which penetrates roof deck is completed.

   b. Determine adequacy of deck anchorage, presence of foreign material, moisture and unlevel surfaces, or other conditions that would prevent application of roofing system from commencing or cause a roof failure.

   c. Examine samples and installation instructions of manufacturer.

   d. Perform pull out test of fasteners (See paragraph 3.2).

1.7 PERFORMANCE REQUIREMENTS

A. FM Approval Listing: Membrane roofing, base flashing, tapered insulation and component materials must6 comply with requirements in FM Approvals 4450 and 4470 as part of a membrane roofing system.
   1. Fire/Windstorm Classification: Class 1A-90

1.8 DELIVERY

A. Deliver, store and handle material as specified by manufacturer.
B. Deliver products in manufacturer's original sealed packaging.
C. Mark packaging, legibly. Indicate manufacturer's name or brand, type, and manufacture date.
D. Before installation, return or dispose of products within distorted, damaged, or opened packaging.
E. Store volatile materials separate from other materials with separation to prevent fire from damaging the work, or other materials.

1.9 STORAGE AND HANDLING

A. Comply with NRCA Manual storage and handling requirements.
B. Store products indoors in dry, weathertight facility.
C. Store adhesives according to manufacturer's instructions.
D. Protect products from damage during handling and construction operations.
E. Products stored on the roof deck must not cause permanent deck deflection.

1.10 FIELD CONDITIONS

A. Environment:
   1. Product Temperature: Minimum 4 degrees C (40 degrees F) and rising before installation.
   2. Weather Limitations: Install roofing only during dry current and forecasted weather conditions.

1.11 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."
B. Manufacturer's Warranty: Warrant roofing system against material and manufacturing defects and agree to repair any leak caused by a defect in the roofing system materials or workmanship of the installer.
   1. Warranty Period: 10 years.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Roofing System: Fully Adhered roofing membrane, base flashing, roof insulation, fasteners, cover boards, substrate boards copings,edge metal.

2.2 SYSTEM PERFORMANCE

A. Design roofing system meeting specified performance:
   1. Load Resistance: ASCE/SEI 7; Design criteria :as indicated on Drawings.
   2. Energy Performance:
      a. EPA Energy Star Listed for low-slope roof products.
      b. ASTM E1980; Minimum 78 Solar Reflectance Index (SRI).
      c. CRRC-1; Minimum 0.70 initial solar reflectance and minimum 0.75 emissivity.
      d. Three-Year Aged Performance: Minimum 0.55 solar reflectance tested in according to ASTM C1549 or ASTM E1918, and minimum 0.75 thermal emittance tested in according to ASTM C1371 or ASTM E408.
         1) Where tested aged values are not available:
            a) Calculate compliance adjusting initial solar reflectance according to ASHRAE 90.1.
            b) Provide roofing system with minimum 64 three-year aged Solar Reflectance Index calculated according to ASTM E1980 with 12 watts/square meter/degree K
               (2.1 BTU/hour/square foot) convection coefficient.

2.3 PRODUCTS - GENERAL

A. Basis of Design: Section 09 06 00, SCHEDULE FOR FINISHES.
B. Provide roof system components from one manufacturer.
C. Sustainable Construction Requirements:
   1. Bio-Based Materials: Where applicable, provide products designated by USDA and meeting or exceeding USDA recommendations for bio-based content, and products meeting Rapidly Renewable Materials and certified sustainable wood content definitions; refer to www.biopreferred.gov.

2. Low Pollutant-Emitting Materials: Comply with VOC limits specified in Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for the following products:
   a. Non-flooring adhesives and sealants.

2.4 EPDM ROOFING MEMBRANE

A. EPDM Sheet: ASTM D4637/D4637M, Type I - non-reinforced.
   1. Thickness: 1.5 mm (60 mils).
   2. Color: See finish schedule.

B. Additional Properties:

PROPERTY	TEST METHOD	REQUIREMENT
Shore A Hardness	ASTM D2240	55 to 75 Durometer
Water Vapor Permeance	ASTM E96/E96M	Minimum 8 ng/Pa/s/sq. m (0.14 perms) Water Method
Fungi Resistance	ASTM G21	After 21 days, no sustained growth or discoloration.
Fire Resistance	ASTM E108 Class A	No Combustion Beyond Flame/Heat Source

2.5 MEMBRANE ACCESSORY MATERIALS

A. Sheet roofing manufacturer's specified products.

B. Flashing Sheet: Manufacturer's standard; same material, and color as roofing membrane.
   1. Self-curing EPDM flashing adaptable to irregular shapes and surfaces.
   2. Minimum Thickness: 1.5 mm (0.060 inch).

C. Factory Formed Flashings: Inside and outside corners, pipe boots, and other special flashing shapes to minimize field fabrication.

D. Splice Adhesive or Tape: Manufacturer's standard for roofing membrane and flashing sheet.

E. Splice Lap Sealant: Liquid EPDM rubber for exposed lap edge.

F. Bonding Adhesive: Manufacturer's standard, water based, to suit substrates.

G. Termination Bars: Manufacturer's standard, stainless steel or aluminum, 25 mm wide by 3 mm thick (1 inch wide by 1/8 inch thick) factory drilled for fasteners.

H. Battens: Manufacturer's standard, galvannealed or galvanized steel, 25 mm wide by 1.3 mm thick (1 inch wide by 0.05 inch thick), factory punched for fasteners.

I. Pipe Compression Clamp:
   1. Stainless steel drawband.
   2. Worm drive clamp device.

J. Fasteners: Manufacturer's standard coated steel with metal or plastic plates, to suit application.

K. Fastener Sealer: One part elastomeric adhesive sealant.

L. Temporary Closure Sealers (Night Sealant): Polyurethane two part sealer.

M. Primers, Splice Tapes, Cleaners, and Butyl Rubber Seals: As specified by roof membrane manufacturer.

N. Asphalt Roof Cement: ASTM D4586/D4586M.

2.6 FASTENERS

A. Fasteners and washers required for securing sheet roofing to deck:
   1. Steel stress plate washers as required by sheet roofing manufacturer:
      a. Coated against corrosion.
      b. Separate or attached to fastener.
      c. Approximately 50 mm (2 inch) diameter or 40 mm x 65 mm (1-1/2 by 2-1/2 inches) rectangular plate with rounded corners, minimum thickness 0.6 mm (0.023-inch).
   2. Fastening strip or batten strip for securing roof membrane to deck:
      a. Stainless steel strip: ASTM A167 type 302 or 304, minimum 0.5 mm (0.018 inch) thick.
      b. Aluminum strip: ASTM B209, minimum 2.4 mm (0.094-inch) thick.
      c. Rounded corners on strips.
      d. Forms strips 38 mm (1-1/2 inches) wide, 3000 mm (10 feet) maximum length with 6 mm x 10 mm (1/4 by 3/8 inch) punched slotted holes at 100 mm (4 inch) centers; centered on width of strip. Punch holes 2 mm (1/16 inch) larger than fastener shank when shank is larger than 5 mm (3/16 inch).
   3. Steel Decks: Screws; Fed Spec FF-S-107, hardened nylon screw or steel screw coated to resist corrosion, self-drilling, anti-backout

thread design. Minimum pullout resistance of 135 Kg (300 pounds), minimum thread penetration of 13 mm (1/2 inch).

4. Gypsum, Insulating Concrete, and Structural Cement Fiber Decks: Diverging or hooking point fastener, anti-spin fitting; or specifically designed for anchorage to deck as recommended by roofing membrane manufacturer, coated to resist corrosion, minimum pullout resistance of 200 Kg (450 pounds).
5. Concrete and Masonry Wall Surfaces:
   a. Nail penetration 13 mm (1/2 inch)
6. Wood:
   a. Screws: Fed. Spec. FF-S-111, Type I, Style 2.5, coated to resist corrosion, length to provide 19 mm (3/4 inch) minimum penetration.
   b. Nails: Barbed shank, galvanized.
7. Washers: Neoprene backed metal washer 28 mm (1-1/8 inch) minimum diameter.
8. To Sheet Metal: Self tapping screw; Fed. Spec. FF-S-107, 2 mm (No. 14), sheet metal screw, minimum thread penetration of 6 mm (1/4 inch); stainless steel.

B. Pipe Compression Clamp or Drawband:
   1. Stainless steel or cadmium plated steel drawband.
   2. Worm drive clamp device.

C. Surface mounted base flashing clamp strip:
   1. Stainless steel strip, ASTM A 167, type 302 or 304, dead soft temper, minimum 0.5 mm (0.018 inch) thick.
   2. Aluminum strip: ASTM B209 24 mm (0.094 inch) thick.
   3. For exposed location, form strips 6 mm (1/4 inch) wide top edge bent out 45 degrees (for sealant) from 40 mm (1-1/2 inch) wide material; 2400 mm (8 feet) maximum length with slotted 6 mm x 10 mm (1/4 by 3/8 inch) holes punched at 200 mm (8 inch) centers, centered between bend and bottom edges.
   4. For locations covered by cap flashings, form strips 30 mm (1-1/4) wide, 2400 mm (8 feet) maximum length with slotted holes 6 mm x 10 mm (1/4 by 3/8 inch) punched at 200 mm (8 inch) centers, centered on strip width.

D. Fasteners and washers required for securing pavers together with straps and to walls or other anchorage:
   1. Straps for Securing Pavers Together:
      a. Stainless Steel: ASTM A276/A276M, Type 302 or 304, minimum 0.46 mm (0.018 inch) thick.
      b. Aluminum Strap: ASTM B209/B209M, minimum 2.39 mm (0.094 inch) thick.
      c. Round corners on straps.
      d. Form straps 38 mm (1-1/2 inches) wide, 3 m (10 feet) maximum length with 6 by 10 mm (1/4 by 3/8 inch) punched slotted holes at 100 mm (4 inch) centers centered on width of strap. Punch hole size 2 mm (1/16 inch) larger than fastener shank when shank is thicker than 5 mm (3/16 inch).

E. Fasteners or Connectors for Pavers:
   1. For Concrete Pavers: Extruded interlocking hollow shape polyethylene connector:
      a. ASTM D1248, Type 1, low density, Class C, black weather resistant, Grade E6, tensile strength 15 MPa (2200 psi), Shore D hardness of 4, brittleness low temperature - 82 degrees C (180 degrees F), softening temperature above 80 degrees C (176 degrees F).
      b. Length: 50 mm (2 inches), with center stop and insert leg with ribs to resist withdrawal; minimum 1.3 mm (0.05 inch) thick.
   2. Fasteners for Pavers Straps:
      a. Stainless steel as recommended by manufacturer of paver in which fastener is anchored.
      b. Fasteners that are not acceptable include:
         1) Impact or power actuated fasteners.
         2) Fasteners that do not require a predrilled pilot hole.
         3) Fasteners with lead or white metal anchors.
         4) Plastic anchors not stabilized against ultraviolet light.

2.7 SEPARATION SHEET

A. Polyethylene Film: ASTM D2103, 0.2 mm (6 mils) thick.

B. Building Paper: Fed. Spec. UU-B-790.
   1. Water Vapor Resistance: Type I, Grade A, Style 4, reinforced.
   2. Water Vapor Permeable: Type I, Grade D, Style 4, reinforced.

2.8 FLEXIBLE TUBING

A. Closed cell neoprene, butyl polyethylene, vinyl, or polyethylene tube or rod.

B. Diameter approximately 1-1/2 times joint width.

2.9 WALKWAY PADS

A. Manufacturer's standard, slip resistant, approximately 450 mm by 450 mm (30 by 30 inches) square and 5 mm (3/16 inch) thick with rounded corners.

2.10 PROTECTION MAT OR SEPARATOR SHEET

A. Protection Mat:

1. Water pervious; either woven or non-woven sheet of long chain polymeric filaments or yarns such as polypropylene, black polyethylene, polyester, or polyamide; or, polyvinylidene-chloride formed into a pattern with distinct and measurable openings.
2. Filter fabric equivalent opening size (EOS): Not finer than the U.S.A. Standard Sieve Number 120 and not coarser than the U.S.A. Standard Sieve Number 100. EOS is defined as the number of the U.S.A. Standard Sieve having openings closest in size to the filter cloth openings.
3. Edges of fabric selvaged or otherwise finished to prevent raveling.
4. Abrasion Resistance:
   a. After being abraded in conformance with ASTM D3884 using rubber-hose abrasive wheels with one kg load per wheel and 1000 revolutions, perform tensile strength test as specified in ASTM D1682, paragraph.
   b. Result: 25 kg (55 pounds) minimum in any principle direction.
5. Puncture Strength:
   a. ASTM D751 tension testing machine with ring clamp; steel ball replaced with an 8 mm (5/16 inch) diameter solid steel cylinder with a hemispherical tip centered within the ring clamp.
   b. Result: 57 kg (125 pounds) minimum.
6. Non-degrading under a wet or humid condition within minimum 4 degrees C (40 degrees F) to maximum 66 degrees C (150 degrees F) when exposed to ultraviolet light.
7. Minimum Sheet Width: 2400 mm (8 feet).

2.11 ROOF PAVERS (NOT USED)

2.12 ACCESSORIES

A. Temporary Protection Materials:
   1. Expanded Polystyrene (EPS) Insulation: ASTM C578.
   2. Plywood: NIST DOC PS 1, Grade CD Exposure 1.
   3. Oriented Strand Board (OSB): NIST DOC PS 2, Exposure 1.

PART 3 - EXECUTION

3.1 GENERAL

A. Do not apply if deck will be used for subsequent work platform, storage of materials, or staging or scaffolding will be erected thereon unless protection provided to distribute loads less than one-half compression resistance of roofing system materials.
   1. Curbs, blocking, edge strips, and other components to which roofing and base flashing is attached in place ready to receive insulation and, roofing.
   2. Coordinate roof operation with sheet metal work and roof insulation work so that insulation and flashing are installed concurrently to permit continuous roofing operations.
   3. Complete installation of flashing, insulation, and roofing in the same day except for the area where temporary protection is required when work is stopped.
B. Phased construction is not permitted. The complete installation of roofing system is required in the same day except for area where temporary protection is required when work is stopped. Complete installation includes pavers and ballast for ballasted systems.
C. Dry out surfaces, including the flutes of metal deck, that become wet from any cause during progress of the work before roofing work is resumed.
D. Apply materials only to dry substrates.
E. Except for temporary protection specified, do not apply materials during damp or rainy weather, during excessive wind conditions, nor while moisture (dew, snow, fog, ice, or frost) is present in any amount in or on the materials.

1. Do not apply materials to substrate having temperature of 4° C (40° F) or less, or when materials applied with the roof require higher application temperature.
2. Do not apply materials when the temperature is below 4° C (40° F).

F. Temporary Protection:

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

3.2 EXAMINATION

A. Examine and verify substrate suitability for product installation with roofing installer and roofing inspector present.

1. Verify roof penetrations are complete, secured against movement.
2. Verify roof deck is adequately secured to resist wind uplift.
3. Verify roof deck is clean, dry, and in-plane ready to receive roofing system.

B. Correct unsatisfactory conditions before beginning roofing work.

3.3 PREPARATION

A. Complete roof deck construction before beginning roofing work:
1. Curbs, blocking, edge strips, and other components to which roofing and base flashing is attached in place ready to receive insulation and roofing.
2. Coordinate roofing membrane installation with flashing work and roof insulation work so insulation and flashing are installed concurrently to permit continuous roofing operations.
3. Complete installation of flashing, insulation, and roofing in same day except for the area where temporary protection is required when work is stopped for inclement weather or end of work day.

B. Dry out surfaces including roof deck flutes, that become wet from any cause during progress of the work before roofing work is resumed. Apply materials to dry substrates, only.

C. Broom clean roof decks. Remove dust, dirt and debris.

D. Remove projections capable of damaging roofing materials.

E. Concrete Decks, except Insulating Concrete:
1. Test concrete decks for moisture according to ASTM D4263 before installing roofing materials.
2. Prime concrete decks. Keep primer back 100 mm (f4our inches) from precast concrete deck joints.
3. Allow primer to dry before application of bitumen.

F. Insulating Concrete Decks:
1. Allow deck to dry out minimum five days after installation before installing roofing materials.
2. Allow additional drying time when precipitation occurs before installing roofing materials.

G. Existing Membrane Roofs and Repair Areas:
1. Comply with Section 07 01 50.19 PREPARATION FOR REROOFING.

H. Test Pull out resistance of fasteners in deck in the presence of the Contracting Officer's Representative before starting roofing work. Tests are not required for wood.
   1. Test applicable fastener type in applicable deck.
   2. Install fasteners through a sample of the insulation, if any is to be used, into the structural deck.
   3. Test the pull out resistance with a pull out tester.
   4. Test one fastener in each deck level and one for every 230 m^2 (2500 square feet) of deck type and level.
   5. Test at locations designated by Contracting Officer's Representative.
   6. Do not proceed with the roofing work if the pull out resistance of the fasteners is less than specified.
   7. Test Result:
      a. Repeat tests using other type fasteners or use additional fasteners to stay within the pullout load resistance criteria.
      b. Patch cementitious deck to repair areas of fastener tests holes.

3.4 TEMPORARY PROTECTION

A. Install temporary protection consisting of a temporary seal and water cut-offs at the end of each day's work and when work is halted for an indefinite period or work is stopped when precipitation is imminent.

B. Install temporary cap flashing over top of base flashings where permanent flashings are not in place to protect against water intrusion into roofing system. Securely anchor in place to prevent blow off and damage by construction activities.

C. Temporarily seal exposed insulation surfaces within roofing membrane.
   1. Apply temporary seal and water cut off by extending roofing membrane beyond insulation and securely embedding edge of the roofing membrane in 6 mm (1/4 inch) thick by 50 mm (2 inches) wide strip of temporary closure sealant. Weight roofing membrane edge with sandbags, to prevent displacement; space sandbags maximum 2400 mm (8 feet) on center.
   2. Direct water away from work. Provide drainage, preventing water accumulation.
   3. Check daily to ensure temporary seal remains watertight. Reseal open areas and weight down.

D. Before the work resumes, cut off and discard portions of roof membrane in contact with temporary seal.
   1. Cut minimum 150 mm (6 inches) back from sealed edges and surfaces.
E. Remove sandbags and store for reuse.

3.5 INSTALLATION, GENERAL

A. Install products according to manufacturer's instructions.
   1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.
B. Comply with NRCA Manual installation requirements.
C. Comply with UL 1897 for uplift resistance.
D. Do not allow membrane and flashing to contact surfaces contaminated with asphalt, coal tar, oil, grease, or other substances incompatible with EPDM.

3.6 ROOFING INSTALLATION

A. Install membrane perpendicular to long dimension of insulation boards.
B. Begin membrane installation at roof low point and work towards high point. Lap membrane shingled in water flow direction.
C. Position membrane free of buckles and wrinkles.
D. Roll membrane out; inspect for defects as membrane is unrolled. Remove defective areas:
   1. Allow 30 minutes for membrane to relax before proceeding.
   2. Lap edges and ends minimum 75 mm (3 inches). Clean lap surfaces.
   3. Install seam adhesive or tape, unless furnished with factory applied adhesive strips. Apply pressure to develop full adhesion.
   4. Check seams to ensure continuous adhesion and correct defects.
   5. Finish seam edges with beveled bead of lap sealant.
   6. Finish seams same day as membrane is installed.
   7. Anchor membrane perimeter to roof deck and parapet wall as indicated on drawings.
E. Membrane Perimeter Anchorage:
   1. Install batten with fasteners at perimeter of each roof area, curb flashing, expansion joints and similar penetrations on top of roof membrane as indicated on drawings.
   2. Mechanical Fastening:

a. Top of mechanical fastener set flush with top surface of the nailing strip or stress plate.
b. Space fasteners maximum 300 mm (12 inches) on center, starting 25 mm (1 inch) from ends.
c. When battens are cut, round edge and corners before installing.
d. Set fasteners in lap sealant and cover fastener head with fastener sealer, including batten.
e. Stop batten where batten interferes with drainage. Space ends of batten 150 mm (6 inch) apart.
f. Cover batten with 225 mm (9 inch) wide strip of flashing sheet. Seal laps with lap seam adhesive and finish edges with lap sealant.
g. At fascia-cants turn roofing membrane down over front edge of blocking, cant, or nailer. Secure roofing membrane to vertical portion of nailer; with fasteners spaced maximum 150 mm (6 inches) on centers.
h. At parapet walls intersecting building walls and curbs, secure roofing membrane to structural deck with fasteners 150 mm (6 inches) on center or as shown in NRCA Manual.

F. Fully Adhered System Installation:
1. Apply bonding adhesive in quantities required by roofing membrane manufacturer.
2. Fold sheet back on itself, clean and coat the bottom side of the membrane and the top of substrate with adhesive. Do not coat the lap joint area.
3. After adhesive has set according to adhesive manufacturer's instructions, roll roofing membrane into adhesive minimizing voids and wrinkles.
4. Repeat for other half of sheet.
5. Cut voids and wrinkles to lay flat. Clean and patch cut area.

3.7 FLASHING INSTALLATION

A. Install flashings on same day as roofing membrane is installed. When flashing cannot be completely installed in one day, complete installation until flashing is watertight and provide temporary covers or seals.

B. Flashing Roof Drains:
   1. Install roof drain flashing according to roofing membrane manufacturer's instructions.
      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 roof cement to contact EPDM roofing membrane.
      c. Adhere roofing membrane to metal flashing with bonding adhesive.
   2. Turn metal drain flashing and roofing membrane down into drain body. Install clamping ring and strainer.

C. Installing Base Flashing and Pipe Flashing:
   1. Install flashing sheet to pipes, walls and curbs to minimum 200 mm (8 inches) height above roof surfaces and extend roofing manufacturer's standard lap dimension onto roofing membranes.
      a. Adhere flashing with bonding adhesive.
      b. Form inside and outside corners of flashing sheet according to NRCA Manual. Form pipe flashing according to NRCA Manual.
      c. Lap ends roofing manufacturer's standard dimension.
      d. Adhesively splice flashing sheets together, and adhesively splice flashing sheets to roofing membranes. Finish exposed edges with lap sealant.
   2. Anchor top of flashing to walls and curbs with fasteners spaced maximum 150 mm (6 inches) on center. Use surface mounted fastening strip with sealant on ducts. Use pipe clamps on pipes or other round penetrations.
   3. Apply sealant to top edge of flashing.

D. Installing Building Expansion Joints:
   1. Install base flashing on curbs as specified.
   2. Install flexible tubing 1-1/2 times width of joint centered over joint. Cover tubing with flashing sheet adhered to base flashing and lapping base flashing roofing manufacturer's standard dimension. Finish edges of laps with lap sealant.

E. Repairs to Membrane and Flashings:
   1. Remove sections of roofing membrane or flashing sheet that are creased, wrinkled, or fishmouthed.
   2. Cover removed areas, cuts and damaged areas with patch extending 100 mm (4 inches) beyond damaged, cut, or removed area. Adhesively

splice patch to roofing membrane or flashing sheet. Finish edge of lap with lap sealant.

3.8 WALKWAY PAD INSTALLATION

A. Clean membrane where pads are applied.

B. Adhere pads to membrane with splicing cement.

C. Layout with minimum 25 mm (1 inch) and maximum 50 mm (2 inch) space between pads.

3.9 FIELD QUALITY CONTROL

A. Field Tests: Performed by testing laboratory specified in Section 01 45 29, TESTING LABORATORY SERVICES.

1. Fastener Pull Out Tests: ANSI/SPRI FX-1; one test for every 230 square meter (2,500 square foot) of deck. Perform tests for each combination of fastener type and roof deck type before installing roof insulation.
   a. Test at locations selected by Contracting Officer's Representative.
   b. Do not proceed with roofing work when pull out resistance is less than manufacturer's required resistance.
   c. Test Results:
      1) Repeat tests using different fastener type or use additional fasteners achieve pull out resistance required to meet specified wind uplift performance.
      2) Patch cementitious deck to repair areas of fastener tests holes.
2. Examine and probe roofing membrane and flashing seams in presence of Contracting Officer's Representative and Manufacturer's field representative.
3. Probe seams to detect marginal bonds, voids, skips, and fishmouths.
4. Cut 100 mm (4 inch) wide by 300 mm (12 inch) long samples through seams where directed by Contracting Officer's Representative.
5. Cut one sample for every 450 meter (1500 feet) of seams.
6. Cut samples perpendicular to seams.
7. Failure of samples to pass ASTM D1876 test will be cause for rejection of work.
8. Repair areas where samples are taken and where marginal bond, voids, and skips occur.

9. Repair fishmouths and wrinkles by cutting to lay flat. Install patch over cut area extending 100 mm (4 inches) beyond cut.

3.10 TEMPORARY ROOF

A. Install temporary roof when sequences of work or weather does not permit installation of a completed permanent roof system or roof would be subject to phasing of roof work, construction traffic, scaffolds, and work over roof area.

B. Use of 1.15 mm (0.045-inch) thick non-reinforced EPDM membrane or other temporary membrane as approved.

3.11 CLEANING

A. Remove excess adhesive before adhesive sets.

B. Clean exposed roofing surfaces. Remove contaminants and stains to comply with specified solar reflectance performance.

3.12 PROTECTION

A. Protect roofing system from construction operations.

1. Protect roofing system when used for subsequent work platform, materials storage, or staging.
2. Distribute scaffolding loads to exert maximum 50 percent roofing system materials compressive strength.

B. Loose lay temporary insulation board overlaid with plywood or OSB.

1. Weight boards to secure against wind uplift.

C. Remove protection when no longer required.

D. Repair damage.

- - E N D - -

SECTION 07 60 00
FLASHING AND SHEET METAL

PART 1 - GENERAL

1.1 DESCRIPTION

A. Formed sheet metal work for wall and roof flashing, copings, roof edge metal, fasciae, drainage specialties, and formed expansion joint covers are specified in this section.

1.2 RELATED WORK

A. Section 07 53 23 ETHYLENE-PROPYLENE-DIENE-MONOMER ROOFING Membrane base flashings and stripping.

B. Section 07 71 00 ROOF SPECIALTIES: Manufactured flashing, copings, roof edge metal, and fasciae.

C. Section 07 72 00, ROOF ACCESSORIES: Integral flashing components of manufactured roof specialties and accessories or equipment.

D. Section 07 92 00, JOINT SEALANTS: Joint Sealants.

E. Section 09 91 00, PAINTING: Paint materials and application.

F. Division 22, PLUMBING: Integral flashing components of manufactured roof specialties and accessories or equipment.

G. Division 23 HVAC: Integral flashing components of manufactured roof specialties and accessories or equipment.

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. Aluminum Association (AA):

AA-C22A41.....Aluminum Chemically etched medium matte, with clear anodic coating, Class I Architectural, 0.7-mil thick

AA-C22A42.....Chemically etched medium matte, with integrally colored anodic coating, Class I Architectural, 0.7 mils thick

AA-C22A44.....Chemically etched medium matte with electrolytically deposited metallic compound, integrally colored coating Class I Architectural, 0.7-mil thick finish

C. American National Standards Institute/Single-Ply Roofing Institute/Factory Mutual (ANSI/SPRI/FM):

4435/ES-1-11.....Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems

D. American Architectural Manufacturers Association (AAMA):

AAMA 620-02.....Voluntary Specification for High Performance Organic Coatings on Coil Coated Architectural Aluminum

AAMA 621-02.....Voluntary Specification for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) and Zinc-Aluminum Coated Steel Substrates

E. ASTM International (ASTM):

A240/A240M-20.....Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels and for General Applications.

A653/A653M-20.....Steel Sheet Zinc-Coated (Galvanized) or Zinc Alloy Coated (Galvanized) by the Hot- Dip Process

B32-08(2014).....Solder Metal

B209-14.....Aluminum and Aluminum-Alloy Sheet and Plate

B370-12(2019).....Copper Sheet and Strip for Building Construction

D173/D173M-03(2018).....Bitumen-Saturated Cotton Fabrics Used in Roofing and Waterproofing

D412-16.....Vulcanized Rubber and Thermoplastic Elastomers-Tension

D1187/D1187M-97(2018)...Asphalt Base Emulsions for Use as Protective Coatings for Metal

D1784-20.....Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds

D3656/D3656M-13.....Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns

D4586/D4586M-07(2018)...Asphalt Roof Cement, Asbestos Free

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

G. National Association of Architectural Metal Manufacturers (NAAMM):
AMP 500-06.....Metal Finishes Manual

H. Federal Specification (Fed. Spec):
A-A-1925A.....Shield, Expansion; (Nail Anchors)
UU-B-790A.....Building Paper, Vegetable Fiber

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

1.4 PERFORMANCE REQUIREMENTS

A. Wind Uplift Forces: Resist the following forces per FM Approvals 1-49:

1. Wind Zone 1: 0.48 to 0.96 kPa (10 to 20 pound force/square foot): 1.92-kPa (40 pound force/square foot) perimeter uplift force, 2.87-kPa (60 pound force/square foot pound force/square foot) corner uplift force, and 0.96-kPa (20- pound force/square foot) outward force.
2. Wind Zone 1: 1.00 to 1.44 kPa (21 to 30 pound force/square foot): 2.87-kPa (60 pound force/square foot) perimeter uplift force, 4.31-kPa (90 pound force/square foot) corner uplift force, and 1.44-kPa (30 pound force/square foot) outward force.
3. Wind Zone 2: 1.48 to 2.15 kPa (31 to 45 pound force/square foot): 4.31-kPa (90 pound force/square foot) perimeter uplift force, 5.74-kPa (120 pound force/square foot) corner uplift force, and 2.15-kPa (45 pound force/square foot) outward force.
4. Wind Zone 3: 2.20 to 4.98 kPa (46 to 104 pound force/square foot): 9.96-kPa (208 pound force/square foot) perimeter uplift force, 14.94-kPa (312 pound force/square foot) corner uplift force, and 4.98-kPa (104 pound force/square foot) outward force.

1.5 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
2. Copings
3. Gravel Stop-Fascia
4. Gutter and Conductors

5. Expansion joints
6. Fascia-cant

C. Manufacturer's Literature and Data: For all specified items, including:
1. Two-piece counterflashing
2. Thru wall flashing
3. Expansion joint cover, each type
4. Nonreinforced, elastomeric sheeting
5. Fascia-cant

D. Certificates: Indicating compliance with specified finishing requirements, from applicator and contractor.

PART 2 - PRODUCTS

2.1 FLASHING AND SHEET METAL MATERIALS

A. Stainless Steel: ASTM A240, Type 302B, dead soft temper.

B. Aluminum Sheet: ASTM B209, alloy 3003-H14

C. Nonreinforced, Elastomeric Sheeting: Elastomeric substances reduced to thermoplastic state and extruded into continuous homogenous sheet (0.056 inch) thick. Sheeting shall have not less than 7 MPa (1,000 psi) tensile strength and not more than seven percent tension-set at 50 percent elongation when tested in accordance with ASTM D412. Sheeting shall show no cracking or flaking when bent through 180 degrees over a 1 mm (1/32 inch) diameter mandrel and then bent at same point over same size mandrel in opposite direction through 360 degrees at temperature of -30°C (-20 °F).

2.2 FLASHING ACCESSORIES

A. Solder: ASTM B32; flux type and alloy composition as required for use with metals to be soldered.

B. Rosin Paper: Fed-Spec. UU-B-790, Type I, Grade D, Style 1b, Rosin-sized sheathing paper, weighing approximately 3 Kg/10 m²(6 pounds/100 square feet).

C. Bituminous Paint: ASTM D1187, Type I.

D. Fasteners:
1. Use stainless steel for stainless steel and aluminum alloy. Use galvanized steel or stainless steel for galvanized steel.
2. Nails:
a. Minimum diameter for aluminum nails 3 mm (0.105 inch).

b. Minimum diameter for stainless steel nails: 2 mm (0.095 inch) and annular threaded.

c. Length to provide not less than 22 mm (7/8 inch) penetration into anchorage.

3. Rivets: Not less than 3 mm (1/8 inch) diameter.

4. Expansion Shields: Fed Spec A-A-1925A.

E. Sealant: As specified in Section 07 92 00, JOINT SEALANTS for exterior locations.

F. Roof Cement: ASTM D4586.

2.3 SHEET METAL THICKNESS

A. Except as otherwise shown or specified use thickness or weight of sheet metal as follows:

B. Concealed Locations (Built into Construction):

1. Stainless steel: 0.25 mm (0.010 inch) thick.

2. Galvanized steel: 0.5 mm (0.021 inch) thick.

C. Exposed Locations:

1. Stainless steel: 0.4 mm (0.015 inch).

D. Thickness of galvanized steel is specified with each item.

2.4 FABRICATION, GENERAL

A. Jointing:

1. In general, stainless steel steel joints, except expansion and contraction joints, shall be locked and soldered.

2. Jointing of copper over 0.5 Kg (20 oz) weight or stainless steel over 0.45 mm (0.018 inch) thick shall be done by lapping, riveting and soldering.

3. Joints shall conform to following requirements:

a. Flat-lock joints shall finish not less than 19 mm (3/4 inch) wide.

b. Lap joints subject to stress shall finish not less than 25 mm (one inch) wide and shall be soldered and riveted.

c. Unsoldered lap joints shall finish not less than 100 mm (4 inches) wide.

4. Flat and lap joints shall be made in direction of flow.

5. Edges of nonreinforced elastomeric sheeting shall be jointed by lapping not less than 100 mm (4 inches) in the direction of flow and

cementing with asphalt roof cement or sealant as required by the manufacturer's printed instructions.

6. Soldering:
   a. Pre tin both mating surfaces with solder for a width not less than 38 mm (1 1/2 inches) stainless steel.
   b. Treat in accordance with metal producers recommendations other sheet metal required to be soldered.
   c. Completely remove acid and flux after soldering is completed.

B. Expansion and Contraction Joints:
   1. Fabricate in accordance with the Architectural Sheet Metal Manual recommendations for expansion and contraction of sheet metal work in continuous runs.
   2. Space joints as shown or as specified.
   3. Space expansion and contraction joints for copper, stainless steel, and copper clad stainless steel at intervals not exceeding 7200 mm (24 feet).
   4. Space expansion and contraction joints for aluminum at intervals not exceeding 5400 mm (18 feet), except do not exceed 3000 mm (10 feet) for gravel stops and fascia-cant systems.
   5. Fabricate slip-type or loose locked joints and fill with sealant unless otherwise specified.
   6. Fabricate joint covers of same thickness material as sheet metal served.

C. Cleats:
   1. Fabricate cleats to secure flashings and sheet metal work over 300 mm (12 inches) wide and where specified.
   2. Provide cleats for maximum spacing of 300 mm (12 inch) centers unless specified otherwise.
   3. Form cleats of same metal and weights or thickness as the sheet metal being installed unless specified otherwise.
   4. Fabricate cleats from 50 mm (2 inch) wide strip. Form end with not less than 19 mm (3/4 inch) wide loose lock to item for anchorage. Form other end of length to receive nails free of item to be anchored and end edge to be folded over and cover nail heads.

D. Edge Strips or Continuous Cleats:

1. Fabricate continuous edge strips where shown and specified to secure loose edges of the sheet metal work.
2. Except as otherwise specified, fabricate edge strips or minimum 0.6 mm (0.024 inch) thick stainless steel.
3. Use material compatible with sheet metal to be secured by the edge strip.
4. Fabricate in 3000 mm (10 feet) maximum lengths with not less than 19 mm (3/4 inch) loose lock into metal secured by edge strip.
5. Fabricate Strips for fascia anchorage to extend below the supporting wood construction to form a drip and to allow the flashing to be hooked over the lower edge at least 19 mm (3/4-inch).
6. Fabricate anchor edge maximum width of 75 mm (3 inches) or of sufficient width to provide adequate bearing area to insure a rigid installation using 0.8 mm (0.031 inch) thick stainless steel.

E. Drips:

1. Form drips at lower edge of sheet metal counter-flashings (cap flashings), fascias, gravel stops, wall copings, by folding edge back 13 mm (1/2 inch) and bending out 45 degrees from vertical to carry water away from the wall.
2. Form drip to provide hook to engage cleat or edge strip for fastening for not less than 19 mm (3/4 inch) loose lock where shown.

F. Edges:

1. Edges of flashings concealed in masonry joints opposite drain side shall be turned up 6 mm (1/4 inch) to form dam, unless otherwise specified or shown otherwise.
2. Finish exposed edges of flashing with a 6 mm (1/4 inch) hem formed by folding edge of flashing back on itself when not hooked to edge strip or cleat. Use 6 mm (1/4 inch) minimum penetration beyond wall face with drip for through-wall flashing exposed edge.
3. All metal roof edges shall meet requirements of IBC, current edition.

G. Metal Options:

1. Where options are permitted for different metals use only one metal throughout.
2. Stainless steel may be used in concealed locations for fasteners of other metals exposed to view.

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. Stainless Steel: Finish No. 2B or 2D.
2. Steel and Galvanized Steel:
   a. Finish painted under Section 09 91 00, PAINTING unless specified as prefinished item.
   b. Manufacturer's finish:
      1) Baked on prime coat over a phosphate coating.
      2) Baked-on prime and finish coat over a phosphate coating.
      3) Fluorocarbon Finish: AAMA 621, high performance organic coating.

2.6 THROUGH-WALL FLASHINGS

A. Form through-wall flashing to provide a mechanical bond or key against lateral movement in all directions. Install a sheet having 2 mm (1/16 inch) deep transverse channels spaced four to every 25 mm (one inch), or ribbed diagonal pattern, or having other deformation unless specified otherwise.

1. Fabricate in not less than 2400 mm (8 feet) lengths; 3000 mm (10 feet) maximum lengths.
2. Fabricate so keying nests at overlaps.

B. For Masonry Work When Concealed Except for Drip:

1. Stainless steel.
2. Form an integral dam at least 5 mm (3/16 inch) high at back edge.
3. Form exposed portions of flashing with drip, approximately 6 mm (1/4 inch) projection beyond wall face.

C. For Masonry Work When Exposed Edge Forms a Receiver for Counter Flashing:

1. Use same metal and thickness as counter flashing.
2. Form an integral dam at least 5 mm (3/16 inch) high at back edge.
3. Form exposed portion as snap lock receiver for counter flashing upper edge.

D. For Flashing at Architectural Precast Concrete Panels.

1. Use plan flat sheet of stainless steel.
2. Form exposed portions with drip as specified or receiver.

E. Window Sill Flashing and Lintel Flashing:
1. Use stainless steel.
2. Fabricate flashing at ends with folded corners to turn up 5 mm (3/16 inch) in first vertical masonry joint beyond masonry opening.
3. Turn up back edge as shown.
4. Form exposed portion with drip as specified or receiver.

F. Door Sill Flashing:
1. Where concealed, use 0.5 mm (0.018 inch) thick stainless steel.
2. Where shown on drawings as combined counter flashing under threshold, sill plate, door sill, or where subject to foot traffic, use 0.6 mm (0.024 inch) thick stainless steel.
3. Fabricate flashing at ends to turn up 5 mm (3/16 inch) in first vertical masonry joint beyond masonry opening with folded corners.

2.7 BASE FLASHING

A. Use metal base flashing at vertical surfaces intersecting built-up roofing without cant strips or where shown.
1. Use stainless steel, thickness specified unless specified otherwise.
2. When flashing is over 250 mm (10 inches) in vertical height or horizontal width use 0.5 mm (0.018 inch) stainless steel.
3. Use stainless steel at aluminum roof curbs where flashing contacts the aluminum.
4. Use stainless steel at pipe flashings.

B. Fabricate metal base flashing up vertical surfaces not less than 200 mm (8 inch) nor more than 400 mm (16 inch).

C. Fabricate roof flange not less than 100 mm (4 inches) wide unless shown otherwise. When base flashing length exceeds 2400 mm (8 feet) form flange edge with 13 mm (1/2 inch) hem to receive cleats.

D. Form base flashing bent from strip except pipe flashing. Fabricate ends for riveted soldered lap seam joints. Fabricate expansion joint ends as specified.

E. Pipe Flashing: (Other than engine exhaust or flue stack)
1. Fabricate roof flange not less than 100 mm (4 inches) beyond sleeve on all sides.

2. Extend sleeve up and around pipe and flange out at bottom not less than 13 mm (1/2 inch) and solder to flange and sleeve seam to make watertight.
3. At low pipes 200 mm (8 inch) to 450 mm (18 inch) above roof:
   a. Form top of sleeve to turn down into the pipe at least 25 mm (one inch).
   b. Allow for loose fit around and into the pipe.
4. At high pipes and pipes with goosenecks or other obstructions which would prevent turning the flashing down into the pipe:
   a. Extend sleeve up not less than 300 mm (12 inch) above roofing.
   b. Allow for loose fit around pipe.

2.8 COUNTERFLASHING (CAP FLASHING OR HOODS)

A. Stainless steel, unless specified otherwise.
B. Fabricate to lap base flashing a minimum of 100 mm (4 inches) with drip:
   1. Form lock seams for outside corners. Allow for lap joints at ends and inside corners.
   2. In general, form flashing in lengths not less than 2400 mm (8 feet) and not more than 3000 mm (10 feet).
   3. Two-piece, lock in type flashing may be used in-lieu-of one piece counter-flashing.
   4. Manufactured assemblies may be used.
   5. Where counterflashing is installed at new work use an integral flange at the top designed to be extended into the masonry joint or reglet in concrete.
   6. Where counterflashing is installed at existing work use surface applied type, formed to provide a space for the application of sealant at the top edge.
C. One-piece Counterflashing:
   1. Back edge turned up and fabricate to lock into reglet in concrete.
   2. Upper edge formed to extend full depth of masonry unit in mortar joint with back edge turned up 6 mm (1/4 inch).
D. Two-Piece Counterflashing:
   1. Receiver to extend into masonry wall depth of masonry unit with back edge turned up 6 mm (1/4 inch) and exposed edge designed to receive and lock counterflashing upper edge when inserted.

2. Counterflashing upper edge designed to snap lock into receiver.

E. Surface Mounted Counterflashing; one or two piece:

1. Use at existing or new surfaces where flashing cannot be inserted in vertical surface.
2. One piece fabricate upper edge folded double for 65 mm (2 1/2 inches) with top 19 mm (3/4 inch) bent out to form "V" joint sealant pocket with vertical surface. Perforate flat double area against vertical surface with horizontally slotted fastener holes at 400 mm (16 inch) centers between end holes. Option: One piece surface mounted counter-flashing (cap flashing) may be used. Fabricate as detailed on Plate 51 of SMACNA Architectural Sheet Metal Manual.
3. Two pieces: Fabricate upper edge to lock into surface mounted receiver. Fabricate receiver joint sealant pocket on upper edge and lower edge to receive counterflashing, with slotted fastener holes at 400 mm (16 inch) centers between upper and lower edge.

F. Pipe Counterflashing:

1. Form flashing for water-tight umbrella with upper portion against pipe to receive a draw band and upper edge to form a "V" joint sealant receiver approximately 19 mm (3/4 inch) deep.
2. Fabricate 100 mm (4 inch) over lap at end.
3. Fabricate draw band of same metal as counter flashing. Use 0.6 Kg (24 oz) copper or 0.33 mm (0.013 inch) thick stainless steel or copper coated stainless steel.
4. Use stainless steel bolt on draw band tightening assembly.
5. Vent pipe counter flashing may be fabricated to omit draw band and turn down 25 mm (one inch) inside vent pipe.

G. Where vented edge decks intersect vertical surfaces, form in one piece, shape to slope down to a point level with and in front of edge-set notched plank; then, down vertically, overlapping base flashing.

2.9 GRAVEL STOPS (NOT USED)

2.10 BITUMEN STOPS (NOT USED)

2.11 CONDUCTORS (DOWNSPOUTS)

A. Fabricate conductors of same metal and thickness as gutters in sections approximately 3000 mm (10 feet) long [with 19 mm (3/4 inch) wide flat locked seams].

1. Fabricate open face channel shape with hemmed longitudinal edges.

B. Fabricate elbows by mitering, riveting, and soldering except seal aluminum in lieu of solder. Lap upper section to the inside of the lower piece.

C. Fabricate conductor brackets or hangers of same material as conductor, 2 mm (1/16 inch) thick by 25 mm (one inch) minimum width. Form to support conductors 25 mm (one inch) from wall surface in accordance with Architectural Sheet Metal Manual for rectangular and round shapes.

D. Conductor Heads:

1. Fabricate of same material as conductor.
2. Fabricate conductor heads to not less than 250 mm (10 inch) wide by 200 mm (8 inch) deep by 200 mm (8 inches) from front to back.
3. Form front and side edges channel shape not less than 13 mm (1/2 inch) wide flanges with edge hemmed.
4. Slope bottom to sleeve to conductor or downspout at not less than 60 degree angle.
5. Extend wall edge not less than 25 mm (one inch) above front edge.
6. Solder joints for water tight assembly.
7. Fabricate outlet tube or sleeve at bottom not less than 50 mm (2 inches) long to insert into conductor.

2.12 SPLASHPANS

A. Fabricate splashpans from the following:

1. 1.25 mm (0.050 inch) thick aluminum.

B. Fabricate in accordance with Architectural Sheet Metal Manual Plate 35 with not less than two ribs as shown in alternate section.

2.13 REGLETS

A. Fabricate reglets of one of the following materials:

1. Stainless steel, not less than 0.3 mm (0.012 inch) thick.

B. Fill open-type reglets with fiberboard or other suitable separator, to prevent crushing of the slot during installation.

C. Bend edges of reglets for setting into concrete to an angle of not less than 45 degrees, and make wide enough to provide firm anchorage in the concrete.

D. Fabricate reglets for building into horizontal masonry mortar joints not less than 19 mm (3/4 inch) deep, nor more than 25 mm (one inch) deep.

E. Fabricate mitered corners, fittings, and special shapes as may be required by details.

F. Reglets for concrete may be formed to receive flashing and have a 10 mm (3/8 inch), 45 degree snap lock.

2.14 INSULATED EXPANSION JOINT COVERS

A. Either type optional, use only one type throughout.

B. Types:

1. Construct of two preformed, stainless steel strips, not less than 0.4 mm (0.015 inch) thick, mechanically and adhesively bonded to both sides of a 2 mm (1/16 inch) thick neoprene or butyl sheet, or to a 0.4 mm (32 mil) thick reinforced chlorinated polyethylene sheet. Adhesively attach a 10 mm (3/8 inch) thick sheet of closed cell, neoprene foam insulation, to the underside of the neoprene, butyl, or chlorinated polyethylene sheet.
2. Constructed of a 2 mm (1/16 inch) thick vinyl sheet, flanged at both sides with stainless steel strips not less than 0.4 mm (0.015 inch) thick. Vinyl sheet locked and encased by the stainless steel strip and prepunched for nailing. A 10 mm (3/8 inch) thick closed cell polyvinyl chloride foam insulating strip shall be heat laminated to the underside of the vinyl sheet between the stainless steel strips.

C. Expansion joint covers shall have factory fabricated mitered corners, crossing tees, and other necessary accessories. Furnish in the longest available lengths.

D. Metal flange of sufficient width to extend over the top of the curb and down curb sides 50 mm (2 inches) with hemmed edge for lock to edge strip.

2.15 ENGINE EXHAUST PIPE OR FLUE OR STACK FLASHING (NOT USED)

2.16 SCUPPERS

A. Fabricate scuppers with minimum of 100 mm (4 inch) wide flange.

B. Provide flange at top on through wall scupper to extend to top of base flashing.

C. Fabricate exterior wall side to project not less than 13 mm (1/2 inch) beyond face of wall with drip at bottom outlet edge.

D. Fabricate not less than 100 mm (4 inch) wide flange to lap behind gravel stop fascia.

E. Fabricate exterior wall flange for through wall scupper not less than 25 mm (one inch) wide on top and sides with edges hemmed.

F. Fabricate scupper not less than 200 mm (8 inch) wide and not less than 125 mm (5 inch) high for through wall scupper.

G. Solder joints watertight.

2.17 GOOSENECK ROOF VENTILATORS (NOT USED)

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.
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. Coordinate with roofing work for the installation of metal base flashings and other metal items having roof flanges for anchorage and watertight installation.
8. Nail continuous cleats on 75 mm (3 inch) on centers in two rows in a staggered position.
9. Nail individual cleats with two nails and bend end tab over nail heads. Lock other end of cleat into hemmed edge.

10. Install flashings in conjunction with other trades so that flashings are inserted in other materials and joined together to provide a watertight installation.
11. 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.

3.2 THROUGH-WALL FLASHING

A. General:

1. Install continuous through-wall flashing between top of concrete foundation walls and bottom of masonry building walls; at top of concrete floors; under masonry, concrete, or stone copings and elsewhere as shown.
2. Where exposed portions are used as a counterflashings, lap base flashings at least 100 mm (4 inches) and use thickness of metal as specified for exposed locations.
3. Exposed edge of flashing may be formed as a receiver for two piece counter flashing as specified.
4. Terminate exterior edge beyond face of wall approximately 6 mm (1/4 inch) with drip edge where not part of counter flashing.
5. Turn back edge up 6 mm (1/4 inch) unless noted otherwise where flashing terminates in mortar joint or hollow masonry unit joint.
6. Terminate interior raised edge in masonry backup unit approximately 38 mm (1 1/2 inch) into unit unless shown otherwise.
7. Under copings terminate both edges beyond face of wall approximately 6 mm (1/4 inch) with drip edge.
8. Lap end joints at least two corrugations, but not less than 100 mm (4 inches). Seal laps with sealant.
9. Where dowels, reinforcing bars and fastening devices penetrate flashing, seal penetration with sealing compound. Sealing compound is specified in Section 07 92 00, JOINT SEALANTS.
10. Coordinate with other work to set in a bed of mortar above and below flashing so that total thickness of the two layers of mortar and flashing are same as regular mortar joint.
11. Where ends of flashing terminate turn ends up 25 mm (1 inch) and fold corners to form dam extending to wall face in vertical mortar or veneer joint.

12. Turn flashing up not less than 200 mm (8 inch) between masonry or behind exterior veneer.
13. When flashing terminates in reglet extend flashing full depth into reglet and secure with lead or plastic wedges spaced 150 mm (6 inch) on center.
14. Continue flashing around columns:
    a. Where flashing cannot be inserted in column reglet hold flashing vertical leg against column.
    b. Counterflash top edge with 75 mm (3 inch) wide strip of saturated cotton unless shown otherwise. Secure cotton strip with roof cement to column. Lap base flashing with cotton strip 38 mm (1 1/2 inch).

B. Flashing at Top of Concrete Foundation Walls Where concrete is exposed. Turn up not less than 200 mm (8 inch) high and into masonry backup mortar joint or reglet in concrete backup as specified.

C. Flashing at Top of Concrete Floors (except where shelf angles occur): Place flashing in horizontal masonry joint not less than 200 mm (8 inch) below floor slab and extend into backup masonry joint at floor slab 38 mm (1 1/2 inch).

D. Flashing at Cavity Wall Construction: Where flashing occurs in cavity walls turn vertical portion up against backup under waterproofing, if any, into mortar joint. Turn up over insulation, if any, and horizontally through insulation into mortar joint.

E. Flashing at Veneer Walls:
    1. Install near line of finish floors over shelf angles or where shown.
    2. Turn up against sheathing.
    3. At stud framing, hem top edge 19 mm (3/4 inch) and secure to each stud with stainless steel fasteners through sheathing.
    4. At concrete backing, extend flashing into reglet as specified.
    5. Coordinate with installation of waterproofing or asphalt felt for lap over top of flashing.

F. Lintel Flashing when not part of shelf angle flashing:
    1. Install flashing full length of lintel to nearest vertical joint in masonry over veneer.
    2. Turn ends up 25 mm (one inch) and fold corners to form dam and extend end to face of wall.

3. Turn back edge up to top of lintel; terminate back edge as specified for back-up wall.

G. Window Sill Flashing:

1. Install flashing to extend not less than 100 mm (4 inch) beyond ends of sill into vertical joint of masonry or veneer.
2. Turn back edge up to terminate under window frame.
3. Turn ends up 25 mm (one inch) and fold corners to form dam and extend to face of wall.

H. Door Sill Flashing:

1. Install flashing under bottom of plate sills of doors over curbs opening onto roofs. Extend flashing out to form counter flashing or receiver for counter flashing over base flashing. Set in sealant.
2. Extend sill flashing 200 mm (8 inch) beyond jamb opening. Turn ends up one inch in vertical masonry joint, extend end to face of wall. Join to counter flashing for water tight joint.
3. Where doors thresholds cover over waterproof membranes install sill flashing over water proof membrane under thresholds. Extend beyond opening to cover exposed portion of waterproof membrane and not less than 150 mm (6 inch) beyond door jamb opening at ends. Turn up approximately 6 mm (1/4 inch) under threshold.

I. Flashing at Masonry, Stone, or Precast Concrete Copings:

1. Install flashing with drips on both wall faces unless shown otherwise.
2. Form penetration openings to fit tight against dowel or other item with edge turned up. Seal penetrations with sealant.

3.3 BASE FLASHING

A. Install where roof membrane type base flashing is not used and where shown.

1. Install flashing at intersections of roofs with vertical surfaces or at penetrations through roofs, to provide watertight construction.
2. Install metal flashings and accessories having flanges extending out on top of the built-up roofing before final bituminous coat and roof aggregate is applied.
3. Set flanges in heavy trowel coat of roof cement and nail through flanges into wood nailers over bituminous roofing.

4. Secure flange by nailing through roofing into wood blocking with nails spaced 75 mm (3 inch) on centers or, when flange over 100 mm (4 inch) wide terminate in a 13 mm (1/2 inch) folded edge anchored with cleats spaced 200 mm (8 inch) on center. Secure one end of cleat over nail heads. Lock other end into the seam.

B. For long runs of base flashings install in lengths of not less than 2400 mm (8 feet) nor more than 3000 mm (ten feet). Install a 75 mm (3 inch) wide slip type, loose lock expansion joint filled with sealant in joints of base flashing sections over 2400 mm (8 feet) in length. Lock and solder corner joints at corners.

C. Extend base flashing up under counter flashing of roof specialties and accessories or equipment not less than 75 mm (3 inch).

3.4 COUNTERFLASHING (CAP FLASHING)

A. General:

1. Install counterflashing over and in conjunction with installation of base flashings, except as otherwise specified or shown.
2. Install counterflashing to lap base flashings not less than 100 mm (4 inch).
3. Install upper edge or top of counterflashing not less than 225 mm (9 inch) above top of the roofing.
4. Lap joints not less than 100 mm (4 inch). Stagger joints with relation to metal base flashing joints.
5. Use surface applied counterflashing on existing surfaces and new work where not possible to integrate into item.
6. When fastening to concrete or masonry, use screws driven in expansion shields set in concrete or masonry. Use screws to wood and sheet metal. Set fasteners in mortar joints of masonry work.

B. One Piece Counterflashing:

1. Where flashing is installed at new masonry, coordinate to insure proper height, embed in mortar, and end lap.
2. Where flashing is installed in reglet in concrete insert upper edge into reglet. Hold flashing in place with lead wedges spaced not more than 200 mm (8 inch) apart. Fill joint with sealant.
3. Where flashing is surface mounted on flat surfaces.

a. When top edge is double folded anchor flat portion below sealant "V" joint with fasteners spaced not over 400 mm (16 inch) on center:
   1) Locate fasteners in masonry mortar joints.
   2) Use screws to sheet metal or wood.
b. Fill joint at top with sealant.

4. Where flashing or hood is mounted on pipe.
   a. Secure with draw band tight against pipe.
   b. Set hood and secure to pipe with a one by 25 mm x 3 mm (1 x 1/8 inch) bolt on stainless steel draw band type clamp, or a stainless worm gear type clamp.
   c. Completely fill joint at top with sealant.

C. Two-Piece Counterflashing:
1. Where receiver is installed at new masonry coordinate to insure proper height, embed in mortar, and lap.
2. Surface applied type receiver:
   a. Secure to face construction in accordance, with manufacturers' instructions.
   b. Completely fill space at the top edge of receiver with sealant.
3. Insert counter flashing in receiver in accordance with fabricator or manufacturer's instructions and to fit tight against base flashing.

D. Where vented edge occur install so lower edge of counterflashing is against base flashing.

E. When counter flashing is a component of other flashing install as shown.

3.5 REGLETS

A. Install reglets in a manner to provide a watertight installation.

B. Locate reglets not less than 225 mm (9 inch) nor more than 400 mm (16 inch) above roofing, and not less than 125 mm (5 inch) nor more than 325 mm (13 inch) above cant strip.

C. Butt and align end joints or each section of reglet and securely hold in position until concrete or mortar are hardened:
1. Coordinate reglets for anchorage into concrete with formwork construction.
2. Coordinate reglets for masonry to locate horizontally into mortar joints.

3.6 COPINGS (NOT USED)

3.7 HANGING GUTTERS (NOT USED)

3.8 CONDUCTORS (DOWNSPOUTS)

A. Where scuppers discharge into downspouts install conductor head to receive discharge with back edge up behind drip edge of scupper. Fasten and seal joint. Sleeve conductors to gutter outlet tubes and fasten joint and joints between sections.

B. Set conductors plumb and clear of wall, and anchor to wall with two anchor straps, located near top and bottom of each section of conductor. Strap at top shall be fixed to downspout, intermediate straps and strap at bottom shall be slotted to allow not less than 13 mm (1/2 inch) movement for each 3000 mm (10 feet) of downspout.

C. Install elbows, offsets and shoes where shown and required. Slope not less than 45 degrees.

3.9 SPLASH PANS

A. Install where downspouts discharge on low slope roofs unless shown otherwise.

B. Set in roof cement prior to pour coat installation or sealant compatible with single ply roofing membrane.

3.10 GOOSENECK ROOF VENTILATORS (NOT USED)

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SECTION 07 71 00
ROOF SPECIALTIES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies copings, gravel stops, fascias, and expansion joints.

1.2 RELATED WORK

A. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS: Sustainable Design Requirements.

B. Section 07 21 13, THERMAL INSULATION: General Insulation.

C. Section 07 22 00, ROOF AND DECK INSULATION: Rigid Insulations for Roofing.

D. Section 07 92 00, JOINT SEALANTS: Sealant Material and Installation.

1.3 QUALITY CONTROL

A. Provide roof accessories that products of manufacturers regularly engaged in producing the kinds of products specified.

B. For each accessory type provide products made by the same manufacturer.

C. Assemble each accessory to the greatest extent possible before delivery to the site.

D. Provide each accessory with FM approval listing for class specified.

1.4 PERFORMANCE REQUIREMENTS

A. Provide roof accessories that withstand exposure to weather and resist thermal movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, or installation.

B. Provide roof accessories listed in FM Approvals “RoofNav” and approved for windstorm classification. Identify materials with FM Approval markings.

C. Manufacture and install roof accessories to allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects.

1. Provide clips that resist rotation and avoid shear stress as a result of thermal movements.

2. For design purposes, base provisions for thermal movement on assumed ambient temperature (range) from minus 18 degrees C (0 degrees F), ambient to 82 degrees C (180 degrees F).

1.5 SUBMITTALS

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

B. Sustainable Design Submittals, as described below:

1. Postconsumer and preconsumer recycled content as specified in PART 2 - PRODUCTS.

C. Samples: Representative sample panel of color-anodized aluminum not less than 101 x 101 mm (4 x 4 inches), except extrusions are to be of a width not less than section to be used. Submit sample that shows coating with integral color and texture. Include manufacturer's identifying label.

D. Shop Drawings: Each item specified showing design, details of construction, installation and fastenings.

E. Manufacturer's Literature and Data: Each item specified.

F. Certificates: Stating that aluminum has been given specified thickness of anodizing.

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. ASTM International (ASTM):

A240/A240M-20.....Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

A653/A653M-20.....Steel Sheet Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot Dip Process

A666-15.....Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar

B209-14.....Aluminum and Aluminum Alloy-Sheet and Plate

B209M-14.....Aluminum and Aluminum Alloy-Sheet and Plate (Metric)

B221-14.....Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

B221M-13.....Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes (Metric)

B32-08(2014).....Solder Metal

B370-12(2019).....Copper Sheet and Strip for Building Construction

B882-10(2018).....Pre-Patinated Copper for Architectural Applications

C612-14(2019).....Mineral Fiber Block and Board Thermal Insulation

D1187/D1187M-97(2018)...Asphalt-Base Emulsions for Use as Protective Coatings for Metal

D1970/D1970M-20.....Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection

D226/D226M-17.....Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing

D4869/D4969M-16a.....Asphalt-Saturated Organic Felt Underlayment Used In Steep Slope Roofing

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.

611-14.....Anodized Architectural Aluminum

E. FM Global (FM):

RoofNav.....Approved Roofing Assemblies and Products

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum, Extruded: ASTM B221M (B221).

B. Aluminum Sheet: ASTM B209M (B209).

C. Galvanized Sheet Steel: ASTM A653/A653M; G-90 coating.

D. Stainless-Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304.

E. Copper Sheet: ASTM B370, cold-rolled copper sheet, H00 or H01 temper.

F. Recycled Content of Metal Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 30 percent.

G. Insulation: ASTM C612, Class 1 or 2.

H. Asphalt Coating: ASTM D1187, Type I, quick setting.

2.2 UNDERLAYMENT

A. Self-Adhering Modified Bitumen Underlayment:

1. Provide self-adhering modified bitumen membrane underlayment material in compliance with ASTM D1970/D1970M, suitable for use as underlayment for metal copings and fascias.
2. Provide membrane resistant to cyclical elevated temperatures for extended period of time in high heat service conditions (stable after testing at 116 degrees C (240 degrees F)).
3. Provide membrane with integral non-tacking top surface of polyethylene film or other surface material to serve as separator between bituminous material and metal products to be applied above.
4. Provide primer.

B. Felt Underlayment: Provide No. 30 asphalt saturated organic, non-perforated felt underlayment in compliance with ASTM D226/D226M, Type II, or ASTM D4869/D4869M.

C. Slip Sheet: Provide 0.24 kg per square meter (5 pounds per 100 sf) rosin sized unsaturated building paper for slip sheet.

2.3 COPINGS

A. Fabricate of aluminum sheet not less than 0.5 mm (0.018 inch) thick; stainless steel

B. Turn outer edges down each face of wall as shown on construction documents.

C. Maximum lengths of 3.05 M (10 feet).

D. Shop fabricate external and internal corners as one-piece assemblies with not less than 305 mm (12 inch) leg lengths.

E. Provide 101 mm (4 inch) wide 0.81 mm (0.032 inch) thick watertight joint covers.

F. Provide anchor gutter bar of 0.81 mm (0.032 inch) thick with anchor holes formed for underside of joint.

G. Provide concealed guttered splice plate of 0.81 mm (0.032 inch) thick with butyl or other resilient seal strips anchored to splice plate for

underside of joint. Use galvanized steel anchor plate providing compression spring anchoring of coping cover.

H. Finish: as specified.

2.4 EXTRUDED ALUMINUM GRAVEL STOPS AND FASCIAS

A. Fabricate of aluminum not less than 2 mm (0.078 inch) thick.

B. Turn fascia down face of wall and up above roof as shown in construction documents.

C. Maximum lengths of 3.05 M (10-feet).

D. Shop fabricate external and internal corners as one (1)-piece assemblies with not less than 305 mm (12 inch) leg lengths.

E. Provide 101 mm (4 inch) wide 2 mm (0.078 inch) thick watertight joint covers with 152 mm (6 inch) wide 0.8 mm (0.030 inch) thick underside joint flashing.

F. Finish: as specified.

2.5 FINISH:

A. In accordance with NAAMM AMP 500-505.

B. Aluminum, Mill Finish: AA-MIX, as fabricated.

C. Fluoropolymer Finishes: High performance organic coating. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat.
2. Concealed Surface Finish: Apply pretreatment and manufacturer's standard acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.013 mm (0.5 mil).

D. Stainless-Steel Finish: No. 2B (bright, cold rolled, unpolished).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examine substrates, areas, and conditions, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage where applicable, and securely anchored.

C. Underlayment Installation:

1. Self-Adhering Sheet Underlayment:

a. Apply primer as required by manufacturer.

b. Comply with temperature restrictions of underlayment manufacturer for installation.

c. Apply wrinkle free, in shingle fashion to shed water, and with end laps of not less than 152 mm (6 inches) staggered 610 mm (24 inches) between courses.

d. Overlap side edges not less than 89 mm (3-1/2 inches). Roll laps with roller.

e. Cover underlayment within 14 days.

f. Apply continuously under copings and roof-edge fascias and gravel stops.

g. Coordinate application of self-adhering sheet underlayment under roof specialties with requirements for continuity with adjacent air barrier materials.

2. Slip Sheet:

a. Install with tape or adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties.

b. Apply in shingle fashion to shed water, with lapped joints of not less than 50 mm (2 inches).

D. Install roof accessories where indicated in construction documents.

E. Secure with fasteners in accordance with manufacture's printed installation instructions and approved shop drawings unless shown otherwise. Provide fasteners suitable for application, for metal types being secured and designed to meet performance requirements.

F. Where soldered joints are required, clean surfaces to be soldered, removing oils and foreign matter.

1. Pre-tin edges of sheets to be soldered to a width of 38 mm (1-1/2 inches).

2. Reduce pre-tinning where pre-tinned surface would show in completed work.

3. Do not use torches for soldering.

4. Heat surfaces to receive solder and flow solder into joint.

5. Fill joint completely.

6. Completely remove flux and spatter from exposed surfaces.

G. Coordinate to install insulation where shown; see Section 07 21 13, THERMAL INSULATION and Section 07 22 00, ROOF AND DECK INSULATION.

H. Comply with section 07 92 00, JOINT SEALANTS to install sealants where required by manufactures installation instructions.

I. Coordinate with roofing work for installation of items in sequence to prevent water infiltration.

J. Gravel Stops and Fascias:

1. Install gravel stops and fascia with butt joints with approximately 6 mm (1/4 inch) space for expansion.
2. Over each joint provide cover plates of sheet aluminum, complete with concealed sheet aluminum flashing, centered under each joint.
3. Provide lap cover plates and concealed flashing over the gravel stop and fascia not less than 101 mm (4 inches).
4. Extend concealed flashing over built-up roofing, embed in roof cement and turn down over face of blocking at roof edge.

K. Aluminum Coping:

1. Install sections of coping with approximately 6 mm (1/4-inch) space between ends of sections.
2. Center joint gutter bar and covers at joints and lock in place.
3. When snap-on system is installed ensure front and back edges are locked in place.

L. Fascia-Cant System:

1. Install galvanized steel cant; coordinate with roofing work and after completion of roofing work install extruded aluminum fascia, concealed joint cover plate, and aluminum compression clamp, where shown in construction documents.
2. Install system to allow for expansion and contraction with 6 mm (1/4 inch) space between extruded aluminum members and galvanized steel cant as required by manufacturer of system.
3. Offset joints in extruded aluminum members from galvanized steel cant joints.

M. Expansion Joint Covers:

1. Install to terminate base flashing 203 mm (8 inches) above roof.
2. Install moisture seals to drain water to outlets that do not permit water to enter building.
3. Provide stainless steel screws when exposed.
4. Three piece assembly:

a. Install curb section with screws to wood blocking, allowing 6 mm (1/4 inch) at butt joints between sections with splice plate at joint.
b. Install cant to wood blocking by nailing along horizontal flange every 152 mm (6 inches), with galvanized roofing nails 25 mm (1 inch) long.
c. After completion of base flashing install cap flashing and compression clamp and fasten to the curb or metal cant with stainless steel self-tapping screws with neoprene washers under head spaced approximately 457 mm (18 inches) on center.
d. Install expansion joint cover with a 6 mm (1/4 inch) wide end joints.
e. Install over end joint a cover plate complete with concealed aluminum flashing, centered under each joint. Fabricate flashing to lap cover not less than 101 mm (4 inches.

5. Two piece assembly:
   a. Install curb section with screws allowing 6 mm (1/4 inch) space at end joints with splice plate at joint.
   b. After completion of base flashing bend down cap flashing flange and secure to blocking with screws.
   c. Install expansion joint cover with 6 mm (1/4 inch) wide space at end joints and tension bars at 610 mm (24 inches) on center.
   d. Install cover plates with formed aluminum flashing concealed and centered on joint. Flashing to lap cover not less than 101 mm (4 inches).

3.2 PROTECTION OF ALUMINUM

A. Provide protection for aluminum against galvanic action wherever dissimilar materials are in contact, by painting the contact surfaces of the dissimilar material with two (2) coats of asphalt coating (complete coverage), or by separating the contact surfaces with a preformed neoprene tape having pressure sensitive adhesive coating on one (1) side.

B. Paint aluminum in contact with wood, concrete and masonry, or other absorptive materials, that may become repeatedly wet, with two (2) coats of asphalt coating.

3.3 ADJUSTING

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

3.4 PROTECTION

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

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SECTION 07 72 00
ROOF ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies roof hatches; equipment supports; gravity ventilators; and metal grating roof walkway system.

1.2 RELATED WORK

A. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS: Sustainable Design Requirements.

B. Section 07 21 13, THERMAL INSULATION: General insulation.

C. Section 07 22 00, ROOF AND DECK INSULATION: Rigid insulations for roofing.

D. Section 07 92 00, JOINT SEALANTS: Sealant material and installation.

1.3 QUALITY ASSURANCE

A. Provide roof accessories that are the products of manufacturers regularly engaged in producing the kinds of products specified.

B. For each accessory type provide the same product made by the same manufacturer.

C. Assemble each accessory 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. Sustainable Design Submittals, as described below:

1. Postconsumer and preconsumer recycled content as specified in PART 2 - PRODUCTS.

C. Samples: Submit representative sample panel of color anodized aluminum not less than 101 x 101 mm (4 x 4 inches). For extrusions, submit width not less than section to be installed. Show coating with integral color and texture and include manufacturer's identifying label.

D. Shop Drawings: Each item specified showing design, details of construction, installation and fastenings.

E. Manufacturer's Literature and Data: Each item specified.

F. 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. ASTM International (ASTM):

A653/A653M-20.....Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) By the Hot-Dip Process

B209-14.....Aluminum and Aluminum-Alloy Sheet and Plate

B209M-14.....Aluminum and Aluminum-Alloy Sheet and Plate (Metric)

B221-14.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

B221M-13.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes (Metric)

C726-17.....Mineral Wool Roof Insulation Board

C1289-19.....Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board

D1187/D1187M-97(2018)...Asphalt-Base Emulsions for Use as Protective Coatings for Metal

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

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

D. American Architectural Manufacturers Association (AAMA):

2603-20.....Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix).

2605-20.....Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Architectural Extrusions and Panels (with Coil Coating Appendix).

611-14.....Anodized Architectural Aluminum

621-02.....High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) and Zinc-Aluminum Coated Steel Substrates

E. American Society of Civil Engineers (ASCE):

ASCE/SEI 7-16.....Minimum Design Loads and Associated Criteria for Buildings and Other Structures

F. U.S. Occupational Safety and Health Standards (OSHA): 29 CFR 1910 Subpart D... Walking-Working Surfaces (1910.21-1910.30)

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum, Extruded: ASTM B221M (B221).

B. Aluminum Sheet: ASTM B209M (B209).

C. Galvanized Sheet Steel: ASTM A653/A653M; G-90 coating.

D. Recycled Content of Metal Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 30 percent.

E. Asphalt Coating: ASTM D1187/D1187M, Type I, quick setting.

2.2 EQUIPMENT SUPPORTS

A. Supported Load Capacity: as required to provide extra capacity over the weight of the equipment being supported.

B. Fabricate equipment supports from 1.3 mm (0.0516 inch) thick galvanized ASTM A653/A653M steel fabricate with welded corners and with seams joined by continuous water and air tight welds.

C. Equipment supports to be internally reinforced with angles 1.22 m (48 inches) on center.

D. Form exterior curb with integral base.

E. Use galvanized steel liners for curbs having inside dimension over 305 mm (12 inches).

F. Internally insulate with 38 mm (1-1/2 inch) glass-fiber board insulation (ASTM C726).

G. Fabricate curb with a minimum height of 203 mm (8 inches) above roof surface.

H. Attach preservative treated wood nailers to top of curb. Provide 50 mm (2 inch) by 50 mm (2 inch) minimum nominal size on curb with openings and 50 mm (2 inch) thick, width of curb up to 305 mm (12 inches) on equipment support curbs.

I. Make size of supports suit size of equipment furnished, with height as shown on construction documents, but not less than 203 mm (8 inches) above roof surface.

J. Top of Equipment Supports: Level with pitch built into curb when deck slopes. Equip supports with water diverter or cricket on side that obstructs water flow.

K. Finish: as indicated

2.3 FINISH:

A. In accordance with NAAMM AMP 500 Series.

B. Aluminum, Mill Finish: AA-MIX, as fabricated.
Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 0.04 mm (1.5 mils). Comply with coating manufacturer’s written instructions for cleaning, conversion coating, and applying and baking finish.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install roof specialties where indicated on construction documents.

B. Secure with fasteners in accordance with manufacture's printed installation instructions and approved shop drawings unless shown otherwise.

C. Coordinate to install insulation where shown; see Section 07 21 13, THERMAL INSULATION and Section 07 22 00, ROOF AND DECK INSULATION.

D. Comply with section 07 92 00, JOINT SEALANTS to install sealants where required by manufactures installation instructions require sealant.

E. Coordinate with roofing work for installation of items in sequence to prevent water infiltration.

1. After completion of base flashing bend down cap flashing flange and secure to blocking with screws.
2. Install expansion joint cover with 6 mm (1/4 inch) wide space at end joints and tension bars at 610 mm (24 inches) on center.
3. Install cover plates with formed aluminum flashing concealed and centered on joint. Flashing to lap cover not less than 101 mm (4 inches).

F. Equipment Supports: Do not anchor to insulating concrete or metal deck. Anchor only to building structure as per manufacturers recommendations.

3.2 PROTECTION OF ALUMINUM

A. Provide protection for aluminum against galvanic action wherever dissimilar materials are in contact, by painting the contact surfaces of the dissimilar material with two (2) coats of asphalt coating

(complete coverage), or by separating the contact surfaces with a preformed neoprene tape having pressure sensitive adhesive coating on side.

B. Paint aluminum in contact with wood, concrete and masonry, or other absorptive materials, that may become repeatedly wet, with two coats of asphalt coating.

3.3 ADJUSTING

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

3.4 PROTECTION

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

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SECTION 07 92 00
JOINT SEALANTS

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This Section covers interior and exterior sealant and their application, wherever required for complete installation of building materials or systems, except where specifically provided by other trades in the Construction Documents.

B. Work not included in this Section:

1. Glazing Sealants: See Section 08 80 00.

1.2 RELATED WORK (Including but not limited to the following):

A. Sealing of Site Work Concrete Paving: Section 32 05 23, CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS.

B. Masonry Control and Expansion Joint: Section 04 20 00, UNIT MASONRY.

C. Glazing: Section 08 80 00, GLAZING.

D. Glazed Aluminum Curtain Wall: Section 08 44 13, GLAZED ALUMINUM CURTAIN WALLS.

E. Mechanical Work: Section 22 05 11 COMMON WORK RESULTS FOR PLUMBING, Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

1.3 QUALITY ASSURANCE:

A. Installer Qualifications: An experienced installer with a minimum of three (3) years' experience and 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. Submit qualification.

B. Source Limitations: Obtain each type of joint sealant through one (1) source from a single manufacturer.

1. Obtain elastomeric materials only from manufacturers who will, if required, send a qualified technical representative to project site, for the purpose of advising the installer of proper procedures and precautions for the use of the materials.

C. Correlation of Performance Requirements: The Work of this Section is subject to the performance requirements indicated in the Contract Documents and as follows:
   1. Requirements of Regulatory Agencies: The Work is subject to all applicable provisions of the Codes and Standards required by the authorities having jurisdiction.
   2. Reference Standards: Standards referenced in this Section are commonplace in the industry (unless noted otherwise) and are referred to by basic designation only. Standards form a part of this Specification to the extent referenced.
   3. Correlation and Intent of the Contract Documents: In the event of conflicts or discrepancies between the Contract Documents, the requirements of regulatory agencies, and the indicated Reference Standards, the most stringent requirements govern.

D. 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.

E. Lab Tests: Submit samples of materials that will be in contact or affect joint sealants to joint sealant manufacturers for tests as follows:
   1. Adhesion Testing: Before installing elastomeric sealants, test their adhesion to protect joint substrates according to the method in ASTM C794 to determine if primer or other specific joint preparation techniques are required.

2. Compatibility Testing: Before installing elastomeric sealants, determine compatibility when in contact with glazing and gasket materials.
3. Stain Testing: Perform testing per ASTM C1248 on interior and exterior sealants to determine if sealants or primers will stain adjacent surfaces. No sealant work is to start until results of these tests have been submitted to the Contracting Officer Representative (COR) and the COR has given written approval to proceed with the work.

F. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to joint substrates according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1.1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
1. Locate test joints where indicated in Construction Documents or, if not indicated, as directed by COR.
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 (7) 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.

G. Mockups: Before installing joint sealants, apply elastomeric sealants as follows to verify selections and to demonstrate aesthetic effects and qualities of materials and execution:
1. Joints in mockups of assemblies that are indicated to receive elastomeric joint sealants.
2. After all approvals have been obtained, provide job Mockup of typical joints with sealant installed according to shop drawings. Mockup is to be standard of quality with respect to color, workmanship and tooling. Obtain approval of Architect.

1.4 CERTIFICATION:

A. Contractor is to submit to the COR written certification that joints are of the proper size and design, that the materials supplied are

compatible with adjacent materials and backing, that the materials will properly perform to provide permanent watertight, airtight or vapor tight seals (as applicable), and that materials supplied meet specified performance requirements.

1.5 DEFINITIONS:

A. Definitions of terms in accordance with ASTM C717 and as specified.

B. Back-up Rod (Backing 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.

E. Terminology: "Sealant", "Joint Sealer", "Caulk", and "Caulking" are interchangeable terms for purposes of this Section.

F. Types of Sealant Surface Exposures:

1. Exterior: Any sealant surfaces that are exposed to the weather and/or direct sunlight.
2. Non-conditioned Interior: Sealant surfaces that do not fit the definition of Exterior Exposure above and are within enclosed spaces that are not conditioned and/or any un-enclosed (open) building spaces. For the purposes of this Specification, a non-conditioned interior exposure must be considered equivalent to an exterior exposure in terms of temperature and humidity.
3. Conditioned Interior: Sealant surfaces that are within enclosed building spaces that are partially or fully-conditioned.

1.6 SUBMITTALS:

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

B. Manufacturer's Data: Submit manufacturer's specifications, recommendations and installation instructions for sealant, caulking compound and associated miscellaneous material required. Include manufacturer's published data, or letter of certification, or certified test laboratory report indicating that each material complies with the requirements and is intended generally for the applications shown.

C. Samples

1. Samples for Initial Selection: For products involving selection of color.

2. Samples for Verification: Cured samples of exposed sealants for each color.

D. Warranties: Sample of special warranties.

E. Quality Control Submittals

1. Qualification Data

a. Installer.

b. Manufacturer’s Representative.

2. Certifications: Provide certifications indicating compliance with the Quality Assurance and Certification Articles above.

3. Test Reports

a. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.

b. Preconstruction Field-Adhesion Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in “Contractor's Quality Control System” Article below.

c. Field-Adhesion Test Reports: For each sealant application tested. See "Field Quality Control" Article in Part 3 of this Section for additional information.

1.7 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 degrees C (40 degrees 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.

1.8 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 degrees C (90 degrees F) or less than 5 degrees C (40 degrees F).

1.9 WARRANTY:

A. Construction Warranty: Comply with FAR clause 52.246-21 "Warranty of Construction".

B. Manufacturer Warranty: Manufacturer must warranty their sealant for a minimum of five (5) years from the date of installation and final acceptance by the Government. Submit manufacturer warranty.

C. Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five (5) years from date of Substantial Completion.

1.10 CONTRACTOR'S QUALITY CONTROL SYSTEM:

A. General: In accordance with Division 1 requirements, the Contractor must establish a Quality Control System for the work of this Section. Controls must be adequate to cover all construction operations.

B. Pre-construction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:

1. Perform test on-site, on field-constructed mock-ups or on actual construction, and far enough in advance of sealant work to allow curing of sealants and retesting if necessary.
2. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
3. Conduct field tests for each application indicated below:
4. Each kind of sealant and joint substrate indicated.

5. Arrange for tests to take place with joint-sealant manufacturer's qualified representative present.
   a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
      1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
6. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
7. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

C. Field-Adhesion Testing: Provide field-adhesion testing in addition to pre-construction testing as indicated in Part 3 of this Section.

1.11 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. ASTM International (ASTM):

C509-06.....Elastomeric Cellular Preformed Gasket and Sealing Material

C612-14.....Mineral Fiber Block and Board Thermal Insulation

C717-14a.....Standard Terminology of Building Seals and Sealants

C734-06(R2012).....Test Method for Low-Temperature Flexibility of Latex Sealants after Artificial Weathering

C794-10.....Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants

C919-12.....Use of Sealants in Acoustical Applications.

C920-14a.....Elastomeric Joint Sealants.

C1021-08(R2014).....Laboratories Engaged in Testing of Building Sealants

C1193-13.....Standard Guide for Use of Joint Sealants.

C1248-08(R2012).....Test Method for Staining of Porous Substrate by Joint Sealants

C1330-02(R2013).....Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants

C1521-13.....Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints

D217-10.....Test Methods for Cone Penetration of Lubricating Grease

D1056-14.....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

D. Environmental Protection Agency (EPA):
40 CFR 59(2014).....National Volatile Organic Compound Emission Standards for Consumer and Commercial Products

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 SEALANTS:

A. Exterior Sealants:

1. S-1: Two-Component Polyurethane Non-Sag Sealant: Federal Specification TT-S-00227E, Type II, Class A; ASTM C920, Type M, Grade NS, Class 25; proprietary two-component primerless sealant.
2. S-2: Immersible, Two-Component Polyurethane Self-Leveling Sealant: Polyurethane-based, 2-part elastomeric sealant, complying with Federal Specification TT-S-00227E, Type I and II, Class A; ASTM C920, Type M, Grade P, Class 25, Use T, NT, M, A and I.
3. Provide location(s) of exterior sealant as follows:
   a. See schedule in Part 3 of this Section.

B. Interior Sealants:
1. Provide location(s) of interior sealant as follows:
   a. See schedule in Part 3 of this Section.

2.3 COLOR:

A. Sealants used with exposed masonry are to match color of mortar joints.
B. Sealants used with unpainted concrete are to match color of adjacent concrete.
C. Color of sealants for other locations to be light gray or aluminum, unless otherwise indicated in construction documents.

2.4 JOINT SEALANT BACKING:

A. General: Provide sealant backings of material and type that are non-staining; 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 or synthetic rubber (ASTM C509), nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 32 degrees C (minus 26 degrees 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 fiberboard: 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-POROUS SURFACES:

A. Chemical cleaners compatible with sealant and acceptable to manufacturer of sealants and sealant backing material. Cleaners to be 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.

D. Report all deviations from the Contract Documents and/or conditions detrimental to performance of the Work to the Architect in writing.

E. Proceed with installation only after unsatisfactory conditions have been corrected. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 PREPARATIONS:

A. Prepare joints in accordance with manufacturer's instructions and SWRI (The Professionals' Guide).

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 but are not limited to 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. Nonporous surfaces include but are not limited to the following:
   a. Metal.
   b. Glass.
   c. Porcelain enamel.
   d. Glazed surfaces of ceramic tile.

C. Do not cut or damage joint edges.

D. Apply non-staining 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 or as indicated by pre-construction joint sealant substrate test.
   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. Avoid application to or spillage onto adjacent substrate surfaces.

3.3 BACKING INSTALLATION:

A. Install backing 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 backing rod and position the rod at proper depth.
C. Cut fillers installed by others to proper depth for installation of backing rod and sealants.
D. Install backing 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 backing rod does not exist, install bond breaker tape strip at bottom (or back) of joint so sealant bonds only to two opposing surfaces.

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 degrees C and 38 degrees C (40 degrees and 100 degrees F).
   2. Do not install 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 install 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 exposed joints to form smooth and uniform beds, with slightly concave surface conforming to joint configuration per Figure 5A in ASTM C1193 unless shown or specified otherwise in construction documents. Remove masking tape immediately after tooling of sealant and before sealant face starts to "skin" over. Remove any excess sealant from adjacent surfaces of joint, leaving the working in a clean finished condition.
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. Submit test reports.
11. Replace sealant which is damaged during construction process.

B. For application of sealants, follow requirements of ASTM C1193 unless specified otherwise. Take all necessary steps to prevent three-sided adhesion of sealants.

C. Interior Sealants: 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 cutouts 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 according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
   1. Extent of Testing: Test completed elastomeric sealant joints as follows:
      a. Perform 10 tests for first 305 m (1000 feet) of joint length for each type of elastomeric sealant and joint substrate.
      b. Perform one test for each 305 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 manufacturer of the adjacent material or if not otherwise indicated by the caulking or sealant manufacturer.

B. Leave adjacent surfaces in a clean and unstained condition.

3.8 PROTECTION:

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.9 SCHEDULE:

1. S-1: Two-component polyurethane non-sag sealant at joints in the following vertical surfaces and non-traffic horizontal surfaces (unless noted otherwise):
   a. Exterior building facades and cladding (non-fire-rated) joints; provide at the following locations:
      1) Control and expansion joints in cast-in-place concrete.
      2) Joints between architectural precast concrete units where self-leveling sealant has not been specified.
      3) Joints between dissimilar materials.

4) Through-penetrations.

b. Other Joints (not included above):

1) Control joints and construction joints (horizontal or vertical).

2) All joints between masonry and concrete (top and sides).

3) Joints between dissimilar materials, including but not limited to the following:

a) Between finished steel components and concrete (including base plates and railing posts).

b) Perimeter of bollard bases (cove sealant).

c) Anchor locations for vehicular barriers (including perimeter of faying surfaces).

4) Perimeter joints between materials listed above and frames of doors and windows (exterior exposure locations).

5) Under thresholds.

6) Refrigerant lines and other Div. 22/23 and 26 items entering building and where these items pass between conditioned and unconditioned spaces.

7) Joints in coping caps and exposed roof counter flashing.

8) Sleeves through structural elements; sealant must be appropriately detailed to prevent structural deterioration.

9) Other joints as indicated.

10) Other exterior joints for which no other sealant is indicated.

2. S-2: Two-component polyurethane self-leveling sealant at exterior joints in the following horizontal traffic surfaces:

a. Control, expansion, and isolation joints in cast-in-place concrete slabs.

b. Tee-to-tee flange joints.

c. Other joints as indicated.

3. S-3: Acrylic latex sealant at interior joints (conditioned areas), not subject to movement, in the following vertical surfaces and horizontal non-traffic surfaces (unless noted otherwise):

a. Control joints on exposed interior surfaces of exterior walls.

b. Perimeter joints of interior openings where indicated.

c. Vertical control joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
d. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
e. Other joints as indicated.

4. Polyethylene joint fillers at expansion joints shown to be caulked or indicated for sealant.
5. Bituminous joint fillers at slab-on-grade concrete installations not required to be caulked.
6. All associated auxiliary materials as required to complete joint seal per Manufacturer's requirements.

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SECTION 07 95 13
EXPANSION JOINT COVER ASSEMBLIES

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes: The extent of work included in this Section is shown on the Drawings and is specified as follows:

1. Expansion Joint Control System (EJCS or "System"): EJCS assemblies include, but are not limited to, the following expansion joint control assembles:
   a. Exterior EJCS:
      1) Joint Seals: Watertight expansion joint seals at the following locations:
         a) Horizontal deck joint seals adjacent to elevator tower slabs and walls.
      2) Cover Plates: Horizontal cover plate assemblies at door thresholds, pedestrian traffic crossings and as otherwise indicated.
2. Providing the services of a qualified technical representative to provide Manufacturer representation on site to ensure installation quality.

1.2 RELATED WORK

A. Section 05 50 00, METAL FABRICATIONS: Steel Plate Expansion Joint Covers.

B. Section 07 60 00, FLASHING AND SHEET METAL: Sheet Metal Expansion Joint Seals.

C. Section 07 72 00, ROOF ACCESSORIES: Roof Expansion Joint Cover Assemblies.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this Section.

B. American Society of Civil Engineers (ASCE):
ASCE/SEI 7-10 - Minimum Design Loads For Buildings and Other Structures.

C. ASTM International (ASTM):
A36/A36M-19 - Structural Steel.

A240/A240M-20 - Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels and for General Applications.

A283/A283M-18 - Low and Intermediate Tensile Strength Carbon Steel Plates.

A786/A786M-15 - Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates.

B36/B36M-18 - Brass, Plate, Sheet, Strip, and Rolled Bar.

B121/B121M-16 - Leaded Brass Plate, Sheet, Strip and Rolled Bar.

B209-14 - Aluminum and Aluminum-Alloy Sheet and Plate.

B209M-14 - Aluminum and Aluminum-Alloy Sheet and Plate (Metric).

B221-14 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

B221M-13 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).

B455/B455M-20 - Copper-Zinc-Lead Alloy (Leaded-Brass) Extruded Shapes.

C864-05(2019) - Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.

D1187/D1187M-97(2018) - Asphalt-Base Emulsions for Use as Protective Coatings for Metal.

E1399/E1399M-97(2017) - Standard Test Method for Cyclic Movement and Measuring the Minimum and Maximum Joint Widths of Architectural Joint Systems.

E1966-15(2019) - Standard Test Method for Fire-Resistive Joint Systems.

D. National Association of Architectural Metal Manufacturers (NAAMM):
AMP 500-06 - Metal Finishes Manual.

E. UL LLC (UL):
2079-15 - Standard for Tests for Fire Resistance of Building Joint Systems.

1.4 DEFINITIONS

A. Expansion Joint Control (EJCS) Assembly: A complete system of components including but not limited to joint seals, cover plates, joint covers, barriers, and all necessary accessory and/or supplementary items to provide a complete installation thereof at an expansion joint gap.

B. Expansion Joint Gap (Joint Opening): The linear opening width of an open joint located between two separate building elements (portions of a building structure and/or building components) to provide accommodation of differential movement (in any direction) between the two elements. When measured from a nominal condition, expansion joint gaps may be subject to increasing or decreasing width due to the deflection, expansion and/or contraction of the adjacent building elements.

C. Gap-Temperature Correlation: At the time of construction, the formed expansion joint gap must be adjusted based on the current ambient temperature and the joint movement criteria provided on the Structural Drawings.

D. Maximum Joint Width: Widest linear gap a joint system tolerates and in which it performs its designed function without damaging its functional capabilities.

E. Minimum Joint Width: Narrowest linear gap a joint system tolerates and in which it performs its designed function without damaging its functional capabilities.

F. Movement Capability: Value obtained from the difference between widest and narrowest widths of a joint opening typically expressed in numerical values (mm or inches) or a percentage (plus or minus) of nominal value of joint width.

G. Nominal Gap Width: The width of the expansion joint gap in which a joint system is to be installed, assuming building elements have been exposed to a sustained ambient temperature of 70 deg F or as otherwise shown in the Structural Drawings.

1.5 PREINSTALLATION MEETINGS

A. Conduct preinstallation meeting at project site minimum 30 days before beginning Work of this Section.

1. Required Participants:
   a. Contracting Officer's Representative.
   b. Contractor.
   c. Installer.
   d. Manufacturer's field representative.
2. Meeting Agenda: Distribute agenda to participants minimum 3 days before meeting.

a. Installation schedule.
b. Installation sequence.
c. Preparatory work.
d. Protection before, during, and after installation.
e. Installation.
f. Terminations.
g. Transitions and connections to other work.
h. Other items affecting successful completion.

3. Contractor must have a copy of all approved Shop Drawings and Submittals applicable to the Work present at the Pre-Installation Conference.
4. Document and distribute meeting minutes to participants to record decisions affecting installation.
5. See Division 1 for additional requirements pertaining to Pre-Installation Conference.

1.6 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submittal Drawings:

1. Include large-scale details indicating profiles of each type of expansion joint cover, splice joints between joint sections, transitions to other assemblies, terminations, anchorages, fasteners, and relationship to adjoining work and finishes.
2. Show size, configuration, and fabrication and installation details.
3. Include composite drawings showing work specified in other Sections coordinated with expansion joints.
4. Placement Drawings
   a. Layout: Include line diagrams showing plans, elevations, sections, details, splices, block-out requirements, entire route of each joint system, and attachments to other work.
   b. Transitions: Where Systems change planes or intersect, provide isometric or other detail drawings clearly indicating how components relate and/or interconnect.
5. Gap-Temperature Adjustment Table(s): Tabular format and prepared by or under the supervision of the Manufacturer’s technical representative utilizing joint performance criteria provided in the

Contract Documents. Table must show expansion joint gaps (for each unique condition) calculated in 5 deg. F increments based on a temperature range of 20 deg F to 120 deg F.

6. System Schedule: Tabular format and prepared by or under the supervision of the Manufacturer’s technical representative. At a minimum, include the following information for each System:
   a. Manufacturer’s identifying product name and/or model number.
   b. Identify System location (cross-reference to Drawings).
   c. Indicate the following for each System:
      1) Nominal joint width.
      2) Movement capability.
      3) Materials, colors, and finishes.
      4) Product options.

C. Manufacturer's Literature and Data:
   1. Description of each product specified.
   2. Show movement capability of each cover assembly.
   3. Description of materials and finishes.
   4. Installation instructions.

D. Samples: Submit 300 mm (12 inch) long samples.
   1. Each type and color of metal finish for each required thickness and alloy.
   2. Each type and color of flexible seal.

E. Sustainable Construction Submittals: Not applicable.

F. Operation and Maintenance Data:
   1. Care instructions for each exposed finish product. Include precautions against any known materials and methods which may be detrimental to finishes and/or performance.

G. Quality Control Submittals (Informational Submittals)
   1. Qualification Data: For firms and/or persons specified in the QUALITY ASSURANCE Article of this Section; data must demonstrate their capabilities and experience. Include list of completed projects.
   2. Certifications
      a. Manufacturer's certification of product compliance with applicable Codes and standards.

b. Provide certifications with substantiating test reports indicating compliance with the Quality Assurance article below.
   1) Testing Laboratory Labels: Certification of satisfactory testing to meet required labeling requirements.
c. Certified Test Reports: Test reports based on evaluation of comprehensive tests performed by a qualified testing agency indicating compliance with performance requirements. Prepare test reports in accordance with reporting procedure described in the referenced test standards.
   1) Testing for Material Properties: For each listed product, test reports indicating compliance with requirements.

3. Coordination Shop Drawings: Drawings must be sufficient to indicate coordination with adjacent work.
4. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".
5. Warranty: Sample warranty form.

1.7 QUALITY ASSURANCE

A. Source Quality Control
   1. Provide primary System components for all Systems used on Project which are the products of one Manufacturer.
   2. Except where specified otherwise, obtain supplemental System components and/or accessories from the System Manufacturer or from manufacturers which are acceptable to the System Manufacturer.

B. Correlation of Performance Requirements: The Work of this Section is subject to the performance requirements indicated in the Contract Documents and as follows:
   1. Requirements of Regulatory Agencies: The Work is subject to all applicable provisions of the Codes and Standards required by the authorities having jurisdiction.
   2. Accessibility Guidelines: Work of this Section must be in full compliance with all applicable accessibility requirements for buildings capable of accommodating the public as required by the authorities having jurisdiction. See Code Summary on the Drawings for additional information.
   3. Reference Standards: Standards referenced in this Section are commonplace in the industry (unless noted otherwise) and are

referred to by basic designation only. Standards form a part of this Specification to the extent referenced.

4. Correlation and Intent of the Contract Documents: In the event of conflicts or discrepancies between the Contract Documents, the requirements of regulatory agencies, and the indicated Reference Standards, the most stringent requirements govern.

C. Manufacturer Qualifications: The Manufacturer must have sufficient production capacity to produce required units without causing delay in work.

1. Manufacturer must be capable of providing field service representation during construction, approving an acceptable installer, and recommending appropriate installation methods.

D. Installer Qualifications:

1. Regularly installs specified products.
2. Installed specified products with satisfactory service on five similar installations for minimum five years.
   a. Project Experience List: Provide contact names and addresses for completed projects.
   b. The installer must be approved by the Manufacturer in writing on company letterhead. Attach this letter to warranty. The Installer must be certified at the time of bidding.

1.8 DELIVERY

A. Deliver products in manufacturer's original sealed packaging.

B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, and manufacture date.

C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.9 STORAGE AND HANDLING

A. Store products indoors in dry, weathertight facility.

B. Protect products from damage during handling and construction operations.

1.10 FIELD CONDITIONS

A. Field Measurements: Verify field conditions affecting expansion joint cover assembly fabrication and installation. Show field measurements on Submittal Drawings.

1. Coordinate field measurement and fabrication schedule to avoid delay.

B. Weather Conditions: Do not proceed with installation of expansion joints and sealants under adverse weather conditions, or when temperatures are below or above Manufacturer's recommended limitations for installation. Proceed with the work only when forecasted weather conditions are favorable for proper cure and strength development of the adhesive materials.

1.11 COORDINATION

A. Contractor to provide approved Gap-Temperature Adjustment Table(s) to provide sufficient guidance to allow other trades to adjust the nominal joint opening on the day of gap construction.

B. Coordinate installation of complete Systems with interfacing and adjoining construction to provide a successful installation without failure and fully-functional.

C. For locations of exterior exposure and all parking areas, coordinate configuration and installation of EJCS assemblies to ensure that transitions are watertight.

1.12 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

B. Special Project Warranty:

1. Special warranty requirements specified in this Article shall in no way deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and must be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

2. Materials Manufacturer and approved installer must be jointly and severally responsible and must submit an affidavit signed by both parties warrantying the installed system for a minimum period of five (5) years from the date of substantial completion of the Work provided under this Section. Warranty must also include the following:

a. Installer must repair or replace EJCS work which leaks water, deteriorates excessively, wears prematurely or otherwise fails to perform as required within the warranty period, due to failure of

materials and/or workmanship under normal traffic and/or exposure conditions. Any type of failure of the new joint seal which occurs within the specified warranty period must be repaired by the Contractor at no cost to the Owner.

b. An agreement to remove and reinstall other work which has been superimposed on EJCS work as required to repair or replace the EJCS work; such other work is limited to work shown in the Contract Documents.

1.13 CONTRACTOR'S QUALITY CONTROL SYSTEM

A. General: In accordance with Division 1 requirements, the Contractor must establish a Quality Control System for the work of this Section. Controls must be adequate to cover all construction operations.

1. Review of existing conditions, substrate conditions, requirements of related work, installation instructions, storage and handling procedures, and protection measures.
2. Scheduling and convening of a Pre-Installation Conference.

B. Pre-Installation Conference: See Article 1.5 above.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Provide joint cover assemblies that permit unrestrained movement of joint without disengagement of cover, and, where applicable, maintain moisture, watertight and fire-rated protection.

B. Provide templates to related trades for location of support and anchorage items.

2.2 SYSTEM PERFORMANCE

A. General Performance: Provide factory-fabricated expansion joint assemblies, with a proven track record of successful in-service performance, capable of meeting specified requirements without failure.

1. Environmental Exposure: EJCS assemblies must be designed, fabricated, and installed to operate effectively under the climate and exposure conditions to which the installation will be exposed. Unless otherwise indicated, any EJCS assemblies located within the parking areas are for exterior, exposed-to-weather use.
2. Accommodation of Joint Movement
   a. General

1) Design, fabricate and install EJCS assemblies that are capable of accommodating movement and variation in joint widths through compression and flexure of the internal EJCS structure. In addition, design, fabricate and install expansion joint systems so that the installed joints will withstand the following:
   a) Vertical Shear: Upward and downward.
   b) Horizontal Shear: Outward and inward.
   c) Rotation: Outward and inward.
2) Where seals are indicated, design structure of seal to exert and maintain a continuous and uniform pressure against joint sidewalls effectively providing a watertight seal.
3) EJCS assemblies must comply with ASTM E1399, without failure or other detrimental effects.

b. Thermal Movements: Design, fabricate and install component parts of EJCS assemblies exposed to the environment to accommodate dynamic changes to the Expansion Joint Gap due to expansions and contractions of the superstructure resulting from the following changes in ambient and surface temperatures:
   1) Temperature Change: Assuming a mean temperature 59 deg F, accommodate the following:
      a) Average Low-to-Mean: 56 deg F
      b) Average High-to-Mean: 29 deg F

c. Movements Due to Superstructure Creep and Shrinkage: System must accommodate relative displacements of System supports due to anticipated creep and shrinkage of the superstructure.

d. Joint Performance Criteria: See Structural Drawings for information pertaining to anticipated joint movement due to the combined effects of thermal movement and creep and shrinkage of the superstructure.

e. Shop drawings must include temperature adjustment table with expansion joint opening calculated at increments as indicated in Article “Submittals”.

f. Gap-Temperature Correlation: Shop Drawings must include a Gap-Temperature Adjustment Table with expansion joint gap calculated

at temperature increments as indicated in Submittals Article below.

3. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

B. Components Exposed to Traffic: For areas where EJCS assemblies are utilized in the horizontal position and pedestrian and/or vehicular traffic is anticipated, select EJCS components with a proven record of in-service performance for supporting floor loads equal to or greater that those indicated in the Drawings while providing a suitable non-slip surface that complies with all applicable Codes, standards and accessibility guidelines when installed.

2.3 MATERIALS

A. Stainless Steel: ASTM A240/A240M, Type 302 or 304.

B. Structural Steel Shapes: ASTM A36/A36M.

C. Steel Plate: ASTM A283/A283M, Grade C.

D. Rolled Steel Floor Plate: ASTM A786/A786M.

E. Aluminum:

1. Extruded: ASTM B221M (ASTM B221), alloy 6063-T5, 6063-T6, or 6061-T6.
2. Plate and Sheet: ASTM B209M (ASTM B209), alloy 6061-T6.
3. Finishes:
   a. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.
   b. Finish: Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

F. Elastomeric Sealant: As specified in Section 07 92 00, JOINT SEALANTS.

G. Glands: The gland elements must be a continuous, factory extruded unit for the entire straight run length of the joint. Changes in direction or elevation must be accomplished by factory molded elbows, tees, crosses and the like. Where seal terminates at a vertical joint transition, the seal must be turned up a minimum of 6 inches (vertically) unless otherwise shown on plans. The seal element must meet or exceed the following performance criteria:

1. Tensile Strength (ASTM D412): 850 psi
2. Elongation at Break (ASTM D412): 300 % (Min.)
3. Hardness, Type A Durometer (ASTM D2240): 67 ± 3

H. Pre-compressed Joints: Pre-compressed elements must work by means of a constant internal pressure to provide a weather tight seal. Seals must be protected a factory-applied silicone coating on one side or two sides as indicated in the Contract Documents. Field splices (silicone sealed) must be allowed at regular intervals not less than 5'-0" apart. The seal element must meet or exceed the following performance criteria:

1. Tensile Strength (ASTM D3575): 21 psi
2. Elongation (ASTM D3575): 125 % +/- 20%
3. Density/Uncompressed (ASTM D3575): >10 lbs/ft2

I. Accessories: Manufacturer's standard anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

2.4 PRODUCTS - GENERAL

A. Provide each product from one manufacturer.

1. Provide expansion joint cover assembly designs, profiles, materials and configuration indicated, as required to accommodate joint size variations in adjacent surfaces, and anticipated movement.

B. Sustainable Construction Requirements: Not applicable.

2.5 SYSTEMS

A. Horizontal Joints

1. Building-to-Tower Joints at Lobby Floors (Not-Rated): Floor location, one continuous joint flush with top of slab.

a. The following system types are acceptable:

1) Hollow compression seal (gland) made from an extruded, thermoplastic rubber material (or equivalent material with proven record of in-service performance). When compressed into place this system provides an excellent seal against the intrusion of moisture and debris into an expansion joint gap.

2) Silicone-Coated, Preformed Compression Seal Expansion Joints: Silicone precoated, preformed, precompressed, self-expanding open-cell foam sealant manufactured from polyurethane foam and impregnated with a water-based, stabilized, polymer-modified

acrylic for adhesion by means of manufacturer's recommended adhesive system.

b. Cover Plate at Door Thresholds and Pedestrian Traffic Crossings: Specially designed and fabricated metal plate with eased edges designed to fasten to the floor on one side of joint and stay firmly seated on the adjacent floor (across the gap).

1) Material: Aluminum.

2) Finish: Manufacturer's standard non-slip finish.

2.6 FABRICATION

A. Fabricate Expansion Joint Cover Assemblies:

1. As complete assembly ready for installation.
2. In longest practicable lengths to minimize number of end joints.
3. With factory mitered corners where joint changes directions or abuts other materials.
   a. With closure materials and transition pieces, tee-joints, corners, curbs, cross-connections and other assemblies.
4. Seal Strip: Factory-formed and bonded to metal frames and anchor members.
5. Compression Seals: Fabricate from expanding foam as secondary seal and elastomeric sealant to sizes and profiles shown.

B. Floor-to-Floor Metal Plate Joints:

1. Frames: Metal, continuous on both sides of joint designed to support cover plate.
   a. Flush Design: Seating surface and raised floor rim to accommodate adjacent flooring.
   b. Anchorage: Concealed bolt and steel anchors for embedment in concrete.
2. Cover Plate: Metal, matching frames where exposed.
   a. Supported Load: 19.2 MPa (400 psf), minimum.
   b. Rattle-free due to traffic.
3. Fillers: Resilient material between raised rim of frame and edge of cover plate, where shown.
   a. No gaps or bulges over full design range joint movement.
4. Fire Barrier: As required for fire resistance rating.
5. Water Stop: Manufacturer's standard, continuous, full length of joint.

6. Seismic: As required by Code.

C. Floor-to-Wall Metal Plate Joints:

1. Frames: Metal, continuous on floor side of joint only.
   a. Provide wall side frame where required by manufacturer's design.
2. Cover Plates: Angle cover plates with countersunk flat-head exposed fasteners for securing cover plate to wall unless shown otherwise.
   a. Fastener Spacing: As recommended by manufacturer.
3. Joint Design: Match adjacent floor to floor design.
4. Fire Barrier: As required for fire resistance rating.
5. Water Stop: Manufacturer's standard, continuous, full length of joint.
6. Seismic: As required by Code.

D. Interior Wall Joint Cover Assemblies: Not used.

E. Exterior Wall Joint Assemblies: Not used.

F. Extruded Thermoplastic Rubber Joint Assemblies: Not Used.

G. Ceiling and Soffit Assemblies: Not Used.

H. Carbon Steel: NAAMM AMP 500, Galvanized G90.

I. Stainless Steel: NAAMM AMP 500, No. 2B bright finish.

J. Aluminum Anodized Finish: NAAMM AMP 500.

1. Clear Anodized Finish: AA-C22A41; Class I Architectural, 0.018 mm (0.7 mil) thick.

2.7 ACCESSORIES

A. General: Manufacturer's standard anchors, fasteners, set screws, spaces, protective coating, and filler materials, adhesive and other accessories required for installation.

B. Barrier Coating: ASTM D1187/D1187M.

C. Adhesives: Low pollutant-emitting, water based type recommended by adhered product manufacturer for each application.

D. Fasteners: Type and size recommended by expansion joint cover assembly manufacturer.

1. Exterior Applications: Stainless steel.
2. Fasteners for Aluminum: Stainless steel.
3. Other Applications: Galvanized steel or stainless steel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces, blockouts, and conditions under which the work of this Section is to be performed before installation, with Installer present, for compliance with requirements for installation tolerances, preparation and reinforcements, and/or other conditions affecting performance and timely completion of the work of this Section.

B. Complete any pre-construction requirements per the FIELD QUALITY CONTROL Article below.

C. Report all deviations from the Contract Documents and/or conditions detrimental to performance of the Work to the Architect in writing.

D. Proceed with installation only after unsatisfactory conditions have been corrected. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 PREPARATION

A. Examine and verify substrate suitability for product installation.

1. Provide items embedded in concrete and masonry in time for building into work without delaying work.

B. Protect existing construction and completed work from damage.

C. Surface Preparation

1. Prepare surfaces to receive EJCS assemblies and protect all surrounding areas as recommended by the Manufacturer or as directed by the Architect.
2. Remove dirt, dust and materials that will interfere with the proper and effective installation of the work of this Section. Protect all surrounding areas during cleaning operations. Allow surfaces to dry prior to installing subsequent Work.
3. Immediately prior to installation of System, clean the joint opening of all contaminants. Repair cracked, spalled, irregular or unsound joint surfaces using accepted industry practices for repair of the substrates in question. Remove protruding roughness to ensure joint sides are smooth. Ensure that there is sufficient depth to receive the full-depth of System being installed.

D. Horizontal Deck Joints Requiring Blockouts

1. Blockouts must be provided to the specified dimensions where indicated on the approved Shop Drawings and as otherwise acceptable

to the Manufacturer. Any edge raveling at the joint opening or spalls must be repaired using Manufacturer's recommended repair grout to provide a solid, square-edged blockout.

a. All proposed repair materials must be approved by the Architect prior to use.

2. Blockout substrates must be sandblasted clean of all contaminants and impurities immediately prior to the system installation to assure proper adhesion.
3. The membrane gland element must be unpackaged and laid in a relaxed position to relieve any temporary set from shipment packaging prior to placement. The pre-molded element must be wiped clean with a solvent solution recommended by the Manufacturer.
4. It is recommended that adjacent deck surfaces be taped off and protected to assure a clean, neat and professional installation.

3.3 INSTALLATION

A. General

1. Follow standard Manufacturer’s recommendation for installation of materials, taking into account ambient temperature conditions and joint width including any block-out dimensions. All installations for the Project must be made in strict accordance with the Manufacturer’s written instructions.
2. Do not install damaged components. Fit joints to produce hairline joints free of burrs and distortion. Anchor securely in place. Seal joints watertight.
3. Coordinate System installation with related Work to facilitate an optimized installation.
4. Install metallic components to prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

a. Where dissimilar metals are in contact with each other, protect against galvanic action by painting faying surfaces with primer, applying sealant or tape, or installing nonconductive spacers as recommended by Manufacturer for this purpose.

b. All metallic products mounted on concrete must have faying surfaces coated with bituminous mastic to prevent corrosion due

to cathodic reaction or, subject to Architect approval, suitable gasket/gasket washers must be provided.

B. Install products according to manufacturer's instructions and approved submittal drawings.
   1. When manufacturer's instructions deviate from Specifications, submit proposed resolution for Contracting Officer's Representative consideration.
C. Install anchorage devices and fasteners for securing expansion joint assemblies to in-place construction where anchors are not embedded in concrete and masonry.
   1. Secure with metal fasteners, type and size to suit application.
D. Perform cutting, drilling and fitting required for installation of expansion joint cover assemblies.
E. Install joint cover assemblies aligned and positioned in correct relationship to expansion joint opening and adjoining finished surfaces measured from established lines and levels.
   1. Allow for thermal expansion and contraction of metal to avoid buckling.
   2. Accommodate joint opening size at time of installation.
F. Locate anchors at interval recommended by manufacturer, but minimum 75 mm (3 inches) from each end, and, maximum 600 mm (24 inches) on centers.
G. Maintain continuity of expansion joint cover assemblies with end joints held to a minimum and metal members aligned mechanically using splice joints.
H. Cut and fit ends to accommodate thermal expansion and contraction of metal to avoid buckling of frames and cover plates.
I. Apply sealant where required to prevent water infiltration.
J. Cover Plates: Secure cover plate to concrete floor slab by utilizing manufacturer’s recommended anchoring system suitable for expected conditions.

3.4 TESTING

A. Horizontal Seal Testing: Each new horizontal joint seal installation must be tested once Contractor ascertains that all System components are fully-cured. Test installations by subjecting System to continuous hose steam and/or ponded water for a period not less than 8 hours.

Any leaking observed from areas below seal must be rectified by the Contractor and the test must be repeated for the repaired area until no leakage is observed. It is the responsibility of the Contractor to absolutely make certain that the joints are totally waterproofed.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Services

1. A qualified technical representative of the Manufacturer must:
   a. Provide technical assistance and guidance for installation of EJCS assemblies.
   b. Periodically inspect Work to ensure installation is proceeding in accordance with Manufacturer's designs, recommendations, instructions, and warranty requirements. Representative must submit written reports of each visit indicating observations, findings, and conclusions of inspection.
   c. Send reports to the Contractor, Architect and Owner. At a minimum, reports must indicate:
      1) Non-complying conditions and locations.
      2) Proposed repair methods for non-complying conditions.
      3) Successful and unsuccessful repair of non-complying conditions noted in previous inspection reports.
      4) Final certification(s).
2. Scheduling: Contractor must notify Manufacturer in timely manner to arrange for Manufacturer’s technical representative’s site visits to verify EJCS work is in accordance with Manufacturer’s requirements, and warranty requirements have been met.

3.6 CLEANING

A. Clean exposed surfaces of EJC systems and adjacent areas using materials and methods cleaners recommended by the manufacturer. Utilize test applications to verify cleaners that will not harm or attack the finish.

B. Remove excess adhesive before adhesive sets.

C. Clean exposed metal surfaces. Remove contaminants and stains.

3.7 PROTECTION

A. Cover floor joints with plywood where wheel traffic occurs before Substantial completion.

B. Remove protective covering when adjacent work areas are completed. Clean exposed surfaces in compliance with manufacture's printed instructions.

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DIVISION 08

SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Hollow metal doors hung in hollow metal frames at exterior locations.

1.2 RELATED WORK

A. Section 05 50 00, METAL FABRICATIONS: Frames fabricated of structural steel.

B. Section 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS: Aluminum frames entrance work.

C. Section 08 71 00, DOOR HARDWARE: Door Hardware:

D. Section 08 80 00, GLAZING: Glazing.

E. Security Monitors: Section 28 23 00, VIDEO SURVEILLANCE.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. American National Standard Institute (ANSI):

A250.8-2014.....Standard Steel Doors and Frames

C. ASTM International (ASTM):

A240/A240M-15b.....Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

A653/A653M-15.....Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip

A1008/A1008M-15.....Steel, Sheet, Cold-Rolled, Carbon, Structural, High Strength Low Alloy and High Strength Low Alloy with Improved Formability, Solution Hardened, and Bake Hardenable

B209-14.....Aluminum and Aluminum-Alloy Sheet and Plate

B209M-14.....Aluminum and Aluminum-Alloy Sheet and Plate (Metric)

B221-14.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

B221M-13.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)

D3656/D3656M-13.....Insect Screening and Louver Cloth Woven from Vinyl Coated Glass Yarns

E90-09.....Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

D. Federal Specifications (Fed. Spec.):

L-S-125B.....Screening, Insect, Nonmetallic

E. Master Painters Institute (MPI):

No. 18.....Primer, Zinc Rich, Organic

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

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

G. National Fire Protection Association (NFPA):

80-16.....Fire Doors and Other Opening Protectives

H. UL LLC (UL):

10C-09.....Positive Pressure Fire Tests of Door Assemblies

1784-15.....Air Leakage Tests of Door Assemblies and Other Opening Protectives

I. Department of Veterans Affairs

VA Physical Security and Resiliency Design Manual October 1, 2020

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submittal Drawings:

1. Show size, configuration, and fabrication and installation details.

C. Manufacturer's Literature and Data:

1. Description of each product.
2. Include schedule showing each door and frame requirements for openings.
3. Installation instructions.

D. Sustainable Construction Submittals:

1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.

E. Test reports: Certify products comply with specifications.

F. Qualifications: Substantiate qualifications comply with specifications.
   1. Manufacturer with project experience list.
G. Blast Design Calculations.
   1. Submit calculations for review and approval prepared by qualified blast consultant, with a minimum of 5 years of experience in design of blast resistant window systems, verifying door assembly including anchors comply with specified blast resistance performance. The magnitudes of the design threats W1, W2 and GP1, GP2 are defined in the Physical Security and Resiliency Design Standards Data Definitions which is a document separate from the referenced VA Security and Resiliency Design Manual. The Physical Security and Resiliency Design Standards Data Definitions are provided on a need-to-know basis by the structural blast specialist performing the blast design on VA projects. It is the responsibility of the delegated engineer responsible for the design of blast resistant doors to request and obtain the Physical Security and Resiliency Design Data Standard Data Definitions from the VA Office of Construction and Facilities Management (CFM). Any associated delays or increased costs due to failure to obtain this information will be borne by the contractor.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. Regularly manufactures specified products.
   2. Manufactured specified products with satisfactory service on five similar installations for minimum five years.
      a. Project Experience List: Provide contact names and addresses for completed projects.

1.6 DELIVERY

A. Fasten temporary steel spreaders across the bottom of each door frame before shipment.
B. Deliver products in manufacturer's original sealed packaging.
C. Mark packaging, legibly. Indicate manufacturer's name or brand, type, production run number, and manufacture date.
D. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.7 STORAGE AND HANDLING

A. Store products indoors in dry, weathertight facility.

B. Protect products from damage during handling and construction operations.

1.8 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE (NOT USED)

2.2 MATERIALS

A. Stainless Steel: ASTM A240/A240M; Type 304.

B. Sheet Steel: ASTM A1008/A1008M, cold-rolled.

C. Galvanized Sheet Steel: ASTM A653.

2.3 PRODUCTS - GENERAL

A. Provide hollow metal doors and frames from one manufacturer.

B. Sustainable Construction Requirements:

1. Steel Recycled Content: 30 percent total recycled content, minimum.
2. Stainless Steel Recycled Content: 70 percent total recycled content, minimum.
3. Aluminum Recycled Content: 50 percent total recycled content, minimum.

2.4 HOLLOW METAL DOORS

A. Hollow Metal Doors: ANSI A250.8; 44 mm (1-3/4 inches) thick. See drawings for sizes and designs.

1. Exterior Doors: Level 3 and Physical Performance Level A, extra-heavy duty; Model 2, seamless at all locations.

B. Door Faces:

1. Exterior Doors: Stainless steel.

C. Door Cores:

1. Exterior Doors: Polystyrene or polyurethane.

2.5 HOLLOW METAL FRAMES

A. Hollow Metal Frames: ANSI A250.8; face welded. See drawings for sizes and designs.

B. Frame Materials:

1. Exterior Frames: Stainless steel.

2.6 FABRICATION

A. Hardware Preparation: ANSI A250.8; for hardware specified in Section 08 71 00, DOOR HARDWARE.

B. Hollow Metal Door Fabrication:

1. Close top edge of exterior doors flush and seal to prevent water intrusion.
2. Fill spaces between vertical steel stiffeners with insulation.

C. Hollow Metal Frame Fabrication:

1. Fasten mortar guards to back of hardware reinforcements.
2. Concealed Closers in Head Frame: 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.
3. Terminated Stops: ANSI A250.8.
4. Panel Opening Frames:
   a. Provide integral stop on exterior, corridor, or secure side of door.
   b. Design rabbet width and depth to receive glazing material or panel shown on drawings.
5. Frame Anchors:
   a. Floor anchors:
      1) Provide extension type floor anchors to compensate for depth of floor fills.
      2) Provide 1.3 mm (0.053 inch) thick steel clip angles welded to jamb and drilled to receive floor fasteners.
      3) Provide 50 mm by 50 mm by 9 mm (2 inch by 2 inch by 3/8 inch) clip angle for lead lined frames, drilled for floor fasteners.
      4) Provide mullion 2.3 mm (0.093 inch) thick steel channel anchors, drilled for two floor fasteners and frame anchor screws.
      5) Provide continuous 1 mm (0.042 inch) thick steel rough bucks drilled for floor fasteners and frame anchor screws for sill sections.
         a) Space floor bolts50 mm (24 inches) on center.

b. Jamb anchors:
   1) Place anchors on jambs:
      a) Near top and bottom of each frame.
      b) At intermediate points at maximum 600 mm (24 inches) spacing.
   2) Form jamb anchors from steel minimum 1 mm (0.042 inch) thick.
   3) Anchors set in masonry: Provide adjustable anchors designed for friction fit against frame and extended into masonry minimum 250 mm (10 inches). Provide one of following types:
      a) Wire Loop Type: 5 mm (3/16 inch) diameter wire.
      b) T-Shape type.
      c) Strap and stirrup type: Corrugated or perforated sheet steel.
   4) Anchors for stud partitions: Provide tabs for securing anchor to sides of studs. Provide one of the following:
      a) Welded type.
      b) Lock-in snap-in type.
   5) Anchors for frames set in prepared openings:
      a) Steel pipe spacers 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.
      b) Drill jamb stop and strap spacers for 6 mm (1/4 inch) flat head bolts to pass through frame and spacers.
      c) Two piece frames: Subframe or rough buck drilled for 6 mm (1/4 inch) bolts.
   6) Anchors for observation windows and other continuous frames set in stud partitions.
      a) Weld clip anchors to sills and heads of continuous frames over 1200 mm (4 feet) long.
      b) Space maximum 600 mm (24 inches) on centers.
   7) Modify frame anchors to fit special frame and wall construction.

D. Louver Fabrication:
   1. Fabricate louvers as complete units.

2. Weld stationary blades to frames.
3. Factory install louvers in door cutouts, welded to door.

E. Louver Screen Fabrication:
1. Fabricate frame to hold wire fabric in channel with retaining bar anchor and to mount on surface of door with screws.
2. Do not lap frame over louver opening.
3. Miter frame corners and join by concealed mechanical fastenings extending about 57 mm (2-1/4 inches) into ends of each member.
4. Drill frame and doors for screw attachment:
5. Space screws 50 mm (2 inches) from end of each leg of frame and maximum 300 mm (12 inches) on center.
6. Insect Screens: Fasten insect screens to interior side of doors with retaining bar against door and not exposed to view.
7. Wire Guards: Fasten wire guard to exterior side of door with retaining bar against door and not exposed to view.

2.7 FINISHES

A. Stainless Steel: NAAMM AMP 500; No. 4 polished finish.
1. Blend welds to match adjacent finish.

B. Finish exposed surfaces after fabrication.

C. Aluminum Anodized Finish: NAAMM AMP 500.
1. Clear Anodized Finish: AA-C22A41; Class I Architectural, 0.018 mm (0.7 mil) thick.
2. Color Anodized Finish: AA-C22A42 or AA-C22A44; Class I Architectural, 0.018 mm (0.7 mil) thick.
3. Clear Anodized Finish: AA-C22A31; Class II Architectural, 0.01 mm (0.4 mil) thick.
4. Color Anodized Finish: AA-C22A32 or AA-C22A34; Class II Architectural, 0.01 mm (0.4 mil) thick.

2.8 ACCESSORIES

A. Primers: ANSI A250.8.

B. Barrier Coating: ASTM D1187/D1187M.

C. Welding Materials: AWS D1.1/D1.1M, type to suit application.

D. Clips Connecting Members and Sleeves: Match door faces.

E. Fasteners: stainless steel.
1. Metal Framing: Steel drill screws.

2. Masonry and Concrete: Expansion bolts.

F. Anchors: stainless steel.

G. Galvanizing Repair Paint: MPI No. 18.

H. Insulation: Unfaced mineral wool.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.

B. Protect existing construction and completed work from damage.

C. Apply barrier coating to metal surfaces in contact with cementitious materials to minimum 0.7 mm (30 mils) dry film thickness.

3.2 INSTALLATION - GENERAL

A. Install products according to manufacturer's instructions and approved submittal drawings.

1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.
2. Install fire doors and frames according to NFPA 80.
3. Install smoke control doors and frames according to NFPA 105.

3.3 FRAME INSTALLATION

A. Apply barrier coating to concealed surfaces of frames built into masonry.

B. Plumb, align, and brace frames 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 when shipping spreader is removed.
3. Where construction permits concealment, leave shipping spreaders in place after installation, otherwise remove spreaders when frames are set and anchored.
4. Remove wood spreaders and braces when walls are built and jamb anchors are secured.

C. Floor Anchors:

1. Anchor frame jambs to floor with two expansion bolts.
   a. Lead Lined Frames: Use 9 mm (3/8 inch) diameter bolts.
   b. Other Frames: Use 6 mm (1/4 inch) diameter bolts.

2. Power actuated drive pins are acceptable to secure frame anchors to concrete floors.

D. Jamb Anchors:

1. Masonry Walls:
   a. Embed anchors in mortar.
   b. Fill space between frame and masonry with grout or mortar as walls are built.
2. Metal Framed Walls: Secure anchors to sides of studs with two fasteners through anchor tabs.
3. Prepared Masonry and Concrete Openings:
   a. Direct Securement: 6 mm (1/4 inch) diameter expansion bolts through spacers.
   b. Subframe or Rough Buck Securement:
      1) 6 mm (1/4 inch) diameter expansion bolts on 600 mm (24 inch) centers.
      2) Power activated drive pins on 600 mm (24 inches) centers.
   c. Secure two-piece frames to subframe or rough buck with machine screws on both faces.

E. Touch up damaged factory finishes.

1. Repair galvanized surfaces with galvanized repair paint.
2. Repair painted surfaces with touch up primer.

3.4 DOOR INSTALLATION

A. Install doors plumb and level.

B. Adjust doors for smooth operation.

C. Touch up damaged factory finishes.

1. Repair galvanized surfaces with galvanized repair paint.
2. Repair painted surfaces with touch up primer.

3.5 CLEANING

A. Clean exposed door and frame surfaces. Remove contaminants and stains.

3.6 PROTECTION

A. Protect doors and frames from construction operations.

B. Remove protective materials immediately before acceptance.

C. Repair damage.

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SECTION 08 41 13
ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aluminum-framed entrances and storefronts.

1.2 RELATED REQUIREMENTS

A. Glass and Glazing: Section 08 80 00, GLAZING.

B. Hardware: Section 08 71 00, DOOR HARDWARE.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. American Architectural Manufacturers Associations (AAMA):

2603-15.....Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels

2604-13.....Performance Requirements and Test Procedures or High Performance Organic Coatings on Architectural Extrusions and Panels

2605-13.....Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels

C. American Welding Society (AWS):

D1.2/D1.2M-14.....Structural Welding Code - Aluminum

D. ASTM International (ASTM):

A240/A240M-20.....Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

B209-14.....Aluminum and Aluminum-Alloy Sheet and Plate.

B209M-14.....Aluminum and Aluminum-Alloy Sheet and Plate (Metric)

B221-14.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

B221M-13.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)

D1187/D1187M-97(2018)...Asphalt-Base Emulsions for Use as Protective Coatings for Metal

E283/E283M-19.....Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

E330/E330M-14.....Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference

E331-00(2016).....Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference

E1886-19.....Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missiles and Exposes to Cyclic Pressure Differentials

E1996-17.....Performance of Exterior Windows, Curtain Walls, Doors, and impact Protective Systems Impacted by Windborne Debris in Hurricanes

F468-16.....Nonferrous Bolts, Hex Cap Screws, and Studs for General Use

F593-17.....Stainless Steel Bolts, Hex Cap Screws, and Studs

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

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

F. National Fenestration Rating Council (NFRC):

500-14(E1A0).....Determining Fenestration Product Condensation Resistance Values

G. Department of Veterans Affairs(VA):

1. VA Physical Security and Resiliency Design Manual October 1, 2020

1.4 PREINSTALLATION MEETINGS

A. Conduct preinstallation meeting minimum 30 days before beginning Work of this section.

1. Required Participants:

a. Contracting Officer's Representative.

b. Contractor.

c. Installer.

d. Manufacturer's field representative.

e. Other installers responsible for adjacent and intersecting work.

2. Meeting Agenda: Distribute agenda to participants minimum 3 days before meeting.
   a. Installation schedule.
   b. Installation sequence.
   c. Preparatory work.
   d. Protection before, during, and after installation.
   e. Installation.
   f. Terminations.
   g. Transitions and connections to other work.
   h. Other items affecting successful completion.
3. Document and distribute meeting minutes to participants to record decisions affecting installation.

1.5 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submittal Drawings: Minimum 1 to 2 (half size) scale.
   1. Show size, configuration, and fabrication and installation details.
   2. Show anchorage and reinforcement.
   3. Show interface and relationship to adjacent work, including thermal, air, and water barrier continuity.

C. Manufacturer's Literature and Data:
   1. Description of each product.
   2. Doors, each type.
   3. Entrance and Storefront construction.
   4. Installation instructions.
   5. Warranty.

D. Samples:
   1. Door Corner Section: Minimum 450 mm x 450 mm (18 x 18 inches) for each specified door type, showing head rail and hinge stile, door closer reinforcement, and internal reinforcement .
   2. Aluminum Anodized Finish: wo sample extrusions minimum 150 mm (6 inches) long for each specified color in sets of three showing maximum color range.

E. Sustainable Construction Submittals:

1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.

F. Test reports: Certify each product complies with specifications.

G. Certificates: Certify each product complies with specifications.
   1. Certify anodized finish thickness.

H. Qualifications: Substantiate qualifications comply with specifications.
   1. Manufacturer with project experience list.
   2. Installer with project experience list.
   3. Welders and welding procedures.

I. Delegated Design Drawings and Calculations: Signed and sealed by responsible design professional.
   1. Show location and magnitude of loads applied to building structural frame.
   2. Identify deviations from details shown on drawings.
   3. Blast Design Calculations
      a. Submit calculations for review and approval prepared by qualified blast consultant, with a minimum of 5 years of experience in design of blast resistant window systems, verifying storefront assembly including anchors comply with specified blast resistance performance. The magnitudes of the design threats W1, W2 and GP1, GP2 are defined in the Physical Security and Resiliency Design Standards Data Definitions which is a document separate from the referenced VA Security and Resiliency Design Manual. The Physical Security and Resiliency Design Standards Data Definitions are provided on a need-to-know basis by the structural engineer blast specialist performing the blast design on VA projects. It is the responsibility of the delegated engineer responsible for the design of blast resistant entrances and storefronts to request and obtain the Physical Security and Resiliency Design Data Standard Data Definitions from the VA Office of Construction and Facilities Management (CFM). Any associated delays or increased costs due to failure to obtain this information will be borne by the contractor.

J. Operation and Maintenance Data:
   1. Care instructions for each exposed finish product.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. Regularly manufactures specified products.
   2. Manufactured specified products with satisfactory service on five similar installations for minimum five years.
      a. Project Experience List: Provide contact names and addresses for completed projects.

B. Installer Qualifications: Manufacturer authorized representative.
   1. Regularly installs specified products.
   2. Installed specified products with satisfactory service on five similar installations for minimum five years.
      a. Project Experience List: Provide contact names and addresses for completed projects.

C. Welders and Welding Procedures Qualifications: AWS D1.2/D1.2M.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver products in manufacturer's original sealed packaging.

B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, production run number, and manufacture date.

C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

D. Store products indoors in dry, weathertight conditioned facility.

E. Protect products from damage during handling and construction operations.

1.8 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

B. Manufacturer's Warranty: Warrant painted finish against material and manufacturing defects.
   1. Warranty Period: 20 years.

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

A. Delegated Design: Prepare submittal documents including design calculations and drawings signed and sealed by registered design professional, licensed in state where work is located.
   1. Minor deviations to details shown on drawings to accommodate manufacturer’s standard products may be accepted by Contracting

Officer's Representative when deviations do not affect design concept and specified performance.

B. Design aluminum framed entrances and storefronts complying with specified performance:

1. Wind Load Resistance: ASCE/SEI 7; Design criteria as indicated on Drawings when tested according to ASTM E330/E330M.
   a. Wind Load: as indicated in drawings.
   b. Maximum Deflection: 1/175 of span, maximum with minimum 1.65 safety factor.
2. Thermal Movement: Accommodate ambient temperature range of 67 degrees C (120 degrees Fahrenheit).
3. Condensation Resistance: NFRC 500.
   a. Fixed Framing: 45 CRF, minimum.
4. Water Resistance: ASTM E331; No uncontrolled penetration at380 Pa (8 pounds/square foot), minimum, pressure differential.
5. Fixed Framing Air Infiltration Resistance: ASTM E283; 0.30 liter/second/square meter (0.06 cubic foot/minute/square foot), maximum at 300 Pa (6.24 pounds/square foot), minimum, pressure differential.
6. Entrance Doors Air Infiltration Resistance: ASTM E283; maximum allowable at 75 Pa (1.57 pounds/square foot), minimum, pressure differential.
   a. Single Doors: 2.5 liter/second/square meter (0.5 cubic foot/minute/square foot).
   b. Paired Doors: 6 liter/second/square meter (1.2 cubic foot/minute/square foot).

2.2 MATERIALS

A. Aluminum:

1. Sheet Metal: ASTM B209M (ASTM B209), minimum 1.6 mm (0.063 inch) thick.
2. Extrusions: ASTM B221M (ASTM B221).
   a. Framing: Minimum 3 mm (0.125 inch) wall thickness.
   b. Glazing Beads, Moldings, and Trim: Minimum 1.25 mm (0.050 inch) thick.
3. Alloy 6063 temper T5 for doors, door frames, and transoms.

4. Alloy 6061 temper T6 for guide tracks for sliding doors and other extruded structural members.
   a. Color Anodized Aluminum: Provide aluminum alloy required to produce specified color.

B. Stainless Steel: ASTM A240/A240M; Type 302 or Type 304.

C. Thermal Break: Manufacturer standard low conductive material retarding heat flow in the framework, where insulating glass is scheduled.

2.3 PRODUCTS - GENERAL

A. Provide aluminum framed entrances and storefronts from one manufacturer and from one production run .

B. Provide aluminum entrances, systems from same manufacturer.

C. Sustainable Construction Requirements:
   1. Aluminum Recycled Content: 50 percent total recycled content, minimum.

2.4 FRAMES

A. Framing Members: Extruded aluminum, thermally broken .

B. Stops: Provide integral fixed stops and glass rebates and snap-on removable stops.

C. Provide concealed screws, bolts and other fasteners.

D. Secure cover boxes to frames in back of lock strike cutouts.

2.5 STILE AND RAIL DOORS

A. Stiles and Rails: Extruded aluminum, thermally broken.
   1. Thickness: 45 mm (1-3/4 inch).
   2. Stiles and Head Rails: 90 mm (3-1/2 inches) wide.
   3. Bottom Rails: 250 mm (10 inches) wide.

B. Single-Acting Doors:
   1. Bevel: 3 mm (1/8 inch) at lock, hinge, and meeting stile edges.
   2. Clearances: 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.

C. Glass Rebates: Integral with stiles and rails.

D. Glazing Beads: Extruded aluminum, 1.3 mm (0.050 inch) thick. Integral with stiles and rails or applied type, snap-fit secured.

E. Stile and Rail Joints: Welded or interlocking dovetail joints between stiles and rails.

1. Clamp door together through top and bottom rails with 9 mm (3/8 inch) primed steel tie rod extending into stiles, and having self-locking nut and washer at both ends.
2. Reinforce stiles and rails to prevent door distortion when tie rods are tightened.
3. Provide compensating spring-type washer under each nut for stress relief.
4. Construct joints to remain rigid and tight when door is operated.

F. Weather-stripping: Removable, woven pile type (silicone-treated) weather-stripping attached to aluminum or vinyl holder.
1. Make slots for applying weather-stripping integral with doors and door frame stops.
2. Apply continuous weather-stripping to heads, jambs, bottom, and meeting stiles of doors and frames so doors swing freely and close positively.

2.6 FLUSH PANEL DOORS

2.7 FABRICATION

A. Form metal parts and fit and assemble joints, except joints designed to accommodate movement. Seal joints to resist air infiltration and water penetration.

B. Welding:
1. Make welds without distorting and discoloring exposed surfaces.
2. Clean and dress welds. Remove welding flux and weld spatter.

C. Prepare and reinforce doors and frames for hardware and accessories.
1. Coordinate preparation with specified hardware. See Section 08 71 00, DOOR HARDWARE.
2. Fabricate reinforcement from stainless steel plates.
   a. Hinge and pivot reinforcing: Minimum 4.5 mm (0.179 inch) thick.
   b. Lock Face, Flush Bolts, Concealed Holders, Concealed and Surface Mounted Closers Reinforcing: Minimum 2.6 mm (0.104 inch) thick.
   c. Other Surface Mounted Hardware Reinforcing: Minimum 1.5 mm (0.059 inch) thick.
3. Where concealed hardware is specified, provide space, cutouts, and reinforcement for installation and secure fastening.

D. Factory assembled doors.

2.8 FINISHES

A. Aluminum Anodized Finish: NAAMM AMP 500.
   1. Color Anodized Finish: AA-C22A42 or AA-C22A44; Class I Architectural, 0.018 mm (0.7 mil) thick.

2.9 ACCESSORIES

A. Dielectric Tape: Plastic, non-absorptive, with pressure sensitive adhesive; 0.18 to 0.25 mm (7 to 10 mils) thick.
B. Barrier Coating: ASTM D1187/D1187M.
C. Welding Materials: AWS D1.2/D1.2M, type to suit application.
D. Fasteners:
   1. Aluminum: ASTM F468, Alloy 2024.
   2. Stainless Steel: ASTM F593, Alloy Groups 1, 2 and 3.
E. Anchors: Aluminum or stainless steel; type to suit application.
F. Galvanizing Repair Paint: MPI No. 18.
G. Touch-Up Paint: Match shop finish.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.
   1. Coordinate floor closer installation recessed into concrete slabs.
   2. Coordinate anchor installation built into masonry and concrete.
B. Protect existing construction and completed work from damage.
C. Clean substrates. Remove contaminants capable of affecting subsequently installed product's performance.
D. Apply dielectric tape or barrier coating to aluminum surfaces in contact with dissimilar metals and cementitious materials to minimum 0.7 mm (30 mils) dry film thickness.

3.2 INSTALLATION - GENERAL

A. Install products according to manufacturer's instructions and approved submittal drawings.
   1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.
B. Install aluminum framed entrances and storefronts plumb and true, in alignment and to lines shown on drawings.
C. Anchor frames to adjoining construction at heads, jambs and sills.
D. Provide concealed aluminum clips to connect adjoining frame sections.

E. Install door hardware and hang doors. See Section 08 71 00, DOOR HARDWARE.

F. Adjust doors and hardware uniform clearances and proper operation.

G. Touch up damaged factory finishes.

1. Repair galvanized surfaces with galvanized repair paint.
2. Repair painted surfaces with touch up primer.

H. Tolerances:

1. Variation from Plumb, Level, Warp, and Bow: Maximum 3 mm in 3 meters (1/8 inch in 10 feet).
2. Variation from Plane: Maximum3 mm in 3.65 meters (1/8 inch in 12 feet); 6 mm (1/4 inch) over total length.
3. Variation from Alignment: Maximum 1.5 mm (1/16 inch) in-line offset and maximum3 mm (1/8 inch) corner offset.
4. Variation from Square: Maximum 3 mm (1/8 inch) diagonal measurement differential.

3.3 PROTECTION, CLEANING AND REPAIRING

A. Clean exposed aluminum and glass surfaces. Remove contaminants and stains.

B. Protect aluminum-framed entrances and storefronts from construction operations.

C. Remove protective materials immediately before acceptance.

D. Repair damage.

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SECTION 08 44 13
GLAZED ALUMINUM CURTAIN WALLS

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies glazed aluminum curtain wall system.
   1. Thermally isolated, pressure equalized on interior.
   2. Type: Stick system to include following:
      a. Glass, Glass Spandrel Panels.
      b. Integral reinforcing.
      c. Closures, trim, subsills and flashings.
      d. Column covers.
      e. Fasteners, anchors, and related reinforcement.

1.2 RELATED WORK:

A. Sustainable Design Requirements: Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.
B. Structural Steel: Section 05 12 00, STRUCTURAL STEEL FRAMING.
C. Miscellaneous Metal Members: Section 05 50 00, METAL FABRICATIONS.
D. Joint Sealants: Section 07 92 00, JOINT SEALANTS.
E. Aluminum and Glass Hinged Entry Doors and Storefront Construction: Section 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS.
F. Glazing: Section 08 80 00, GLAZING.
G. Louvers and Wall Vents: Section 08 90 00, LOUVERS AND VENTS.

1.3 QUALITY ASSURANCE:

A. Qualifications:
   1. Approval by Contracting Officer Representative (COR) 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 similar type and for projects of equivalent size.
      b. Installer: Manufacturer approved in writing who has continuously installed glazed aluminum curtain walls systems of similar type and for projects of equivalent size for previous five (5) years.
      c. Manufacturer is to provide technical field representation at project site, as a minimum, at start of project, during middle,

towards end of project, and during field testing of field mockup panel.

d. Testing Laboratory: Contractor is to retain AAMA accredited commercial testing laboratory to perform tests specified. Submit information regarding testing laboratory's facilities and qualifications of technical personnel to perform testing specified in this section.

e. Product Options: Information on construction documents 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 (1) 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 is to be performed by certified welders qualified in accordance with AWS D1.2/D1.2M, 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 COR to demonstrate the following:

a. Clear understanding of construction documents.

b. Onsite inspection and acceptance of structural and pertinent structural details relating to curtain wall system.

c. Coordination of work of various trades involved. Conference is to 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 are to be resolved and confirmed in writing.

1.4 SUBMITTALS:

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

B. Sustainable Design Submittals, as described below:

1. Volatile organic compounds per volume as specified in PART 2 - PRODUCTS.

C. 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, performance test data and instructions for installation, and adjustments.
4. Recommendations for maintenance and cleaning of exterior surfaces.

D. Shop Drawings:

1. Show elevations of glazed curtain wall system at 1:48 (1/4 inch) scale, metal gages, details of construction, methods of anchorage, flashing and coping details, glazing details, firestopping assemblies at edge of slabs and details of installation. Show interfaces and relationships to work of other trades and continuity with adjacent thermal, weather, air and vapor barriers.
2. Submit for curtain wall system and accessories. Tentative approval of drawings is to be received before fabrication of mock-up. Final approval of drawings is to be deferred pending approval of mock-up and accessories.
3. Operation and Maintenance Manuals
   a. Submit cleaning and maintenance instructions.

E. Samples:

1. Submit pairs of samples of each specified color and finish on 305 mm (12-inch) long section by width of each tubular, or extruded shape section or 305 mm by 305 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 (1) sample minimum 305 mm by 305 mm (12 inches by 12 inches). In lieu of submitting separate samples for corner section,

intermediate section, and panel, one (1) composite sample incorporating all components and features listed may be submitted.

3. Where normal color variations are anticipated, include two (2) or more units of each sample indicating extreme limits of color variations.

F. Glass:

1. Specified in Section 08 80 00, GLAZING.

G. Quality Assurance Submittals:

1. Design Data:
   a. Submit structural and thermal calculations for complete wall assembly. Structural calculations and design shop drawings signed and sealed by a Professional Engineer (PE).
2. Factory Test Reports:
   a. Test Reports: Submit 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. 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. Submit appropriate testing reports for specific tests indicated below:
      1) Deflection and structural tests.
      2) Water penetration tests.
      3) Air infiltration tests.
      4) Delamination tests.
      5) Thermal conductance tests.

H. Manufacturer's Certificates:

1. Submit Certificates of Compliance, with specification requirements, for the following:
   a. Metal extrusions.
   b. Metal accessories.

c. Statement(s) that aluminum has been given specified thickness of anodizing or organic coating finish.

d. Statement(s) indicating manufacturers and installers conform with qualifications as specified.

e. Submit list (minimum of five (5)) of equivalent project size installations for both manufacturer and installer.

I. 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.

J. Welders: Submit welders qualifications as specified.

K. Testing Laboratory: Submit Testing Laboratory qualifications.

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 sequence.

C. Prior to shipment from factory, place knocked-down lineal curtain wall 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 to permit easy access for inspection and handling. Sealing and caulking compounds, including handling, is to be in accordance with requirements of Section 07 92 00, JOINT SEALANTS.

1.6 PROJECT CONDITIONS:

A. 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):

501.8-14.....Test Method for Determination of Resistance of Human Impact of Window Systems Intended for Use in Psychiatric Applications

MCWM-1-89.....Metal Curtain Wall Manual

CW 10-12.....Care and Handling of Architectural Aluminum from Shop to Site

CW 11-85.....Design Windloads for Buildings and Boundary Layer Wind Tunnel Testing

CW 13-85.....Structural Sealant Glazing Systems (A Design Guide)

TIR A11-04.....Maximum Allowable Deflection of Framing Systems for Building Cladding Components of Design Wind Loads

501-05.....Methods of Test for Exterior Walls

503-08.....Field Testing of Metal Storefronts, Curtain walls and Sloped Glazing Systems

2605-13.....High Performance Organic Coatings on Architectural Extrusions and Panels

C. American Society of Civil Engineers (ASCE):

ASCE 7-10.....Minimum Design Loads for Buildings and Other Structures

D. ASTM International (ASTM):

A36/A36M-12.....Structural Steel

A123/A123M-13.....Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

A193/A193M-14a.....Alloy-Steel and Stainless Steel Bolting Materials for High Temperature Service

A307-14.....Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength

B209-14.....Aluminum and Aluminum Alloy Sheet and Plate

B209M-14 .....Aluminum and Aluminum Alloy Sheet and Plate (Metric)

B211-12 .....Aluminum and Aluminum Alloy Bar, Rod, Wire

B211M-12 .....Aluminum and Aluminum Alloy Bar, Rod, Wire (Metric)

B221-14 .....Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Shapes and Tubes

B221M-13 .....Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Shapes and Tubes (Metric)

B316/B316M-10 .....Aluminum and Aluminum Alloy Rivet and Cold-Heading, Wire, and Rods

C578-14a .....Rigid Cellular Polystyrene Thermal Insulation

C612-14 .....Mineral Fiber Block and Board Thermal Insulation

C920-14a .....Elastomeric Joint Sealants

C794-10 .....Standard Test Method for Adhesion-In-Peel of Elastomeric Joint Sealants.

C1193-13 .....Guide for Use of Joint Sealants

C1363-11 .....Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus

C1521-13 .....Practice for Evaluating Adhesion of Installed Weatherproofing

D1037-12 .....Evaluating the Properties of Wood-Base Fibers and Particle Panel Materials

E84-14 .....Surface Burning Characteristics of Building Materials

E330/E330M-14 .....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/D.1.2M-06(R2014)..Structural Welding Code-Aluminum

F. Military Specifications (MIL):

MIL-C-18480.....(Rev. B) Coating Compound, Bituminous Solvent, Coal Tar Base

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

500 Series (2006).....Metal Finishes Manual

H. Society for Protective Coatings (SSPC)

Paint 25-97 (2004).....Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel Type 1 and Type II

Paint 20-82 (2019).....Zinc-Rich Coating, Type I-Inorganic, and Type II-Organic.

I. U.S. Veterans Administration:

Physical Security Design Manual for VA Facilities (VAPSDG); Life Safety Protected

Physical Security Design Manual for VA Facilities (VAPSDG); Mission Critical Facilities

Architectural Design Manual for VA Facilities (VASDM)

J. Environmental Protection Agency (EPA):

40 CFR 59(2014).....National Volatile Organic Compound Emission Standards for Consumer and Commercial Products

1.8 WARRANTY:

A. Construction Warranty: Comply with FAR clause 52.246-21, “Warranty of Construction”.

B. Manufacturer Warranty: Manufacturer shall warranty their glazed aluminum curtain wall system for a minimum of five (5) years from date of installation and final acceptance by the Government. Submit manufacturer warranty.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION:

A. Design Requirements:

1. Curtain Wall System: Tubular aluminum sections with thermal break condition self-supporting and supplementary support framing, factory prefinished, vision glass, glass, and spandrel infill; related flashings, anchorage and attachment devices.
2. Basis of Design intent is to match existing curtain wall system manufacturer’s system or, where existing manufacturer is not able to be identified, match the profiles, jointing, color and appearance of the existing curtain wall system.
3. System Assembly: Site assembled.
4. Maximum wall framing member deflection, in a direction normal to plane of wall: 1/175 of its clear span or 20 mm (3/4 inch), whichever is less, when designed in accordance with requirements of AAMA TIR A11 and tested in accordance with ASTM E330/E330M.
5. Maximum Framing Member Permanent Deformation: 0.2 percent of its clear span when tested in accordance with ASTM E330/E330M for a minimum test period of 10 seconds at 1.5 times design wind pressures indicated as part of structural drawing wind load requirements.

B. No glass breakage, or damage to fasteners, hardware or accessories is permitted due to deformation design requirements indicated.

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 AAMA MCWM-1.

b. Obtain all components of curtain wall system, including framing, spandrel panels, and entrances from single 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. Coordinate continuity with adjacent thermal, weather, air and vapor barriers.

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.

C. Calculations: Submit professionally prepared calculations to indicate how design requirements for structural loading, thermal, and other performance criteria have been satisfied.

2.2 PERFORMANCE REQUIREMENTS:

A. Delegated Design: Engage a qualified Professional Engineer, to design glazed aluminum curtain walls.

B. Conform with system performance requirements specified.

C. Provide curtain wall components tested in accordance with requirements below and meeting performance requirements specified:

1. 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.
2. Seismic Loads: Design and size components to withstand seismic loads and sway displacement as calculated in accordance with New York State Building code. Provide with the following tolerances.
3. Water Penetration:
   a. No water penetration is to 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.
4. 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.

5. Deflections Test: ASTM E330/E330M, Procedure B:

a. No member is to 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, is to 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 is to be minimum 1.5 mm (1/16 inch).

2.3 MATERIALS:

A. Extruded Aluminum Framing Members: ASTM B221M (B221); 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 (B209); 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 A36/A36M.

D. Primer: TS TT-P-645; red, for shop application and field touch-up.

E. Fasteners:

1. For Exterior Cap Retainers: ASTM A193/A193M B8 300 series, stainless steel screws.

2. For Framework Connections: ASTM B211M (B211) 2024-T4 aluminum, ASTM A193/A193M B8 300 series, stainless steel, and ASTM B316 aluminum rivets, as required by connection.

3. For Anchoring Glazed Aluminum Curtain Wall to Support Structure: ASTM A307 zinc plated steel fasteners.

F. Shims: Metal or plastic.

G. Joint Sealants and Accessories:

1. In accordance with requirements specified in Section 07 92 00, JOINT SEALANTS.

2. Structural Flush Glazed Joints: High performance silicone sealant applied in accordance with manufacturer's recommendations.
3. Non-structural Flush Glazed Joints and Weather Seal Joints: Silicone sealants applied in accordance with manufacturer's recommendations.
4. Comply with recommendations of sealant manufacturer for specific sealant selections.
5. Provide only sealants that have been tested per ASTM C794 to exhibit adequate adhesion to samples of glass and metal equivalent to those required for project.
6. Exposed Metal to Metal Joints: Silicone sealant selected from manufacturer’s standard colors.

H. Glazing Materials:
1. As specified under Section 08 80 00, GLAZING.
2. Glazing Gaskets:
   a. Exterior: Continuous EPDM gaskets at each glass and spandrel panel.
   b. Interior: Continuous, closed cell PVC foam sealant tape, sealed at corners.
3. Glass Sizes and Clearances:
   a. Accommodate up to 25 mm (1 inch) glazing.
   b. Sizes indicated are nominal. Verify actual sizes required by measuring frames. Coordinate dimensions for glass and glass holding members to meet applicable minimum clearances as recommended by glass manufacturer. Do not nip glass to remove flares or to reduce oversized dimensions. All cutting is to occur in factory.
4. Glass Setting Materials:
   a. Provide head bead and drive wedge required for glass installation to suit curtain wall system in accordance with manufacture’s recommendations.

2.4 FABRICATION:

A. Curtain wall components are to be of materials and thickness indicated in construction documents. Details indicated are representative of required design and profiles. Maintain sightlines. Unless specifically indicated or specified otherwise, methods of fabrication and assembly

are to be at discretion of curtain wall manufacturer. Perform fitting and assembling of components in shop to maximum extent practicable. Anchorage devices are to permit adjustment in three directions. No exposed fasteners are permitted.

B. Joints: Joints exceeding +1.5 mm (+1/16") are to 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 are to 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 A36/A36M steel shapes as required for strength and mullion size limitations, hot dip galvanized after fabrication in accordance with ASTM A123/A123M.

2.5 METAL FINISHES:

A. In accordance with NAAMM AMP500 series.

B. Anodized Aluminum:

1. AA-C22A41 Chemically etched medium matte, with clear anodic coating, Class 1 Architectural, 0.7-mil thick (min.).

C. Shop and Touch-Up Primer for Steel Components: SSPC Paint 25 zinc oxide.

D. Touch-Up Primer for galvanized Steel Surfaces: SSPC Paint 20 zinc rich.

E. Concealed Steel Items: Galvanized in accordance with ASTM A123/A123M to 610 gm/sq. m (2.0 oz./sq. ft.). Primed with iron oxide paint.

F. Apply one (1) 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 are to receive a protective coating of bituminous paint for prevention of electrolytic action and corrosion.

3.3 INSTALLATION:

A. Install and erect glazed curtain wall system and all components 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 3657 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 (2) 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: Are to be in accordance with requirements of Section 07 92 00, JOINT SEALANTS.
2. Surfaces to be primed and sealed are to 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 are to 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 are to 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 is to be uniformly smooth and free of wrinkles and, unless indicated otherwise, is to 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 (4) hours, but at no time is this amount exceed 19 liters (5 gallons).

4. Apply primer to masonry, concrete, wood, and other surfaces as recommended by sealant manufacturer. Do not apply primer to surfaces which will be exposed after sealant work 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 in construction documents. 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 solvent approved by sealant and curtain wall manufacturers. Upon completion of sealing, remove remaining smears, stains, and other soiling, and leave work in clean neat condition.

J. Glass:

1. Refer to Section 08 80 00, GLAZING, and drawings for glass types. Install in accordance with manufacturer's recommendations as modified herein.
2. Before installing glass, inspect sash and frames to receive glass for defects such as dimensional variations, glass clearances, open joints, or other conditions that will prevent satisfactory glass installation. Do not proceed with installation until defects have been corrected.
3. Clean sealing surfaces at perimeter of glass and sealing surfaces of rebates and stop beads before applying glazing compound, sealing compound, glazing tape, or gaskets.
4. Use only approved solvents and cleaning agents recommended by compound or gasket manufacturer and by curtain wall manufacturer.
5. Provide sashes designed for outside glazing.
6. Provide continuous snap in glazing beads to suit glass as specified.

7. Insulating and tempered glass, and glass of other types that exceed 2540 mm (100 united inches) in size: Provide void space at head and jamb to allow glass to expand or move without exuding sealant. Provide perimeter frames and ventilator sections with glazing rebates for unobstructed glazing surface 19 mm (3/4 inch) in height. Glazing rebate surfaces must be sloped to shed water.
8. Provide adequate means to weep incidental water and condensation away from sealed edges of insulated glass units and out of wall system. Provide weeping of lock-strip gaskets in accordance with recommendation of glass manufacturer.

K. Metal Copings:
1. Refer to Section 07 60 00, FLASHING AND SHEET METAL for requirements of metal copings when they are not a part of glazed curtain wall system work.
2. Coordinate curtain wall installation with metal coping detail on construction documents. Provide watertight seal to meet criteria set forth in this section regarding air and water penetration.

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 FIELD QUALITY CONTROL:

A. Testing Agency: Engage an AAMA accredited commercial qualified independent testing and inspecting agency to perform field

quality-control tests specified, and to prepare test reports: Submit information regarding testing laboratory's facilities and qualifications of technical personnel to COR for approval.

B. Conduct field check test for water leakage on designated wall areas after erection to comply with AAMA MCWM-1. Conduct test on two (2) wall areas, two (2) bays wide by two (2) stories high where directed. Conduct test and take necessary remedial action as directed by COR.

C. Test Specimen:
   1. Test specimen is to include curtain wall assembly and construction. Test chamber is to be affixed to exterior side of test specimen and test is to be conducted using positive static air pressure.
   2. Test specimens are to be selected by COR after curtain wall system has been installed in accordance with construction documents.

D. Sealant Adhesion Tests: Test installed sealant, in presence of sealant manufacturer’s field representative, in a minimum of two (2) areas and as follows:
   1. Test weatherseal sealant adhesion to joint substrates according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.

E. Air Infiltration: Test glazed aluminum curtain wall system according to AAMA 503, which requires testing according to ASTM E783 and to values indicated below, whichever is more stringent.
   1. Field air leakage testing is not required for continuous curtain wall systems.
   2. Static-Air-Pressure Differential: 75 Pa (1.57 lbf/sq. ft.) minimum.
   3. Air Leakage: 0.03 L/s per sq. m (0.06 cfm/sq. ft.) of surface maximum.

F. Water Penetration: Test glazed aluminum curtain wall system for compliance with requirements according to AAMA 503, which requires testing according to ASTM E1105.
   1. Uniform Static-Air-Pressure Difference: 20 percent of positive design wind load, but not less than 479 Pa (10 psf). No uncontrolled water is to be present.

G. Retesting:
   1. Should system fail field test, system may be modified or repaired, and retested.

2. Should system fail second field test, system may be additionally modified or repaired, and retested.
3. All modifications and repairs made to tested areas are to be recorded, and same modifications and repairs made to all system and adjacent construction on project.
4. Should second test fail, COR may require testing of additional areas of the curtain wall.

H. Rejection:

1. Failure of any of specimens to meet test requirements of third test is cause for rejection of wall system and adjacent construction on project.

3.6 PROTECTION:

A. After installation, protect windows, and other exposed surfaces from disfiguration, contamination, contact with harmful materials, and from other construction hazards that will interfere with their operation, or damage their appearance or finish. Protection methods are to be in accordance with recommendations of product manufacturers or of respective trade association. Remove paper or tape factory applied protection immediately after installation. Clean surfaces of mortar, plaster, paint, smears of sealants, and other foreign matter to present neat appearance and prevent fouling of operation. In addition, wash with a stiff fiber brush, soap and water, and thoroughly rinse. Where surfaces become stained or discolored, clean or restore finish in accordance with recommendations of product manufacturer or respective trade association.

- - - END - - -

SECTION 08 71 00
DOOR HARDWARE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Door hardware and related items necessary for complete installation and operation of doors.

1.2 RELATED WORK

A. Caulking: Section 07 92 00 JOINT SEALANTS.

B. Application of Hardware: Section 08 11 13, HOLLOW METAL DOORS AND FRAMES, Section 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

C. Painting: Section 09 91 00, PAINTING.

D. Card Readers: Section 28 13 11, PHYSICAL ACCESS CONTROL SYSTEMS.

E. Electrical: Division 26, ELECTRICAL.

F. Fire Detection: Section 28 31 00, FIRE DETECTION AND ALARM.

1.3 GENERAL

A. All hardware shall comply with ABAAS, (Architectural Barriers Act Accessibility Standard) unless specified otherwise.

B. Provide rated door hardware assemblies where required by most current version of the International Building Code (IBC).

C. Hardware for Labeled Fire Doors and Exit Doors: Conform to requirements of NFPA 80 for labeled fire doors and to NFPA 101 for exit doors, as well as to other requirements specified. Provide hardware listed by UL, except where heavier materials, large size, or better grades are specified herein under paragraph HARDWARE SETS. In lieu of UL labeling and listing, test reports from a nationally recognized testing agency may be submitted showing that hardware has been tested in accordance with UL test methods and that it conforms to NFPA requirements.

D. Hardware for application on metal and wood doors and frames shall be made to standard templates. Furnish templates to the fabricator of these items in sufficient time so as not to delay the construction.

E. The following items shall be of the same manufacturer, except as otherwise specified:

1. Mortise locksets.
2. Hinges for hollow metal and wood doors.
3. Surface applied overhead door closers.
4. Exit devices.
5. Floor closers.

1.4 WARRANTY

A. Automatic door operators shall be subject to the terms of FAR Clause 52.246-21, except that the Warranty period shall be two years in lieu of one year for all items except as noted below:

1. Locks, latchsets, and panic hardware: 5 years.
2. Door closers and continuous hinges: 10 years.

1.5 MAINTENANCE MANUALS

A. In accordance with Section 01 00 00, GENERAL REQUIREMENTS Article titled "INSTRUCTIONS", furnish maintenance manuals and instructions on all door hardware. Provide installation instructions with the submittal documentation.

1.6 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Submit 6 copies of the schedule per Section 01 33 23. Submit 2 final copies of the final approved schedules to VAMC Locksmith as record copies (VISN Locksmith if the VAMC does not have a locksmith).

B. Hardware Schedule: AHC certified hardware consultant to prepare and submit hardware schedule in the following form:

Hardware Item	Quantity	Size	Reference Publication Type No.	Finish	Mfr. Name and Catalog No.	Key Control Symbols	UL Mark (if fire rated and listed)	ANSI/BHMA Finish Designation

C. Samples and Manufacturers' Literature:

1. Samples: All hardware items (proposed for the project) that have not been previously approved by Builders Hardware Manufacturers Association shall be submitted for approval. Tag and mark all items with manufacturer's name, catalog number and project number.
2. Samples are not required for hardware listed in the specifications by manufacturer's catalog number, if the contractor proposes to use the manufacturer's product specified.

D. Certificate of Compliance and Test Reports: Submit certificates that hardware conforms to the requirements specified herein. Certificates shall be accompanied by copies of reports as referenced. The testing shall have been conducted either in the manufacturer's plant and certified by an independent testing laboratory or conducted in an independent laboratory, within four years of submittal of reports for approval.

1.7 DELIVERY AND MARKING

A. Deliver items of hardware to job site in their original containers, complete with necessary appurtenances including screws, keys, and instructions. Tag one of each different item of hardware and deliver to COR for reference purposes. Tag shall identify items by Project Specification number and manufacturer's catalog number. These items shall remain on file in COR's office until all other similar items have been installed in project, at which time the COR will deliver items on file to Contractor for installation in predetermined locations on the project.

1.8 PREINSTALLATION MEETING

A. Convene a 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. ASTM International(ASTM):

F883-13.....Padlocks

E2180-18.....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)

A156.5-14.....Cylinders and Input Devices for Locks.

A156.6-05.....Architectural Door Trim

A156.8-05.....Door Controls-Overhead Stops and Holders

A156.11-14.....Cabinet Locks

A156.12-05 .....Interconnected Locks and Latches

A156.13-05.....Mortise Locks and Latches Series 1000

A156.14-07 .....Sliding and Folding Door Hardware

A156.15-06.....Release Devices-Closer Holder, Electromagnetic and Electromechanical

A156.16-08.....Auxiliary Hardware

A156.17-04 .....Self-Closing Hinges and Pivots

A156.18-06.....Materials and Finishes

A156.20-06 .....Strap and Tee Hinges, and Hasps

A156.21-09.....Thresholds

A156.22-05.....Door Gasketing and Edge Seal Systems

A156.23-04.....Electromagnetic Locks

A156.24-03.....Delayed Egress Locking Systems

A156.25-07 .....Electrified Locking Devices

A156.26-06.....Continuous Hinges

A156.28-07 .....Master Keying Systems

A156.29-07 .....Exit Locks and Alarms

A156.30-03 .....High Security Cylinders

A156.31-07 .....Electric Strikes and Frame Mounted Actuators

A156.36-10.....Auxiliary Locks

A250.8-03.....Standard Steel Doors and Frames

D. National Fire Protection Association (NFPA):

80-10.....Fire Doors and Other Opening Protectives

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 only three-knuckle hinges, except five-knuckle where the required hinge type is not available in a three-knuckle version (e.g., some types of swing-clear hinges). The following types of butt hinges shall be used for the types of doors listed, except where otherwise specified:
   1. Exterior Doors: Type A2112/A5112 for doors 900 mm (3 feet) wide or less and Type A2111/A5111 for doors over 900 mm (3 feet) wide. Hinges for exterior outswing doors shall have non-removable pins. Hinges for exterior fire-rated doors shall be of stainless steel material.
   2. Interior Doors: Type A8112/A5112 for doors 900 mm (3 feet) wide or less and Type A8111/A5111 for doors over 900 mm (3 feet) wide. Hinges for doors exposed to high humidity areas (shower rooms, toilet rooms, kitchens, janitor rooms, etc. shall be of stainless steel material.

B. Provide quantity and size of hinges per door leaf as follows:
   1. Doors up to 1210 mm (4 feet) high: 2 hinges.
   2. Doors 1210 mm (4 feet) to 2260 mm (7 feet 5 inches) high: 3 hinges minimum.
   3. Doors greater than 2260 mm (7 feet 5 inches) high: 4 hinges.
   4. Doors up to 900 mm (3 feet) wide, standard weight: 114 mm x 114 mm (4-1/2 inches x 4-1/2 inches) hinges.
   5. Doors over 900 mm (3 feet) to 1065 mm (3 feet 6 inches) wide, standard weight: 127 mm x 114 mm (5 inches x 4-1/2 inches).
   6. Doors over 1065 mm (3 feet 6 inches) to 1210 mm (4 feet), heavy weight: 127 mm x 114 mm (5 inches x 4-1/2 inches).
   7. Provide heavy-weight hinges where specified.
      8. At doors weighing 330 kg (150 pounds) 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. Provide with non-removable pin (hospital tip option) at lockable outswing doors.
   3. Where required to clear adjacent casing, trim, and wall conditions and allow full door swing, provide wide throw hinges of minimum width required.
   4. Provide with manufacturer’s cut-outs for separate mortised power transfers and/or mortised automatic door bottoms where they occur.
   5. Where thru-wire power transfers are integral to the hinge, provide hinge with easily removable portion to allow easy access to wiring connections.
   6. 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.

2.4 OVERHEAD CLOSERS

A. Conform to ANSI A156.4, Grade 1.
B. Closers shall conform to the following:
   1. The closer shall have minimum 50 percent adjustable closing force over minimum value for that closer and have adjustable hydraulic back check effective between 60 degrees and 85 degrees of door opening.
   2. Where specified, closer shall have hold-open feature.

3. Size Requirements: Provide multi-size closers, sizes 1 through 6, except where multi-size closer is not available for the required application.
4. Material of closer body shall be forged or cast.
5. Arm and brackets for closers shall be steel, malleable iron or high strength ductile cast iron.
6. Where closers are exposed to the exterior or are mounted in rooms that experience high humidity, provide closer body and arm assembly of stainless steel material.
7. Closers shall have full size metal cover; plastic covers will not be accepted.
8. Closers shall have adjustable hydraulic back-check, separate valves for closing and latching speed, adjustable back-check positioning valve, and adjustable delayed action valve.
9. Provide closers with any accessories required for the mounting application, including (but not limited to) drop plates, special soffit plates, spacers for heavy-duty parallel arm fifth screws, bull-nose or other regular arm brackets, longer or shorter arm assemblies, and special factory templating. Provide special arms, drop plates, and templating as needed to allow mounting at doors with overhead stops and/or holders.
10. Closer arms or backcheck valve shall not be used to stop the door from overswing, except in applications where a separate wall, floor, or overhead stop cannot be used.
11. Provide parallel arm closers with heavy duty rigid arm.
12. Where closers are to be installed on the push side of the door, provide parallel arm type except where conditions require use of top jamb arm.
13. Provide all surface closers with the same body attachment screw pattern for ease of replacement and maintenance.
14. All closers shall have a 1 ½" (38mm) minimum piston diameter.

2.5 FLOOR CLOSERS AND FLOOR PIVOT SETS

A. Comply with ANSI A156.4. Provide stainless steel floor plates for floor closers and floor pivots, except where metal thresholds occur. Provide cement case for all floor closers. Floor closers specified for fire doors shall comply with Underwriters Laboratories, Inc., requirements

for concealed type floor closers for classes of fire doors indicated on drawings. Hold-open mechanism, where required, shall engage when door is opened 105 degrees, except when door swing is limited by building construction or equipment, the hold-open feature shall engage when door is opened approximately 90 degrees. The hold-open mechanism shall be selectable on/off by turning a screw through the floor plate. Floor closers shall have adjustable hydraulic back-check, adjustable close speed, and adjustable latch speed. Provide closers with delayed action where a hold-open mechanism is not required. Floor closers shall be multi-sized. Single acting floor closers shall also have built in dead stop. Where required, provide closers with special cement cases appropriate for shallow deck installation or where concrete joint lines run through the floor blockout. At offset-hung doors installed in deep reveals, provide special closer arm and spindle to allow for installation. Where stone or terrazzo is applied over the floor closer case, provide closer without floor plate and with extended spindle (length as required) and special cover pan (depth as required) to allow closer to be accessed without damaging the material applied over the closer. Pivots for non-labeled doors shall be cast, forged or extruded brass or bronze.

B. Where floor closer appears in hardware set provide the following as applicable.
   1. Double Acting Floor Closers: Type C06012.
   2. Single Acting Floor Closer: Type C06021 (center pivoted). (Intermediate pivot is not required).
   3. Single Acting Floor Closers: Type C06041 (offset pivoted).
   4. Single Acting Floor Closer for Labeled Fire Doors: Type C06051 (offset pivoted).
   5. Single Acting Floor Closers For Lead Lined Doors: Type C06071 (offset pivoted).

2.6 DOOR STOPS

A. Conform to ANSI A156.16.

B. Provide door stops wherever an opened door or any item of hardware thereon would strike a wall, column, equipment or other parts of building construction. For concrete, masonry or quarry tile construction, use expansion shields for mounting door stops.

C. Where cylindrical locks with turn pieces or pushbuttons occur, equip wall bumpers Type L02251 (rubber pads having concave face) to receive turn piece or button.

D. Provide floor stops (Type L02141 or L02161) in office areas; Type L02121 x 3 screws into floor elsewhere. Wall bumpers, where used, must be installed to impact the trim or the door within the leading half of its width. Floor stops, where used, must be installed within 4-inches of the wall face and impact the door within the leading half of its width.

E. Where drywall partitions occur, use floor stops, Type L02141 or L02161 in office areas, Type L02121 elsewhere.

F. Provide stop Type L02011, as applicable for exterior doors. At outswing doors where stop can be installed in concrete, provide stop mated to concrete anchor set in 76mm (3-inch) core-drilled hole and filled with quick-setting cement.

G. Omit stops where floor mounted door holders are required and where automatic operated doors occur.

H. Provide appropriate roller bumper for each set of doors (except where closet doors occur) where two doors would interfere with each other in swinging.

I. Provide appropriate door mounted stop on doors in individual toilets where floor or wall mounted stops cannot be used.

J. Provide overhead surface applied stop Type C02541, ANSI A156.8 on patient toilet doors in bedrooms where toilet door could come in contact with the bedroom door.

K. Provide door stops on doors where combination closer magnetic holders are specified, except where wall stops cannot be used or where floor stops cannot be installed within 4-inches of the wall.

L. Where the specified wall or floor stop cannot be used, provide concealed overhead stops (surface-mounted where concealed cannot be used).

2.7 OVERHEAD DOOR STOPS AND HOLDERS

A. Conform to ANSI Standard A156.8. Overhead holders shall be of sizes recommended by holder manufacturer for each width of door. Set overhead holders for 110 degree opening, unless limited by building construction or equipment. Provide Grade 1 overhead concealed slide type: stop-only at rated doors and security doors, hold-open type with exposed hold-open on/off control at all other doors requiring overhead door stops.

2.8 FLOOR DOOR HOLDERS

A. Conform to ANSI Standard A156.16. Provide extension strikes for Types L01301 and L01311 holders where necessary.

2.9 LOCKS AND LATCHES

A. Conform to ANSI A156.2. Locks and latches for doors 45 mm (1-3/4 inch) thick or over shall have beveled fronts. Lock cylinders shall have not less than seven pins. Cylinders for all locksets shall be removable core type. Cylinders shall be furnished with construction removable cores and construction master keys. Cylinder shall be removable by special key or tool. Construct all cores so that they will be interchangeable into the core housings of all mortise locks, rim locks, cylindrical locks, and any other type lock included in the Great Grand Master Key System. Disassembly of lever or lockset shall not be required to remove core from lockset. All locksets or latches on double doors with fire label shall have latch bolt with 19 mm (3/4 inch) throw, unless shorter throw allowed by the door manufacturer’s fire label. Provide temporary keying device or construction core to allow opening and closing during construction and prior to the installation of final cores.

B. In addition to above requirements, locks and latches shall comply with following requirements:

1. Mortise Lock and Latch Sets: Conform to ANSI/BHMA A156.13. Mortise locksets shall be series 1000, minimum Grade 2. All locksets and latchsets, except on designated doors in Psychiatric (Mental Health) areas, shall have lever handles fabricated from cast stainless steel. Provide sectional (lever x rose) lever design matching [_____]. No substitute lever material shall be accepted. All locks and latchsets shall be furnished with 122.55 mm (4-7/8-inch) curved lip strike and wrought box. At outswing pairs with overlapping astragals, provide flat lip strip with 21mm (7/8-inch) lip-to-center dimension. Lock function F02 shall be furnished with emergency tools/keys for emergency entrance. All lock cases installed on lead lined doors shall be lead lined before applying final hardware finish. Furnish armored fronts for all mortise locks. Where mortise locks are installed in high-humidity locations or where exposed to the exterior on both sides of the opening, provide non-ferrous mortise lock case.

2. Cylindrical Lock and Latch Sets: levers shall meet ADA (Americans with Disabilities Act) requirements. Cylindrical locksets shall be series 4000 Grade I. All locks and latchsets shall be furnished with 122.55 mm (4-7/8-inch) curved lip strike and wrought box. At outswing pairs with overlapping astragals, provide flat lip strip with 21mm (7/8-inch) lip-to-center dimension. Provide lever design to match design selected by Architect or to match existing lever design. Where two turn pieces are specified for lock F76, turn piece on inside knob shall lock and unlock inside knob, and turn piece on outside knob shall unlock outside knob when inside knob is in the locked position. (This function is intended to allow emergency entry into these rooms without an emergency key or any special tool.)
3. Auxiliary locks shall be as specified under hardware sets and conform to ANSI A156.36.
4. Locks on designated doors in Psychiatric (Mental Health) areas shall be paddle type with arrow projection covers and be UL Listed. Provide these locks with paddle in the down position on both sides of the door. Locks shall be fabricated of wrought stainless steel.

2.10 PUSH-BUTTON COMBINATION LOCKS

A. ANSI/BHMA A156.5, Grade 1. Battery operated pushbutton entry.

B. Construction: Heavy duty mortise lock housing conforming to ANSI/BHMA A156.13, Grade 1. Lever handles and operating components in compliance with the ABAAS and the ADA Accessibility Guidelines. Match lever handles of locks and latchsets on adjacent doors.

C. Special Features: Key override to permit a master keyed security system and a pushbutton security code activated passage feature to allow access without using the entry code.

1. (101mm) from the underside of the frame head stop.

2.11 ELECTRIC STRIKES

A. ANSI/ BHMA A156.31 Grade 1.

B. General: Use fail-secure electric strikes at fire-rated doors.

2.12 KEYS

A. Stamp all keys with change number and key set symbol. Furnish keys in quantities as follows:

Locks/Keys	**Quantity**
Cylinder locks	2 keys each

Locks/Keys	**Quantity**
Cylinder lock change key blanks	100 each different key way
Master-keyed sets	6 keys each
Grand Master sets	6 keys each
Great Grand Master set	5 keys
Control key	2 keys

B. Psychiatric keys shall be cut so that first two bittings closest to the key shoulder are shallow to provide greater strength at point of greatest torque.

2.13 KEY CABINET

A. ANSI Standard A156.11. Provide key cabinet made of cold rolled, 1.2 mm (0.0478 inch) thick furniture steel electro-welded. Doors shall have "no sag" continuous brass-pin piano type hinge and be equipped with chrome plated locking door handles, hook cam and mechanical pushbutton door lock. Key Cabinet and Key Control System shall accommodate all keys for this project plus 25 percent. Provide minimum number of multiple cabinets where a single cabinet of largest size will not accommodate the required number of keys.

B. Key tags shall consist of two sets: Permanent self-locking and loan key snaphook type with tag colors as follows: Red fiber marker of the permanent self-locking type approximately 32 mm (1-1/4 inch) in diameter engraved with the legend "FILE KEY MUST NOT BE LOANED." Also furnish for each hook a white cloverleaf key marker with snap-hooks engraved with the legend "LOAN KEY."

C. The manufacturer of the lock cylinders and locks shall attach a key tag to keys of each lock cylinder and shall mark thereon the respective item number and key change number. Provide each group of keys in a key gathering envelope (supplied by Key Cabinet Manufacturer) in which the lock manufacturer shall include the following information: Item number, key change number and door number. The contractor shall furnish the Key Cabinet Manufacturer the hardware and keying schedules and change keys.

D. The Key Cabinet Manufacturer shall set up a three-way cross index system, including master keys, listing the keys alphabetically, the hooks numerically and the key changes numerically on different colored

index cards. Index cards shall be typewritten and inserted in a durable binder. Attach the keys to the two sets of numbered tags supplied with the cabinet. (The permanent tag and the loan key tag). Instruct the owner in proper use of the system. Install cabinet as directed by the COR.

2.14 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) or 305 mm (12 inches) high. Mop plates shall be 152 mm (6 inches) high. Both kick and mop plates shall be minimum 1.27 mm (0.050 inches) thick. Provide kick and mop plates beveled on all 4 edges (B4E). On push side of doors where jamb stop extends to floor, make kick plates 38 mm (1-1/2 inches) less than width of door, except pairs of metal doors which shall have plates 25 mm (1 inch) less than width of each door. Extend all other kick and mop plates to within 6 mm (1/4 inch) of each edge of doors. Kick and mop plates shall butt astragals. For jamb stop requirements, see specification sections pertaining to door frames.
3. Kick plates and/or mop plates are not required on following door sides:
   a. Armor plate side of doors;
   b. Exterior side of exterior doors;
   c. Closet side of closet doors;
   d. Both sides of aluminum entrance doors.
4. Armor plates for doors are listed under Article "Hardware Sets". Armor plates shall be thickness as noted in the hardware set, 875 mm (35 inches) high and 38 mm (1-1/2 inches) less than width of doors, except on pairs of metal doors. Provide armor plates beveled on all 4 edges (B4E). Plates on pairs of metal doors shall be 25 mm (1 inch) less than width of each door. Where top of intermediate rail of door is less than 875 mm (35 inches) from door bottom, extend armor plates to within 13 mm (1/2 inch) of top of intermediate rail. On doors equipped with panic devices, extend armor plates to within 13 mm (1/2 inch) of panic bolt push bar.

5. Where louver or grille occurs in lower portion of doors, substitute stretcher plate and kick plate in place of armor plate. Size of stretcher plate and kick plate shall be 254 mm (10 inches) high.
6. Provide stainless steel edge guards where so specified at wood doors. Provide mortised type instead of surface type except where door construction and/or ratings will not allow. Provide edge guards of bevel and thickness to match wood door. Provide edge guards with factory cut-outs for door hardware that must be installed through or extend through the edge guard. Provide full-height edge guards except where door rating does not allow; in such cases, provide edge guards to height of bottom of typical lockset armor front. Forward edge guards to wood door manufacturer for factory installation on doors.

2.15 EXIT DEVICES

A. Conform to ANSI Standard A156.3. Exit devices shall be Grade 1; type and function are specified in hardware sets. Provide flush with finished floor strikes for vertical rod exit devices in interior of building. Trim shall have cast satin stainless steel lever handles of design similar to locksets, unless otherwise specified. Provide key cylinders for keyed operating trim and, where specified, cylinder dogging.

B. Surface vertical rod panics shall only be provided less bottom rod; provide fire pins as required by exit device and door fire labels. Do not provide surface vertical rod panics at exterior doors.

C. Concealed vertical rod panics shall be provided less bottom rod at interior doors, unless lockable or otherwise specified; provide fire pins as required by exit device and door fire labels. Where concealed vertical rod panics are specified at exterior doors, provide with both top and bottom rods.

D. Where removable mullions are specified at pairs with rim panic devices, provide mullion with key-removable feature.

E. At non-rated openings with panic hardware, provide panic hardware with key cylinder dogging feature.

F. Exit devices for fire doors shall comply with Underwriters Laboratories, Inc., requirements for Fire Exit Hardware. Submit proof of compliance.

2.16 FLUSH BOLTS (LEVER EXTENSION)

A. Conform to ANSI A156.16. Flush bolts shall be Type L24081 unless otherwise specified. Furnish proper dustproof strikes conforming to ANSI A156.16, for flush bolts required on lower part of doors.

B. Lever extension manual flush bolts shall only be used at non-fire-rated pairs for rooms only accessed by maintenance personnel.

C. Face plates for cylindrical strikes shall be rectangular and not less than 25 mm by 63 mm (1 inch by 2-1/2 inches).

D. Friction-fit cylindrical dustproof strikes with circular face plate may be used only where metal thresholds occur.

E. Provide extension rods for top bolt where door height exceeds 2184 mm (7 feet 2 inches).

2.17 FLUSH BOLTS (AUTOMATIC)

A. Conform to ANSI A156.3. Dimension of flush bolts shall conform to ANSI A115. Bolts shall conform to Underwriters Laboratories, Inc., requirements for fire door hardware. Flush bolts shall automatically latch and unlatch. Furnish dustproof strikes conforming to ANSI A156.16 for bottom flushbolt. Face plates for dustproof strike shall be rectangular and not less than 38 mm by 90 mm (1-1/2 by 3-1/2 inches).

B. At interior doors, provide auto flush bolts less bottom bolt, unless otherwise specified, except at wood pairs with fire-rating greater than 20 minutes; provide fire pins as required by auto flush bolt and door fire labels.

2.18 DOOR PULLS WITH PLATES

A. Conform to ANSI A156.6. Pull Type J401, 152 mm CTC (6 inches CTC) length by 19 mm (3/4 inches) diameter minimum with plate Type J302, 90 mm by 381 mm (3-1/2 inches by 15 inches), unless otherwise specified. Provide pull with projection of 57.2 mm (2 1/4 inches) minimum and a clearance of 38.1 mm (1 1/2 inches) minimum. Cut plates of door pull plate for cylinders, or turn pieces where required.

2.19 PUSH PLATES

A. Conform to ANSI A156.6. Metal, Type J302, 203 mm (8 inches) wide by 406.4 mm (16 inches) high. Provide metal Type J302 plates 102 mm (4 inches) wide by 406.4 mm (16 inches) high where push plates are specified for doors with stiles less than 203 mm (8 inches) wide. Cut plates for cylinders, and turn pieces where required.

2.20 COMBINATION PUSH AND PULL PLATES

A. Conform to ANSI 156.6. Type J303, stainless steel 3 mm (1/8 inch) thick, 80 mm (3-1/3 inches) wide by 800 mm (16 inches) high), top and bottom edges shall be rounded. Secure plates to wood doors with 38 mm (1-1/2 inch) long No. 12 wood screws. Cut plates for turn pieces, and cylinders where required. Pull shall be mounted down.

2.21 COORDINATORS

A. Conform to ANSI A156.16. Coordinators, when specified for fire doors, shall comply with Underwriters Laboratories, Inc., requirements for fire door hardware. Coordinator may be omitted on exterior pairs of doors where either door will close independently regardless of the position of the other door. Coordinator may be omitted on interior pairs of non-labeled open where open back strike is used. Open back strike shall not be used on labeled doors. Paint coordinators to match door frames, unless coordinators are plated. Provide bar type coordinators, except where gravity coordinators are required at acoustic pairs. For bar type coordinators, provide filler bars for full width and, as required, brackets for push-side surface mounted closers, overhead stops, and vertical rod panic strikes.

2.22 THRESHOLDS

A. Conform to ANSI A156.21, mill finish extruded aluminum, except as otherwise specified. In existing construction, thresholds shall be installed in a bed of sealant with ¼-20 stainless steel machine screws and expansion shields. In new construction, embed aluminum anchors coated with epoxy in concrete to secure thresholds. Furnish thresholds for the full width of the openings.

B. For thresholds at elevators entrances see other sections of specifications.

C. At exterior doors and any interior doors exposed to moisture, provide threshold with non-slip abrasive finish.

D. Provide with miter returns where threshold extends more than 12 mm (0.5 inch) beyond face of frame.

2.23 WEATHERSTRIPS (FOR EXTERIOR DOORS)

A. Conform to ANSI A156.22. Air leakage shall not to exceed 0.50 CFM per foot of crack length (0.000774m^3/s/m).

2.24 MISCELLANEOUS HARDWARE

A. Access Doors (including Sheet Metal, Screen and Woven Wire Mesh Types): Except for fire-rated doors and doors to Temperature Control Cabinets, equip each single or double metal access door with Lock Type E07213, conforming to ANSI A156.11. Key locks as directed. Ship lock prepaid to the door manufacturer. Hinges shall be provided by door manufacturer.

B. Cylinders for Various Partitions and Doors: Key cylinders same as entrance doors of area in which partitions and door occur, except as otherwise specified. Provide cylinders to operate locking devices where specified for following partitions and doors:

1. Folding doors and partitions.
2. Wicket door (in roll-up door assemblies).
3. Slide-up doors.
4. Swing-up doors.
5. Fire-rated access doors-Engineer's key set.
6. Doors from corridor to electromagnetic shielded room.
7. Day gate on vault door.

C. Mutes: Conform to ANSI A156.16. Provide door mutes or door silencers Type L03011 or L03021, depending on frame material, of white or light gray color, on each steel or wood door frame, except at fire-rated frames, lead-lined frames and frames for sound-resistant, lightproof and electromagnetically shielded doors. Furnish 3 mutes for single doors and 2 mutes for each pair of doors, except double-acting doors. Provide 4 mutes or silencers for frames for each Dutch type door. Provide 2 mutes for each edge of sliding door which would contact door frame.

2.25 THERMOSTATIC TEMPERATURE CONTROL VALVE CABINETS

A. Where lock is shown, equip each cabinet door (metal) with lock Type E06213, conforming to ANSI A156.36. Key locks in Key Sets approved by Contracting Officer. See mechanical drawings and specifications for location of cabinets.

B. Cabinet manufacturer shall supply the hinges, bolts and pulls. Ship locks to cabinet manufacturer for installation.

2.26 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. Pivots: Match door trim.
3. Door Closers: Factory applied paint finish. Dull or Satin Aluminum color.
4. Thresholds: Mill finish aluminum.
5. Cover plates for floor hinges and pivots: 630.
6. Other primed steel hardware: 600.

D. Hardware Finishes for Existing Buildings: U.S. Standard finishes shall match finishes of hardware in (similar) existing spaces except where otherwise specified.

E. Special Finish: Exposed surfaces of hardware for dark bronze anodized aluminum doors shall have oxidized oil rubbed bronze finish (dark bronze) finish on door closers shall closely match doors.

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.

2.27 BASE METALS

A. Apply specified U.S. Standard finishes on different base metals as following:

Finish	**Base Metal**
652	Steel
626	Brass or bronze
630	Stainless steel

PART 3 - EXECUTION

3.1 HARDWARE HEIGHTS

A. For existing buildings locate hardware on doors at heights to match existing hardware. The Contractor shall visit the site, verify location of existing hardware and submit locations to VA COR for approval.

B. For new buildings locate hardware on doors at heights specified below, with all hand-operated hardware centered within 864 mm (34 inches) to 1200 mm (48 inches), unless otherwise noted:

C. Hardware Heights from Finished Floor:

1. Exit devices centerline of strike (where applicable) 1024 mm (40-5/16 inches).
2. Locksets and latch sets centerline of strike 1024 mm (40-5/16 inches).
3. Deadlocks centerline of strike 1219 mm (48 inches).
4. Hospital arm pull 1168 mm (46 inches) to centerline of bottom supporting bracket.
5. Centerline of door pulls to be 1016 mm (40 inches).
6. Push plates and push-pull shall be 1270 mm (50 inches) to top of plate.
7. Push-pull latch to be 1024 mm (40-5/16 inches) to centerline of strike.
8. Locate other hardware at standard commercial heights. Locate push and pull plates to prevent conflict with other hardware.

3.2 INSTALLATION

A. Closer devices, including those with hold-open features, shall be equipped and mounted to provide maximum door opening permitted by building construction or equipment. Closers shall be mounted on side of door inside rooms, inside stairs, and away from corridors . At exterior doors, closers shall be mounted on interior side. Where closers are mounted on doors they shall be mounted with hex 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	125 mm (5 inches)

Door Thickness	Door Width	Hinge Height
	not more than 1200 mm (4 feet)	
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:

Door Description	Number butts
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 Medical Center Director along with the bitting list. Also a copy of the invoice shall be sent to the COR for his records.) Installation of locks which do not meet specified keying requirements shall be

considered sufficient justification for rejection and replacement of all locks installed on project.

3.3 FINAL INSPECTION

A. Installer to provide letter to VA Resident/Project Engineer that upon completion, installer has visited the Project and has accomplished the following:

1. Re-adjust hardware.
2. Evaluate maintenance procedures and recommend changes or additions, and instruct VA personnel.
3. Identify items that have deteriorated or failed.
4. Submit written report identifying problems.

3.4 DEMONSTRATION

A. Demonstrate efficacy of mechanical hardware and electrical, and electronic hardware systems, including adjustment and maintenance procedures, to satisfaction of Resident/Project Engineer and VA Locksmith.

3.5 HARDWARE SETS

A. Following sets of hardware correspond to hardware symbols shown on drawings. Only those hardware sets that are shown on drawings will be required. Disregard hardware sets listed in specifications but not shown on drawings.

B. Hardware Consultant working on a project will be responsible for providing additional information regarding these hardware sets. The numbers shown in the following sets come from BHMA standards.

ELECTRIC HARDWARE ABBREVIATIONS LEGEND:

ADO = Automatic Door Operator

EMCH = Electro-Mechanical Closer-Holder

MHO = Magnetic Hold-Open (wall- or floor-mounted)

C. INTERIOR SINGLE DOORS

HW-5G

Each Door to Have:	NON-RATED
Hinges	QUANTITY & TYPE AS REQUIRED
1 Storeroom Lock	F07
1 Kick Plate	J102
1 Floor Stop	L02121 x 3 FASTENERS
1 Threshold	J32300 x 57 MM WIDTH (2-1/4 INCHES)
1 Auto Door Bottom	R0Y346 - HEAVY DUTY
2 Sets Self-Adhesive Seals	R0Y154

D. EXTERIOR DOUBLE DOORS

HW-8E

Each [ADO] Pair to Have:	NON-RATED
2 Continuous Hinges	x INTEGRAL HINGE GUARD CHANNEL X ADJUSTA-SCREWS x 4-THRUWIRE TRANSFERS X IN-HINGE ACCESS PANEL
2 Push Plate	J304 8” x 16”
2 Hospital Grip	J401
2 Kick Plate	J102
2 Mop Plate (@ Inswing Doors)	J103
2 Edge Guard (@ Wood Doors)	J208M / J211 (VERIFY), CUT: HARDWARE
2 Floor Stop	L02121 x 3 FASTENERS
2 Silencers	L03011

AUTOMATIC DOOR OPERATORS AND CONTROLS FROM SECTION 08 71 13, AUTOMATIC DOOR OPERATORS.

DOOR SWITCH ACTIVATORS, “TOUCHLESS WAVE TO OPEN WALL SWITCH”, FROM SECTION 08 71 13, AUTOMATIC DOOR OPERATORS.

POWER TRANSFERS FOR RE-ACTIVATION SENSOR WIRING (RE-ACTIVATION SENSORS PROVIDED IN SECTION 08 71 13).

E. EXTERIOR SINGLE DOORS

HW-E3

Each Door to Have:	RATED
Hinges	QUANTITY & TYPE AS REQUIRED
1 Storeroom Lock	F13-MOD x RIGID OUTSIDE LEVER x KEY RETRACTS DEADBOLT AND LATCHBOLT
1 Latch Protector (outswing dr.)	
1 Closer	C02011/C02021
1 Edge Guard (@ Wood Doors)	J208M / J211 (VERIFY), CUT: HARDWARE
1 Armor Plate	J101 x 3.125 MM (0.125 INCH) THICKNESS
1 Overhead Holder	C01511-ADJUSTABLE
1 Threshold (outswing door)	J32120 x SILICONE GASKET
1 Threshold (inswing door)	ALUMINUM, PER ARCHITECTURAL DETAIL
1 Door Sweep	R0Y416
1 Set Frame Seals	R0Y164
1 Drip	R0Y976

HW-E4

Each Door to Have:	NON-RATED
1 Continuous Hinge	
1 Anti-Vandal Pull	
1 Exit Device	TYPE 1 F03 LESS TRIM
1 Latch Protector	(outswing dr.)
1 Key Cylinder	TYPE AS REQUIRED
1 Closer	C02011
1 Ridged Arm Opener	TYPE AS REQUIRED
2 Touchless “Wave to Open Wall Switch”	TYPE AS REQUIRED
1 Kick Plate	J102
1 Floor Stop	L02121 x 3 FASTNERS
1 Threshold	J32120 x SILICONE GASKET
1 Door Sweep	R0Y416
1 Set Frame Seals	R0Y164
1 Drip	R0Y976

AUTOMATIC DOOR OPERATORS AND CONTROLS FROM SECTION 08 71 13, AUTOMATIC DOOR OPERATORS.

POWER TRANSFERS FOR RE-ACTIVATION SENSOR WIRING (RE-ACTIVATION SENSORS PROVIDED BY SECTION 08 71 13).

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SECTION 08 71 13
AUTOMATIC DOOR OPERATORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Touchless automatic operators for swinging and sliding doors.

1.2 RELATED WORK

A. Section 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS: Aluminum Frames Entrance Work.

B. Section 08 71 00, DOOR HARDWARE: Door Hardware.

C. Division 26, ELECTRICAL Electric General Wiring, Connections and Equipment Requirements.

D. Division 28, ELECTRONIC SAFETY AND SECURITY: Access Control Devices.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. ASTM International (ASTM):

1. B209-14 - Aluminum and Aluminum-Alloy Sheet and Plate.
2. A1008/A1008M-20 - Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Baked Hardenable.

C. Builders Hardware Manufacturers Association (BHMA):

1. BHMA A156.10-11 - Power Operated Pedestrian Doors.

D. National Fire Protection Association (NFPA):

1. 101-15 - Life Safety Code.

E. Underwriters Laboratories (UL):

1. 325-13 - Standard for Doors, Drapery, Gate, Louver, and Window Operators and Systems.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submittal Drawings:

1. Show size, configuration, fabrication and installation details.

C. Manufacturer's Literature and Data:

1. Description of each product.
2. Installation instructions.
3. Warranty.

D. Sustainable Construction Submittals:

1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.

E. Test reports: Certify each product complies with specifications.

F. Qualifications: Substantiate qualifications comply with specifications.

1. Manufacturer with project experience list.
2. Installer with project experience list.

G. Operation and Maintenance Data:

1. Care instructions for each exposed finish product.
2. Start-up, maintenance, troubleshooting, emergency, and shut-down instructions for each operational product.

1.5 QUALITY ASSURANCE

A. Manufacturer’s Qualifications:

1. Regularly manufactures specified products.
2. Manufactured specified products with satisfactory service on five similar installations for minimum five years.
   a. Provide contact names and addresses for completed projects when requested by Contracting Officer's Representative.

B. Installer’s Qualifications: Experienced installer, approved by the manufacturer.

1.6 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

B. Manufacturer's Warranty: Warrant automatic door operators against material and manufacturing defects.

1. Warranty Period: Two years.

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

A. Comply with requirements of BHMA A156.10. Unless otherwise indicated on Drawings, provide operators that move doors from fully closed to fully opened position in three seconds maximum time interval, when speed adjustment is at maximum setting.

B. Equipment: Conforming to UL 325. Provide key operated power disconnect wall switch for each door installation.

C. Electrical Wiring, Connections and Equipment: Motors, starters, controls, associated devices, and interconnecting wiring required for

installation. Equipment and wiring as specified in Division 26, ELECTRICAL.

2.2 PRODUCTS - GENERAL

A. Provide door operators from one manufacturer.

B. Provide one type of operator throughout project.

C. Sustainable Construction Requirements:

1. Steel Recycled Content: 30 percent total recycled content, minimum.
2. Aluminum Recycled Content: 80 percent total recycled content, minimum.

2.3 SWING DOOR OPERATORS

A. General:

1. Type: Institutional type.
2. Size: As recommended by the manufacturer for door weight and sizes.

B. Function:

1. Provide operators, enclosed in housing, permitting opening of door by energizing motor and stopped by electrically reducing Voltage and stalling motor against mechanical stop.
2. Door to close by means of spring energy, and closing force controlled by gear system and motor being used as dynamic brake without power or controlled by hydraulic closer in electro-hydraulic operators.
3. Opening and Closing Speeds: Field adjustable.
4. Operators with checking mechanism providing cushioning action at last part of door travel, in both opening and closing cycle.
5. Operators capable of recycling doors instantaneously to the fully open position from any point in closing cycle when control switch is activated.
6. When automatic power is interrupted or shut-off, permit doors to easily open manually without damage to automatic operator system.

C. Connect hardware with drive arm attached to door with pin linkage rotating in a self-lubricating bearing. Prevent doors from pivoting on shaft of operator.

D. Operator Housing:

1. ASTM B209, Type 6063-T5 aluminum alloy, 112 mm (4-1/2 inches) wide by 140 mm (5.5 inches) high by 3.2 mm (0.125 inch) thick, aluminum

extrusions with enclosed end caps for application to 100 mm (4 inches) and larger frame systems.

E. Power Operator:

1. Completely assembled and sealed unit including gear drive transmission, mechanical spring, and bearings, located in aluminum case and filled with special lubricant for extreme temperature conditions. Rubber mounted units with provisions for easy maintenance and replacement, without removing door from pivots or frame.

F. Motors:

1. Provide with interlock to prevent operation when doors are electrically locked from opening.

G. Electrical Control:

1. Self-contained electrical control unit, including necessary transformers, relays, rectifiers, and other electronic components for proper operation, and switching of power operator.
2. Connecting Harnesses: Interlocking plugs.

H. Accessories:

1. Metal mounting supports, brackets, and other accessories necessary for installation of operators at head of door frames.

I. Microprocessor Controls:

1. Multi-function microprocessor control providing adjustable hold open time (1-30 seconds) with fully adjustable opening speed, LED indications for sensor input signals and operator status and power assist close options. Control capable of receiving activation signals from any device with normally open dry contact output.
2. Hold doors held open by low Voltage applied to the continuous duty motor.
3. Controls:
   a. Adjustable safety circuit that monitors door operation and stops opening direction of door if obstruction is sensed.
   b. Recycle feature that reopens door if obstruction is sensed at any point during closing cycle.
   c. Standard three position key switch with functions for ON, OFF, and HOLD OPEN, mounted on operator enclosure, door frame, or wall, as indicated on drawings.

2.4 SLIDING DOOR OPERATORS (NOT USED)

2.5 SLIDING DOOR UNITS (NOT USED)

2.6 POWER UNITS

A. Self-contained, electric operated and independent of door operator.
   1. Capacity and size of power circuits according to automatic door operator manufacturer's specifications and Division 26 - ELECTRICAL.

2.7 DOOR CONTROLS

A. Control Devices: BHMA A156.10; control opening and closing functions.
B. Open doors when control device is actuated; hold doors in open positions; then, close doors after an adjustable time period, unless safety device or reactivated control interrupts operation.
C. Motion Detector:
   1. Mounting: Surface or concealed.
   2. Detection Area: 1500 mm (60 inches) deep and 1500 mm (60 inches) across, plus or minus 150 mm (6 inches).
   3. Response Time: 25 milliseconds, maximum.
   4. Control Power: 24 Volt DC.
   5. Design units to be unaffected by cleaning material, solvents, dust, dirt, and outdoor weather conditions.

2.8 SAFETY DEVICES

A. Swing Doors: Install presence sensor on pull side of door to detect any person standing in door swing path and prevent door from opening.
   1. Time delay Switches: Adjustable between 3 to 60 seconds and control closing cycle of doors.
B. Install decal signs with "In" or "Do Not Enter" on both faces of each door where shown.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.
   1. Verify door opening is correctly sized and within acceptable tolerances.
B. Protect existing construction and completed work from damage.

3.2 INSTALLATION

A. Install products according to manufacturer's instructions and approved submittal drawings.

1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

B. Coordinate door installation with other related work.

C. Install manual controls and power disconnect switches recessed or semi-flush mounted in partitions.

D. Secure operator components to adjacent construction with suitable fastenings.

E. Conceal conduits, piping, and electric equipment, in finish work.

F. Install power units in locations shown.

1. Where units are mounted on walls, provide metal supports or shelves for units.
2. Ensure equipment, including time delay switches, are accessible for maintenance and adjustment.

G. Ensure operators are adjusted and function properly for type of expected traffic.

H. Synchronize each leaf of pair doors to open and close simultaneously. Permit each door leaf to be opened manually, independent of other door leaf.

I. Install controls at positions shown and ensuring convenience for expected traffic.

J. Push Plate Wall Switches Mounting Height: 1000 mm (40 inches) maximum, unless otherwise approved by Contracting Officer's Representative.

3.3 DEMONSTRATION AND TRAINING

A. Instruct VA personnel in proper automatic door operator operation and maintenance.

1. Trainer: Manufacturer approved instructor.
2. Training Time: 2 hours minimum.

B. Coordinate instruction to VA personnel with VA Contracting Officer's Representative.

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SECTION 08 80 00
GLAZING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the following:
   1. Glass.
   2. Glazing materials and accessories for both factory and field glazed assemblies.

1.2 RELATED WORK

A. Section 01 81 13, SUSTAINABLE DESIGN REQUIREMENTS: Sustainable Design Requirements.
B. Section 08 11 13, HOLLOW METAL DOORS AND FRAMES
C. Section 08 41 13, ALUMINUM ENTRANCES AND STOREFRONTS
D. Section 26 05 19, LOW VOLTAGE ELECTRICAL POWER AND CONDUCTORS AND CABLES: Wiring (120 V AC, 15A or 20A).
E. Intrusion Detection: Section 28 16 11, INTRUSION DETECTION SYSTEM.
F. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Junction and Switch Boxes.
G. Section 28 13 11, PHYSICAL ACCESS CONTROL SYSTEMS: Access Control Systems.

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 label requirements.
   3. Temporary labels are to remain intact until glass is approved by Contracting Officer Representative (COR).
B. Permanent labels:
   1. Locate in corner for each pane.
   2. Label in accordance with ANSI Z97.1 and SGCC 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. General: Design glazing system consistent with guidance and practices presented in the GANA Glazing Manual, GANA Laminated Glazing Manual,

and GANA Sealant Manual, as applicable to project. Installed glazing is to withstand applied loads, thermal stresses, thermal movements, building movements, permitted tolerances, and combinations of these conditions without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; unsafe engagement of the framing system; deflections beyond specified limits; or other defects in construction.

B. Glazing Unit Design: Design glass, including engineering analysis meeting requirements of authorities having jurisdiction. Thicknesses listed are minimum. Coordinate thicknesses with framing system manufacturers.
   1. Design glass in accordance with ASTM E1300, and for conditions beyond the scope of ASTM E1300, by a properly substantiated structural analysis.
   2. Design Wind Pressures: In accordance with applicable code.
   3. Wind Design Data: In accordance with applicable code.
   4. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than the structural capacity of the glazing unit, the threshold at which frame engagement is no longer safely assured, 1/100 times the short-side length, or 19 mm (0.75 inch) , whichever is less.

C. 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.

1.5 SUBMITTALS

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

B. Sustainable Design Submittals, as described below:
   1. Volatile organic compounds per volume as specified in

MANUFACTURER'S CERTIFICATES:

2. Certificate stating that fire-protection and fire-resistive glazing units meet code requirements for fire-resistance-rated assembly and applicable safety glazing requirements.
3. Certificate on solar heat gain coefficient when value is specified.
4. Certificate on "R" value when value is specified.
5. Certificate test reports confirming compliance with specified bullet resistive rating.
6. Certificate that blast resistant glass meets the specified requirements.

C. Manufacturer Warranty.

D. Manufacturer's Literature and Data:

1. Glass, each kind required.
2. Insulating glass units.
3. Elastic compound for metal sash glazing.
4. Putty, for wood sash glazing.
5. Glazing cushion.
6. Sealing compound.

E. Samples:

1. Size: 305 mm by 305 mm (12 inches by 12 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 to 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 are to 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 is to be approved and applied by manufacturer.
4. Edge protection: To cushion and protect glass clad, and polycarbonate edges from contamination or foreign matter, the four (4) edges are to be sealed the depth of glazing with continuous standard-thickness thermoplastic rubber tape. Alternatively, continuous channel shaped extrusion of thermoplastic rubber are to 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 degrees C (60 to 75 degrees F), during the fabricating, handling, shipping, storing, installation, and subsequent protection of glazing.

1.7 PROJECT CONDITIONS:

A. Field Measurements: Field measure openings before ordering tempered glass products to assure for proper fit of field measured products.

1.8 WARRANTY

A. Construction Warranty: Comply with the FAR clause 52.246-21 "Warranty of Construction".

B. Manufacturer Warranty: Manufacturer shall warranty their glazing from the date of installation and final acceptance by the Government as follows. Submit manufacturer warranty.

1. Insulating glass units to remain sealed for ten (10) years.
2. Laminated glass units to remain laminated for five (5) 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 Architectural Manufacturers Association (AAMA):

800.....Test Methods for Sealants
810.1-77.....Expanded Cellular Glazing Tape

C. American National Standards Institute (ANSI):

Z97.1-14.....Safety Glazing Material Used in Building - Safety Performance Specifications and Methods of Test

D. American Society of Civil Engineers (ASCE):

7-10.....Wind Load Provisions

E. ASTM International (ASTM):

C542-05(2017).....Lock-Strip Gaskets
C716-06(2020).....Installing Lock-Strip Gaskets and Infill Glazing Materials
C794-18.....Adhesion-in-Peel of Elastomeric Joint Sealants
C864-05(2019).....Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers
C920-18.....Elastomeric Joint Sealants
C964-20.....Standard Guide for Lock-Strip Gasket Glazing
C1036-16.....Flat Glass
C1048-18.....Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass.

C1172-19.....Laminated Architectural Flat Glass

C1349-17.....Standard Specification for Architectural Flat Glass Clad Polycarbonate

C1376-15.....Pyrolytic and Vacuum Deposition Coatings on Flat Glass

D635-18.....Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastic in a Horizontal Position

D4802-16.....Poly (Methyl Methacrylate) Acrylic Plastic Sheet

E84-20.....Surface Burning Characteristics of Building Materials

E119-20.....Standard Test Methods for Fire Test of Building Construction and Material

E1300-16.....Load Resistance of Glass in Buildings

E1886-19.....Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials

E1996-17.....Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes

E2141-14.....Test Methods for Assessing the Durability of Absorptive Electrochromic Coatings on Sealed Insulating Glass Units

E2190-19.....Insulating Glass Unit

E2240-06.....Test Method for Assessing the Current-Voltage Cycling Stability at 90 Degree C (194 Degree F) of Absorptive Electrochromic Coatings on Sealed Insulating Glass Units

E2241-06.....Test Method for Assessing the Current-Voltage Cycling Stability at Room Temperature of Absorptive Electrochromic Coatings on Sealed Insulating Glass Units

E2354-10.....Assessing the Durability of Absorptive Electrochromic Coatings within Sealed Insulating Glass Units

E2355-10.....Test Method for Measuring the Visible Light Transmission Uniformity of an Absorptive Electrochromic Coating on a Glazing Surface

F1233-08(2019).....Standard Test Method for Security Glazing Materials and Systems

F1642/F1642M-17.....Test Method for Glazing and Glazing Systems Subject to Airblast Loadings

F. Code of Federal Regulations (CFR):

16 CFR 1201-10.....Safety Standard for Architectural Glazing Materials

G. Glass Association of North America (GANA):

2010 Edition.....GANA Glazing Manual

2008 Edition.....GANA Sealant Manual

2009 Edition.....GANA Laminated Glazing Reference Manual

2010 Edition.....GANA Protective Glazing Reference Manual

H. International Code Council (ICC):

IBC.....International Building Code

I. Insulating Glass Certification Council (IGCC)

J. Insulating Glass Manufacturer Alliance (IGMA):

TB-3001-13.....Guidelines for Sloped Glazing

TM-3000.....North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use

K. Intertek Testing Services - Warnock Hersey (ITS-WHI)

L. National Fire Protection Association (NFPA):

80-16.....Fire Doors and Windows

252-12.....Fire Tests of Door Assemblies

257-12.....Standard on Fire Test for Window and Glass Block Assemblies

M. National Fenestration Rating Council (NFRC)

N. Safety Glazing Certification Council (SGCC) 2012:

Certified Products Directory (Issued Semi-Annually).

O. Underwriters Laboratories, Inc. (UL):

9-08(R2009).....Fire Tests of Window Assemblies

263-14.....Fire Tests of Building Construction and Materials

752-11.....Bullet-Resisting Equipment.

P. Department of Veterans Affairs:

Q. Physical Security Design Manual for VA Mission Critical Protected Facilities January 2015

R. Architectural Design Manual for VA Facilities (VASDM)

S. Environmental Protection Agency (EPA):

40 CFR 59(2014).....National Volatile Organic Compound Emission Standards for Consumer and Commercial Products

PART 2 - PRODUCT

2.1 GLASS

A. Provide minimum thickness stated and as additionally required to meet performance requirements.

1. Provide minimum 6 mm (1/4 inch) thick glass units unless otherwise indicated.

B. Obtain glass units from single source from single manufacturer for each glass type.

C. Clear Glass:

1. ASTM C1036, Type I, Class 1, Quality q3.

D. Ultra-clear-Low-Iron Float Glass:

1. ASTM C1036, Type I, Class 1, Quality q3and with visible light transmission of not less than 90 percent.

E. Tinted Heat reflective and low emissivity coated glass:

1. ASTM C1036, Type I, Class 2, Quality q3.

2.2 HEAT-TREATED GLASS

A. Roller Wave Limits for Heat-Treated Glass: Orient all roller wave distortion parallel to bottom surface of glazing, and provide units complying with the following limitations:

1. Measurement Parallel to Line: Maximum peak to valley 0.203 mm (0.008 inch).

2. Measurement Perpendicular to Line: Maximum 0.0254 mm (0.001 inch).

3. Bow/Warp: Maximum 50 percent of bow and warp allowed by ASTM C1048.

B. Clear Heat Strengthened Glass:

1. ASTM C1048, Kind HS, Condition A, Type I, Class 1, Quality q3.

C. Tinted Heat Strengthened Glass:
   1. ASTM C1048, Kind HS, Condition A, Type I, Class 2, Quality q3.
D. Clear Tempered Glass:
   1. ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality q3.
E. Tinted Tempered Glass.
   1. ASTM C1048, Kind FT, Condition A, Type I, Class 2, Quality q3.

2.3 COATED GLASS

A. Reflective-Coated Spandrel Glass:
   1. ASTM C1376, Kind CS and ASTM C1048, Kind HS, Condition B, Type I.
B. Reflective-Coated Low-E Coated Tempered Glass:
   1. ASTM C1376 and ASTM C1048, Kind FT, Condition C, Type I, Class 1, Quality q3 with reflective metallic coating.
C. Silicone Coated Spandrel Glass:
   1. ASTM C1048, Kind HS or FT, Condition B, Type I, Quality q3 with silicone coating applied over glass surface.
   2. Pattern as indicated in construction documents

2.4 ELECTROCHROMIC COATED GLASS (NOT USED)

2.5 PLASTIC GLAZING (NOT USED)

2.6 LAMINATED GLASS

A. Laminated Glass: ASTM C1172. Two or more lites of heat treated glass bonded with polyvinyl butyral, ionomeric polymer, or cast-in-place and cured-transparent-resin interlayer complying with interlayer manufacturer's written instructions. Minimum total laminated thickness of 1/4” for blast resistant glazing.
B. Interlayer: Use min. 0.75 mm (0.030 inch) thick interlayer for vertical glazing unless otherwise indicated in construction documents.
C. Interlayer: Use 1.5 mm (0.060 inch) thick interlayer for:
   1. Horizontal or sloped glazing.
   2. Acoustical glazing.
   3. Assemblies requiring heat strengthened or fully tempered glass.
D. Interlayer: Use 2.28 mm (0.090 inch) thick interlayer where required to meet performance requirements.
E. Interlayer Color: Clear, unless otherwise indicated in construction documents.

2.7 SECURITY GLAZING ASSEMBLY (NOT USED)

2.8 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. The exterior glass unit shall be fully tempered and the inner glass unit shall be laminated annealed at a minimum for all blast resistant glazing.

B. Assemble units using glass types specified in Insulating Glass Schedule and Blast Glazing assembly requirements

2.9 FIRE PROTECTION AND FIRE RESISTANCE GLAZING (NOT USED)

2.10 SWITCHABLE PRIVACY GLASS (NOT USED) INSULATING PLASTIC SHEETS (NOT USED)

2.11 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 are to have a finish that will not corrode or stain while in service. Fire rated glazing to be installed with glazing accessories in accordance with the manufacturer’s installation instructions.

B. Setting Blocks: ASTM C864:

1. Silicone type.
2. Channel shape; having 6 mm (1/4 inch) internal depth.
3. Shore A hardness of 80 to 90 Durometer.
4. Block lengths: 50 mm (2 inches) except 100 to 150 mm (4 to 6 inches) for insulating glass.
5. Block width: Approximately 1.6 mm (1/16 inch) less than the full width of the rabbet.
6. 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: 25 to 76 mm (1 to 3 inches).
4. Shore A hardness of 40 to 50 Durometer.

D. Glazing Tapes:

1. Semi-solid polymeric based closed cell 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.
3. Complying with AAMA 800 for the following types:
   a. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
   b. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

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.

I. Lock-Strip Glazing Gaskets: ASTM C542, shape, size, and mounting as indicated.

J. Glazing Sealants: ASTM C920, silicone neutral cure:
1. Type S.
2. Class 25 or 50 as recommended by manufacturer for application.
3. Grade NS.
4. Shore A hardness of 25 to 30 Durometer.
5. VOC Content: For sealants used inside the weatherproofing system, not more than 250 g/L or less when calculating according to 40 CFR 59, (EPA Method 24).

K. 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.

L. Color:

1. Color of glazing compounds, gaskets, and sealants used for aluminum color frames to 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 are to 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 is approved shop drawings.

B. Review for 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.

3.2 PREPARATION

A. For sealant glazing, prepare glazing surfaces in accordance with GANA 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 Glazing Manual, GANA Sealant Manual, IGMA TB-3001, and IGMA TM-3000 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 in a securely fixed or closed and locked position, until sealant, glazing compound, or putty has thoroughly set.

F. Tempered Glass: Install with roller distortions in horizontal position unless otherwise directed.

G. Laminated Glass:

1. Tape edges to seal interlayer and protect from glazing sealants.
2. Do not use putty or glazing compounds.

H. Insulating Glass Units:

1. Glaze in compliance with glass manufacturer's written instructions.
2. When glazing gaskets are used, they are to be of sufficient size and depth to cover glass seal or metal channel frame completely.
3. Do not use putty or glazing compounds.
4. Do not grind, nip, cut, or otherwise alter edges and corners of fused glass units after shipping from factory.
5. Install with tape or gunnable sealant in wood sash.

3.4 INSTALLATION – ELECTROCHROMIC GLAZING (NOT USED)

3.5 INSTALLATION - DRY METHOD (TAPE AND GASKET SPLINE GLAZING)

A. Cut glazing tape to length; install on glazing pane. Seal corners by butting and sealing junctions with butyl sealant.

B. Place setting blocks at 1/4 points with edge block no more than 150 mm (6 inches) from corners.

C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.

D. Install removable stops without displacing glazing spline. Exert pressure for full continuous contact.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Trim protruding tape edge.

3.6 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 152 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 sealant to depth equal to bite of frame on glazing, but not more than 9 mm (3/8 inch) below sight line. Sealant type is to be compatible with glazing tape.

G. Apply cap bead of sealant along void between the stop and the glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.7 INSTALLATION - WET METHOD (SEALANT AND SEALANT)

A. Place setting blocks at 1/4 points and install glazing pane or unit.

B. Install removable stops with glazing centered in space by inserting spacer shims both sides at 600 mm (24 inch) intervals, 6 mm (1/4 inch) below sight line.

C. Fill gaps between glazing and stops with sealant to depth of bite on glazing, but not more than 9 mm (3/8 inch) below sight line to ensure full contact with glazing and continue the air and vapor seal.

D. Apply sealant to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.8 INSTALLATION - EXTERIOR BUTT GLAZED METHOD (SEALANT ONLY) (NOT USED)

3.9 INSTALLATION - INTERIOR WET/DRY METHOD (TAPE AND SEALANT) (NOT USED)

3.10 INSTALLATION - INTERIOR WET METHOD (COMPOUND AND COMPOUND) (NOT USED)

3.11 INSTALLATION - REGLAZING HISTORIC FRAMING (NOT USED)

3.12 COMMISSIONING – ELECTROCHROMIC GLAZING (NOT USED)

3.13 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.

3.14 PROTECTION

A. Protect finished surfaces from damage during erection, and after completion of work. Strippable plastic coatings on colored anodized finish are not acceptable.

3.15 MONOLITHIC GLASS SCHEDULE

A. Glass Type MG# 1 : Low-e coated tempered float glass.

1. Unit Thickness: match existing
2. Tint Color: match existing
3. Visible Light Transmittance: match existing
4. Solar Heat Gain Coefficient: match existing
5. Safety glazing label required.

3.16 LAMINATED GLASS SCHEDULE (NOT USED)

3.17 INSULATING GLASS SCHEDULE

A. Glass Type IGU# 1 : Low-E-coated, clear insulating glass.

1. Overall Unit Thickness: 25 mm (1 inch).
2. Minimum Thickness of Each Glass Lite: 6 mm (0.23 inch).
3. Outdoor Lite: Annealed float glass, except heat-strengthened float glass where required, and fully tempered float glass where indicated.
4. Interspace Content: Air
5. Indoor Lite: Fully tempered float glass.
6. Low-E Coating: Sputtered on second surface.
7. Visible Light Transmittance: 68 percent minimum.
8. Solar Heat Gain Coefficient: 0.39 maximum.
9. Safety glazing label required.

B. Glass Type IGU# 2 : Ceramic-coated, insulating spandrel glass.
   1. Match adjacent vision unit profile, glass thickness, tint, low-E coating, and performance.
   2. Overall Unit Thickness: 25 mm (1 inch).
   3. Minimum Thickness of Each Glass Lite: 6 mm (0.23 inch).
   4. Outdoor Lite: Clear annealed float glass, except heat-strengthened float glass where required, and fully tempered float glass where indicated.
   5. Interspace Content: Air.
   6. Indoor Lite: Fully tempered float glass.
      a. Opaque Coating Location: Fourth surface.
      b. Coating Color: As selected by Architect from manufacturer's full range.

3.18 INSULATING LAMINATED GLASS SCHEDULE (FORCE PROTECTION AND PHYSICAL SAFETY) (NOT USED)

3.19 ELECTROCHROMIC LAMINATED INSULATING GLASS SCHEDULE (NOT USED)

3.20 FIRE-PROTECTIVE AND FIRE-RESISTANCE GLAZING SCHEDULE (NOT USED)

3.21 SECURITY GLAZING SCHEDULE (NOT USED)

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SECTION 08 90 00
LOUVERS AND VENTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies fixed and operable wall louvers, door louvers and wall vents.

1.2 RELATED WORK

A. Section 08 11 13, HOLLOW METAL DOORS AND FRAMES: Louvers in Steel Doors.

1.3 SUBMITTALS

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

B. Shop Drawings:

1. Each type, showing material, finish, size of members, operating devices, method of assembly, and installation and anchorage details.

C. Manufacturer's Literature and Data:

1. Each type of louver and vent.

D. Color samples.

E. Blast Design Calculations: Louver System and Anchorage

1. Submit calculations for review and approval prepared by qualified blast consultant, with a minimum of 5 years experience in design of blast resistant window systems, verifying louver assembly including anchors comply with specified blast resistance performance. The magnitudes of the design threats W1,W2 and GP1,GP2 are defined in the Physical Security Design Standards Data Definitions which is a document separate from the referenced VA Security Design Manual. The Physical Security Design Standards Data Definitions are provided on a need-to-know basis by the blast/structural engineer performing the blast design on VA projects. It is the responsibility of the engineer of blast resistant windows to request and obtain the Physical Security Design Data Standard Data Definitions from the VA Office of Construction and Facilities Management (CFM). Any associated delays or increased costs due to failure to obtain this information will be borne by the contractor.

1.4 APPLICABLE PUBLICATIONS:

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

B. The Master Painters Institute (MPI):
Approved Product List - Updated Monthly

C. ASTM International (ASTM):

A240/A240M-20.....Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

A653/A653M-20.....Steel Sheet Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot Dip Process

A1008/A1008M-20.....Steel, Sheet, Carbon, Cold Rolled, Structural, and High Strength Low-Alloy with Improved Formability

B209-14.....Aluminum and Aluminum Alloy, Sheet and Plate

B209M-14.....Aluminum and Aluminum Alloy, Sheet and Plate (Metric)

B221-14.....Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

B221M-13.....Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes (Metric)

D1187/D1187M-97(2018)...Asphalt-Base Emulsions for Use as Protective Coatings for Metal

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

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

E. National Fire Protection Association (NFPA):

90A-15.....Installation of Air Conditioning and Ventilating Systems

F. American Architectural Manufacturers Association (AAMA):

2605-13.....High Performance Organic Coatings on Architectural Extrusions and Panels

G. Air Movement and Control Association, Inc. (AMCA):

500-L-07 Testing Louvers

H Department of Veterans Affairs:

VA Physical Security Design Manual for Mission Critical Protected Facilities January 2015

I. Protective Design Center
PDC-TR-08 Single Degree of Freedom Structural Response Limits for Antiterrorism Design

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Aluminum, Extruded: ASTM B221M (B221).

B. Stainless Steel: ASTM A240/A240M, Type 302B.

C. Galvanized Steel Sheet: ASTM A653/A653M; G90 min.

D. Carbon Steel and Sheet: ASTM A1008/A1008M (interior use louvers only).

E. Aluminum, Plate and Sheet: ASTM B209M (B209); alloy 3003 or 5005 with temper as required for forming.

F. Fasteners: Fasteners for securing louvers and wall vents to adjoining construction, except as otherwise specified or indicated in construction documents, to be toggle or expansion bolts of size and type as required for each specific type of installation and service condition.

1. Where type, size, or spacing of fasteners is not shown or specified, submit shop drawings showing proposed fasteners, and method of installation.
2. Fasteners for louvers, louver frames, and wire guards to be of stainless steel or aluminum with same finish as louvers.
3. Fasteners for louvers, louver frames and wire guards within mental health areas to be non-removable/tamper-proof type.

G. Inorganic Zinc Primer: MPI No. 19.

H. Bituminous Coating: ASTM D1187/D1187M; cold applied asphalt mastic emulsion.

2.2 EXTERIOR WALL LOUVERS:

A. General:

1. Provide fixed type louvers of size and design shown.
2. Heads, sills and jamb sections are to have formed caulking slots or be designed to retain caulking. Head sections are to have exterior drip lip, and sill sections an integral water stop.
3. Furnish louvers with sill extension or separate sill as shown.

4. Frame is to be mechanically fastened or welded construction with welds dressed smooth and flush.

5. Louvers are to bear AMCA certified rating seals for air performance and water penetration ratings.

B. Stainless Steel Louvers: Form stainless steel louvers using 1.6 mm (0.063-inch) thick sheet for frames, blades, sills and mullions.

1. Provide louver with fixed 45 degree drainable blades with water baffle. Make overall frame size 13 mm (1/2-inch) less than opening, unless otherwise indicated in construction documents.
2. Single louver sections are not to exceed 1676 mm (66 inches) in width. For openings larger than 1676 mm (66 inches) wide, provide multiple sections not larger than 1676 mm (66 inches) wide separated by mullions.

2.3 CLOSURE ANGLES AND CLOSURE PLATES:

A. Fabricate from 2 mm (0.078-inch) thick stainless steel or aluminum.

B. Provide continuous closure angles and closure plates on inside head, jambs and sill of exterior wall louvers.

C. Secure angles and plates to louver frames with screws, and to masonry or concrete with fasteners as indicated in construction documents.

2.4 WIRE GUARDS:

A. Provide wire guards on outside of all exterior louvers, except on exhaust air louvers.

B. Fabricate frames from 1.5 mm (0.059-inch) thick stainless steel designed to retain wire mesh.

C. Wire mesh to be woven from not less than 1.3 mm (0.05-inch) diameter stainless steel wire.

D. Miter corners and join by concealed corner clips or locks extending not less than 57 mm (2-1/4 inches) into rails and stiles. Equip wire guards over 1219 mm (4 feet) in height with a mid-rail constructed as specified for frame components.

E. Fasten frames to outside of louvers with aluminum or stainless steel devices of same finish as louvers designed to allow removal and replacement without damage to the wire guard or the louver.

2.5 BLANK-OFF PANELS (NOT USED)

2.6 EXTERIOR DOOR LOUVERS: (NOT USED)

2.7 INTERIOR DOOR LOUVERS: (NOT USED)

2.8 WALL VENTS:

A. Fabricate exterior wall vents from either 4.7 mm (0.185-inch) thick aluminum plate or 6 mm (1/4-inch) thick cast iron, perforated in diamond lattice pattern, with not over 19 mm (3/4-inch) openings.

B. Vents are to have aluminum screen frame with aluminum alloy insect screening mounted on back of vent by means of 19 mm x 5 mm (3/4-inch by 3/16-inch) top and bottom bars screwed to grille.

C. Vent Frames in Masonry: Fabricate of 45 mm x 30 mm x 5 mm (1-3/4 inch by 1-1/4 inch by 3/16-inch) steel angles bolted with 6 mm (1/4-inch) diameter expansion bolts at jambs.

2.9 AIR INTAKE VENTS:

A. Fabricate exterior louvered wall ventilators for fresh air intake for air conditioning units from extruded aluminum, ASTM B221M (B221). Form with integral horizontal louvers and frame, with drip extending beyond face of wall and integral water stops.

2.10 FINISH:

A. In accordance with NAAMM Metal Finishes Manual: AMP 500-505

B. Steel: Surfaces of steel work, for which no other finish is specified, are to be cleaned free from scale, rust, oil and grease, and then given a light colored prime paint after fabrication, except ferrous metals concealed in finished work. Paint all contact surfaces of assembled work (except welded contact surfaces) with an additional shop coat of similar paint.

2.11 PROTECTION:

A. Provide protection for aluminum against galvanic action wherever dissimilar materials are in contact, by painting the contact surfaces of the dissimilar material with a heavy coat of bituminous coating (complete coverage), or by separating the contact surfaces with a performed synthetic rubber tape having pressure sensitive adhesive coating on one side.

B. Isolate the aluminum from plaster, concrete and masonry by coating aluminum with zinc-chromate primer.

C. Protect finished surfaces from damage during fabrication, erection, and after completion of the work.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Set work accurately, in alignment and where indicated in construction documents. Install plumb, level, free of rack and twist, and set parallel or perpendicular as required to line and plane of surface.

B. Furnish setting drawings and instructions for installation of anchors and for the positioning of items having anchors to be built into masonry construction. Provide temporary bracing for such items until masonry is set.

C. Provide anchoring devices and fasteners as shown and as necessary for securing louvers and vents to building construction as specified. Power actuated drive pins may be used, except for removal items and where members would be deformed or substrate damaged by their use.

D. Set wall louvers and vents in masonry walls during progress of the work. If wall louvers and vents are not delivered to job in time for installation in prepared openings, make provision for later installation. Set in cast-in-place concrete in prepared openings.

3.2 CLEANING AND ADJUSTING:

A. After installation, all exposed prefinished and plated items and all items fabricated from stainless steel and aluminum are to be cleaned as recommended by the manufacturer and protected from damage until completion of the project.

B. All movable parts, including hardware, are to be cleaned and adjusted to operate as designed without binding or deformation of the members, so as to be centered in the opening of frame, and where applicable, to have all contact surfaces fit tight and even without forcing or warping the components.

C. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Contracting Officer Representative (COR) damaged units and replace with new units.

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DIVISION 09

SECTION 09 91 00
PAINTING, INCLUDING PAINTED TRAFFIC MARKINGS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the painting and finishing as shown on the construction documents and/or specified herein, including, but not limited to, the following:

1. Prime coats which may be applied in shop under other sections.
2. Prime painting unprimed surfaces to be painted under this Section.
3. Painting items furnished with a prime coat of paint, including touching up of or repairing of abraded, damaged or rusted prime coats applied by others.
4. Painting ferrous metal (except stainless steel) exposed to view.
5. Painting galvanized ferrous metals exposed to view.
6. Painting concrete block exposed to view.
7. Painting all traffic markings indicated in the drawings for parking areas within the project site, the extent of which includes but is not limited to the following:
   a. Painting parking stall striping, traffic markings (painted arrows, etc), and curb edges.
   b. Markings for “no parking” areas
   c. Markings for parking stall identification and zone identification
   d. Markings for drive aisles
   e. Markings for pedestrian traffic
8. Painting pipes, pipe coverings, conduit, ducts, insulation, hangers, supports and other mechanical and electrical items and equipment exposed to view.
9. Painting surfaces above, behind or below grilles, gratings, diffusers, louvers lighting fixtures, and the like, which are exposed to view through these items.
10. Painting includes shellacs, stains, varnishes, coatings specified, and striping or markers and identity markings.
11. Incidental painting and touching up as required to produce proper finish for painted surfaces, including touching up of factory finished items.

12. Painting of any surface not specifically mentioned to be painted herein or on construction documents, but for which painting is obviously necessary to complete the job, or work which comes within the intent of these specifications, is to be included as though specified.

1.2 **RELATED WORK**

A. Section 01 35 26, SAFETY REQUIREMENTS: Activity Hazard Analysis.

B. Section 02 83 33.13, LEAD-BASED PAINT REMOVAL AND DISPOSAL: Lead Paint Removal.

C. Section 04 05 13, MASONRY MORTARING: Masonry Repairs.

D. Section 04 05 16, MASONRY GROUTING: Masonry Repairs.

E. Division 05 METALS: Shop prime painting of steel and ferrous metals.

F. Division 08 OPENINGS: Shop prime painting of steel and ferrous metals.

G. Division 10 SPECIALTIES: Shop prime painting of steel and ferrous metals.

H. Division 11 EQUIPMENT: Shop prime painting of steel and ferrous metals.

I. Division 12 FURNISHINGS: Shop prime painting of steel and ferrous metals.

J. Division 13 SPECIAL CONSTRUCTION: Shop prime painting of steel and ferrous metals.

K. Division 14 CONVEYING EQUIPMENT: Shop prime painting of steel and ferrous metals.

L. Division 22 PLUMBING: Shop prime painting of steel and ferrous metals.

M. Division 23 HEATING; VENTILATION AND AIR-CONDITIONING: Shop prime painting of steel and ferrous metals.

N. Division 26 ELECTRICAL: Shop prime painting of steel and ferrous metals.

O. Division 27 COMMUNICATIONS: Shop prime painting of steel and ferrous metals.

P. Division 28 ELECTRONIC SAFETY AND SECURITY: Shop prime painting of steel and ferrous metals.

Q. Division 32 EXTERIOR IMPROVEMENTS: Shop prime painting of steel and ferrous metals.

R. Section 32 17 23, PAVEMENT MARKINGS: Asphalt and concrete pavement marking.

1.3 **SUBMITTALS**

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

B. Painter qualifications.

C. Manufacturer's Literature and Data:

1. Before work is started, or sample panels are prepared, submit manufacturer's literature and technical data, the current Master Painters Institute (MPI) "Approved Product List" indicating brand label, product name and product code as of the date of contract award, will be used to determine compliance with the submittal requirements of this specification. The Contractor may choose to use subsequent MPI "Approved Product List", however, only one (1) list may be used for the entire contract and each coating system is to be from a single manufacturer. All coats on a particular substrate must be from a single manufacturer. No variation from the MPI "Approved Product List" where applicable is acceptable.

D. Sample Panels:
   1. After painters' materials have been approved and before work is started, submit sample panels showing each type of finish and color specified.
   2. Panels to Show Color: Composition board, 100 x 250 mm (4 x 10 inch).
   3. Panel to Show Transparent Finishes: Wood of same species and grain pattern as wood approved for use, 100 x 250 mm (4 x 10 inch face) minimum, and where both flat and edge grain will be exposed, 250 mm (10 inches) long by sufficient size, 50 x 50 mm (2 x 2 inch) minimum or actual wood member to show complete finish.
   4. Attach labels to panel stating the following:
      a. Federal Specification Number or manufacturers name and product number of paints used.
      b. Product type and color.
      c. Name of project.
   5. Strips showing not less than 50 mm (2 inch) wide strips of undercoats and 100 mm (4 inch) wide strip of finish coat.

E. Sample of identity markers if used.

F. Manufacturers' Certificates indicating compliance with specified requirements:
   1. Manufacturer's paint substituted for Federal Specification paints meets or exceeds performance of paint specified.
   2. High temperature aluminum paint.
   3. Epoxy coating.
   4. Intumescent clear coating or fire-retardant paint.

5. Plastic floor coating.

1.4 **DELIVERY AND STORAGE**

A. Deliver materials to site in manufacturer's sealed container marked to show following:
   1. Name of manufacturer.
   2. Product type.
   3. Batch number.
   4. Instructions for use.
   5. Safety precautions.

B. In addition to manufacturer's label, provide a label legibly printed as following:
   1. Federal Specification Number, where applicable, and name of material.
   2. Surface upon which material is to be applied.
   3. Specify Coat Types: Prime; body; finish; etc.

C. Maintain space for storage, and handling of painting materials and equipment in a ventilated, 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 7 and 30 degrees C (45 and 85 degrees F).

1.5 **QUALITY ASSURANCE**

A. Qualification of Painters: Use only qualified journeyman painters for the mixing and application of paint on exposed surfaces. Submit evidence that key personnel have successfully performed surface preparation and application of coating on a minimum of three (3) similar projects within the past three (3) years.

B. Paint Coordination: Provide finish coats which are compatible with the prime paints used. Review other Sections of these specifications in which prime paints are to be provided to ensure compatibility of the total coatings system for the various substrates. Upon request from other subcontractors, furnish information on the characteristics of the finish materials proposed to be used, to ensure that compatible prime coats are used. Provide barrier coats over incompatible primers or remove and re-prime as required. Notify the Contracting Officer Representative (COR) in writing of any anticipated problems using the coating systems as specified with substrates primed by others.

C. Source Quality Control: Obtain all materials for each coating system from the same manufacturer.

D. Correlation of Performance Requirements: The Work of this Section is subject to the performance requirements indicated in the Contract Documents and as follows:

1. Requirements of Regulatory Agencies: The Work is subject to all applicable provisions of the Codes and Standards required by the authorities having jurisdiction.
2. Reference Standards: Standards referenced in this Section are commonplace in the industry (unless otherwise noted) and are referred to by basic designation only. Standards form a part of this specification to the extent referenced.
3. Correlation and Intent of the Contract Documents: In the event of conflicts or discrepancies between the Contract Documents, the requirements of regulatory agencies, and the indicated Reference Standards, the most stringent requirements govern.

E. Pavement Marking Paint System Coordination: Pavement marking paint system must be compatible for installation over the completed traffic bearing surfaces.

1. Certification Letter: Manufacturer must certify that the Pavement Marking Paint System is compatible with the specific substrates, sealers, sealants and traffic bearing membranes to be used. Contractor to coordinate.

1.6 **REGULATORY REQUIREMENTS**

A. Paint materials are to conform to the restrictions of the local Environmental and Toxic Control jurisdiction.

1. Volatile Organic Compounds (VOC) Emissions Requirements: Field-applied paints and coatings that are inside the waterproofing system to not exceed limits of authorities having jurisdiction.
2. Lead-Base Paint:
   a. Comply with Section 410 of the Lead-Based Paint Poisoning Prevention Act, as amended, and with implementing regulations promulgated by Secretary of Housing and Urban Development.
   b. Regulations concerning prohibition against use of lead-based paint in federal and federally assisted construction, or rehabilitation of

residential structures are set forth in Subpart F, Title 24, Code of Federal Regulations, Department of Housing and Urban Development.

c. Do not use coatings having a lead content over 0.06 percent by weight of non-volatile content.

d. For lead-paint removal, see Section 02 83 33.13, LEAD-BASED PAINT REMOVAL AND DISPOSAL.

3. Asbestos: Provide materials that do not contain asbestos.

4. Chromate, Cadmium, Mercury, and Silica: Provide materials that do not contain zinc-chromate, strontium-chromate, Cadmium, mercury or mercury compounds or free crystalline silica.

5. Human Carcinogens: Provide materials that do 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.

1.7 SAFETY AND HEALTH

A. Apply paint materials using safety methods and equipment in accordance with the following:

1. Comply with applicable Federal, State, and local laws and regulations, and with the ACCIDENT PREVENTION PLAN, including the Activity Hazard Analysis (AHA) as specified in Section 01 35 26, SAFETY REQUIREMENTS. The AHA is to include analyses of the potential impact of painting operations on painting personnel and on others involved in and adjacent to the work zone.

B. Safety Methods Used During Paint Application: Comply with the requirements of SSPC PA Guide 10.

C. Toxic Materials: To protect personnel from overexposure to toxic materials, conform to the most stringent guidance of:

1. The applicable manufacturer’s Material Safety Data Sheets (MSDS) or local regulation.

2. 29 CFR 1910.1000.

3. ACHIH-BKLT and ACGHI-DOC, threshold limit values.

1.8 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. ASME International (ASME):

A13.1-07(R2013).....Scheme for the Identification of Piping Systems

D. Code of Federal Regulation (CFR):

40 CFR 59.....Determination of Volatile Matter Content, Water Content, Density Volume Solids, and Weight Solids of Surface Coating

E. Commercial Item Description (CID):

A-A-1272A.....Plaster Gypsum (Spackling Compound)

F. Federal Specifications (Fed Spec):

TT-P-1411A.....Paint, Copolymer-Resin, Cementitious (For Waterproofing Concrete and Masonry Walls) (CEP)

G. Master Painters Institute (MPI):

1.....Aluminum Paint

3.....Primer, Alkali Resistant, Water Based

4.....Interior/ Exterior Latex Block Filler

5.....Exterior Alkyd Wood Primer

6.....Exterior, Latex for Exterior Wood Primer

7.....Exterior Oil Wood Primer

8.....Exterior Alkyd, Flat MPI Gloss Level 1

9.....Exterior Alkyd Enamel MPI Gloss Level 6

10.....Exterior Latex, Flat

11.....Exterior Latex, Semi-Gloss

15.....Exterior Latex, Low Sheen (MPI Gloss Level 3-4)

17.....Primer, Bonding, Waterbased

18.....Organic Zinc Rich Primer

22.....Aluminum Paint, High Heat (up to 590% - 1100F)

23.....Primer, Metal, Surface Tolerant

27.....Exterior / Interior Alkyd Floor Enamel, Gloss

31.....Polyurethane, Moisture Cured, Clear Gloss

36.....Knot Sealer

39.....Primer, Latex, for Interior Wood
40.....Exterior, Latex High Build
42.....Textured Coating, Latex, Flat
43.....Interior Satin Latex, MPI Gloss Level 4
44.....Interior Low Sheen Latex, MPI Gloss Level 2
45.....Interior Primer Sealer
46.....Interior Enamel Undercoat
47.....Interior Alkyd, Semi-Gloss, MPI Gloss Level 5
48.....Interior Alkyd, Gloss, MPI Gloss Level 6
50.....Interior Latex Primer Sealer
51.....Interior Alkyd, Eggshell, MPI Gloss Level 3
52.....Interior Latex, MPI Gloss Level 3
53.....Interior Latex, Flat, MPI Gloss Level 1
54.....Interior Latex, Semi-Gloss, MPI Gloss Level 5
59.....Interior/Exterior Alkyd Porch & Floor Enamel, Low Gloss
60.....Interior/Exterior Latex Porch & Floor Paint, Low Gloss
66.....Interior Alkyd Fire Retardant, Clear Top-Coat (ULC Approved)
67.....Interior Latex Fire Retardant, Top-Coat (ULC Approved)
68.....Interior/ Exterior Latex Porch & Floor Paint, Gloss
71.....Polyurethane, Moisture Cured, Clear, Flat
77.....Epoxy Cold Cured, Gloss
79.....Marine Alkyd Metal Primer
90.....Interior Wood Stain, Semi-Transparent
91.....Wood Filler Paste
94.....Exterior Alkyd, Semi-Gloss
95.....Fast Drying Metal Primer
98.....High Build Epoxy Coating
99.....Sealer, Water-based, for Concrete Floors
101.....Epoxy Anti-Corrosive Metal Primer
107.....Primer, Rust-Inhibitive, Water-based

108.....High Build Epoxy Coating, Low Gloss

113.....Elastomeric, Pigmented, Exterior, Water-based, Flat

114.....Interior Latex, Gloss

115.....Epoxy-Modified Latex, Interior Gloss (MPI gloss level 6)

118.....Dry Fall, Latex Flat

119.....Exterior Latex, High Gloss (acrylic)

134.....Galvanized Water Based Primer

135.....Non-Cementitious Galvanized Primer

138.....Interior High Performance Latex, MPI Gloss Level 2

139.....Interior High Performance Latex, MPI Gloss Level 3

140.....Interior High Performance Latex, MPI Gloss Level 4

141.....Interior High Performance Latex (SG) MPI Gloss Level 5

144.....Latex, Interior, Institutional Low Odor / VOC, (MPI Gloss Level 2)

145.....Latex, Interior, Institutional Low Odor / VOC, (MPI Gloss Level 3)

146.....Latex, Interior, Institutional Low Odor / VOC, (MPI Gloss Level 4)

151.....Light Industrial Coating, Interior, Water-based, (MPI Gloss Level 3)

153.....Light Industrial Coating, Interior, Water-based, (MPI Gloss Level 4)

163.....Exterior Water Based Semi-Gloss Light Industrial Coating, MPI Gloss Level 5

164.....Exterior, Water Based, Gloss, Light Industrial Coating, MPI Gloss Level 6

H. Society for Protective Coatings (SSPC):

SSPC SP 1-82(R2004).....Solvent Cleaning

SSPC SP 2-82(R2004).....Hand Tool Cleaning

SSPC SP 3-28(R2004).....Power Tool Cleaning

SSPC SP 10/NACE No.2....Near-White Blast Cleaning

SSPC PA Guide 10.....Guide to Safety and Health Requirements

I. Maple Flooring Manufacturer’s Association (MFMA):

J. U.S. National Archives and Records Administration (NARA):
29 CFR 1910.1000.....Air Contaminants

K. Underwriter's Laboratory (UL)

PART 2 - PRODUCTS

2.1 **MATERIALS:**

A. Conform to the coating specifications and standards referenced in PART 3. Submit manufacturer's technical data sheets for specified coatings and solvents.

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.

C. Provide undercoat paint produced by the same manufacturer as the finish coats. Use only thinners approved by the paint manufacturer and use only to recommended limits.

D. VOC test method for paints and coatings is to be in accordance with 40 CFR 59 (EPA Method 24). Part 60, Appendix A with the exempt compounds' content determined by Method 303 (Determination of Exempt Compounds) in the South Coast Air Quality Management District's (SCAQMD) "Laboratory Methods of Analysis for Enforcement Samples" manual.

2.3 **PLASTIC TAPE:**

A. Pressure sensitive adhesive back.

B. Widths as shown on construction documents.

2.4 **BIOBASED CONTENT**

A. Paint products shall comply with following bio-based standards for biobased materials:

Material Type	Percent by Weight
Exterior Paint	20 percent biobased material
Wood & Concrete Stain	39 percent biobased content
Polyurethane Coatings	25 percent biobased content
Water Tank Coatings	59 percent biobased content
Wood & Concrete Sealer-	11 percent biobased content

Membrane Concrete Sealers	
Wood & Concrete Sealer-Penetrating Liquid	79 percent biobased content

B. The minimum-content standards are based on the weight (not the volume) of the material.

2.5 **PAINT COATINGS FOR CURED CONCRETE AND ASPHALT SURFACES**

A. Paint Coating: Durable 100% acetone-based traffic marking paint system (meeting Federal Specification TT-P-1952B or A-A-2886B) applied at a spreading rate recommended by the manufacturer or as required to achieve a total dry film thickness of not less than 7.0 mils (whichever is greater). If total dry film thickness is not achievable with one coat, provide additional coat(s) as required by system properties. System must be quick-drying to allow traffic within one hour.

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 day’s 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 COR and the product manufacturer. Under no circumstances are application conditions to exceed manufacturer recommendations.
   c. When the relative humidity exceeds 85 percent; or to damp or wet surfaces; unless otherwise permitted by the paint manufacturer’s printed instructions.
2. Maintain interior temperatures until paint dries hard.
3. Do no exterior painting when it is windy and dusty.

4. Do not paint in direct sunlight or on surfaces that the sun will warm.
5. Apply only on clean, dry and frost-free surfaces except as follows:
   a. Apply water thinned acrylic and cementitious paints to damp (not wet) surfaces only when allowed by manufacturer's printed instructions.
   b. Concrete and masonry when permitted by manufacturer’s recommendations, dampen surfaces to which water thinned acrylic and cementitious paints are applied with a fine mist of water on hot dry days to prevent excessive suction and to cool surface.
6. Varnishing:
   a. Apply in clean areas and in still air.
   b. Before varnishing vacuum and dust area.
   c. Immediately before varnishing wipe down surfaces with a tack rag.

3.2 **INSPECTION:**

A. Examine the areas and conditions where painting and finishing are to be applied and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

B. Report all deviations from the Contract Documents and/or conditions detrimental to performance of the Work to the Architect in writing.

3.3 **GENERAL WORKMANSHIP REQUIREMENTS:**

A. Application may be by brush or roller. Spray application only upon acceptance from the COR in writing.

B. Furnish to the COR a painting schedule indicating when the respective coats of paint for the various areas and surfaces will be completed. This schedule is to be kept current as the job progresses.

C. Protect work at all times. Protect all adjacent work and materials by suitable covering or other method during progress of work. Upon completion of the work, remove all paint and varnish spots from floors, glass and other surfaces. Remove from the premises all rubbish and accumulated materials of whatever nature not caused by others and leave work in a clean condition.

D. Remove and protect hardware, accessories, device plates, lighting fixtures, and factory finished work, and similar items, or provide in place protection. Upon completion of each space, carefully replace all removed items by workmen skilled in the trades involved.

E. When indicated to be painted, remove electrical panel box covers and doors before painting walls. Paint separately and re-install after all paint is dry.

F. Materials are to be applied under adequate illumination, evenly spread and flowed on smoothly to avoid runs, sags, holidays, brush marks, air bubbles and excessive roller stipple.

G. Apply materials with a coverage to hide substrate completely. When color, stain, dirt or undercoats show through final coat of paint, the surface is to be covered by additional coats until the paint film is of uniform finish, color, appearance and coverage, at no additional cost to the Government.

H. All coats are to be dry to manufacturer's recommendations before applying succeeding coats.

I. All suction spots or "hot spots" in plaster after the application of the first coat are to be touched up before applying the second coat.

J. Do not apply paint behind frameless mirrors that use mastic for adhering to wall surface.

3.4 **SURFACE PREPARATION:**

A. General:

1. The Contractor shall be held wholly responsible for the finished appearance and satisfactory completion of painting work. Properly prepare all surfaces to receive paint, which includes cleaning, sanding, and touching-up of all prime coats applied under other Sections of the work. Broom clean all spaces before painting is started. All surfaces to be painted or finished are to be completely dry, clean and smooth.
2. See other sections of specifications for specified surface conditions and prime coat.
3. Perform preparation and cleaning procedures in strict accordance with the paint manufacturer's instructions and as herein specified, for each particular substrate condition.
4. Clean surfaces before applying paint or surface treatments 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. Schedule the cleaning

and painting so that dust and other contaminants from the cleaning process will not fall in wet, newly painted surfaces.

5. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
   a. Concrete: 12 percent.
   b. Fiber-Cement Board: 12 percent.
   c. Masonry (Clay and CMU’s): 12 percent.
   d. Wood: 15 percent.
   e. Gypsum Board: 12 percent.
   f. Plaster: 12 percent.

B. Wood:
1. Sand to a smooth even surface and then dust off.
2. Sand surfaces showing raised grain smooth between each coat.
3. Wipe surface with a tack rag prior to applying finish.
4. Surface painted with an opaque finish:
   a. Coat knots, sap and pitch streaks with MPI 36 (Knot Sealer) before applying paint.
   b. Apply two coats of MPI 36 (Knot Sealer) over large knots.
5. After application of prime or first coat of stain, fill cracks, nail and screw holes, depressions and similar defects with wood filler paste. Sand the surface to make smooth and finish flush with adjacent surface.
6. Before applying finish coat, reapply wood filler paste if required, and sand surface to remove surface blemishes. Finish flush with adjacent surfaces.
7. Fill open grained wood such as oak, walnut, ash and mahogany with MPI 91 (Wood Filler Paste), colored to match wood color.
   a. Thin filler in accordance with manufacturer's instructions for application.
   b. Remove excess filler, wipe as clean as possible, dry, and sand as specified.

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).
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. Fill flat head countersunk screws used for permanent anchors.
   b. Do not fill screws of item intended for removal such as glazing beads.
4. Spot prime abraded and damaged areas in shop prime coat which expose bare metal with same type of paint used for prime coat. Feather edge of spot prime to produce smooth finish coat.
5. Spot prime abraded and damaged areas which expose bare metal of factory finished items with paint as recommended by manufacturer of item.

D. Zinc-Coated (Galvanized) Metal Surfaces Specified Painted:
1. Clean surfaces to remove grease, oil and other deterrents to paint adhesion in accordance with SSPC-SP 1 (Solvent Cleaning).
2. Spot coat abraded and damaged areas of zinc-coating which expose base metal on hot-dip zinc-coated items with MPI 18 (Organic Zinc Rich Coating). Prime or spot prime with MPI 134 (Waterborne Galvanized Primer) or MPI 135 (Non-Cementitious Galvanized Primer) depending on finish coat compatibility.

E. Masonry, Concrete, Cement Board, Cement Plaster and Stucco:
1. Clean and remove dust, dirt, oil, grease efflorescence, form release agents, laitance, and other deterrents to paint adhesion.
2. Use emulsion type cleaning agents to remove oil, grease, paint and similar products. Use of solvents, acid, or steam is not permitted.
3. Remove loose mortar in masonry work.
4. Replace mortar and fill open joints, holes, cracks and depressions with new mortar specified in Section 04 05 13, MASONRY MORTARING or Section 04 05 16, MASONRY GROUTING. Do not fill weep holes. Finish to match adjacent surfaces.
5. Neutralize Concrete floors to be painted by washing with a solution of 1.4 Kg (3 pounds) of zinc sulfate crystals to 3.8 L (1 gallon) of

water, allow to dry three (3) days and brush thoroughly free of crystals.

6. Repair broken and spalled concrete edges with concrete patching compound to match adjacent surfaces as specified in Division 03, CONCRETE Sections. Remove projections to level of adjacent surface by grinding or similar methods.

F. Gypsum Plaster and Gypsum Board:

1. Remove efflorescence, loose and chalking plaster or finishing materials.
2. Remove dust, dirt, and other deterrents to paint adhesion.
3. Fill holes, cracks, and other depressions with CID-A-A-1272A 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.

G. Traffic Surfaces

1. General: Allow new traffic surfaces to cure for a period of not less than 14 days before application of pavement marking materials. If traffic surfaces have been treated with waterproofing sealer, allow sealer to cure for a period of not less than 7 days after sealer installation before application of pavement marking materials.
2. Coordination of Work: Review other Sections in which sealers, sealants and traffic bearing membranes are provided to ensure compatibility of the total system for various substrates. Notify the Architect about anticipated problems using the materials specified over substrates primed by others.
3. Cleaning: Thoroughly clean all surfaces to be marked before application of paint. Remove dust, dirt, and other granular surface deposits by sweeping, blowing with compressed air, rinsing with water, or a combination of these methods. Pavement marking must follow as closely as practicable after the surface has been cleaned and dried.
4. Alignment: All detail pavement markings (painted directional arrows, international handicapped symbols, etc), “striped areas” (no parking areas), parking stalls and marking lines to be as detailed and located as shown on the Drawings. Lay out all painted lines and define with chalk markings for approval before proceeding with painting.

5. Materials Preparation: Mix and prepare paint materials according to manufacturer’s written instructions.
   a. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
   b. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
   c. Use only thinners approved by manufacturer and only within recommended limits.

3.5 **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 (2) component and two (2) 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.

3.6 **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 (3) coats; prime, body, and finish. When two (2) coats applied to prime coat are the same, first coat applied over primer is body coat and second coat is finish coat.
C. Apply each coat evenly and cover substrate completely.
D. Allow not less than 48 hours between application of succeeding coats, except as allowed by manufacturer's printed instructions, and approved by COR.
E. Apply by brush or roller. Spray application for new or existing occupied spaces only upon approval by acceptance from COR in writing.

1. Apply painting materials specifically required by manufacturer to be applied by spraying.
2. In new construction and in existing occupied spaces, 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 "Building and Structural Work Field Painting"; "Work not Painted"; motors, controls, telephone, and electrical equipment, fronts of sterilizes and other recessed equipment and similar prefinished items.

F. Do not paint in closed position operable items such as access doors and panels, window sashes, overhead doors, and similar items except overhead roll-up doors and shutters.

G. Traffic Surfaces
1. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied and comply with the following:
   a. Apply paint for the arrows and symbols using a suitable template that will provide a pavement marking with true, sharp edges and ends. Place detail pavement markings of the color(s), width(s) and length(s), and design pattern at the locations shown.
   b. Unless otherwise detailed, single marking line width must be four-inches (4") wide.
   c. Unless otherwise detailed, "striped areas" must have four-inch (4") wide lines located eighteen inches (18") on center and rotated 45-degrees to the direction of vehicle travel.
2. Painted Signage: Painted signage includes all detail pavement markings, exclusive of actual traffic lane marking, at exit and entrance islands and turnouts, on curbs, at croswalks, at parking bays, and at such other locations as shown. Show the International Handicapped Symbol at indicated parking spaces. Color must be as shown. Apply paint for the symbol using a suitable template that will provide a pavement marking with true, sharp edges and ends. Place detail pavement markings of the color(s), width(s) and length(s), and design pattern at the locations shown.

3. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.

3.7 **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 rabbets for stop and face glazing of wood, and for face glazing of steel.

E. Wood and Wood Particleboard:

1. Use same kind of primer specified for exposed face surface.
   a. Exterior wood: MPI 7 (Exterior Oil Wood Primer) for new construction and MPI 5(Exterior Alkyd Wood Primer) for repainting bare wood primer except where MPI 90 (Interior Wood Stain, Semi-Transparent) is scheduled.
   b. Interior wood except for transparent finish: MPI 45 (Interior Primer Sealer) or MPI 46 (Interior Enamel Undercoat), thinned if recommended by manufacturer.
   c. Transparent finishes as specified under "Transparent Finishes on Wood Except Floors Article".
2. Apply two (2) coats of primer MPI 7 (Exterior Oil Wood Primer) or MPI 5 (Exterior Alkyd Wood Primer) or sealer MPI 45 (Interior Primer Sealer) or MPI 46 (Interior Enamel Undercoat) to surfaces of wood doors, including top and bottom edges, which are cut for fitting or for other reason.
3. Apply one (1) coat of primer MPI 7 (Exterior Oil Wood Primer) or MPI 5 (Exterior Alkyd Wood Primer) or sealer MPI 45 (Interior Primer Sealer) or MPI 46 (Interior Enamel Undercoat) as soon as delivered to site to surfaces of unfinished woodwork, except concealed surfaces of shop fabricated or assembled millwork and surfaces specified to have varnish, stain or natural finish.

4. Back prime and seal ends of exterior woodwork, and edges of exterior plywood specified to be finished.
5. Apply MPI 67 (Interior Latex Fire Retardant, Top-Coat (UL Approved) to wood for fire retardant finish.

F. Metals except boilers, incinerator stacks, and engine exhaust pipes:
1. Steel and iron: MPI 79 (Marine Alkyd Metal Primer) finish is specified.
2. Zinc-coated steel and iron: MPI 134 (Waterborne Galvanized Primer.
3. Aluminum scheduled to be painted: MPI 95 (Fast Drying Metal Primer).
4. Terne Metal: MPI 79 (Marine Alkyd Metal Primer.
5. Copper and copper alloys scheduled to be painted: MPI 95 (Fast Drying Metal Primer).
6. Machinery not factory finished: MPI 9 (Exterior Alkyd Enamel).
7. Asphalt coated metal: MPI 1 (Aluminum Paint).
8. Metal over 94 degrees C (201 degrees F), Boilers, Incinerator Stacks, and Engine Exhaust Pipes: MPI 22 (High Heat Resistant Coating).

G. Concrete Masonry Units except glazed or integrally colored and decorative units:
1. MPI 4 (Block Filler) on interior surfaces.
2. Prime exterior surface as specified for exterior finishes.

3.8 **EXTERIOR FINISHES:**

A. Apply following finish coats where specified in the finish schedule.

B. Steel and Ferrous Metal, Including Tern:
1. Two (2) coats of MPI 8 (Exterior Alkyd, Flat) on exposed surfaces, except on surfaces over 94 degrees C (201 degrees F).

C. Concrete Masonry Units, Concrete:
1. General:
a. Where specified shown.
b. Mix as specified in manufacturer's printed directions.
c. Do not mix more paint than can be used within four (4) hours after mixing. Discard paint that has started to set.
d. Dampen warm surfaces above 24 degrees C (75 degrees F) with fine mist of water before application of paint. Do not leave free water on surface.
e. Cure paint with a fine mist of water as specified in manufacturer's printed instructions.

2. Use two (2) coats of TT-P-1411 (Paint, Co-polymer-Resin, Cementitious), unless specified otherwise.

3.9 **INTERIOR FINISHES:**

A. Interior finishes shall match exterior finishes. Refer to Exterior Finishes section above.

3.10 **REFINISHING EXISTING PAINTED SURFACES:**

A. Clean, patch and repair existing surfaces as specified under "Surface Preparation". No "telegraphing" of lines, ridges, flakes, etc., through new surfacing is permitted. Where this occurs, sand smooth and re-finish until surface meets with COR's approval.

B. Remove and reinstall items as specified under "General Workmanship Requirements".

C. Remove existing finishes or apply separation coats to prevent non compatible coatings from having contact.

D. Patched or Replaced Areas in Surfaces and Components: Apply spot prime and body coats as specified for new work to repaired areas or replaced components.

E. Except where scheduled for complete painting apply finish coat over plane surface to nearest break in plane, such as corner, reveal, or frame.

F. Refinish areas as specified for new work to match adjoining work unless specified or scheduled otherwise.

G. Coat knots and pitch streaks showing through old finish with MPI 36 (Knot Sealer) before refinishing.

H. Sand or dull glossy surfaces prior to painting.

I. Sand existing coatings to a feather edge so that transition between new and existing finish will not show in finished work.

3.11 **PAINT COLOR:**

A. Color and gloss of finish coats is specified in the finish legend.

B. For additional requirements regarding color see Articles, "REFINISHING EXISTING PAINTED SURFACE" and "MECHANICAL AND ELECTRICAL FIELD PAINTING SCHEDULE".

C. Coat Colors:

1. Color of priming coat: Lighter than body coat.
2. Color of body coat: Lighter than finish coat.
3. Color prime and body coats to not show through the finish coat and to mask surface imperfections or contrasts.

D. Painting, Caulking, Closures, and Fillers Adjacent to Casework:
   1. Paint to match color of casework where casework has a paint finish.
   2. Paint to match color of wall where casework is stainless steel, plastic laminate, or varnished wood.

3.12 **PAVEMENT MARKING PAINT SCHEDULE**

A. See Drawing AJ501.

3.13 **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 based upon finish schedule, paint as specified below.

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 “BUILDING AND STRUCTURAL WORK FIELD PAINTING”; “Building and Structural Work not Painted”.

H. Color:
   1. Paint items having no color specified in finish schedule to match surrounding surfaces.
   2. Paint colors as specified in finish schedule except for following:
      a. White: Exterior unfinished surfaces of enameled plumbing fixtures. Insulation coverings on breeching and uptake inside boiler house, drums and drum-heads, oil heaters, condensate tanks and condensate piping.

b. Gray: Heating, ventilating, air conditioning and refrigeration equipment (except as required to match surrounding surfaces), and water and sewage treatment equipment and sewage ejection equipment.

c. Aluminum Color: Ferrous metal on outside of boilers and in connection with boiler settings including supporting doors and door frames and fuel oil burning equipment, and steam generation system (bare piping, fittings, hangers, supports, valves, traps and miscellaneous iron work in contact with pipe).

d. Federal Safety Red: Exposed fire protection piping hydrants, post indicators, electrical conducts containing fire alarm control wiring, and fire alarm equipment.

e. Federal Safety Orange: Entire lengths of electrical conduits containing feeders 600 volts or more.

f. Color to match brickwork sheet metal covering on breeching outside of exterior wall of boiler house.

I. Apply paint systems on properly prepared and primed surface as follows:

1. Exterior Locations:

a. Apply two (2) coats of MPI 94 (Exterior Alkyd, Semi-gloss) to the following ferrous metal items:

Vent and exhaust pipes with temperatures under 94 degrees C(201 degrees F), roof drains, fire hydrants, post indicators, yard hydrants, exposed piping and similar items.

b. Apply two (2) coats of MPI 10 (Exterior Latex, Flat to galvanized and zinc-copper alloy metal.

c. Apply one (1) coat of MPI 22 (High Heat Resistant Coating), 650 degrees C (1200 degrees F) to incinerator stacks, boiler stacks, and engine generator exhaust.

2. Interior Locations:

a. Interior locations shall match exterior locations. Refer to exterior locations section above.

3.14 **BUILDING AND STRUCTURAL WORK FIELD PAINTING:**

A. Painting and finishing of interior and exterior work except as specified here-in-after.

1. Painting and finishing of new and existing work including colors and gloss of finish selected is specified in Finish Schedule.

2. Painting of disturbed, damaged and repaired or patched surfaces when entire space is not scheduled for complete repainting or refinishing.
3. Painting of ferrous metal and galvanized metal.
4. Painting of wood with fire retardant paint exposed in attics, when used as mechanical equipment space (except shingles).
5. Identity painting and safety painting.

B. Building and Structural Work not Painted:

1. Prefinished items:
   a. Casework, doors, elevator entrances and cabs, metal panels, wall covering, and similar items specified factory finished under other sections.
   b. Factory finished equipment and pre-engineered metal building components such as metal roof and wall panels.
2. Finished surfaces:
   a. Hardware except ferrous metal.
   b. Anodized aluminum, stainless steel, chromium plating, copper, and brass, except as otherwise specified.
   c. Signs, fixtures, and other similar items integrally finished.
3. Concealed surfaces:
   a. Inside dumbwaiter, elevator and duct shafts, interstitial spaces, pipe basements, crawl spaces, pipe tunnels, above ceilings, attics, except as otherwise specified.
   b. Inside walls or other spaces behind access doors or panels.
   c. Surfaces concealed behind permanently installed casework and equipment.
4. Moving and operating parts:
   a. Shafts, chains, gears, mechanical and electrical operators, linkages, and sprinkler heads, and sensing devices.
   b. Tracks for overhead or coiling doors, shutters, and grilles.
5. Labels:
   a. Code required label, such as Underwriters Laboratories Inc., Intertek Testing Service or Factory Mutual Research Corporation.
   b. Identification plates, instruction plates, performance rating, and nomenclature.
6. Galvanized metal:

a. Exterior chain link fence and gates, corrugated metal areaways, and gratings.
b. Gas Storage Racks.
c. Except where specifically specified to be painted.

7. Metal safety treads and nosings.
8. Gaskets.
9. Concrete curbs, gutters, pavements, retaining walls, exterior exposed foundations walls and interior walls in pipe basements.
10. Face brick.
11. Structural steel encased in concrete, masonry, or other enclosure.
12. Structural steel to receive sprayed-on fire proofing.
13. Ceilings, walls, columns in interstitial spaces.
14. Ceilings, walls, and columns in pipe basements.
15. Wood Shingles.

3.15 **IDENTITY PAINTING SCHEDULE:**

A. Identify designated service in new buildings or projects with extensive remodeling in accordance with ASME A13.1, unless specified otherwise, on exposed piping, piping above removable ceilings, piping in accessible pipe spaces, interstitial spaces, and piping behind access panels. For existing spaces where work is minor match existing.

1. Legend may be identified using snap-on coil plastic markers or by paint 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 12.2 M (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 using black stencil paint.
5. Identify pipe contents with sufficient additional details such as temperature, pressure, and contents to identify possible hazard. Insert working pressure shown on construction documents where asterisk appears for High, Medium, and Low Pressure designations as follows:
   a. High Pressure - 414 kPa (60 psig) and above.
   b. Medium Pressure - 104 to 413 kPa (15 to 59 psig).
   c. Low Pressure - 103 kPa (14 psig) and below.

d. Add Fuel oil grade numbers.

6. Legend name in full or in abbreviated form as follows:

PIPING	COLOR OF EXPOSED PIPING	COLOR OF BACKGROUND	COLOR OF LETTERS	LEGEND ABBREVIATIONS
Blow-off		Green	White	Blow-off
Boiler Feedwater		Green	White	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		Blue	White	Shop Air
Air-Instrument Controls		Green	White	Air-Inst Cont
Drain Line		Green	White	Drain
Emergency Shower		Green	White	Emg Shower
High Pressure Steam		Green	White	H.P. _____*
High Pressure Condensate Return		Green	White	H.P. Ret ____*
Medium Pressure Steam		Green	White	M. P. Stm ____*
Medium Pressure Condensate Return		Green	White	M.P. Ret _____*
Low Pressure Steam		Green	White	L.P. Stm _____*
Low Pressure Condensate Return		Green	White	L.P. Ret _____*
High Temperature Water Supply		Green	White	H. Temp Wtr Sup
High Temperature Water Return		Green	White	H. Temp Wtr Ret
Hot Water Heating Supply		Green	White	H. W. Htg Sup
Hot Water Heating Return		Green	White	H. W. Htg Ret
Gravity Condensate Return		Green	White	Gravity Cond Ret
Pumped Condensate Return		Green	White	Pumped Cond Ret
Vacuum Condensate Return		Green	White	Vac Cond Ret
Boiler Water Sampling		Green	White	Sample
Chemical Feed		Green	White	Chem Feed
Continuous Blow-Down		Green	White	Cont. B D
Pumped Condensate		Green	White	Pump Cond
Pump Recirculating		Green	White	Pump-Recirc.
Vent Line		Green	White	Vent

Alkali		Orange	Black	Alk
Bleach		Orange	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		Orange	Black	Acid Waste
Vent		Orange	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	Red	White	Auto Spr
Standpipe	Red	Red	White	Stand
Sprinkler	Red	Red	White	Drain

7. Electrical Conduits containing feeders over 600 volts, paint legends using 50 mm (2 inch) high black numbers and letters, showing the voltage class rating. Provide legends where conduits pass through walls and floors and at maximum 6096 mm (20 foot) intervals in between. Use labels with yellow background with black border and words Danger High Voltage Class 5000.
8. See Sections for methods of identification, legends, and abbreviations of the following:

a. Conduits containing high voltage feeders over 600 volts:
Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS /
Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS /
Section 28 05 28.33, CONDUITS AND BACKBOXES FOR ELECTRONIC SAFETY AND SECURITY.

3.16 **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.

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DIVISION 10

SECTION 10 14 00
SIGNAGE

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies interior signage for room numbers, directional signs exterior signage, code required signs and temporary signs.

B. This section specifies exterior signage.

1.2 RELATED WORK

A. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS: Sustainable Design Requirements.

B. Section 03 30 53, MISCELLANEOUS CAST-IN-PLACE CONCRETE: Concrete Post Footings.

C. Section 05 12 00, STRUCTURAL STEEL FRAMING: Structural Steel Supports.

D. Division 26, ELECTRICAL Lighted EXIT signs for egress purposes are specified under and Electrical Work.

1.3 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Provide signage, that is the product of one manufacturer, who has provided signage as specified for a minimum of three (3) years. Submit manufacturer’s qualifications.

B. Installer’s Qualifications: Minimum three (3) years’ experience in the installation of signage of the type as specified in this Section. Submit installer’s qualifications.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 00, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

B. Sustainable Design Submittals, as described below:

1. Volatile organic compounds per volume as specified in PART 2 - PRODUCTS.

C. Interior Sign Samples: Sign panels and frames, with letters and symbols, for each sign type.

1. Sign Panel, 203 x 254 mm (8 x 10 inches), with letters.
2. Color samples of each color, 152 x 152 mm (6 x 6 inches. Show anticipated range of color and texture.
3. Sample of typeface, arrow, and symbols in a typical full-size layout.

D. Exterior Sign Samples: 152 x 152 mm (6 x 6 inches) samples of each color and material.

E. Manufacturer's Literature:
   1. Showing the methods and procedures proposed for the anchorage of the signage system to each surface type.
   2. Manufacturer’s printed specifications and maintenance instructions.
F. Sign Location Plan, showing location, type and total number of signs required.
G. Shop Drawings: Scaled for manufacture and fabrication of sign types. Identify materials, show joints, welds, anchorage, accessory items, mounting and finishes.
H. Full size layout patterns for dimensional letters.
I. Manufacturer’s qualifications.
J. Installer’s qualifications.

1.5 DELIVERY AND STORAGE

A. Deliver materials to the job in manufacturer's original sealed containers with brand name marked thereon. Protect materials from damage.
B. Package to prevent damage or deterioration during shipment, handling, storage, and installation. Maintain protective covering in place and in good repair until removal is necessary.
C. Deliver signs only when the site and mounting services are ready for installation work to proceed.
D. Store products in dry condition inside enclosed facilities.

1.6 WARRANTY

A. Construction Warranty: Comply with FAR clause 52.246-21, “Warranty of Construction”.

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 Architectural Manufacturers Association (AAMA):
   611-14.....Anodized Architectural Aluminum
   2603-13.....Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels
C. American National Standards Institute (ANSI):

A117.1-09.....Accessible and Usable Buildings and Facilities

D. ASTM International (ASTM):

A36/A36M-19.....Carbon Structural Steel

A240/A240M-20.....Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

A666-15.....Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar

A1011/A1011M-18a.....Steel, Sheet, and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength

B36/B36M-18.....Brass Plate, Sheet, Strip, and Rolled Bar

B152/B152M-19.....Copper Sheet, Strip, Plate, and Rolled Bar

B209-14.....Aluminum and Aluminum-Alloy Sheet and Plate

B209M-14.....Aluminum and Aluminum-Alloy Sheet and Plate (Metric)

B221-14.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

B221M-13.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes (Metric)

C1036-16.....Flat Glass

C1048-18.....Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass

C1349-17.....Architectural Flat Glass Clad Polycarbonate

D1003-13.....Test Method for Haze and Luminous Transmittance of Transparent Plastics

D4802-16.....Poly (Methyl Methacrylate) Acrylic Plastic Sheet

E. Code of Federal Regulation (CFR):

40 CFR 59.....Determination of Volatile Matter Content, Water Content, Density Volume Solids, and Weight Solids of Surface Coating

F. Federal Specifications (Fed Spec):

MIL-PRF-8184F.....Plastic Sheet, Acrylic, Modified.

MIL-P-46144C.....Plastic Sheet, Polycarbonate

G. National Fire Protection Association (NFPA):

70-14.....National Electrical Code

PART 2 - PRODUCTS

2.1 SIGNAGE GENERAL

A. Provide signs of type, size and design shown on the construction documents.

B. Provide signs complete with lettering, framing and related components for a complete installation.

C. Provide graphics items as completed units produced by a single manufacturer, including necessary mounting accessories, fittings and fastenings.

D. Do not scale construction documents for dimensions. Verify dimensions and coordinate with field conditions. Notify Contracting Officer Representative (COR) of discrepancies or changes needed to satisfy the requirements of the construction documents.

2.2 EXTERIOR SIGNAGE PERFORMANCE REQUIREMENTS

A. Structural Calculations: Engage a Professional Engineer (PE) who is registered in the state where the work is located to design sign structure and anchorage to withstand design loads.

B. Thermal Movements: For exterior signs, allow for thermal movements from ambient and surface temperature changes 67 degrees C (120 degrees F) ambient and 100 degrees C (180 degrees F) material surfaces.

1. Provide installed electrical components and sign installations bearing the label and certifications of Underwriter’s Laboratories, Inc., and comply with NFPA 70 as well as applicable federal codes for installation techniques, fabrication methods and general product safety.

2.3 EXTERIOR SIGN MATERIALS

A. Aluminum Sheet and Plate: ASTM B209M (B209).

B. Aluminum Extrusions: ASTM B221M (B221).

C. Brass Sheet (Yellow Brass): ASTM B36/B36M.

D. Bronze Plate: ASTM B36/B36M.

E. Copper Sheet: ASTM B152/B152M.

F. Steel Products: Structural steel products that conform to ASTM A36/A36M. Sheet and strip steel products that conform to ASTM A1011/A1011M.

G. Stainless Steel Sheet: ASTM A240/A240M, stretcher leveled standard of flatness.

H. Acrylic Sheet: ASTM D4802; category as standard with manufacturer for each sign. Provide type UVF.

I. Fiberglass Sheet: Multiple laminations of glass fiber reinforced polyester resin with UV light stabilized, colorfast, nonfading, weather and stain resistant, colored polyester gel coat with manufacturer's standard finish.

J. Polycarbonate Sheet: ASTM C1349, Appendix X1, Type II (coated, mar resistant, UV stabilized polycarbonate) with coating on both sides.

K. Finish:

1. ALUMINUM FINISHES:
   a. Color Anodic Finish: AAMA 611.
2. Metallic Coated Steel Finish:
   a. Baked Enamel or Powder Coat Finish: After cleaning and pretreating, apply manufacturer's standard two (2) coat baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of 0.07 mm (2 mills).

2.4 EXTERIOR SIGN TYPES

A. General:

1. Fabricate signs that comply with VA Signage Design Manual.

B. Text and Graphics:

1. Illuminated Signs: Form graphics with router and backed with 3 mm (0.0125 inch) thick minimum translucent white acrylic diffuser. Mechanically fasten diffuser and letter voids to sign face.
2. Non-illuminated Signs: Provide surface applied reflective white opaque vinyl graphics.

C. Non-illuminated Monument with Stacking Text Modules:

1. Provide non-illuminated sign cabinet mounted to concrete base with reveal between base and cabinet.
2. Constructed of aluminum extrusion system including the following integral features:
   a. Water relief channel for proper drainage.
   b. Internal flanges for attachment of additional structural supports and mounting to base.

c. Interchangeable side loading sign text modules to allow for individual sign panel removal without the removal of the entire face.

D. Non-illuminated Post and Panel Sign:

1. Provide non-illuminated sign cabinet mounted to extruded aluminum posts with adjustable reveal between posts and cabinet.
2. Construct sign of aluminum extrusion system including the following integral features:
   a. Water relief channel for proper drainage.
   b. Internal flanges for attachment of additional structural supports and mounting to posts.
   c. Extruded aluminum posts.
   d. Extruded aluminum reveal which is adjustable and frame retainer (maximum 25 mm (1 inch) face dimension) to allow for sign face removal.
3. Weld sign cabinet at mitered corners and provide internal bracing to ensure structural rigidity. Shop weld and grind exposed welds smooth so surface is consistent with surrounding surface and accepts paint finish in like manner.
4. Sign Faces: 2.3 mm (0.090 inch) thick aluminum. Mount aluminum faces into the framed extruded cabinet to allow for removal from the top or side, so faces can be changed without affecting extruded sign structure.

E. Non-illuminated Wall Panel Sign:

1. Provide sign constructed of an aluminum extrusion system including:
   a. Internal flanges for attachment of additional structural supports and mounting to wall.
   b. Frame retainer maximum 25 mm (1 inch) face dimension to allow for sign face removal.
2. Weld sign cabinet at mitered corners and provide internal bracing to ensure structural rigidity. Shop weld and grind smooth exposed welds so that surface is consistent with surrounding surface and accepts paint finish in a like manner.
3. Sign Faces: 2.3 mm (0.090 inch) thick aluminum with surface applied reflective white vinyl graphics.

a. Mount aluminum face in extruded cabinet frame to allow for removal from top or side, so that faces can be changed without affecting extruded sign structure.

F. Non-illuminated Wall Panel Sign:
1. Constructed of flat sheet of aluminum for wall mounting.
2. Sign Face: 3.2 mm (0.125 inch) thick aluminum with surface applied reflective white vinyl graphics.
3. Install mechanical fasteners into wall surface. Exposed support brackets are not acceptable.

G. Non-Illuminated Cut Out Dimensional Letters:
1. Provide cut out aluminum letters which are mill cut (vertical sides) out of 19 mm (0.75 inch) plate as required by sign type.
2. Letters: Studded and mounted with 9 mm (.375 inch) spacers to wall surface using adhesive appropriate to the surface.
3. Paint letters with acrylic polyurethane in specified color and finish on drawing sheet AW603.

2.5 FABRICATION

A. Design interior signage components to allow for expansion and contraction for a minimum material temperature range of 38 degrees C (100 degrees F), without causing buckling, excessive opening of joints or over stressing of adhesives, welds, and fasteners.

B. Form work to required shapes and sizes, with true curve lines and angles. Provide necessary rebates, lugs, and brackets for assembly of units. Provide concealed fasteners wherever possible.

C. Shop fabricate so far as practicable. Fasten joints flush to conceal reinforcement, or weld joints, where thickness or section permits.

D. Level and assemble contract surfaces of connected members so joints will be tight and practically unnoticeable, without applying filling compound.

E. Signs: Fabricate with fine, even texture to be flat and sound.
1. Maintain lines and miters sharp, arises unbroken, profiles accurate and ornament true to pattern.
2. Plane surfaces to be smooth, flat and without oil-canning, free of rack and twist.
3. Maximum variation from plane of surface plus or minus 0.3 mm (0.015 inches). Restore texture to filed or cut areas.

F. Finish extruded members to be free from extrusion marks. Fabricate square turns, sharp corners, and true curves.

G. Finish hollow signs with matching material on all faces, tops, bottoms and ends. Miter edge joints give appearance of solid material.

H. Do not manufacture signs until final sign message schedule and location review has been completed by the COR and forwarded to contractor.

I. Drill holes for bolts and screws. Mill smooth exposed ends and edges with corners slightly rounded.

J. Form joints exposed to weather to exclude water.

K. Movable Parts, Including Hardware: Cleaned and adjusted to operate as designed without binding or deformation of members. Center doors and covers in opening or frame.

1. Align contact surfaces fit tight and even without forcing or warping components.

L. Pre-assemble items in shop to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for re-assembly and coordinated installation.

M. Prime painted surfaces as required. Apply finish coating of paint for complete coverage with no light or thin applications allowing substrate or primer to show.

1. Finish surface smooth, free of scratches, gouges, drips, bubbles, thickness variations, foreign matter, and other imperfections.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Locate signs as shown on the construction documents.

B. Where not otherwise indicated conform to the VA Signage Design Manual for installation requirements.

C. At each sign location there are no utility lines behind each sign location that will be affected by installation of signs.

1. Correct and repair damage done to utilities during installation of signs at no additional cost to Government.

D. Provide inserts and anchoring devices which must be set in concrete or other material for installation of signs. Submit setting drawings, templates, instructions, and directions for installation of anchorage devices, which may involve other trades.

E. Refer to Sign Message Schedule for mounting method. Mount signs in proper alignment, level and plumb according to the Sign Location Plan and the dimensions given on elevation and Sign Location Plans. When the exact position, angle, height or location is not clear, contact COR for resolution.

F. When signs are installed on glass, provide blank glass back up to be placed on opposite side of glass exactly behind sign being installed. Provide blank glass back that is the same size as sign being installed.

G. Touch up exposed fasteners and connecting hardware to match color and finish of surrounding surface.

H. At completion of sign installation, clean exposed sign surfaces. Clean and repair adjoining or adjacent surfaces that became soiled or damaged as a result of installation of signs.

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SECTION 10 44 13
FIRE EXTINGUISHER CABINETS

PART 1 - GENERAL

1.1 DESCRIPTION

This section covers surface mounted fire extinguisher cabinets.

1.2 RELATED WORK (NOT USED)

1.3 SUBMITTALS

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

B. Manufacturer's Literature and Data: Fire extinguisher cabinet including installation instruction and rough opening required.

1.4 APPLICATION PUBLICATIONS

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

B. American Society of Testing and Materials (ASTM):
D4802-15.....Poly (Methyl Methacrylate) Acrylic Plastic Sheet

PART 2 - PRODUCTS

2.1 FIRE EXTINGUISHER CABINET

Surface mounted type with flat trim of size and design shown.

2.2 FABRICATION

A. Form body of cabinet from 0.9 mm (0.0359 inch) thick sheet steel.

B. Fabricate door and trim from 1.2 mm (0.0478 inch) thick sheet steel with all face joints fully welded and ground smooth.

1. Glaze doors with 6 mm (1/4 inch) thick ASTM D4802, clear acrylic sheet, Category B-1, Finish 1.
2. Design doors to open 180 degrees.
3. Provide continuous hinge, pull handle, and adjustable roller catch.

2.3 FINISH

A. Finish interior of cabinet body with baked-on semigloss white enamel.

B. Finish door, frame with manufacturer's standard baked-on prime coat suitable for field painting.

PART 3 - EXECUTION

A. Install fire extinguisher cabinets in prepared openings and secure in accordance with manufacturer's instructions.

B. Install cabinet so that the extinguisher height within meets the requirements of NFPA 10

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SECTION 10 73 00
AWNING SYSTEMS

Part 1 – General

1.1 SUMMARY

A. Provide fixed custom awnings as shown on the drawings, as specified and as needed for a complete and proper installation.

B. The drawings show the extent of the work, the dimensioned profile and depth of the awning to be provided.

1.2 RELATED REQUIREMENTS

A. Materials Testing and Inspection During Construction: Section 01 45 29, TESTING LABORATORY SERVICES.

B. SECTION 05 – METAL FABRICATIONS

1.3 SUBMITTALS

A. Product Data

1. Submit specifications, data and installation instructions from the manufacturer of the awning system.

B. Shop Drawings

1. Include elevations, sections, and specific details for each awning.
2. Show anchorage details and connections for all component parts.
3. Include signed and sealed calculations, prepared by a registered professional engineer.

C. Samples

1. Submit one sample minimum 24” long of each material to be utilized at each awning with appropriate finish.

D. Submit color chips for approval.

E. Warranty

1. A written warranty to the owner that the products will be free of defective materials or workmanship for a period of one year from date of installation.

1.4 QUALITY ASSURANCE

A. Single subcontract responsibility: Subcontract the work to a single firm that has had not less than ten years’ experience in the design and manufacturing of work similar to that shown and required. For quality and delivery control, awnings must be

purchased from a single source.

B. Performance

1. Design awnings to accommodate local requirements for snow and wind loading. Provide engineering calculations to support design. Calculations to be by a registered engineer licensed in the state the project is located. Analysis to include all components of awning including but not limited to capacity and deflection. Deflection to be limited to L/120, ¾", or as required by code.

C. Professional Engineer Requirements: Structural calculations to be signed and sealed by a professional engineer licensed to practice in the project state.

D. Warranty: Provide written warranty to the owner that all products will be free of defective materials or workmanship for a period of one year from date of installation.

1.5 DELIVERY, STORAGE AND HANDLING

A. Delivery: At the time of delivery all materials shall be visually inspected for damage. Any damaged boxes, crates, louver sections, etc. shall be noted on the receiving ticket and immediately reported to the shipping company and the material manufacturer.

B. Storage:

1. Material may be stored flat, on end or on its side.
2. Material may be stored either indoors or outdoors.
3. If stored outdoors the material must be raised sufficiently off the ground to prevent it being flooded.
4. If stored outdoors the material must be covered with a weather-proof flame-resistant sheeting or tarpaulin.

C. Handling:

1. Material shall be handled in accordance with sound material handling practices and in such a way as to minimize racking.

Part 2 – Products

2.1 MANUFACTURERS

A. Basis of Design is Construction Specialties Modular Awning System or VA approved equal.

2.2 MATERIALS

A. Aluminum Extrusions: ASTM B211, Alloy 6063-T5, 6063-T6, 6005-T5, 6105-T5, 3003, 5005 or 6061-T6.

B. Fasteners: Fasteners to be aluminum or stainless steel. Provide types, gauges and lengths to suit unit installation conditions.

C. Anchors and Inserts: Use non-ferrous metal or hot dip galvanized anchors and inserts for installation and elsewhere as required for corrosion resistance. Use stainless steel or lead expansion bolt devices for drill in place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

2.3 FABRICATION GENERAL

A. Provide fixed awnings and accessories materials, sizes, depths, arrangements and material thickness to be as indicated or as required for optimal performance with respect to strength; durability; and uniform appearance.

B. Include supports, anchorage, and accessories required for complete assembly.

2.4 AWNING MODELS

A. Platform MBS Awning System.

1. Outriggers: 1/4” custom profile flat aluminum plate members, cut to match blade profile exactly.
2. Infill: by awning manufacturer
3. Fascia: 2” x 8” Tube
4. Diagonal Support: 5/8” aluminum rod
5. Mounting Bracket:
   i. Aluminum mounting bracket, by awning manufacturer. All fasteners mounting to structure to be designed and supplied by awning manufacturer. Fasteners to be stainless steel 300 Series.

2.5 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.

Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of abutting or

adjacent pieces are acceptable if they are within one-half of the range of approved Samples. 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.

C. Baked-Enamel Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Color and Gloss: Matte black as selected by Architect and approved by VA.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine openings to receive the work. Do not proceed until any unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's instructions and recommendations for installation of the work.

B. Verify dimensions of supporting structure at the site by accurate field measurements so that the work will be accurately designed, fabricated, and fitted to the structure.

C. Anchor awnings to the building substructure as indicated on architectural drawings.

D. Erection Tolerances:

1. Maximum variation from plane or location shown on the approved shop drawings: 1/8" per 12 feet of length, but not exceeding 1/2" in any total building length or portion thereof (non-cumulative).
2. Maximum offset from true alignment between two members abutting end to end, edge-to-edge in line or separated by less than 3": 1/16" (shop or field joints). This limiting condition shall prevail under both load and no- load conditions.

E. Cut and trim component parts during erection only with the

approval of the manufacturer or fabricator, and in accordance with his recommendations. Restore finish completely. Remove and replace members where cutting and trimming has impaired the strength or appearance of the assembly.

F. Do not erect warped, bowed, deformed or otherwise damaged or defaced members. Remove and replace any members damaged in the erection process as directed.

G. Set units level, plumb and true to line, with uniform joints.

3.3 PROTECTION

A. Protect installed materials to prevent damage by other trades. Use materials that may be easily removed without leaving residue or permanent stains.

3.4 ADJUSTING AND CLEANING

A. Immediately clean exposed surfaces to remove fingerprints and dirt accumulation during the installation process. Do not let soiling remain until the final cleaning.

B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to the material finishes. Thoroughly rinse surfaces and dry.

C. Restore components damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by the Architect, remove damaged materials and replace with new materials.

1. Touch up minor abrasions in finishes with a compatible air-dried coating that matches the color and gloss of the factory applied coating.

- - END - -

DIVISION 14

SECTION 142100

ELECTRIC TRACTION ELEVATORS

PART 1: GENERAL

1.1 SUMMARY

A. Section Includes: Electric Traction Elevators.

B. Products Supplied but Not Installed Under this Section:

1. Hoist Beam
2. Pit Ladder
3. Inserts mounted in block walls for rail attachments.

C. Work Supplied Under Other Sections:

1. Temporary lighting, including temporary lighting in hoistway for machine space with switch located in hoistway on the strike jamb side of top landing door.
2. Main line disconnects for each elevator.
   a. One fused three phase permanent power in building electrical distribution room.
3. Hoistway ventilation shall be in accordance with local and national building code requirements.
4. Guide Rail Support shall be structurally adequate to extend from pit floor to top of hoistway, with spans in accordance with requirements of authority having jurisdiction and final layouts.
5. Removable barricades at all hoistway openings, in compliance with OSHA 29 CFR 1926.502 in addition to any local code requirements.
6. Lifeline attachments capable of withstanding 5000 lb load in accordance with OSHA 29 CFR 1926.502. Provide a minimum of 2 at the top, front of each hoistway.
7. Pit lighting: Fixture with switch and guards. Provide illumination level equal to or greater than that required by ASME A17.1/CSA B44 2000, or applicable version.
8. Control space lighting with switch. Coordinate switch with lighting for machine space as allowable by code.

D. Related sections:

1. Section 033000 - Cast-in-Place Concrete:
2. Section 042000 - Unit Masonry
3. Section 055000 - Metal Fabrications

4. Division 23 - Heating, Ventilating, and Air Conditioning
5. Division 26 - Electrical
6. Section 263000 - Electric Power Generating and Storing Equipment
7. Section 273000 - Voice Communications
8. Section 283100 - Fire Detection and Alarm
9. Section 310000 – Earthwork

E. Industry and government standards:

1. ICC/ANSI A117.1 Accessible and Usable Buildings and Facilities
2. ADAAG - Accessibility Guidelines for Buildings and Facilities
3. ANSI/NFPA 70, National Electrical Code
4. ANSI/NFPA 80, Standard for Fire Doors and Fire Windows
5. ASME/ANSI A17.1, Safety Code for Elevators and Escalators.

1.2 DESCRIPTION OF ELEVATOR

A. Elevator Equipment: Machine Room-Less gearless traction elevator

B. Equipment Control: KCM831

C. Drive: Regenerative

D. Quantity of Elevators: 2 Elevators

E. Landings: 5

F. Openings: 5 Front Openings, 2 Back Openings

G. Main Power Supply: 480 V Volts + 5%, three-phase

H. Operation: Duplex

I. Machine Location: Inside the hoistway mounted on car guide rail

J. Control Space Location: Integrated control

K. Elevator Equipment shall conform to the requirements of seismic zone: Non-Seismic

L. Maintenance Service Period: 12 Months

1.3 PERFORMANCE REQUIREMENTS

A. Car Performance

1. Car Speed ± 5% of contract speed under any loading condition or direction of travel.
2. Car Capacity: Safely lower, stop and hold (per code) up

to 125% of rated load.

B. System Performance

1. Vertical Vibration (maximum): 15 mg ISO187338/ISO 8041 system pk - pk
2. Horizontal Vibration (maximum): 12 mg ISO187338/ISO 8041 system pk - pk
3. Jerk Rate (maximum): 3.3 ft/sec3
4. Acceleration (maximum): 1.3 ft/sec2
5. In Car Noise: 55 dB(A) Maximum
6. Leveling Accuracy: ±0.2 inches
7. Starts per hour (maximum): 240

1.4 SUBMITTALS

A. Comply with Section 01 33 23 - Shop Drawings, Product Data and Samples.

B. Product Data: Submit manufacturer's product literature for each proposed system.

1. Cab design, dimensions and layout.
2. Layout, finishes, and accessories and available options.
3. Controls, signals and operating system.
4. Color selection charts for cab and entrances.

C. Shop Drawings:

1. Clearances and travel of car.
2. Clear inside hoistway and pit dimensions.
3. Location and layout of equipment and signals.
4. Car, guide rails, buffers and other components in hoistway.
5. Maximum rail bracket spacing.
6. Maximum loads imposed on building structure.
7. Hoist beam requirements.
8. Location and sizes of access doors.
9. Location and details of hoistway door and frames.
10. Electrical characteristics and connection requirements.

D. Operation and maintenance data:

1. Provide manufacturer's standard maintenance and operation manual.

E. Diagnostic Tools

1. Prior to seeking final acceptance for the completed project as specified by the Contract Documents, the Elevator Contractor shall deliver to the Owner any specialized tool(s) that may be required to perform diagnostic evaluations, adjustments, and/or parametric software changes and/or test and inspections on any piece of control or monitoring equipment installed.
   This shall include any specialized tool(s) required for monitoring, inspection and/or maintenance where the means of suspension other than conventional wire ropes are furnished and installed by the Elevator Contractor. Any and all such tool(s) shall become property of the Owner.
   Any diagnostic tool provided to the Owner by the Elevator Contractor shall be configured to perform all levels of diagnostics, systems adjustment and parametric software changes which are available to the Elevator Contractor.
   In those cases where diagnostic tools provided to the Owner require periodic recalibration/or re-initiation, the Elevator Contractor shall perform such tasks at no additional cost to the Owner for a period equal to the term of the maintenance agreement from the date of final acceptance of the competed project During those intervals in which the Owner might find it necessary to surrender a diagnostic tool for re-calibration, re-initiation, or repair, the Elevator Contractor shall provide a temporary replacement for the tool at no additional cost to the Owner.
   The Elevator Contractor shall deliver to the Owner, printed instructions for the proper use of any tool that may be necessary to perform diagnostic evaluations, system adjustment, and/or parametric software changes on any unit of microprocessor-based elevator control equipment and means of suspension other than standard elevator steel cables furnished and install by the Elevator Contractor.
   Accompanying the printed instructions shall be any and all access codes, password, or other proprietary information that is necessary to interface with the

microprocessor-control equipment.

1.5 QUALITY ASSURANCE

A. Manufacturer: Minimum of fifteen years' experience in the fabrication, installation and service of elevators of the type and performance of the specified. The manufacturer shall have a documented quality assurance program.

B. Installer: The equipment manufacturer shall install the elevator.

C. Inspection and Testing: In accordance with requirements of local jurisdiction, obtain required permits, inspections and tests.

1.6 DELIVERY, STORAGE AND HANDLING

A. If the construction site is not prepared to receive the elevator equipment at the agreed ship date, the General Contractor shall be responsible for the cost of storage at an approved facility. Additional labor costs for double handling will be the responsibility of the General Contractor.

B. Delivered elevator materials shall be stored in a protected environment in accordance with manufacturer recommendations. A minimum storage area of 10 feet by 20 feet is required adjacent to the hoistway.

1.7 WARRANTY

A. Provide manufacturer warranty for a period of one year. The warranty period is to begin upon final acceptance of the Contract. Warranty covers defects in materials and workmanship. Damage due to ordinary use, vandalism, improper or insufficient maintenance, misuse, or neglect do not constitute defective material or workmanship.

1.8 MAINTENANCE SERVICE

A. The elevator manufacturer shall provide maintenance service consisting of regular examinations and adjustments of the elevator equipment for a period of 12 Months after date of final acceptance.

Predictive maintenance shall be included for the full maintenance period. This service must be capable of using AI-based analytics to identify potential equipment issues and

notifying the elevator provider via an internet connection.

Replacement parts shall be produced by the original equipment manufacturer.

B. Maintenance service to be performed during regular working hours of regular working days and shall include emergency call back service during regular working hours.

C. Maintenance service shall not include adjustments, repairs or replacement of parts due to negligence, misuse, abuse or accidents.

PART 2: PRODUCTS

2.1 MANUFACTURER

A. Provide AC gearless machine room-less elevator systems subject to compliance with the design and performance requirements of this specification.

1. Basis of Design or VA approved equal: KONE Machine Room-Less traction elevators by KONE, Inc. (www.kone.com).

2.2 EQUIPMENT: CONTROL COMPONENTS AND CONTROL SPACE

A. Controller: Provide microcomputer-based control system to perform all functions.

1. All high voltage (110V or above) contact points inside the controller cabinet shall be protected from accidental contact in a situation where the controller doors are open.
2. Controller shall be separated into two distinct halves; Motor Drive side and Control side. High voltage motor power conductors shall be routed and physically segregated from the rest of the controller.
3. Provide a serial cardrack and main CPU board containing a non- erasable EPROM and operating system firmware.
4. Variable field parameters and adjustments shall be contained in a non- volatile memory module.
5. Integrate Elevator Control with existing BMS, Building Management System and existing PACS, Program Automation Control Systems.

B. Drive: Provide Variable Voltage Variable Frequency AC drive system to develop high starting torque with low starting

current.

C. Controller Location: Locate controller{s} in the front wall integrated with the top landing entrance frame, machine side of the elevator. One non-fused three phase permanent power in hoist way at top landing. A separate control space should not be required.

2.3 EQUIPMENT: HOISTWAY COMPONENTS

A. Machine: AC gearless machine, with permanent magnet synchronous motor, direct current electro-mechanical disc brakes and integral traction drive sheave, mounted to the car guide rail at the top of the hoistway

B. Governor: Friction type over-speed governor rated for the duty of the elevator specified.

C. Buffers, Car and Counterweight: Polyurethane buffer.

D. Hoistway Operating Devices:

1. Emergency stop switch in the pit
2. Terminal stopping switches.
3. Emergency stop switch on the machine

E. Positioning System: System consisting of magnets and proximity switches.

F. Guide Rails and Attachments: Steel rails with brackets and fasteners.

2.4 EQUIPMENT: HOISTWAY ENTRANCES

A. Hoistway Entrances

1. Sills: Extruded Aluminum.
2. Doors: Hollow metal construction with vertical internal channel reinforcements.
3. Fire Rating: Entrance and doors shall be UL fire-rated for 1-1/2 hour.
4. Entrance Finish: Brushed Stainless Steel.
5. Entrance Markings Jamb Plates: Provide standard entrance jamb tactile markings on both jambs, at all floors. Plate Mounting: Refer to manufacturer drawings.

2.5 EQUIPMENT: CAR COMPONENTS

A. Car Frame: Provide car frame with adequate bracing to support the platform and car enclosure.

B. Car Safeties: Device will be provided and mounted under the car platform, securely bolted to the Car Frame. The safety will be actuated by a centrifugal governor mounted at the top of the hoistway. The Safety is designed to operate in case the car attains excessive descending speed.

C. Platform: Platform shall be all steel construction.

D. Car Guides: Provide guide-shoes mounted to top and bottom of both car and counterweight frame. Each guide-shoe assembly shall be arranged to maintain constant contact on the rail surfaces. Provide retainers in areas with Seismic design requirements.

E. Cab Finish: Industrial Chic - 42005

F. Car Wall Finish:

1. Side Walls: Asturias Satin (F) Brushed Stainless Steel
2. Car front, Door and Skirting: Asturias Satin (F) Stainless Steel
3. Ceiling: CL88 Asturias Satin (F) Brushed Stainless Steel
4. Handrails: HR61 Asturias Satin (F) Brushed Stainless Steel
   a. Rails to be located on Side Walls of car enclosure.
5. Sills: Aluminum extruded.

G. Flooring: By others. (Not to exceed 6lb/sqft and 1/2" finished depth.)

H. Emergency Car Signals

1. Emergency Siren: Siren mounted on top of cab that is activated when the alarm button in the car operating panel is engaged. Siren shall have rated sound pressure level of 80 dB(A) at a distance of three feet from device. Siren shall respond with a delay of not more than one second after activation of alarm button.
2. Emergency Car Lighting: Provide emergency power unit employing a 12- volt sealed rechargeable battery and totally static circuits shall illuminate the elevator car and provide current to the alarm bell in the event of building power failure.
3. Emergency Exit Contact: An electrical contact shall be provided on the car-top exit.

I. Ventilation: Manufacturer's standard cab fan

2.6 EQUIPMENT: SIGNAL DEVICES AND FIXTURES

A. Car Operating Panel: Provide car operating panel with all push buttons, key switches, and message indicators for elevator operation. Fixture finish to be Brushed Stainless Steel

1. Main Flush mounted car operating panel shall contain a bank of round, mechanical, illuminated buttons marked to correspond to landings served, emergency call button, door open button, door close button, and key switches for lights, inspection, and exhaust fan. Buttons have Amber Dot Matrix illumination (halo). All buttons to have raised text and Braille marking on left hand side. The car operating display panel shall be Amber Dot Matrix. All texts, when illuminated, shall be Amber Dot Matrix. The car operating panel shall have a Brushed Stainless Steel finish.

2. Additional features of car operating panel shall include:

a. Car Position Indicator within operating panel Brushed Stainless Steel

b. Elevator Data Plate marked with elevator capacity and car number on car top.

c. Help buttons with raised markings.

d. In car stop switch per local code.

e. Call Cancel Button.

B. Hall Fixtures: Wall mounted hall fixtures shall be provided with necessary push buttons and key switches for elevator operation. Wall mounted hall fixtures shall have a Brushed Stainless Steel finish.

1. Hall fixtures shall feature round, mechanical, buttons in applied mount face frame. Hall fixtures shall correspond to options available from that landing. Buttons shall be in a vertically mounted fixture.

C. Car Lantern and Chime: A directional lantern visible from the corridor shall be provided in the car entrance. When the car stops and the doors are opening, the lantern shall indicate the direction in which the car is to travel, and a chime will

sound. The chime will sound once for up and twice for down. The car riding lantern face plate shall have a Brushed Stainless Steel finish.

2.7 EQUIPMENT: ELEVATOR OPERATION AND CONTROLLER

A. Elevator Operation

1. Duplex Collective Operation (two cars): Using a microprocessor-based controller, the operation shall be automatic by means of the car and hall buttons. In the absence of system activity, one car can be made to park at the pre-selected main landing. The other car shall remain at the last landing served. Only one car shall respond to a hall call. If either car is removed from service, the other car shall immediately answer all hall calls, as well as its own car calls.
2. Zoned Car Parking.
3. Relative System Response Dispatching.

B. Standard Operating Features to include:

1. Full Collective Operation
2. Fan and Light Control.
3. Load Weighing Bypass.
4. Ascending Car Uncontrolled Movement Protection
5. Top of Car Inspection Station.

C. Additional Operating Features to include:

D. Elevator Control System for Inspections and Emergency

1. Provide devices within controller to run the elevator in inspection operation.
2. Provide devices on car top to run the elevator in inspection operation.
3. Provide within controller an emergency stop switch to disconnect power from the brake and prevents motor from running.
4. Provide the means from the controller to mechanically lift and control the elevator brake to safely bring car to nearest available landing when power is interrupted.
5. Provide the means from the controller to reset the governor over speed switch and also trip the governor.

6. Provide the means from the controller to reset the emergency brake when set because of an unintended car movement or ascending car over speed.
7. Provide the means for the control to reset elevator earthquake operation.

2.8 EQUIPMENT: DOOR OPERATOR AND CONTROL

A. Door Operator: A closed loop permanent magnet VVVF high-performance door operator shall be provided to open and close the car and hoistway doors simultaneously. Door movement shall be cushioned at both limits of travel. Electro-mechanical interlock shall be provided at each hoistway entrance to prevent operation of the elevator unless all doors are closed and locked. An electric contact shall be provided on the car at each car entrance to prevent the operation of the elevator unless the car door is closed.

B. The door operator shall be arranged so that, in case of interruption or failure of electric power, the doors can be readily opened by hand from within the car, in accordance with applicable code. Emergency devices and keys for opening doors from the landing shall be provided as required by local code.

C. Doors shall open automatically when the car has arrived at or is leveling at the respective landings. Doors shall close after a predetermined time interval or immediately upon pressing of a car button. A door open button shall be provided in the car. Momentary pressing of this button shall reopen the doors and reset the time interval.

D. Door hangers and tracks shall be provided for each car and hoistway door. Tracks shall be contoured to match the hanger sheaves. The hangers shall be designed for power operation with provisions for vertical and lateral adjustment. Hanger sheaves shall have polyurethane tires and pre-lubricated sealed-for-life bearings.

E. Electronic Door Safety Device. The elevator car shall be equipped with an electronic protective device extending the full height of the car. When activated, this sensor shall prevent the doors from closing or cause them to stop and

reopen if they are in the process of closing. The doors shall remain open as long as the flow of traffic continues and shall close shortly after the last person passes through the door opening.

PART 3: EXECUTION

3.1 EXAMINATION

A. Field measure and examine substrates, supports, and other conditions under which elevator work is to be performed.

B. Do not proceed with work until unsatisfactory conditions are corrected.

C. Prior to start of work, verify hoistway is in accordance with shop drawings. Dimensional tolerance of hoistway from shop drawings: -0 inches +2 inches. Do not begin work of this section until dimensions are within tolerances.

D. Prior to start of work, verify projections greater than two inches (four inches if ASME A17.1/CSA B44 2000 applies) must be beveled not less than 75 degrees from horizontal.

E. Prior to start of work, verify landings have been prepared for entrance sill installation. Traditional sill angle or concrete sill support shall not be required.

F. Prior to start of work, verify elevator pit has been constructed in accordance with requirements, is dry and reinforced to sustain vertical forces, as indicated in approved submittal. Verify that sumps or sump pumps located within pit will not interfere with installed elevator equipment.

G. Prior to start of work, verify control space has been constructed in accordance with requirements, with access coordinated with elevator shop drawings, including sleeves and penetrations.

H. Verify installation of GFCI protected 20-amp in pit and adjacent to each signal control cabinet in control space.

3.2 PREPARATION

A. Coordinate installation of anchors, bearing plates, brackets and other related accessories.

3.3 INSTALLATION

A. Install equipment, guides, controls, car and accessories in

accordance with manufacturer installation methods and recommended practices.

B. Properly locate guide rails and related supports at locations in accordance with manufacturer's recommendations and approved shop drawings. Anchor to building structure using isolation system to minimize transmission of vibration to structure.

C. All hoistway frames shall be securely fastened to fixing angles mounted in the hoistway. Coordinate installation of sills and frames with other trades.

D. Lubricate operating system components in accordance with manufacturer recommendations.

E. Perform final adjustments, and necessary service prior to final acceptance.

3.4 CONSTRUCTION

A. Interface with Other Work:

1. Guide rail brackets attached to steel shall be installed prior to application of fireproofing.
2. Coordinate construction of entrance walls with installation of door frames and sills. Maintain front wall opening until elevator equipment has been installed.
3. Ensure adequate support for entrance attachment points at all landings.
4. Coordinate wall openings for hall push buttons, signal fixtures and sleeves. Each elevator requires sleeves within the hoistway wall.
5. Coordinate emergency power transfer switch and power change pending signals as required for termination at the primary elevator signal control cabinet in each group.
6. Coordinate interface of elevators and fire alarm system.
7. Coordinate interface of dedicated telephone line.

3.5 TESTING AND INSPECTIONS

A. Perform recommended and required testing in accordance with authority having jurisdiction

B. Obtain required permits and provide originals to Owner's Representative.

3.6 DEMONSTRATION

A. Prior to final acceptance, instruct Owner's Representative on the proper function and required daily maintenance of elevators. Instruct personnel on emergency procedures.