

# Expand Parking Garage Harry S. Truman Veterans' Memorial Hospital

Columbia, Missouri

## Volume 1

Specifications: Divisions 00-14

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**589-401**

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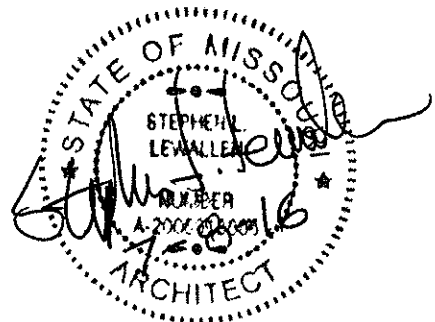
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Health Facilities Group, LLC

9229 Ward Parkway

Suite 110

Kansas City, Missouri 64114



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**SECTION 00 01 15**  
**LIST OF DRAWING SHEETS**

The drawings listed below accompanying this specification form a part of  
the contract.

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**SECTION 01 00 00  
GENERAL REQUIREMENTS**

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**SECTION 01 00 00  
GENERAL REQUIREMENTS**

**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 utilities and existing structures, and furnish labor and materials and perform work for VA Project No. 589-401, Expand Parking Garage, Department of Veterans Affairs as required by drawings and specifications.
- B. Only one (1) site visit will be scheduled prior to the bid date. Attendance is highly recommended.
- C. Offices of Health Facilities Group, LLC (HFG), 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

GENERAL REQUIREMENTS

Government without affirmations by Contracting Officer or his duly authorized representative. The A/E information is as follows:

Health Facilities Group, LLC

142 N. Mosley

Wichita, KS 67202

316-262-2500

Contact Person: **Mark Crane**

- D. Before placement and installation of work subject to tests by testing laboratory retained by Department of Veterans Affairs, the Contractor shall notify the COR in sufficient time to enable testing laboratory personnel to be present at the site in time for proper taking and testing of specimens and field inspection. Such prior notice shall be not less than three work days unless otherwise designated by the COR.
- E. All employees of general contractor and subcontractors shall comply with VA security management program and obtain permission of the VA police, be identified by project and employer, and restricted from unauthorized access.
- F. Throughout the drawings and specifications, references to Contracting Officer shall be represented by the abbreviation "CO". References to Resident Engineer, Contracting Officer's Technical Representative or Contracting Officer's Representative shall be represented by the abbreviation "COR". The COR for this project shall be **Darren Grayson**.

### **1.3 STATEMENT OF BID ITEM(S)**

- A. **BID ITEM 1 (BASE BID):** Work includes general construction of a new 694 stall parking garage to be constructed as an expansion of an existing garage, repaving and/or resurfacing of portions of the existing surface parking lot that remains, including alterations, roads, walks, grading, drainage, mechanical and electrical work, utility systems, and necessary removal of existing structures and construction and certain other items as defined in the drawings and specifications. Period of performance for this bid item shall be 480 calendar days.
- B. **BID ITEM 2 (DEDUCT #1):** Includes everything in Bid Item 1 (Base Bid) with the exception of constructing the top floor (third elevated deck)

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of the southernmost bay as identified on sheet S-002 of the drawings. Period of performance for this bid item shall be 480 calendar days.

C. **BID ITEM 3 (DEDUCT #2):** Includes everything in Bid Item 2 with the exception of constructing the second elevated deck of the southernmost bay as identified on sheet S-002 of the drawings. Period of performance for this bid item shall be 480 calendar days.

D. **BID ITEM 4 (DEDUCT #3):** Includes everything in Bid Item 3 with the exception of constructing the first elevated deck of the southernmost bay as identified on sheet S-002 of the drawings such that surface parking only shall remain at the location of the 3rd bay. Period of performance for this bid item shall be 440 calendar days.

E. **BID ITEM 5 (DEDUCT #4):** Includes everything in Bid Item 4 with the exception of constructing the top floor (third elevated deck) of the middle bay as identified on sheet S-003 of the drawings. Period of performance for this bid item shall be 440 calendar days.

F. **BID ITEM 6 (DEDUCT #5):** Includes everything in Bid Item 5 with the exception of constructing the top floor (third elevated deck) of the northernmost bay as identified on sheet S-003 of the drawings. Period of performance for this bid item shall be 440 calendar days.

G. **BID ITEM 7:** Provide unit pricing (price per cubic yard) for additions and deletions of excavated material in drilled caissons. Classifications listed below are defined in specification section 31 63 26, 1.5, paragraph A:

|                        |                        |
|------------------------|------------------------|
| 1) Soil/Fill Add:      | Soil/Fill Delete:      |
| 2) Soil/Soft Rock Add: | Soil/Soft Rock Delete: |
| 3) Hard Rock Add:      | Hard Rock Delete:      |

H. **BID ITEM 8:** Provide unit pricing (price per ton) for additional steel that may be required for additional pier depths as defined in specification section 31 63 26, 1.4, par. A, (3).

#### GENERAL REQUIREMENTS

- I. **BID ITEM 9:** Provide unit pricing (price per ton) for additional steel that may be required for cast in place concrete as defined in specification section 03 30 00, 2.2, par. A.

**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.
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 COR for the purpose of security inspections of every area of project including tool boxes and parked machines and take any emergency action.

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

E. Document Control:

1. Before starting any work, the General Contractor/Sub Contractors shall submit an electronic security memorandum describing the approach to following goals and maintaining confidentiality of "sensitive information".
2. The General Contractor is responsible for safekeeping of all drawings, project manual and other project information. This information shall be shared only with those with a specific need to accomplish the project.
3. Certain documents, sketches, videos or photographs and drawings may be marked "Law Enforcement Sensitive" or "Sensitive Unclassified". Secure such information in separate containers and limit the access to only those who will need it for the project. Return the information to the Contracting Officer upon request.
4. These security documents shall not be removed or transmitted from the project site without the written approval of Contracting Officer.
5. All paper waste or electronic media such as CD's and diskettes shall be shredded and destroyed in a manner acceptable to the VA.
6. Notify Contracting Officer and Site Security Officer immediately when there is a loss or compromise of "sensitive information".
7. All electronic information shall be stored in specified location following VA standards and procedures using an Engineering Document Management Software (EDMS).
  - a. Security, access and maintenance of all project drawings, both scanned and electronic shall be performed and tracked through the EDMS system.
  - b. "Sensitive information" including drawings and other documents may be attached to e-mail provided all VA encryption procedures are followed.

F. Motor Vehicle Restrictions

1. Vehicle authorization request shall be required for any vehicle entering the site and such request shall be submitted 24 hours before the date and time of access. Access shall be restricted to picking up and dropping off materials and supplies.

GENERAL REQUIREMENTS

2. A limited number of (2 to 5) permits shall be issued for General Contractor and its employees for parking in designated areas only.

#### **1.6 OPERATIONS AND STORAGE AREAS**

- A. The Contractor shall confine all operations (including storage of materials) on Government premises to areas authorized or approved by the Contracting Officer. The Contractor shall hold and save the Government, its officers and agents, free and harmless from liability of any nature occasioned by the Contractor's performance.
- B. The Contractor shall, under regulations prescribed by the Contracting Officer, use only established roadways, or use temporary roadways constructed by the Contractor when and as authorized by the Contracting Officer. When materials are transported in prosecuting the work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by any Federal, State, or local law or regulation. When it is necessary to cross curbs or sidewalks, the Contractor shall protect them from damage. The Contractor shall repair or pay for the repair of any damaged curbs, sidewalks, or roads.

#### **(FAR 52.236-10)**

- C. Working space and space available for storing materials shall be located within the project limits// as shown on the drawings.
- D. Workmen are subject to rules of Medical Center applicable to their conduct.
- E. 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.
- F. Phasing:
- 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

#### **GENERAL REQUIREMENTS**

be used during the work, and a schedule defining the duration of the work with milestone subtasks.

To insure 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 insure accomplishment of this work in successive phases mutually agreeable to Medical Center Director, COR, and Contractor, as follows:

**Phase I:** Demolish existing and install new underground utility lines, vaults, casings and related work as indicated on drawings. Reference drawings for phasing plans.

**Phase II:** After Phase 1 work is complete, construct parking garage and associated vehicular access drives and site work as indicated on drawings. If Bid Item 4 is accepted, the remaining portion of the existing surface parking lot shall be used for construction staging and contractor parking at this phase of construction. Reference drawings for phasing plans.

**Phase III:** After Phase 2 work is complete, and the parking garage is available for use by the Medical Center. If Bid Item 4 is accepted, the remaining portions of the existing surface parking lot shall be re-paved or resurfaced as required, and the surface parking lot re-striped as indicated on drawings. All Remaining site work not previously installed shall be constructed during this phase. Reference drawings for phasing plans.

- G. 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.

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- H. 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.
- I. 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. It is the contractor's responsibility to provide temporary utility hook ups in order to minimize any utility down times. Prior to any utility outages the contractor must provide a utility shut down request to the COR with a description of the proposed outage outlining the expected down time and actions that will be taken to minimize impact on the facility. 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 n advance of proposed interruption. Request

## GENERAL REQUIREMENTS

- 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. Interruptions occurring at other than Contractor's normal working hours shall be at no additional cost to the government.
  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.
- J. Abandoned Lines: All service lines such as wires, cables, conduits, ducts, pipes and the like, and their hangers or supports, which are to be abandoned but are not required to be entirely removed, shall be sealed, capped or plugged 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.
- K. 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.
- L. 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.
- M. Contractor shall have a supervisor on site at any/all time(s) that any contractor personnel or sub-contractor personnel are performing work of any kind. Submit this supervisor's qualifications to COR in writing for approval before work begins. At the beginning of the job, supervisor shall meet with COR first thing first day in the COR's office. Any time

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there is a lapse of one or more days (other than weekends/holidays) in contractor working on site, supervisor shall meet with COR in the COTR's office first thing first day back on the job.

- N. Contractor's on-site supervisor shall meet with COR early each day at a time mutually acceptable for the purpose of discussing the work to be performed that day. This meeting shall be held at the COR's office or other mutually agreeable location. If contractor's project manager is on-site daily then he/she shall attend these daily meetings. If contractor's project manager is not on-site daily then he/she shall be available for a once-a-week meeting at the COR's office.
- O. The Contractor's on-site supervisor must be provided with a pager or cellular phone to ensure continuous contact by VA representatives while on the job site. This pager or cellular phone number must be provided to the COR at the Pre-Construction Meeting. This pager or cellular phone must use a Leavenworth, Kansas, local telephone number or a toll-free number (1-800-xxxx, 1-888-xxxx, etc.) and NOT require VA to initiate long distance telephone service in order to be reached.
- P. The Contractor's employees, as well as his/her subcontractors' employees shall be provided with identification badges and/or parking pass hang tags by VA. All contractor and sub-contractor employees must wear an identification badge at all times that the employee is on VA premises. These badges and/or hangtags shall be returned to VA upon completion of the contract/project. A charge of \$10.00 each shall be assessed for any and all badges and/or hangtags not returned. This charge shall be made in the form of a deduct change order to the contract or bill of collection, at the option of the CO.
- Q. The Contractor's Foreman shall, if/as necessary, be issued VA keys. These keys shall be returned to VA upon completion of the contract/project. If the Contractor fails to return any issued keys, the actual costs of re-keying all doors which use that key and/or replacing/reissuing keys to all personnel that possess that key shall be charged to the Contractor. Depending upon the number of doors and keys involved this could range from \$100 to several thousand dollars. This charge shall be made in the form of a deduct change order to the contract or bill of collection, at the option of the CO.
- R. The **Contractor's normal working hours** will be Monday through Friday from 7:30 am to 4:00 pm.

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1. Regularly scheduled federal holidays are: New Years Day, Martin Luther King's Birthday, Presidents Day, Memorial Day, Independence Day, Labor Day, Columbus Day, Veterans' Day, Thanksgiving, and Christmas. No work will be permitted on any regularly scheduled federal holiday. No work will be permitted on any non-regularly scheduled holiday, whether the holiday comes about by Presidential decree, by Congressional decree, or by any other manner.
  2. **Due to operational requirements, portions of the work must be accomplished after weekday business hours and/or on weekends. Reference drawings for locations and times available to perform the work indicated.**
  3. In the event that it becomes necessary for the contractor to work outside the normal business hours of the facility or is required to perform work on weekends or Federal holidays the contractor shall notify the COR a minimum of 48 hours prior to commencing the work.
  4. The Contractor is required to discontinue his work in sufficient time to allow for his clean up of all work areas before he leaves the site each workday. The area shall be returned to "normal condition" for VA use at the end of each workday, including proper secure storage of all equipment, tools, and materials, and the removal of all construction debris.
- S. Contractor shall turn in completed and signed daily logs no later than 11:00AM on the following workday.
- T. Job office trailers, job storage trailers, and parking are subject to VA approval and may be revoked at any time for any reason at no cost to the government. If the contractor is allowed by VA to place any storage trailer(s) or job office trailer(s) on VA grounds contractor shall be responsible for maintaining the area where such trailer is located. If such trailer is on pavement, contractor shall sweep as necessary under and around the trailer as often as necessary to maintain a neat appearance. If such trailer is on lawn area contractor shall mow and trim under and around the trailer at approximately the same interval as VA personnel mow and trim the surrounding lawn such that the lawn appearance is consistent throughout the area.
- U. All metal cutting operations shall be performed in locations approved by COR. All metal shavings must be removed from VA premises completely.

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**1.7 ALTERATIONS**

- A. Survey: Before any work is started, the Contractor shall make a thorough survey, with the COR, of the site 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 contain the following:
2. Existence and conditions of items required by drawings to be either reused or relocated, or both.
  3. Shall note any discrepancies between drawings and existing conditions at site.
- 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 and VAAR 852.236-88).
- C. Re-Survey: Thirty days before expected partial or final inspection date, the Contractor and COR together shall make a thorough re-survey of the areas of buildings involved. They shall furnish a report on conditions then existing, of all items 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 items, despite protection measures; and, will form basis for determining extent of repair work required of Contractor to restore damage caused by Contractor's workmen in executing work of this contract.
- D. Protection: Provide the following protective measures:
1. 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.

**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:

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1. Reserved items which are to remain property of the Government are identified by 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.

**1.9 PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS**

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

**(FAR 52.236-9)**

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

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

- Designating areas for equipment maintenance and repair;
- Providing waste receptacles at convenient locations and provide regular collection of wastes;
- Locating equipment wash down areas on site, and provide appropriate control of wash-waters;
- Providing protected storage areas for chemicals, paints, solvents, fertilizers, and other potentially toxic materials; and
- Providing adequately maintained sanitary facilities.//

#### **1.10 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.

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- C. At Contractor's own expense, Contractor shall immediately restore to service and repair any damage caused by Contractor's workmen to existing piping and conduits, wires, cables, etc., of utility services or of fire protection systems and communications systems (including telephone) which are not scheduled for discontinuance or abandonment.
- D. Expense of repairs to such utilities and systems not shown on drawings or locations of which are unknown will be covered by adjustment to contract time and price in accordance with clause entitled "CHANGES" (FAR 52.243-4 and VAAR 852.236-88) and "DIFFERING SITE CONDITIONS" (FAR 52.236-2).

#### **1.11 PHYSICAL DATA**

- A. Data and information furnished or referred to below is for the Contractor's information. The Government shall not be responsible for any interpretation of or conclusion drawn from the data or information by the Contractor.
  - 1. The indications of physical conditions on the drawings and in the specifications are the result of site investigations indicated in the soils report dated October 13, 2011 by Engineering Surveys and Services, 1113 Fay Street, Columbia, MO 65201.

##### **(FAR 52.236-4)**

- B. Subsurface conditions have been developed by core borings and test pits. Logs of subsurface exploration are shown diagrammatically on drawings.
- C. A copy of the soil report is included with these specifications in the Appendix, found at the back of Volume 2.
- D. The offeror should anticipate **2.5 feet** of weathered limestone requiring the use of core barrel excavation prior to reaching hard rock suitable for rock socket excavation.

#### **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, and 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

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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 also 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 and elevations of roads, streets and parking lots.
- E. Whenever changes from contract drawings are made in line or grading requiring certificates, record such changes on a reproducible drawing bearing the registered land surveyor or registered civil engineer seal, and forward these drawings upon completion of work to COR.
- F. The Contractor shall perform the surveying and layout work of this and other articles and specifications in accordance with the provisions of Article "Professional Surveying Services".

#### **1.14 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 insure 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 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.
- C. When certain buildings (or parts of certain buildings) are required to be completed in advance of general date of completion, all roads leading thereto must be completed and available for use at time set for completion of such buildings or parts thereof.

#### **1.16 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

#### **GENERAL REQUIREMENTS**

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.

#### **1.17 TEMPORARY TOILETS**

- A. Provide where directed, (for use of all Contractor's workmen) ample temporary sanitary toilet accommodations with suitable sewer and water connections; or, when approved by COR , provide suitable dry closets where directed. Keep such places clean and free from flies, and all connections and appliances connected therewith are to be removed prior to completion of contract, and premises left perfectly clean.

#### **1.18 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.
- 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's discretion) of use of water from Medical Center's system.

#### **1.19 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.

#### **1.20 TESTS**

- A. Pre-test mechanical and electrical equipment and systems and make corrections required for proper operation of such systems before requesting final tests. Final test will not be conducted unless pre-tested.
- B. Conduct final tests required in various sections of specifications in presence of an authorized representative of the Contracting Officer. Contractor shall furnish all labor, materials, equipment, instruments, and forms, to conduct and record such tests.

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- C. Mechanical and 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. For example, air conditioning supply air is only one part of entire system which provides comfort conditions for a building. Other related components are return air, exhaust air, steam, chilled water, refrigerant, hot water, controls and electricity, etc. Another example of a system which involves several components of different disciplines is a boiler installation. Efficient and acceptable boiler operation depends upon the coordination and proper operation of fuel, combustion air, controls, steam, feedwater, condensate and other related components.
- D. All related components as defined above shall be functioning when any system component is tested. Tests shall be completed within a reasonable period of time during which operating and environmental conditions remain reasonably constant and are typical of the design conditions.
- E. Individual test result of any component, where required, will only be accepted when submitted with the test results of related components and of the entire system.

#### **1.21 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

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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.

#### **1.22 RELOCATED ITEMS**

- A. Contractor shall disconnect, dismantle as necessary, remove and reinstall in new location, all existing items indicated by symbol "R" or otherwise shown to be relocated by the Contractor.
- B. Perform relocation of such equipment or items at such times and in such a manner as directed by the COR.
- C. Suitably cap existing service lines, such as steam, condensate return, water, drain, gas, air, vacuum and/or electrical, 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".

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- 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.

#### **1.23 CONSTRUCTION SIGN**

- A. Provide a Construction Sign where directed by the COR. All wood members shall be of framing lumber. Cover sign frame with 0.7 mm (24 gage) galvanized sheet steel nailed securely around edges and on all bearings. Provide three 100 by 100 mm (4 inch by 4 inch) posts (or equivalent round posts) set 1200 mm (four feet) into ground. Set bottom of sign level at 900 mm (three feet) above ground and secure to posts with through bolts. Make posts full height of sign. Brace posts with 50 x 100 mm (two by four inch) material as directed.
- B. Paint all surfaces of sign and posts two coats of white gloss paint. Border and letters shall be of black gloss paint, except project title which shall be blue gloss paint.
- C. Maintain sign and remove it when directed by the COR.
- D. Detail Drawing of construction sign showing required legend and other characteristics of sign is shown on the drawings.

#### **1.24 SAFETY SIGN**

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



**1.25 PROJECT MANAGEMENT SOFTWARE**

A. Reference section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

- - - E N D - - -

**SECTION 01 00 10**  
**MEDICAL CENTER REQUIREMENTS**

**1.0 GENERAL INTENTION:** This document pertains to station policy for construction projects performed at the Harry S Truman Memorial Veterans' Hospital (HSTMVH) in Columbia, MO. Safety and health concerns are taken seriously at this facility. Both our staff and yours are expected to strictly adhere to the regulations and requirements. This is exceedingly important, since we must be primarily concerned for the safety of our patients. In this regard, OSHA Standards may protect worker safety and health, but they have minimal benefit for protecting the safety and health of our patients, due primarily to their differing medical conditions. Review this information as orientation with your personnel performing work on site. Where the requirements as outlined in this and Section 01 00 00 are differing, the more stringent shall apply.

**2.0 REQUIREMENTS:**

A. Security:

1. Secure all construction areas, especially mechanical and electrical rooms against entry of unauthorized individuals including patients.
2. Notify the CO's Technical Representative (COTR) for permission to work after hours and weekends. Standard work hours for this project will be Monday through Friday from 7:30 am to 4:00 pm.

B. Key Security:

1. Only a limited number of keys will be issued to the contractor.
2. See section 01 00 00 for procedures in case the Contractor loses a key.
3. Ensure all doors leading to and from construction are either monitored or locked to prevent access to the area from unauthorized persons.

C. General Safety:

1. Follow all federal, state and local safety and health regulations.
2. Maintain safety in the construction site/area in accordance with the provisions of the contract that includes the Occupational Safety and Health Administration (OSHA) Regulations; National Electrical Codes; National Fire Protection Association (NFPA) 70, National Electric Code; and NFPA 101, Life Safety Code. Work in a safe manner and take all proper precautions while performing your work. Extra precautions shall be taken when working around persons occupying the building during construction.
3. Provide Personal Protective Equipment (PPE) for your employees.
4. Post appropriate signs in specific hazardous areas.
5. Keep tools, ladders, etc., away from patients to prevent injuries.

D. Safety Inspections: The professional Occupational Safety and Health staff at this facility will perform safety inspections of all contract

operations. Written reports of unsafe practices or conditions will be reported to the COTR and CO for immediate attention and resolution.

E. Fire Alarms:

1. The fire alarm system connects all buildings at this facility, and is activated by various heat, duct, manual pull stations and smoke sensors. Manual pull stations are provided at each entrance. Please survey the area in which you are working to locate the manual pull stations.
2. In the event of a fire alarm sounding, you are to remain in your area, unless medical center personnel (Safety, Nursing or Engineering) instruct otherwise, or unless a fire situation is in your area, in which case you should immediately evacuate.
3. Any work involving the fire protection systems will require written permission to proceed from the COTR. **Do not tamper with or otherwise disturb any fire alarm system components without prior written permission. To do so without written permission will result in an adverse action.**

F. Hazardous Materials:

1. Many of the operations you are scheduled to perform may involve the use of hazardous materials. Prior to locating hazardous materials on site, all Material Safety Data Sheets (MSDS) will be submitted through the COTR for evaluation by the facility Safety Officer.
2. Storage of hazardous materials within buildings will be minimal with only enough on hand to perform daily work tasks. Flammable materials will either be removed from buildings at the end of the work shift or stored in approved flammable storage containers.
3. Care must be taken to ensure adequate ventilation to remove vapors of hazardous materials in use. Many of the patients being cared for in the facility are susceptible to environmental contaminants, even when odors seem minimal. You will isolate those areas where vapors are produced, and ventilate to the most extent possible to reduce the number of complaints.

G. Airborne Dust Control During Construction:

1. Generation of dust is of major concern within staff and especially in patient occupied buildings. Where operations involve the generation of dust, all efforts will be directed at reducing airborne generated dust to the lowest level feasible. This may be accomplished by a number of methods. These include misting the area with water, or use of tools attached to high efficiency particulate air (HEPA) filtering vacuums. Where large amounts of materials may be disturbed, resulting in airborne dust, establishment of full ceiling-to-floor plastic barriers may be required.
2. Classification of Jobs: *see ICRA (Attachment A)*

H. Infection Control Procedures: *see ICRA (Attachment A)*

1. Implement the requirements of VAMC's Infection Control Risk Assessment (ICRA) team. ICRA Group may monitor dust in the vicinity of the construction work and require the Contractor to take corrective action immediately if the safe levels are exceeded.

MEDICAL CENTER REQUIREMENTS

2. Establish and maintain a dust control program as part of the contractor's infection preventive measures in accordance with the guidelines provided by ICRA Group. Prior to start of work, prepare a plan detailing project-specific dust protection measures, including periodic status reports, and submit to COTR for review for compliance with contract requirements in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS. All personnel involved in the construction or renovation activity shall be educated and trained in infection prevention measures established by the medical center.
3. Medical center Infection Control personnel shall monitor for airborne disease (e.g. aspergillosis) as appropriate during construction. A baseline of conditions may be established by the medical center prior to the start of work and periodically during the construction stage to determine impact of construction activities on indoor air quality. In addition:
  - a. The COTR and VAMC Infection Control personnel shall review pressure differential monitoring documentation to verify that pressure differentials in the construction zone and in the patient-care rooms are appropriate for their settings. The requirement for negative air pressure in the construction zone shall depend on the location and type of activity. Upon notification, the contractor shall implement corrective measures to restore proper pressure differentials as needed.
  - b. In case of any problem, the medical center, along with assistance from the contractor, shall conduct an environmental assessment to find and eliminate the source.
4. In general, following preventive measures shall be adopted during construction to keep down dust and prevent mold.
  - a. Dampen debris to keep down dust and provide temporary construction partitions in existing structures where directed by COTR.
  - b. Do not perform dust producing tasks within occupied areas without the approval of the COTR. For construction in any areas that will remain jointly occupied by the medical Center and Contractor's workers, the Contractor shall:
    - (1) Provide dust proof construction barriers to completely separate construction from the operational areas of the hospital in order to contain dirt debris and dust. A fire retardant polystyrene, 6-mil thick or greater plastic barrier meeting local fire codes may be used where dust control is the only hazard, and an agreement is reached with the COTR. This will be required in the ICU, the Step-Down Unit, and possibly other areas.
    - (2) Adhesive Walk-off Mats, minimum 24" x 36", shall be used at all interior transitions from the construction area to occupied medical center area. These mats shall be changed as often as required to maintain clean work areas directly outside construction area at all times.
    - (3) Vacuum and wet mop all transition areas from construction to the occupied medical center at the completion of each window and at the end of each workday. Vacuum shall utilize

HEPA filtration. Maintain surrounding area frequently. Remove debris as they are created. Transport any dusty debris outside the construction area in containers with tightly fitting lids.

- (4) All equipment, tools, material, etc. transported through occupied areas shall be made free from dust and moisture by vacuuming and wipe down.

I. Contact with Asbestos Containing Materials (ACM):

1. Due to the age of buildings, many contain asbestos containing materials (ACM). Primary ACM uses in the medical center includes floor tile, mastic, piping and HVAC insulation. The medical center has performed a comprehensive asbestos survey and has identified accessible ACM. Some areas contain damaged asbestos and should not be accessed without prior abatement.
2. The most common type of ACM insulation you may encounter includes thermal system insulation (TSI) and floor tile. ACM TSI is generally covered with a cloth wrap or lagging, and the asbestos substrate generally appear white in color. **Do not sand, drill, gouge or otherwise disturb this type of insulation.** Contractors disturbing or releasing asbestos containing materials will be liable for all damages and cleanup costs.
3. Where disturbance of asbestos is likely, it has been addressed in the contract for removal. If contact with the presence of asbestos is presented, stop all work in the immediate area and immediately contact the COTR or Safety Officer to make necessary arrangements for removal.
4. In some areas, asbestos insulation has been identified on elbows, between fiberglass piping insulation, as patching materials among the fiberglass insulation. Fiberglass insulation used in this facility is usually yellow or pink in color, wrapped either by cloth or paper lagging.
5. To protect and ensure all your employees are aware that asbestos containing materials have been used in the construction of this facility, you are required to have them review this section and complete the awareness statement included as Attachment B. Once this documentation has been signed by all employees, forward to the COTR for documentation.
6. A complete assessment of asbestos materials and conditions are available for viewing by contacting the facility Industrial Hygienist at extension 6307. Prior to performing work above any ceiling or starting in a new area, consult with the COTR concerning existing conditions of ACM.
7. Some of the areas in the facility are identified as restricted areas due to condition of ACM. These are readily labeled. **Do not enter these areas** unless first contacting the COTR. Entry requirements to these areas are awareness of the hazards, proper protective clothing (coveralls and respirators) and personal monitoring in accordance with OSHA requirements.
8. Submit contractor asbestos awareness statements for all persons working on the site prior to commencing work.

## J. Environmental Protection:

1. It may help you to be aware of the seriousness that the environmental protection requirements of each contract are regarded. Adherence to these requirements is subject to continuing scrutiny from the community and backed by severe penalties, such as fines and incarceration. These environmental requirements will be strictly enforced.
2. **No** hazardous materials will be disposed of on Government property. All waste will be hauled off-site or disposed in contractor owned and operated waste removal containers.
3. A copy of all waste manifests for special or hazardous wastes will be forwarded to the COTR. Environmental requirements will be strictly enforced.

## K. Permit Required Confined Spaces:

1. Contractors performing work on this facility will follow all requirements outlined in OSHA Standards for working in confined spaces. There are numerous permit required confined spaces on this facility. These spaces have been identified. Some spaces have been posted, but the majority have not due to their configuration. A complete listing of these areas is located in the Safety Office.
2. Confined spaces are areas that are large enough to be entered, have limited egress/exit potential and are not designed for permanent human occupancy. If you encounter any space that meets this definition, and if it is a suspected confined space, contact the COTR.
3. Contractors performing work in confined spaces are responsible for compliance with all applicable standards and regulations.

## L. Housekeeping:

1. Protect patients and VA personnel in occupied areas from the hazards of dust, noise, construction debris and material associated with a construction environment. Keep work area clear, clean and free of loose debris, construction materials and partially installed work that would create a safety hazard or interfere with VA personnel duties and traffic.
2. Wet mop occupied areas clean and remove any accumulation of dust/debris from cutting or drilling from any surface at the end of each workday.
3. Make every effort to keep dust and noise to a minimum at all times. Take special precautions to protect VA equipment from damage including excessive dust.
4. Maintain clear access to mechanical, electrical devices, equipment and main corridors. This will ensure access to existing systems in the event of an emergency.
5. Clean area of all construction debris and dust upon completion of demolition and/or renovation.
6. During construction operations, keep existing finishes protected from damage. Cover and protect all carpets during construction.

Any carpets or surfaces damaged as a result of construction activities will be replaced at the contractor expense.

M. Hot Work Permits:

1. Any hot work operations including cutting, welding, thermal welding, brazing, soldering, grinding, thermal spraying, thawing pipes or any other similar activity, will require a Hot Work Permit to be obtained by the Contractor from the Safety Officer (Hot Work Permit will be as shown in Attachment C or similar, at COTR discretion). The Contractor will be responsible for conforming to all Medical Center regulations, policies and procedures concerning Hot Work Permits as outlined below:
  - a. Prior to the performance of hot work, a request for a Hot Work Permit will be made to the COTR. Submit request at least 48 hours in advance of anticipated work beginning. Designate contractor's responsible project-site fire prevention program manager to supervise permitted hot work.
  - b. The COTR will inspect the area and ensure that the requirements of NFPA 241 and OSHA standards have been satisfied. The Hot Work Permit will be granted and will be posted in the immediate area of the work.
  - c. The Hot Work Permit will apply only to the location identified on the permit. If additional areas involve hot work, additional permits must be requested.
  - d. Upon completion of all hot work, the COTR will be notified by the responsible individual to perform a re-inspection of the area.
2. Do not use any of the extinguishers in the medical center for standby purpose while conducting hot work. Contractors are required to supply their own Class ABC extinguishers. Medical center extinguishers are only to be used in the event of a fire.

N. Emergency Medical Services: Emergency medical services for stabilization purposes are available for contractors at this facility. For medical emergencies, dial 911 when inside any building. Report the nature of the emergency and location. The operator will coordinate outside emergency assistance based on the nature of the emergency.

O. Use of Government-Owned Material and Equipment: Use of Government-owned material and equipment is **prohibited**.

P. Superintendent Communications: At all times during the performance of this contract, the Contractors Superintendent is to be available by cellular phone. At the beginning of the contract and prior to beginning any construction, supply the COTR with the telephone number for the Superintendent.

Q. Parking: Contractor employees shall be assigned a parking area during the preconstruction meeting.

R. Traffic:

1. Traffic hazards are minimal at this facility. Drivers should be particularly concerned with pedestrian traffic.
2. Seat belt use is mandatory on the station.

3. Federal police officers maintain a 24-hour patrol of the area.

- S. Contractor's Trailers: Contractor's trailers shall be located at the area assigned. All utility connections to the trailer shall be installed at the contractor expense. Trailer removal is required upon completion of the contract, unless approved by the COTR to leave in place.
- T. Smoking: No smoking is permitted in buildings or around hazardous areas. Any smoking inside a government building is subject to a fine without warning.
- U. Fluorescent (PCB Containing) Fixtures: All fluorescent lighting fixtures being removed as part of this project are to have their ballasts removed and turned over to the VAMC Safety Officer for disposal. All other components of the lighting fixture are to be disposed of by the Contractor.

Attachments:

A. Infection Control Risk Assessment (ICRA) Form.

B. Contractor/Subcontractor/Employee Notification of Asbestos Form; Cutting and Welding with Portable Gas or Arc Equipment Permit Form; Interim Life Safety Measures/Precautions



## Infection Control Risk Assessment

### Matrix of Precautions for Construction & Renovation

Project Title: \_\_\_\_\_

Project Number: \_\_\_\_\_

Project COTR: \_\_\_\_\_

**Step One:** Using the following table, identify the Type (A-D) of Construction Project Activity.

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

**STEP 1:** \_\_\_\_\_

**Step Two:** Using the following table, identify the *Patient Risk Groups* that will be affected.

| Low Risk | Medium Risk | High Risk | Highest Risk |
|----------|-------------|-----------|--------------|
|----------|-------------|-----------|--------------|

|  |   |  |  |
|--|---|--|--|
| <ul style="list-style-type: none"> <li>Office areas</li> </ul> | <ul style="list-style-type: none"> <li>Cardiology</li> <li>Echocardiography</li> <li>Endoscopy</li> <li>Nuclear Medicine</li> <li>Physical Therapy</li> <li>Radiology/MRI</li> <li>Respiratory Therapy</li> </ul> | <ul style="list-style-type: none"> <li>CCU</li> <li>Emergency Room</li> <li>Labor &amp; Delivery</li> <li>Laboratories (specimen)</li> <li>Newborn Nursery</li> <li>Outpatient Surgery</li> <li>Pediatrics</li> <li>Pharmacy</li> <li>Post Anesthesia Care Unit</li> <li>Surgical Units</li> </ul> | <ul style="list-style-type: none"> <li>Any area caring for immuno-compromised patients</li> <li>Burn Unit</li> <li>Cardiac Cath Lab</li> <li>Central Sterile Supply</li> <li>Intensive Care Units</li> <li>Medical Unit</li> <li>Negative pressure isolation rooms</li> <li>Oncology</li> <li>Operating rooms including C-section rooms</li> </ul> |
|--|---|--|--|

**Step 2:** \_\_\_\_\_

**Step Three:** Match the...

Patient Risk Group (*Low, Medium, High, Highest*) with the planned ...

Construction Project Type (*A, B, C, D*) on the following matrix, to find the ...

Class of Precautions (*I, II, III or IV*) or level of infection control activities required.

(Class I-IV or Color-Coded Precautions are delineated on the following page.)

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

| Patient Risk Group | Construction Project Type |        |        |        |
|--------------------|---------------------------|--------|--------|--------|
|                    | TYPE A                    | TYPE B | TYPE C | TYPE D |
| LOW Risk Group     | I                         | II     | II     | III/IV |
| MEDIUM Risk Group  | I                         | II     | III    | IV     |
| HIGH Risk Group    | I                         | II     | III/IV | IV     |
| HIGHEST Risk Group | II                        | III/IV | III/IV | IV     |

**Note:** Infection Control approval will be required when the Construction Activity and Risk Level indicate that **Class III** or **Class IV** control procedures are necessary.

**Step 3:** \_\_\_\_\_

**Description of Required Infection Control Precautions by Class  
During Construction Project                      Upon Completion of Project**

|                  |   |  |
|------------------|---|--|
| <b>CLASS I</b>   | <ol style="list-style-type: none"> <li>1. Execute work by methods to minimize raising dust from construction operations.</li> <li>2. Immediately replace a ceiling tile displaced for visual inspection.</li> </ol>   |  |
| <b>CLASS II</b>  | <ol style="list-style-type: none"> <li>1. Provide active means to prevent airborne dust from dispersing into atmosphere.</li> <li>2. Water mist work surfaces to control dust while cutting.</li> <li>3. Seal unused doors with duct tape.</li> <li>4. Block off and seal air vents.</li> <li>5. Place dust mat at entrance and exit of work area.</li> <li>6. Remove or isolate HVAC system in areas where work is being performed.</li> </ol>   | <ol style="list-style-type: none"> <li>1. Wipe work surfaces with disinfectant.</li> <li>2. Contain construction waste before transport in tightly covered containers.</li> <li>3. Wet mop and/or vacuum with HEPA filtered vacuum before leaving work area.</li> <li>4. Remove isolation of HVAC system in areas where work is being performed.</li> </ol>  |
| <b>CLASS III</b> | <ol style="list-style-type: none"> <li>1. Remove or isolate HVAC system in area where work is being done to prevent contamination of duct system.</li> <li>2. 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.</li> <li>3. Maintain negative air pressure within work site utilizing HEPA equipped air filtration units.</li> <li>4. Contain construction waste before transport in tightly covered containers.</li> <li>5. Cover transport receptacles or carts. Tape covering unless solid lid.</li> <li>6. All personnel entering work site are required to wear shoe covers. Shoe covers must be changed each time the worker exits the work area.</li> <li>7. Do not remove barriers from work area until completed project is inspected by the owner's Safety Section and Infection Control Department, and thoroughly cleaned by the owner's Environment Services Department.</li> </ol> | <ol style="list-style-type: none"> <li>1. Do not remove barriers from work area until completed project is inspected by the owner's Safety Department and Infection Control Department, and thoroughly cleaned by the owner's Environmental Services Department.</li> <li>2. Remove barrier materials carefully to minimize spreading of dirt and debris associated with construction.</li> <li>3. Vacuum work area with HEPA filtered vacuums.</li> <li>4. Wet mop area with disinfectant.</li> <li>5. Remove isolation of HVAC system in areas where work is being performed.</li> </ol> |

|          |  |   |
|----------|--|---|
| CLASS IV | <ol style="list-style-type: none"> <li>1. Isolate HVAC system in area where work is being done to prevent contamination of duct system.</li> <li>2. 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.</li> <li>3. Maintain negative air pressure within work site utilizing HEPA equipped air filtration units.</li> <li>4. Seal holes, pipes, conduits and punctures appropriately.</li> <li>5. Construct anteroom and require all personnel to pass through this room so they can be vacuumed using a HEPA vacuum cleaner before leaving work site, or they can wear cloth or paper coveralls that are removed each time they leave the work site.</li> <li>6. All personnel entering work site are required to wear shoe covers. Shoe covers must be changed each time the worker exits the work area.</li> <li>7. Do not remove barriers from work area until completed project is inspected by the owner's Safety Department and Infection Control Department, and thoroughly cleaned by the owner's Environmental Services Department.</li> </ol> | <ol style="list-style-type: none"> <li>1. Remove barrier material carefully to minimize spreading of dirt and debris associated with construction.</li> <li>2. Contain construction waste before transport in tightly covered containers.</li> <li>3. Cover transport receptacles or carts. Tape covering unless solid lid.</li> <li>4. Vacuum work area with HEPA filtered vacuums.</li> <li>5. Wet mop area with disinfectant.</li> <li>6. Remove isolation of HVAC system in areas where work is being performed.</li> </ol> |
|----------|--|---|

**Step 4:** Identify the areas surrounding the project area, assessing potential impact.

| <u>Unit Below</u> | <u>Unit Above</u> | <u>Lateral</u> | <u>Lateral</u> | <u>Behind</u> | <u>Front</u> |
|-------------------|-------------------|----------------|----------------|---------------|--------------|
|                   |                   |                |                |               |              |
| Risk Group        | Risk Group        | Risk Group     | Risk Group     | Risk Group    | Risk Group   |

**Step 5:** Identify specific site of activity, e.g., patient rooms, medication room, etc.

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**Step 6:** Identify issues related to: ventilation, plumbing, electrical, in terms of the occurrence of probable outages.

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**Step 7:** Identify containment measures, using prior assessment. What types of barriers (e.g., solids wall barriers)? Will HEPA filtration be required?

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*(Note: Renovation/construction area shall be isolated from the occupied areas during construction and shall be negative with respect to surrounding areas.)*

**Step 8:** Consider potential risk of water damage. Is there a risk due to compromising structural integrity (e.g., wall, ceiling, roof)?

**Step 9:** Work hours - can or will the work be done during non-patient care hours?

**Step 10:** Do plans allow for adequate number of isolation/negative airflow rooms?

**Step 11:** Do the plans allow for the required number and type of handwashing sinks?

**Step 12:** Does the infection control staff agree with the minimum number of sinks for this project? (*Verify against AIA Guidelines for types and area.*)

**Step 13:** Does the infection control staff agree with the plans relative to clean and soiled utility rooms?

**Step 14:** Plan to discuss the following containment issues with the project team: traffic flow, housekeeping, debris removal (how and when).

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**Appendix:** *Identify and communicate the responsibility for project monitoring that includes infection control concerns and risks. The ICRA may be modified throughout the project. Revisions must be communicated to the Project Manager.*

Signatures:

\_\_\_\_\_  
Project COTR

\_\_\_\_\_  
Infection Control Practitioner

## Contractor/Subcontractor/Employee Notification of Asbestos Form

THE DEPARTMENT OF VETERANS AFFAIRS MEDICAL CENTER LOCATED IN COLUMBIA, MO, WAS CONSTRUCTED DURING A PERIOD WHEN ASBESTOS WAS COMMONLY USED IN BUILDING MATERIALS.

THE MEDICAL CENTER HAS COMPLETED A SURVEY FOR ASBESTOS. ALL BUILDINGS CONTAIN SOME TYPE OF ASBESTOS (I.E., STEAM LINES, FLOOR TILES, CRAWL SPACES, ETC.).

IF YOU OR YOUR EMPLOYEE ENCOUNTERS SUSPECTED FRIABLE ASBESTOS OR CONDITIONS THAT MAY CAUSE SUSPECTED ASBESTOS TO BECOME FRIABLE, NOTIFY THE CO'S TECHNICAL REPRESENTATIVE (COTR) IMMEDIATELY.

WHEN WORKING IN AREAS THAT ARE SUSPECTED OF HAVING ASBESTOS, RELOCATE EMPLOYEES AND PATIENTS FROM THE AREA UNTIL WORK IS COMPLETED.

IF THERE ARE ANY QUESTIONS, PLEASE FEEL FREE TO CONTACT THE COTR AT EXT. 6370.

THANK YOU FOR YOUR ASSISTANCE.

CONTRACTOR/SUBCONTRACTOR/EMPLOYEE SIGNATURE, PLEASE SIGN AND DATE BELOW AS ACKNOWLEDGEMENT OF THE ABOVE INFORMATION.

Employee Name

Contractor/Subcontractor

Date

|  |  |  |
|--|--|--|
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|  |  |  |
|  |  |  |

**Cutting and Welding with Portable Gas or Arc Equipment Permit Form**

VA Project No: \_\_\_\_\_

Name of Contractor's Firm: \_\_\_\_\_

Date: \_\_\_\_\_

Building/Location: \_\_\_\_\_

Work To Be Done: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Special Precautions:

\_\_\_\_\_

\_\_\_\_\_

Fire Watch Required: \_\_\_\_ Yes \_\_\_\_ No

The location where the work is to be performed has been examined, necessary precautions have been taken and permission is granted for this work.

Signed \_\_\_\_\_ (Fire Department Official Authorizing Hot Work)

Permit Expires: \_\_\_\_\_ (Date)

Time Hot Work Started: \_\_\_\_\_ Time Hot Work Completed: \_\_\_\_\_

**Final Check-Up:**

Work area and all adjacent areas to which sparks and heat might have spread (including floors above and below and on opposite sides of walls) were inspected 30 minutes after the work was completed and were found fire safe.

Signed \_\_\_\_\_  
(Contractor's Fire Watch)

**Attention:**

Before approving any cutting and welding permit, the contractor's authorized representative or their appointee shall inspect the work area and confirm that precautions have been taken to prevent fire in accordance with NFPA Standard No. 51B.

**Interim Life Safety Measures/Precautions:**

- Sprinklers are in service where installed.
- Cutting and welding equipment in good repair.
- Within 10 meters (30 feet); floors swept clean of combustible, non-combustible materials or flammable liquids, all wall and floor openings covered, and covers suspended beneath work to collect sparks.
- When working on enclosed equipment and in confined space, equipment and area is free of flammable vapors.
- Fire watch provided during and 30 minutes after operation (60 minutes for torch-applied roofing operations).
- Portable fire extinguisher with adequate rating available in the immediate vicinity.
- Standpipe system in service where installed.
- Protection of any sprinkler heads when hot work is in close proximity.
- Smoking prohibited in immediate vicinity.
- Non-combustible shields provided when hot work is done near combustible walls, partitions, floors, roofs.
- Prohibition of hot work on pipes contacting combustible walls.
- Personnel trained in use of equipment including portable fire extinguishers and sounding a fire alarm.
- Final check-up conducted after 30 minutes.



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

**PART 1- GENERAL**

**1.1 DESCRIPTION:**

- A. The Contractor shall develop a Critical Path Method (CPM) plan, using Microsoft Project 10 software, and schedule demonstrating fulfillment of the contract requirements (Project Schedule), and shall keep the Project Schedule up-to-date in accordance with the requirements of this section and shall utilize the plan for scheduling, coordinating and monitoring work under this contract (including all activities of subcontractors, equipment vendors and suppliers). Conventional Critical Path Method (CPM) technique shall be utilized to satisfy both time and cost applications.

**1.2 CONTRACTOR'S REPRESENTATIVE:**

- A. The Contractor shall designate an authorized representative responsible for the Project Schedule including preparation, review and progress reporting with and to the Contracting Officer's Representative (COTR).
- B. The Contractor's representative shall have direct project control and complete authority to act on behalf of the Contractor in fulfilling the requirements of this specification section.
- C. The Contractor's representative shall have the option of developing the project schedule within their organization or to engage the services of an outside consultant. If an outside scheduling consultant is utilized, Section 1.3 of this specification will apply.

**1.3 CONTRACTOR'S CONSULTANT:**

- A. The Contractor shall submit a qualification proposal to the COTR, within 10 days of bid acceptance. The qualification proposal shall include:
1. The name and address of the proposed consultant.
  2. Information to show that the proposed consultant has the qualifications to meet the requirements specified in the preceding paragraph.
  3. A representative sample of prior construction projects, which the proposed consultant has performed complete project scheduling services. These representative samples shall be of similar size and scope.

- B. The Contracting Officer has the right to approve or disapprove the proposed consultant, and will notify the Contractor of the VA decision within seven calendar days from receipt of the qualification proposal. In case of disapproval, the Contractor shall resubmit another consultant within 10 calendar days for renewed consideration. The Contractor shall have their scheduling consultant approved prior to submitting any schedule for approval.

#### **1.4 COMPUTER PRODUCED SCHEDULES**

- A. The contractor shall provide monthly, to the Department of Veterans Affairs (VA), all computer-produced time/cost schedules and reports generated from monthly project updates. This monthly computer service will include: three copies of up to five different reports (inclusive of all pages) available within the user defined reports of the scheduling software approved by the Contracting Officer; a hard copy listing of all project schedule changes, and associated data, made at the update and an electronic file of this data; and the resulting monthly updated schedule in PDM format. These must be submitted with and substantively support the contractor's monthly payment request and the signed look ahead report. The COTR shall identify the five different report formats that the contractor shall provide.
- B. The contractor shall be responsible for the correctness and timeliness of the computer-produced reports. The Contractor shall also responsible for the accurate and timely submittal of the updated project schedule and all CPM data necessary to produce the computer reports and payment request that is specified.
- C. The VA will report errors in computer-produced reports to the Contractor's representative within ten calendar days from receipt of reports. The Contractor shall reprocess the computer-produced reports and associated diskette(s), when requested by the Contracting Officer's representative, to correct errors which affect the payment and schedule for the project.

#### **1.5 THE COMPLETE PROJECT SCHEDULE SUBMITTAL**

- A. Within 45 calendar days after receipt of Notice to Proceed, the Contractor shall submit for the Contracting Officer's review; three blue line copies of the interim schedule on sheets of paper 765 x 1070 mm (30 x 42 inches) and an electronic file in the previously approved CPM schedule program. The submittal shall also include three copies of a computer-produced activity/event ID schedule showing project

duration; phase completion dates; and other data, including event cost. Each activity/event on the computer-produced schedule shall contain as a minimum, but not limited to, activity/event ID, activity/event description, duration, budget amount, early start date, early finish date, late start date, late finish date and total float. Work activity/event relationships shall be restricted to finish-to-start or start-to-start without lead or lag constraints. Activity/event date constraints, not required by the contract, will not be accepted unless submitted to and approved by the Contracting Officer. The contractor shall make a separate written detailed request to the Contracting Officer identifying these date constraints and secure the Contracting Officer's written approval before incorporating them into the network diagram. The Contracting Officer's separate approval of the Project Schedule shall not excuse the contractor of this requirement. Logic events (non-work) will be permitted where necessary to reflect proper logic among work events, but must have zero duration. The complete working schedule shall reflect the Contractor's approach to scheduling the complete project. **The final Project Schedule in its original form shall contain no contract changes or delays which may have been incurred during the final network diagram development period and shall reflect the entire contract duration as defined in the bid documents.** These changes/delays shall be entered at the first update after the final Project Schedule has been approved. The Contractor should provide their requests for time and supporting time extension analysis for contract time as a result of contract changes/delays, after this update, and in accordance with Article, ADJUSTMENT OF CONTRACT COMPLETION.

- D. Within 30 calendar days after receipt of the complete project interim Project Schedule and the complete final Project Schedule, the Contracting Officer or his representative, will do one or both of the following:
1. Notify the Contractor concerning his actions, opinions, and objections.
  2. A meeting with the Contractor at or near the job site for joint review, correction or adjustment of the proposed plan will be scheduled if required. Within 14 calendar days after the joint review, the Contractor shall revise and shall submit three blue line copies of the revised Project Schedule, three copies of the revised

computer-produced activity/event ID schedule and a revised electronic file as specified by the Contracting Officer. The revised submission will be reviewed by the Contracting Officer and, if found to be as previously agreed upon, will be approved.

E. The approved baseline schedule and the computer-produced schedule(s) generated there from shall constitute the approved baseline schedule until subsequently revised in accordance with the requirements of this section.

F. The Complete Project Schedule shall contain approximately 50 work activities/events.

#### **1.6 WORK ACTIVITY/EVENT COST DATA**

A. The Contractor shall cost load all work activities/events except procurement activities. The cumulative amount of all cost loaded work activities/events (including alternates) shall equal the total contract price. Prorate overhead, profit and general conditions on all work activities/events for the entire project length. The contractor shall generate from this information cash flow curves indicating graphically the total percentage of work activity/event dollar value scheduled to be in place on early finish, late finish. These cash flow curves will be used by the Contracting Officer to assist him in determining approval or disapproval of the cost loading. 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 852.236 - 83 (PAYMENT UNDER FIXED-PRICE CONSTRUCTION CONTRACTS).

C. In accordance with FAR 52.236 - 1 (PERFORMANCE OF WORK BY THE CONTRACTOR) and VAAR 852.236 - 72 (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 including ASBESTOS ABATEMENT. The sum of each BID ITEM work shall equal the value of the bid item in the Contractors' bid.

**1.7 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 COTR may approve the showing of a longer duration. The duration for VA approval of any required submittal, shop drawing, or other submittals will not be less than 20 work days.

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.

**PROJECT SCHEDULES**

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.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.
- C. 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 COTR. 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 COTR's approval of the Project Schedule.
- D. Compact Disk Requirements and CPM Activity/Event Record Specifications: Submit to the VA an electronic file(s) containing one file of the data required to produce a schedule, reflecting all the activities/events of the complete project schedule being submitted.

#### **1.8 PAYMENT TO THE CONTRACTOR:**

- A. Monthly, the contractor shall submit an application and certificate for payment using 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 852.236 - 83 (PAYMENT UNDER FIXED-PRICE CONSTRUCTION CONTRACTS). 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 an electronic file (s) of the resulting monthly updated schedule.

- 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.

#### **1.9 PAYMENT AND PROGRESS REPORTING**

- A. Monthly schedule update meetings will be held on dates mutually agreed to by the COTR and the Contractor. Contractor and their CPM consultant (if applicable) 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 COTR 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 Contracting Officer's representative with reports in accordance with the Article, COMPUTER PRODUCED SCHEDULES, 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 resident engineer 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 resident engineer. 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 1.4 and 1.7. This electronic submission is separate from the regular monthly project schedule update requirements and shall be submitted to the resident engineer 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 CPM schedule, the VA, the General Contractor, its approved CPM Consultant, RE office representatives, 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.

#### **1.10 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 of the following remedial actions:
1. Increase construction manpower in such quantities and crafts as necessary to eliminate the backlog of work.



2. Increase the number of working hours per shift, shifts per working day, working days per week, the amount of construction equipment, or any combination of the foregoing to eliminate the backlog of work.
  3. Reschedule the work in conformance with the specification requirements.
- B. Prior to proceeding with any of the above actions, the Contractor shall notify and obtain approval from the COTR 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.

#### **1.11 CHANGES TO THE SCHEDULE**

- A. Within 30 calendar days after VA acceptance and approval of any updated project schedule, the Contractor shall submit a revised electronic file (s) and a list of any activity/event changes including predecessors and successors for any of the following reasons:
1. Delay in completion of any activity/event or group of activities/events, which may be involved with contract changes, strikes, unusual weather, and other delays will not relieve the Contractor from the requirements specified unless the conditions are shown on the CPM as the direct cause for delaying the project beyond the acceptable limits.
  2. Delays in submittals, or deliveries, or work stoppage are encountered which make rescheduling of the work necessary.
  3. The schedule does not represent the actual prosecution and progress of the project.
  4. When there is, or has been, a substantial revision to the activity/event costs regardless of the cause for these revisions.
- B. CPM revisions made under this paragraph which affect the previously approved computer-produced schedules for Government furnished equipment, vacating of areas by the VA Facility, contract phase(s) and sub phase(s), utilities furnished by the Government to the Contractor, or any other previously contracted item, shall be furnished in writing to the Contracting Officer for approval.
- C. Contracting Officer's approval for the revised project schedule and all relevant data is contingent upon compliance with all other paragraphs of this section and any other previous agreements by the Contracting Officer or the VA representative.

- D. The cost of revisions to the project schedule resulting from contract changes will be included in the proposal for changes in work as specified in FAR 52.243 - 4 (Changes) and VAAR 852.236 - 88 (Changes - Supplemental), and will be based on the complexity of the revision or contract change, man hours expended in analyzing the change, and the total cost of the change.
- E. The cost of revisions to the Project Schedule not resulting from contract changes is the responsibility of the Contractor.

#### **1.12 ADJUSTMENT OF CONTRACT COMPLETION**

- A. The contract completion time will be adjusted only for causes specified in this contract. Request for an extension of the contract completion date by the Contractor shall be supported with a justification, CPM data and supporting evidence as the COTR 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) and VAAR 852.236 - 88 (Changes - Supplemental). 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.

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

- 1-1. Refer to Articles titled SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FAR 52.236-21) and, SPECIAL NOTES (VAAR 852.236-91), in GENERAL CONDITIONS.
- 1-2. For the purposes of this contract, samples (including laboratory samples to be tested), test reports, certificates, and manufacturers' literature and data shall also be subject to the previously referenced requirements. The following text refers to all items collectively as SUBMITTALS.
- 1-3. Electronic submittal procedures
  - A. Summary:
    1. Shop drawing and product data submittals shall be transmitted to Architect in electronic (PDF) format using Submittal Exchange ([www.submittalexchange.com](http://www.submittalexchange.com)) or equal website service designed specifically for transmitting submittals, RFI's (Requests for Information), RFP's (Requests for Proposals), cost proposals, change orders, daily logs, contractor & subcontractor payrolls, construction progress photographs, correspondences, meeting minutes, and site visit reports, between all construction team members.
    2. The intent of electronic submittals is to expedite the construction process by reducing paperwork, improving information flow, and decreasing turnaround time.
    3. The electronic submittal process is not intended for color samples, color charts, or physical material samples. These shall be mailed, postage paid, to both VA & A/E.
  - B. Procedures:
    1. Create submittal log in approved electronic submittal system by inserting required submittals listed in individual specification sections.
    2. Submittal Preparation - Contractor may use any or all of the following options:
      - a. Subcontractors and Suppliers provide electronic (PDF) submittals to Contractor via the submittal system website.

- b. Subcontractors and Suppliers provide electronic (PDF) submittals to Contractor via email.
- c. Subcontractors and Suppliers provide paper submittals to Scanning Service which electronically scans and converts to PDF format.
- 3. Contractor shall review and apply electronic stamp certifying that the submittal complies with the requirements of the Contract Documents including verification of manufacturer / product, dimensions and coordination of information with other parts of the work.
- 4. Contractor shall transmit each submittal to Architect using the submittal website.
- 5. Architect / Engineer review comments will be made available on the submittal system website for downloading. Contractor will receive email notice of completed review.
- 6. Distribution of reviewed submittals to subcontractors and suppliers is the responsibility of the Contractor.
- C. Costs:
  - 1. General Contractor shall include the full cost of submittal system project subscription in their proposal. This cost shall be included in the Contract Amount.
  - 2. After award of contract, training will be provided by submittal system vendor regarding use of website and PDF submittals.
  - 3. Internet Service and Equipment Requirements:
    - a. Email address and Internet access at Contractor's main office.
    - b. Adobe Acrobat ([www.adobe.com](http://www.adobe.com)), Bluebeam PDF Revu ([www.bluebeam.com](http://www.bluebeam.com)), or other similar PDF review software for applying electronic stamps and comments.
- D. Products:
  - 4. Basis of specification is submittal system website system for electronic construction submittals ([www.submittalexchange.com](http://www.submittalexchange.com)) or equal.
  - 5. Product requirements:
    - a. Independently hosted, web-based system for automated tracking, storage, and distribution of contract submittals, Requests For Information, and other contract related documents. FTP sites, e-mail exchanges, and server-based systems hosted from inside a contractor's office will not be considered acceptable.

SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

- b. Utilize 256-bit SSL encryption and hosted at SAS70 Type II compliant data centers.
- c. Minimum five years documented experience of use on comparable commercial construction projects. "Comparable commercial construction projects" shall be defined as documented use on a minimum of five hundred governmental, public-entity, or private sector projects each of \$1 million construction value or greater.
- d. Minimum five years documented 99.5% website uptime.
- e. Unlimited individual user accounts and system access for all project subcontractors, general contractor, owner staff, architect, design consultants, and sub-consultants, with no additional fees for those parties to access the system.
- f. Separate locations for owner, architect, design consultant, and sub-consultant review comments with contractors restricted from viewing comments until final review or release by owner or primary design consultant.
- g. Full version histories and dates of exchanges automatically tracked and available for viewing, searching, and reporting in a linear log format compatible with AIA G712.
- h. Functionality to group submittals as required packages and apply forms and review comments to entire package simultaneously.
- i. Functionality for integrated online PDF viewing and review, including graphical markups and stamps, for owner, architect, design consultants, sub-consultants, and general contractor without need for additional software purchase.
- j. Automatic, configurable email notifications for each project team member for new and reviewed submittals and other items.
- k. Automatic, configurable email reminders of past due items.
- l. Customized, automated PDF form generation for submittals, RFIs, RFP's, proposals, change orders, daily logs, contractor & subcontractor payrolls, construction progress photographs, correspondences, and other documents matching standard templates used by owner, design consultants, sub-consultants, and general contractor. Documentation and demonstration of automatic form generation using each entity's templates must be submitted as part of any substitution request.

- m. Prior to project start, system vendor shall create submittal log with all required items from project manual or submittal register. Owner or primary design consultant shall have full control over required items list and access to edit, add, or remove items during project.
  - n. System vendor shall provide minimum one-hour live web meeting training sessions to contractors, design consultants, sub-consultants, and owners staff prior to project start. System vendor shall, if necessary, make this training available separately to individual users in order to tailor the training to ensure that the system works correctly on each user's computer system.
  - o. System vendor shall make available minimum thirty-minute live web meeting training sessions for subcontractors at least twice weekly for the entire duration of the project.
  - p. System vendor shall provide access for owner, design consultants, sub-consultants, general contractor, and subcontractors to live technical support by phone and email minimum of 7 AM to 6 PM CST on standard business days at no additional cost.
  - q. At completion of project closeout, system vendor shall provide minimum of four archival discs that include all documents and tracking logs, and the ability to download this information from the live website in a single complete archive package.
- 1-4. Submit for approval, all of the items specifically mentioned under the separate sections of the specification, with information sufficient to evidence full compliance with contract requirements. Materials, fabricated articles and the like to be installed in permanent work shall equal those of approved submittals. After an item has been approved, no change in brand or make will be permitted unless:
- A. Satisfactory written evidence is presented to, and approved by Contracting Officer, that manufacturer cannot make scheduled delivery of approved item or;
  - B. Item delivered has been rejected and substitution of a suitable item is an urgent necessity or;
  - C. Other conditions become apparent which indicates approval of such substitute item to be in best interest of the Government.

- 1-5. Forward submittals in sufficient time to permit proper consideration and approval action by Government. Time submission to assure adequate lead time for procurement of contract - required items. Delays attributable to untimely and rejected submittals (including any laboratory samples to be tested) will not serve as a basis for extending contract time for completion.
- 1-6. Submittals will be reviewed for compliance with contract requirements by Architect-Engineer, and action thereon will be taken by Resident Engineer on behalf of the Contracting Officer.
- 1-7. Upon receipt of submittals, Architect-Engineer will assign a file number thereto. Contractor, in any subsequent correspondence, shall refer to this file and identification number to expedite replies relative to previously approved or disapproved submittals.
- 1-8. The Government reserves the right to require additional submittals, whether or not particularly mentioned in this contract. If additional submittals beyond those required by the contract are furnished pursuant to request therefor by Contracting Officer, adjustment in contract price and time will be made in accordance with Articles titled CHANGES (FAR 52.243-4) and CHANGES - SUPPLEMENT (VAAR 852.236-88) of the GENERAL CONDITIONS.
- 1-9. Schedules called for in specifications and shown on shop drawings shall be submitted for use and information of Department of Veterans Affairs and Architect-Engineer. However, the Contractor shall assume responsibility for coordinating and verifying schedules. The Contracting Officer and Architect-Engineer assumes no responsibility for checking schedules or layout drawings for exact sizes, exact numbers and detailed positioning of items.
- 1-10. Submittals must be submitted by Contractor only.

A. The file name shall contain the specification section number or drawing sheet that it is being submitted for. Format/nomenclature for file names shall be as directed by CO &/or COR at pre-contract meeting. The 1<sup>st</sup> page of this file shall contain a list of items, name of Medical Center, name of Contractor, contract number, applicable specification paragraph numbers, applicable drawing numbers (and other information required for exact identification of location for each item), manufacturer and brand, ASTM or Federal

SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES



Specification Number (if any) and such additional information as may be required by specifications for particular item being furnished

B. Shop Drawings:

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

C. Product data:

1. Required certificates shall be signed by an authorized representative of manufacturer or supplier of material, and by Contractor.
2. Scanned catalog pages shall be marked to indicate specific items being submitted for approval.

D. If physical samples are required on this project coordinate procedure for submittal with COR.

E. If submittal samples have been disapproved, resubmit new samples as soon as possible after notification of disapproval. Such new samples shall be marked "Resubmitted Sample" in addition to containing other previously specified information required on label and in transmittal letter.

F. Approved samples will be kept on file by the Resident Engineer at the site until completion of contract, at which time such samples will be delivered to Contractor as Contractor's property. Where noted in technical sections of specifications, approved samples in good condition may be used in their proper locations in contract work. At completion of contract, samples that are not approved will be returned to Contractor only upon request and at Contractor's expense. Such request should be made prior to completion of the contract. Disapproved samples that are not requested for return by Contractor will be discarded after completion of contract.

G. All drawings, scanned catalog cuts, scanned certificates, other information, etc., shall be submitted in Adobe (.pdf) format. Entire submittal shall be combined into one Adobe (.pdf) file. Each submittal shall be transmitted separately; don't combine multiple submittals into one submission/file.

H. When work is directly related and involves more than one trade, shop drawings for all trades shall be submitted under one cover and as one submittal.

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**SECTION 01 35 26  
SAFETY REQUIREMENTS**

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**SECTION 01 35 26**  
**SAFETY REQUIREMENTS**

**1.1 APPLICABLE PUBLICATIONS:**

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

- 10 CFR 20 .....Standards for Protection Against Radiation
- H. 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
- I. VHA Directive 2005-007

## 1.2 DEFINITIONS:

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

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7. A significant injury or illness diagnosed by a physician or other licensed health care professional, even if it did not result in (1) through (6) above.

### **1.3 REGULATORY REQUIREMENTS:**

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

### **1.4 ACCIDENT PREVENTION PLAN (APP):**

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

### **SAFETY REQUIREMENTS**

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

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- 6) Lines of authority;
- 7) Policies and procedures regarding noncompliance with safety requirements (to include disciplinary actions for violation of safety requirements) should be identified;

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

- 1) Identification of subcontractors and suppliers (if known);
- 2) Safety responsibilities of subcontractors and suppliers.

**f. TRAINING.**

- 1) Site-specific SOH orientation training at the time of initial hire or assignment to the project for every employee before working on the project site is required.
- 2) Mandatory training and certifications that are applicable to this project (e.g., explosive actuated tools, crane operator, rigger, crane signal person, fall protection, electrical lockout/NFPA 70E, machine/equipment lockout, confined space, etc...) and any requirements for periodic retraining/recertification are required.
- 3) Procedures for ongoing safety and health training for supervisors and employees shall be established to address changes in site hazards/conditions.
- 4) OSHA 10-hour training is required for all workers on site and the OSHA 30-hour training is required for Trade Competent Persons (CPs)

**g. SAFETY AND HEALTH INSPECTIONS.**

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

**h. ACCIDENT INVESTIGATION & REPORTING.** The Contractor shall conduct mishap investigations of all OSHA Recordable Incidents. The APP shall include accident/incident investigation procedure & identify person(s) responsible to provide the following to the

#### SAFETY REQUIREMENTS



Contracting Officer Representative or Government Designated Authority:

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

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

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

C. Submit the APP to the Contracting Officer Representative or Government Designated Authority for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES 15 calendar days prior to the date of the

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preconstruction conference for acceptance. Work cannot proceed without an accepted APP.

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

#### **1.5 ACTIVITY HAZARD ANALYSES (AHAS):**

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

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

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**1.6 PRECONSTRUCTION CONFERENCE:**

- A. Contractor representatives who have a responsibility or significant role in implementation of the accident prevention program, as required by 29 CFR 1926.20(b)(1), on the project shall attend the preconstruction conference to gain a mutual understanding of its implementation. This includes the project superintendent, subcontractor superintendents, and any other assigned safety and health professionals.
- B. Discuss the details of the submitted APP to include incorporated plans, programs, procedures and a listing of anticipated AHAs that will be developed and implemented during the performance of the contract. This list of proposed AHAs will be reviewed at the conference and an agreement will be reached between the Contractor and the Contracting Officer's representative as to which phases will require an analysis. In addition, establish a schedule for the preparation, submittal, review, and acceptance of AHAs to preclude project delays.
- C. Deficiencies in the submitted APP will be brought to the attention of the Contractor within 14 days of submittal, and the Contractor shall revise the plan to correct deficiencies and re-submit it for acceptance. Do not begin work until there is an accepted APP.

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

- A. The Prime Contractor shall designate a minimum of one SSHO at each project site that will be identified as the SSHO to administer the Contractor's safety program and government-accepted Accident Prevention Plan. Each subcontractor shall designate a minimum of one CP in compliance with 29 CFR 1926.20 (b)(2) that will be identified as a CP to administer their individual safety programs.
- B. Further, all specialized Competent Persons for the work crews will be supplied by the respective contractor as required by 29 CFR 1926 (i.e. Asbestos, Electrical, Cranes, & Derricks, Demolition, Fall Protection, Fire Safety/Life Safety, Ladder, Rigging, Scaffolds, and Trenches/Excavations).
- C. These Competent Persons can have collateral duties as the subcontractor's superintendent and/or work crew lead persons as well as fill more than one specialized CP role (i.e. Asbestos, Electrical, Cranes, & Derricks, Demolition, Fall Protection, Fire Safety/Life Safety, Ladder, Rigging, Scaffolds, and Trenches/Excavations).

- D. The SSHO or an equally-qualified Designated Representative/alternate will maintain a presence on the site during construction operations in accordance with FAR Clause 52.236-6: *Superintendence by the Contractor*. CPs will maintain presence during their construction activities in accordance with above mentioned clause. A listing of the designated SSHO and all known CPs shall be submitted prior to the start of work as part of the APP with the training documentation and/or AHA as listed in Section 1.8 below.
- E. The repeated presence of uncontrolled hazards during a contractor's work operations will result in the designated CP as being deemed incompetent and result in the required removal of the employee in accordance with FAR Clause 52.236-5: Material and Workmanship, Paragraph (c).

#### **1.8 TRAINING:**

- A. The designated Prime Contractor SSHO must meet the requirements of all applicable OSHA standards and be capable (through training, experience, and qualifications) of ensuring that the requirements of 29 CFR 1926.16 and other appropriate Federal, State and local requirements are met for the project. As a minimum the SSHO must have completed the OSHA 30-hour Construction Safety class and have five (5) years of construction industry safety experience or three (3) years if he/she possesses a Certified Safety Professional (CSP) or certified Construction Safety and Health Technician (CSHT) certification or have a safety and health degree from an accredited university or college.
- B. All designated CPs shall have completed the OSHA 30-hour Construction Safety course within the past 5 years.
- C. In addition to the OSHA 30 Hour Construction Safety Course, all CPs with high hazard work operations such as operations involving asbestos, electrical, cranes, demolition, work at heights/fall protection, fire safety/life safety, ladder, rigging, scaffolds, and trenches/excavations shall have a specialized formal course in the hazard recognition & control associated with those high hazard work operations. Documented "repeat" deficiencies in the execution of safety requirements will require retaking the requisite formal course.
- D. All other construction workers shall have the OSHA 10-hour Construction Safety Outreach course and any necessary safety training to be able to identify hazards within their work environment.

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- E. Submit training records associated with the above training requirements to the Contracting Officer Representative or Government Designated Authority for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES 15 calendar days prior to the date of the preconstruction conference for acceptance.
- F. Prior to any worker for the contractor or subcontractors beginning work, they shall undergo a safety briefing provided by the SSHO or his/her designated representative. As a minimum, this briefing shall include information on the site-specific hazards, construction limits, VAMC safety guidelines, means of egress, break areas, work hours, locations of restrooms, use of VAMC equipment, emergency procedures, accident reporting etc... Documentation shall be provided to the Resident Engineer that individuals have undergone contractor's safety briefing.
- G. Ongoing safety training will be accomplished in the form of weekly documented safety meeting.

#### **1.9 INSPECTIONS:**

- A. The SSHO shall conduct frequent and regular safety inspections (daily) of the site and each of the subcontractors CPs shall conduct frequent and regular safety inspections (daily) of the their work operations as required by 29 CFR 1926.20(b)(2). Each week, the SSHO shall conduct a formal documented inspection of the entire construction areas with the subcontractors' "Trade Safety and Health CPs" present in their work areas. Coordinate with, and report findings and corrective actions weekly to Contracting Officer Representative or Government Designated Authority.

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

- A. Notify the Contracting Officer Representative or Government Designated Authority as soon as practical, but no more than four hours after any accident meeting the definition of OSHA Recordable Injuries or Illnesses or High Visibility Accidents, property damage equal to or greater than \$5,000, or any weight handling equipment accident. Within notification include contractor name; contract title; type of contract; name of activity, installation or location where accident occurred; date and time of accident; names of personnel injured; extent of property damage, if any; extent of injury, if known, and brief description of accident (to include type of construction equipment

used, PPE used, etc.). Preserve the conditions and evidence on the accident site until the Contracting Officer Representative or Government Designated Authority determine whether a government investigation will be conducted.

- B. Conduct an accident investigation for recordable injuries and illnesses, for Medical Treatment defined in paragraph DEFINITIONS, and property damage accidents resulting in at least \$20,000 in damages, to establish the root cause(s) of the accident. Complete the VA Form 2162, and provide the report to the Contracting Officer Representative or Government Designated Authority within 5 calendar days of the accident. The Contracting Officer Representative or Government Designated Authority will provide copies of any required or special forms.
- C. A summation of all man-hours worked by the contractor and associated sub-contractors for each month will be reported to the Contracting Officer Representative or Government Designated Authority monthly.
- D. A summation of all OSHA recordable accidents experienced on site by the contractor and associated sub-contractors for each month will be provided to the Contracting Officer Representative or Government Designated Authority monthly. The contractor and associated sub-contractors' OSHA 300 logs will be made available to the Contracting Officer Representative or Government Designated Authority as requested.

#### **1.11 PERSONAL PROTECTIVE EQUIPMENT (PPE):**

- A. PPE is governed in all areas by the nature of the work the employee is performing. For example, specific PPE required for performing work on electrical equipment is identified in NFPA 70E, Standard for Electrical Safety in the Workplace.
- B. Mandatory PPE includes:
  - 1. Hard Hats - unless written authorization is given by the Contracting Officer Representative or Government Designated Authority in circumstances of work operations that have limited potential for falling object hazards such as during finishing work or minor remodeling. With authorization to relax the requirement of hard hats, if a worker becomes exposed to an overhead falling object hazard, then hard hats would be required in accordance with the OSHA regulations.
  - 2. Safety glasses - unless written authorization is given by the Contracting Officer Representative or Government Designated

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- Authority appropriate safety glasses meeting the ANSI Z.87.1 standard must be worn by each person on site.
3. Appropriate Safety Shoes - based on the hazards present, safety shoes meeting the requirements of ASTM F2413-11 shall be worn by each person on site unless written authorization is given by the Contracting Officer Representative or Government Designated Authority.
  4. Hearing protection - Use personal hearing protection at all times in designated noise hazardous areas or when performing noise hazardous tasks.

#### 1.12 INFECTION CONTROL

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



- 2) Execute work by methods to minimize raising dust from construction operations.
  - 3) Ceiling tiles: Immediately replace a ceiling tiles displaced for visual inspection.
- b. Upon Completion:
- 1) Clean work area upon completion of task
  - 2) Notify the Contracting Officer Representative or Government Designated Authority
- C. Products and Materials:
1. Sheet Plastic: Fire retardant polystyrene, 6-mil thickness meeting local fire codes
  2. Exhaust Hoses: Heavy duty, flexible steel reinforced; Ventilation Blower Hose
- D. Before any construction on site begins, all contractor personnel involved in the construction or renovation activity shall be educated and trained in infection prevention measures established by the medical center.
- E. A dust control program will be establish and maintained as part of the contractor's infection preventive measures in accordance with the FGI Guidelines for Design and Construction of Healthcare Facilities. Prior to start of work, prepare a plan detailing project-specific dust protection measures with associated product data, including periodic status reports, and submit to COR for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- F. Medical center Infection Control personnel will monitor for airborne disease (e.g. aspergillosis) during construction. A baseline of conditions will be established by the medical center prior to the start of work and periodically during the construction stage to determine impact of construction activities on indoor air quality with safe thresholds established.
- H. In general, the following preventive measures shall be adopted during construction to keep down dust and prevent mold.
1. 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.

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**I. Exterior Construction**

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

**1.13 TUBERCULOSIS SCREENING**

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

**1.14 FIRE SAFETY**

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

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including periodic status reports, and submit to Contracting Officer Representative or Government Designated Authority for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. This plan may be an element of the Accident Prevention Plan.

- B. Site and Building Access: Maintain free and unobstructed access to facility emergency services and for fire, police and other emergency response forces in accordance with NFPA 241.
- C. Separate temporary facilities, such as trailers, storage sheds, and dumpsters, from existing buildings and new construction by distances in accordance with NFPA 241. For small facilities with less than 6 m (20 feet) exposing overall length, separate by 3m (10 feet).
- D. Temporary Heating and Electrical: Install, use and maintain installations in accordance with 29 CFR 1926, NFPA 241 and NFPA 70.
- E. Means of Egress: Do not block exiting for occupied buildings, including paths from exits to roads. Minimize disruptions and coordinate with Contracting Officer Representative or Government Designated Authority.
- F. Egress Routes for Construction Workers: Maintain free and unobstructed egress. Inspect daily. Report findings and corrective actions weekly to Contracting Officer Representative or Government Designated Authority.
- G. Fire Extinguishers: Provide and maintain extinguishers in construction areas and temporary storage areas in accordance with 29 CFR 1926, NFPA 241 and NFPA 10.
- H. Flammable and Combustible Liquids: Store, dispense and use liquids in accordance with 29 CFR 1926, NFPA 241 and NFPA 30.
- I. Standpipes: Install and extend standpipes up with each floor in accordance with 29 CFR 1926 and NFPA 241.
- J. Existing Fire Protection: Do not impair fire alarm systems, except for portions immediately under construction, and temporarily for connections. Request interruptions in accordance with Article, OPERATIONS AND STORAGE AREAS, and coordinate with Contracting Officer Representative or Government Designated Authority.
- K. Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with COR. COR at least 48 hours in advance. Designate contractor's responsible project-site fire prevention program manager to permit hot work.
- L. Fire Hazard Prevention and Safety Inspections: Inspect entire construction areas weekly. Coordinate with, and report findings and

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corrective actions weekly to Contracting Officer Representative or Government Designated Authority.

- M. Smoking: Smoking is prohibited by hospital policy in all buildings on site except the designated smoking areas. Anyone caught smoking in non-designated areas shall be removed from the site permanently.
- N. Dispose of waste and debris in accordance with NFPA 241. Remove from buildings daily. Coordinate removal with COR in order to minimize impacts to facility.
- O. NOTE: False fire alarms caused by inappropriate protection or action by the contractor will result in the government issuing fines to the contractor equal to the amount charged the government by the local fire department.
- P. All construction activities not already covered above shall be in accordance with the latest edition of NFPA No. 241 Standard for Safeguarding Construction, Alteration, and Demolition Operations, in effect at time of contract award.

#### **1.15 ELECTRICAL**

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

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above. An AHA specific to energized work activities will be developed, reviewed, and accepted prior to the start of that work.

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

#### **1.16 FALL PROTECTION**

- A. The fall protection (FP) threshold height requirement is 6 ft (1.8 m) for ALL WORK, unless specified differently or the OSHA 29 CFR 1926 requirements are more stringent, to include steel erection activities,

systems-engineered activities (prefabricated) metal buildings, residential (wood) construction and scaffolding work.

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

#### **1.17 SCAFFOLDS AND OTHER WORK PLATFORMS**

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

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

#### **1.18 EXCAVATION AND TRENCHES**

- A. All excavation and trenching work shall comply with 29 CFR 1926 Subpart P.
- B. All excavations and trenches 5 feet in depth or greater shall require a written trenching and excavation permit (NOTE - some States and other local jurisdictions require separate state/jurisdiction-issued excavation permits). The permit shall be completed and provided to the COR and/or other Government Designated Authority prior to commencing work for the day. At the end of the day, the permit shall be closed out and provided to the COR and/or other Government Designated Authority. The permit shall be maintained onsite and include the following:
1. Determination of soil classification
  2. Indication that utilities have been located and identified. If utilities could not be located after all reasonable attempt, then excavating operations will proceed cautiously.
  3. Indication of selected excavation protective system.
  4. Indication that the spoil pile will be stored at least 2 feet from the edge of the excavation and safe access provided within 25 feet of the workers.
  5. Indication of assessment for a potential toxic, explosive, or oxygen deficient atmosphere.
- C. If not using an engineered protective system such as a trench box, shielding, shoring, or other Professional Engineer designed system and using a sloping or benching system, soil classification cannot be Solid Rock or Type A. All soil will be classified as Type B or Type C and sloped or benched in accordance with Appendix B of 29 CFR 1926.

#### **1.19 CRANES**

- A. All crane work shall comply with 29 CFR 1926 Subpart CC.
- B. Prior to operating a crane, the operator must be licensed, qualified or certified to operate the crane. Thus, all the provisions contained with Subpart CC are effective and there is no "Phase In" date of November 10, 2014.
- C. A detailed lift permit shall be submitted 14 days prior to the scheduled lift complete with route for truck carrying load, crane load

#### **SAFETY REQUIREMENTS**

analysis, siting of crane and path of swing. The lift will not be allowed without approval of this document.

- D. Crane operators shall not carry loads
  - 1. over the general public or VAMC personnel
  - 2. over any occupied building unless
    - a. the top two floors are vacated
    - b. or overhead protection with a design live load of 300 psf is provided

#### **1.20 CONTROL OF HAZARDOUS ENERGY (LOCKOUT/TAGOUT)**

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

#### **1.21 CONFINED SPACE ENTRY**

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

#### **1.22 WELDING AND CUTTING**

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

#### **1.23 LADDERS**

- A. All Ladder use shall comply with 29 CFR 1926 Subpart X.
- B. All portable ladders shall be of sufficient length and shall be placed so that workers will not stretch or assume a hazardous position.
- C. Manufacturer safety labels shall be in place on ladders
- D. Step Ladders shall not be used in the closed position

#### **SAFETY REQUIREMENTS**



- E. Top steps or cap of step ladders shall not be used as a step
- F. Portable ladders, used as temporary access, shall extend at least 3 ft (0.9 m) above the upper landing surface.
  - 1. When a 3 ft (0.9-m) extension is not possible, a grasping device (such as a grab rail) shall be provided to assist workers in mounting and dismounting the ladder.
  - 2. In no case shall the length of the ladder be such that ladder deflection under a load would, by itself, cause the ladder to slip from its support.
- G. Ladders shall be inspected for visible defects on a daily basis and after any occurrence that could affect their safe use. Broken or damaged ladders shall be immediately tagged "DO NOT USE," or with similar wording, and withdrawn from service until restored to a condition meeting their original design.

#### **1.24 FLOOR & WALL OPENINGS**

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

4. Non-load-bearing skylights shall be guarded by a load-bearing skylight screen, cover, or railing system along all exposed sides.
5. Workers are prohibited from standing/walking on skylights.

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**SECTION 01 42 19**  
**REFERENCE STANDARDS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

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

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

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

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

- A. The specifications and standards cited in this solicitation can be examined at the following location:
- DEPARTMENT OF VETERANS AFFAIRS  
Office of Construction & Facilities Management  
Facilities Quality Service (00CFM1A)  
425 Eye Street N.W, (sixth floor)  
Washington, DC 20001  
Telephone Numbers: (202) 632-5249 or (202) 632-5178  
Between 9:00 AM - 3:00 PM

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

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

REFERENCE STANDARDS

|        |  |
|--------|--|
| AA     | Aluminum Association Inc.<br><a href="http://www.aluminum.org">http://www.aluminum.org</a>   |
| AABC   | Associated Air Balance Council<br><a href="http://www.aabchq.com">http://www.aabchq.com</a>  |
| AAMA   | American Architectural Manufacturer's Association<br><a href="http://www.aamanet.org">http://www.aamanet.org</a>                   |
| AAN    | American Nursery and Landscape Association<br><a href="http://www.anla.org">http://www.anla.org</a>                                |
| AASHTO | American Association of State Highway and Transportation<br>Officials<br><a href="http://www.aashto.org">http://www.aashto.org</a> |
| ACGIH  | American Conference of Governmental Industrial Hygienists<br><a href="http://www.acgi.org">http://www.acgi.org</a>                 |
| ACI    | American Concrete Institute<br><a href="http://www.aci-int.net">http://www.aci-int.net</a>   |
| ACPA   | American Concrete Pipe Association<br><a href="http://www.concrete-pipe.org">http://www.concrete-pipe.org</a>                      |
| ACPPA  | American Concrete Pressure Pipe Association<br><a href="http://www.acppa.org">http://www.acppa.org</a>                             |
| ADC    | Air Diffusion Council<br><a href="http://flexibleduct.org">http://flexibleduct.org</a>   |
| AGA    | American Gas Association<br><a href="http://www.aga.org">http://www.aga.org</a>  |
| AGC    | Associated General Contractors of America<br><a href="http://www.agc.org">http://www.agc.org</a>                                   |
| AGMA   | American Gear Manufacturers Association, Inc.<br><a href="http://www.agma.org">http://www.agma.org</a>                             |
| AIA    | American Institute of Architects<br><a href="http://www.aia.org">http://www.aia.org</a>  |
| AISC   | American Institute of Steel Construction<br><a href="http://www.aisc.org">http://www.aisc.org</a>                                  |
| AISI   | American Iron and Steel Institute<br><a href="http://www.steel.org">http://www.steel.org</a>                                       |
| AITC   | American Institute of Timber Construction<br><a href="http://www.aitc-glulam.org">http://www.aitc-glulam.org</a>                   |
| AMCA   | Air Movement and Control Association, Inc.<br><a href="http://www.amca.org">http://www.amca.org</a>                                |

## REFERENCE STANDARDS

|        |  |
|--------|--|
| ANLA   | American Nursery & Landscape Association<br><a href="http://www.anla.org">http://www.anla.org</a>  |
| ANSI   | American National Standards Institute, Inc.<br><a href="http://www.ansi.org">http://www.ansi.org</a>                                       |
| APA    | The Engineered Wood Association<br><a href="http://www.apawood.org">http://www.apawood.org</a>   |
| ARI    | Air-Conditioning and Refrigeration Institute<br><a href="http://www.ari.org">http://www.ari.org</a>  |
| ASAE   | American Society of Agricultural Engineers<br><a href="http://www.asae.org">http://www.asae.org</a>  |
| ASCE   | American Society of Civil Engineers<br><a href="http://www.asce.org">http://www.asce.org</a>   |
| ASHRAE | American Society of Heating, Refrigerating, and<br>Air-Conditioning Engineers<br><a href="http://www.ashrae.org">http://www.ashrae.org</a> |
| ASME   | American Society of Mechanical Engineers<br><a href="http://www.asme.org">http://www.asme.org</a>  |
| ASSE   | American Society of Sanitary Engineering<br><a href="http://www.asse-plumbing.org">http://www.asse-plumbing.org</a>                        |
| ASTM   | American Society for Testing and Materials<br><a href="http://www.astm.org">http://www.astm.org</a>  |
| AWI    | Architectural Woodwork Institute<br><a href="http://www.awinet.org">http://www.awinet.org</a>  |
| AWS    | American Welding Society<br><a href="http://www.aws.org">http://www.aws.org</a>  |
| AWWA   | American Water Works Association<br><a href="http://www.awwa.org">http://www.awwa.org</a>  |
| BHMA   | Builders Hardware Manufacturers Association<br><a href="http://www.buildershardware.com">http://www.buildershardware.com</a>               |
| CISCA  | Ceilings and Interior Systems Construction Association<br><a href="http://www.cisca.org">http://www.cisca.org</a>                          |
| CISPI  | Cast Iron Soil Pipe Institute<br><a href="http://www.cispi.org">http://www.cispi.org</a>   |
| CLFMI  | Chain Link Fence Manufacturers Institute<br><a href="http://www.chainlinkinfo.org">http://www.chainlinkinfo.org</a>                        |
| CPMB   | Concrete Plant Manufacturers Bureau<br><a href="http://www.cpmc.org">http://www.cpmc.org</a>   |

## REFERENCE STANDARDS

|       |   |
|-------|---|
| CRSI  | Concrete Reinforcing Steel Institute<br><a href="http://www.crsi.org">http://www.crsi.org</a>                                     |
| CTI   | Cooling Technology Institute<br><a href="http://www.cti.org">http://www.cti.org</a>   |
| DHI   | Door and Hardware Institute<br><a href="http://www.dhi.org">http://www.dhi.org</a>  |
| EGSA  | Electrical Generating Systems Association<br><a href="http://www.egsa.org">http://www.egsa.org</a>                                |
| EEI   | Edison Electric Institute<br><a href="http://www.eei.org">http://www.eei.org</a>  |
| EPA   | Environmental Protection Agency<br><a href="http://www.epa.gov">http://www.epa.gov</a>  |
| ETL   | ETL Testing Laboratories, Inc.<br><a href="http://www.etl.com">http://www.etl.com</a>   |
| FAA   | Federal Aviation Administration<br><a href="http://www.faa.gov">http://www.faa.gov</a>  |
| FCC   | Federal Communications Commission<br><a href="http://www.fcc.gov">http://www.fcc.gov</a>  |
| FPS   | The Forest Products Society<br><a href="http://www.forestprod.org">http://www.forestprod.org</a>                                  |
| GANA  | Glass Association of North America<br><a href="http://www.cssinfo.com/info/gana.html/">http://www.cssinfo.com/info/gana.html/</a> |
| FM    | Factory Mutual Insurance<br><a href="http://www.fmglobal.com">http://www.fmglobal.com</a>   |
| GA    | Gypsum Association<br><a href="http://www.gypsum.org">http://www.gypsum.org</a>   |
| GSA   | General Services Administration<br><a href="http://www.gsa.gov">http://www.gsa.gov</a>  |
| HI    | Hydraulic Institute<br><a href="http://www.pumps.org">http://www.pumps.org</a>  |
| HPVA  | Hardwood Plywood & Veneer Association<br><a href="http://www.hpva.org">http://www.hpva.org</a>                                    |
|       | ICBO International Conference of Building Officials<br><a href="http://www.icbo.org">http://www.icbo.org</a>                      |
| ICEA  | Insulated Cable Engineers Association Inc.<br><a href="http://www.icea.net">http://www.icea.net</a>                               |
| \ICAC | Institute of Clean Air Companies<br><a href="http://www.icac.com">http://www.icac.com</a>   |

## REFERENCE STANDARDS

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

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

IPCEA Insulated Power Cable Engineers Association

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

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

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

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

NBS National Bureau of Standards  
See - NIST

NEC National Electric Code  
See - NFPA National Fire Protection Association

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

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

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

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

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

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

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

NSF National Sanitation Foundation  
<http://www.nsf.org>

NWWDA Window and Door Manufacturers Association  
<http://www.nwwda.org>

## REFERENCE STANDARDS

|        |   |
|--------|---|
| OSHA   | Occupational Safety and Health Administration<br>Department of Labor<br><a href="http://www.osha.gov">http://www.osha.gov</a>           |
| PCA    | Portland Cement Association<br><a href="http://www.portcement.org">http://www.portcement.org</a>  |
| PCI    | Precast Prestressed Concrete Institute<br><a href="http://www.pci.org">http://www.pci.org</a>   |
| PPI    | The Plastic Pipe Institute<br><a href="http://www.plasticpipe.org">http://www.plasticpipe.org</a>                                       |
| PTI    | Post-Tensioning Institute<br><a href="http://www.post-tensioning.org">http://www.post-tensioning.org</a>                                |
| RMA    | Rubber Manufacturers Association, Inc.<br><a href="http://www.rma.org">http://www.rma.org</a>   |
| SCMA   | Southern Cypress Manufacturers Association<br><a href="http://www.cypressinfo.org">http://www.cypressinfo.org</a>                       |
| SDI    | Steel Door Institute<br><a href="http://www.steeldoor.org">http://www.steeldoor.org</a>   |
| IGMA   | Insulating Glass Manufacturers Alliance<br><a href="http://www.igmaonline.org">http://www.igmaonline.org</a>                            |
| SMACNA | Sheet Metal and Air-Conditioning Contractors<br>National Association, Inc.<br><a href="http://www.smacna.org">http://www.smacna.org</a> |
| SSPC   | The Society for Protective Coatings<br><a href="http://www.sspc.org">http://www.sspc.org</a>  |
| TEMA   | Tubular Exchange Manufacturers Association<br><a href="http://www.tema.org">http://www.tema.org</a>                                     |
| UBC    | The Uniform Building Code<br>See ICBO   |
| UL     | Underwriters' Laboratories Incorporated<br><a href="http://www.ul.com">http://www.ul.com</a>  |
| ULC    | Underwriters' Laboratories of Canada<br><a href="http://www.ulc.ca">http://www.ulc.ca</a>   |
| WCLIB  | West Coast Lumber Inspection Bureau<br>6980 SW Varns Road, P.O. Box 23145<br>Portland, OR 97223<br>(503) 639-0651                       |
| WWPA   | Western Wood Products Association<br><a href="http://www.wwpa.org">http://www.wwpa.org</a>  |

## REFERENCE STANDARDS



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REFERENCE STANDARDS

01 42 19 - 7

**SECTION 01 45 29**  
**TESTING LABORATORY SERVICES**

**PART 1 - GENERAL****1.1 DESCRIPTION:**

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

**1.2 APPLICABLE PUBLICATIONS:**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.
- B. American Association of State Highway and Transportation Officials (AASHTO):
- T27-11.....Standard Method of Test for Sieve Analysis of  
Fine and Coarse Aggregates
- T96-02 (R2006).....Standard Method of Test for Resistance to  
Degradation of Small-Size Coarse Aggregate by  
Abrasion and Impact in the Los Angeles Machine
- T99-10.....Standard Method of Test for Moisture-Density  
Relations of Soils Using a 2.5 Kg (5.5 lb.)  
Rammer and a 305 mm (12 in.) Drop
- T104-99 (R2007).....Standard Method of Test for Soundness of  
Aggregate by Use of Sodium Sulfate or Magnesium  
Sulfate
- T180-10.....Standard Method of Test for Moisture-Density  
Relations of Soils using a 4.54 kg (10 lb.)  
Rammer and a 457 mm (18 in.) Drop
- T191-02 (R2006).....Standard Method of Test for Density of Soil In-  
Place by the Sand-Cone Method
- C. American Concrete Institute (ACI):
- 506.4R-94 (R2004).....Guide for the Evaluation of Shotcrete
- D. American Society for Testing and Materials (ASTM):
- A325-10.....Standard Specification for Structural Bolts,  
Steel, Heat Treated, 120/105 ksi Minimum  
Tensile Strength
- A370-12.....Standard Test Methods and Definitions for  
Mechanical Testing of Steel Products

TESTING LABORATORY SERVICES

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

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

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

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

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

C94/C94M-14a.....Standard Specification for Ready Mixed Concrete

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

C231/C231M-14.....Standard Test Method for Air Content of freshly  
Mixed Concrete by the Pressure Method

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

C457/C457M-12.....Standard Test Method for Microscopical  
Determination of Air-Void Content and  
Parameters of the Air-Void System in Hardened  
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

C1202/C1202M-12.....Standard Test Method for Electrical Indication  
of Concrete's Ability to Resist Chloride Ion  
Penetration

C1218/C1218M-08.....Standard Test Method for Water Soluble Chloride  
Ion in Mortar and Concrete

C1260/C1260M-14.....Standard Test Method for Potential Alkali  
Reactivity of Aggregates (Mortar Bar Method)

C1293/C1293M-08b(2015) ..Standard Test Method for Determination of  
Length Change of Concrete Due to Alkali-Silica  
Reaction

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

C1567/C1567M-13.....Standard Test Method for Determining the  
Potential Alkali-Silica Reactivity of  
Combinations of Cementitious Materials and  
Aggregate (Accelerate Mortar Bar Method)

C1611/C1611M-14.....Standard Test Method for Slump Flow of Self-  
Consolidating Concrete

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

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/ft<sup>3</sup> (2,700 KNm/m<sup>3</sup>))

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

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

E. American Welding Society (AWS):

D1.1/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 Resident Engineer. When it appears materials furnished, or work performed by Contractor fail to meet construction contract requirements, Testing Laboratory shall direct attention of Resident Engineer to such failure.
- C. Written Reports: Testing laboratory shall submit test reports to Resident Engineer, Contractor, unless other arrangements are agreed to in writing by the Resident Engineer. Submit reports of tests that fail to meet construction contract requirements on colored paper.
- D. Verbal Reports: Give verbal notification to Resident Engineer immediately of any irregularity.

### **PART 2 - PRODUCTS (NOT USED)**

### **PART 3 - EXECUTION**

#### **3.1 EARTHWORK:**

- A. General: The Testing Laboratory shall provide qualified personnel, materials, equipment, and transportation as required to perform the services identified/required herein, within the agreed to schedule and/or time frame. The work to be performed shall be as identified herein and shall include but not be limited to the following:
1. Observe fill and subgrades during proof-rolling to evaluate suitability of surface material to receive fill or base course. Provide recommendations to the Resident Engineer regarding

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- suitability or unsuitability of areas where proof-rolling was observed. Where unsuitable results are observed, witness excavation of unsuitable material and recommend to Resident Engineer extent of removal and replacement of unsuitable materials and observe proof-rolling of replaced areas until satisfactory results are obtained.
2. Provide full time observation of fill placement and compaction and field density testing in building areas and provide full time observation of fill placement and compaction and field density testing in pavement areas to verify that earthwork compaction obtained is in accordance with contract documents.
  3. Provide supervised geotechnical technician to inspect excavation, subsurface preparation, and backfill for structural fill.

B. Testing Compaction:

1. Determine maximum density and optimum moisture content for each type of fill, backfill and subgrade material used, in compliance with ASTM D698.
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 Resident Engineer before the tests are conducted.
  - a. Building Slab Subgrade: At least one test of subgrade for every 185 m<sup>2</sup> (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<sup>2</sup> (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<sup>2</sup> (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.

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- 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 Resident Engineer. In each compacted fill layer below wall footings, perform one field density test for every 30 m (100 feet) of wall. Verify subgrade is level, all loose or disturbed soils have been removed, and correlate actual soil conditions observed with those indicated by test borings.
- C. Fill and Backfill Material Gradation: One test per 100 cubic yards stockpiled or in-place source material. Gradation of fill and backfill material shall be determined in accordance with ASTM C136.
- 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 Resident Engineer.

### **3.2 FOUNDATION CAISSONS:**

- A. Concrete Testing: Test concrete including materials for concrete as required in Article, CONCRETE of this section, except make one set of four standard cylinders for each caisson.
- B. Maintain a record of concrete used in each caisson. Compare records with calculated volumes.
- C. Drill and inspect verification holes in bottom of 25% of caissons to determine that material is capable of supporting design load.
- D. Perform down-hole inspection of sides and bottom of each caisson for compliance with contract documents before placing concrete.
- E. Submit a certified "Caisson Field Record" for each caisson, recording actual elevation at bottom of shaft; elevation of rock; final center line location of top; variation of shaft from plumb; results of all tests and observations performed; material type and actual allowable bearing capacity of bottom; depth of socket into rock; levelness of bottom; seepage of water; still water level (if allowed to flood); elevation (top and bottom) of lining left in place; variation of shaft diameter (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.



**3.3 LANDSCAPING:**

- A. Test topsoil for organic materials, pH, phosphate, potash content, and gradation of particles.
  - 1. Test for organic material by using ASTM D2974.
  - 2. Determine percent of silt, sand, clay, and foreign materials such as rock, roots, and vegetation.
- B. Submit laboratory test report of topsoil to Resident Engineer.

**3.4 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.

**3.5 SITE WORK CONCRETE:**

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

**3.6 POST-TENSIONING OF CONCRETE:**

- A. Inspection Prior to Concreting: Inspect tendons, drape of tendons, and anchorage components for compliance prior to concreting.
- B. Concrete Testing: As required in Article, CONCRETE of this section except make three test cylinders representing each area to be tensioned and cylinders shall be cured in same manner as concrete they represent. Make compression test prior to determining minimum specified strength required for post-tensioning.

- C. Post-tensioning: Witness post-tensioning operation and record actual gauge pressures and elongations applied to each tendon.
- D. Submit reports in quadruplicate of the following:
  - 1. Inspection of placement and post-tensioning of all tendons.
  - 2. Size, number, location, and drape of tendons.
  - 3. Calculated elongations, based upon the length, modulus of elasticity, and cross-sectional area of the tendons used.
  - 4. Actual field elongations. Check elongation of tendons within ranges established by manufacturer.
  - 5. Calculated gauge pressure and jacking force applied to each tendon.
  - 6. Actual gauge pressures and jacking force applied to each tendon.
  - 7. Required concrete strength at time of jacking.
  - 8. Actual concrete strength at time of jacking.
  - 9. Do not cut or cover the tendon ends until the Contractor receives the Resident Engineer's written approval of the post-tensioning records.

### **3.7 CONCRETE:**

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

6. Determine air content and parameters of air-void system of proposed concrete mix design per ASTM C457.
7. Determine water soluble chloride ion content of proposed concrete mix design per ASTM C1218.
8. Determine Alkali-Aggregate Reactivity Resistance of approved trial mix concrete by either ASTM C1260, ASTM C1293, or ASTM C1567.
9. Determine Rapid Chloride Permeability of proposed concrete mix design per ASTM C1202.

B. Field Inspection and Materials Testing:

1. Provide a technician at site of placement at all times to perform concrete sampling and testing.
2. Identify those trucks of concrete supplier's which meet requirements of NRMCA Quality Control Manual. Permit only those trucks to deliver concrete to Project. 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, test, and cure compression test cylinders in accordance with ASTM C31. Make at least six cylinders for each 80 m<sup>3</sup> (100 cubic yards) or less of each concrete type, and at least six cylinders for any one day's pour for each concrete type. Additional cylinders shall be taken under conditions of cold weather concreting. Label each cylinder with an identification number. Resident Engineer may require additional cylinders to be molded and cured under job conditions. Provide site cure box for cylinders.
4. Perform slump tests in accordance with ASTM C143. Test each truck. 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. When high-range water-reducing admixture (superplasticizer) is used, initial slump must be verified by Testing Agency. For Self-Consolidating Concrete: Conduct one slump flow test in accordance with ASTM C 1611/C 1611M per truck load of ready mixed concrete delivered to Project at truck for

- superstructure concrete. Conduct slump flow test in accordance with ASTM C1611/C 1611M and ACI 301 for foundation concrete.
5. Determine the air content of concrete per ASTM C231 or ASTM C173.  
For concrete required to be air-entrained, test every truck. After good concrete quality control has been established and maintained as determined by Resident Engineer, test the first truck and every 20 m<sup>3</sup> (25 cubic yards) thereafter each day. Sample fresh concrete immediately following placement and screeding and conduct air content tests in accordance with ASTM C 231 or ASTM C 173 at rate of one for every 10 truck loads of ready-mix, air-entrained concrete delivered to Project. For pumped concrete, initially test concrete at both the hopper and the discharge end of the hose to determine change in air content.
  6. If slump or air content fall outside specified limits, make another test immediately from another portion of same batch.
  7. Perform unit weight tests in compliance with ASTM C138 for normal weight concrete. Test the first truck and each time cylinders are made.
  8. For chloride permeability, mold two 4 in. diameter cylinders for every 20,000 sq. ft. of topping or structural slab, unless directed otherwise by Engineer. Perform rapid chloride permeability test per ASTM C1202. Make and cure cylinders in accordance with ASTM C 31
  9. Notify laboratory technician at batch plant of mix irregularities and request materials and proportioning check.
  10. Verify that specified mixing has been accomplished.
  11. Environmental Conditions: Determine the temperature per ASTM C1064 each time cylinders are taken and 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.

12. Inspect the structural embeds/anchorage and reinforcing steel placement, including bar size, epoxy coating, bar spacing, top and bottom concrete cover, proper tie into the chairs, splices, bends, anchorages, 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. Inspect formwork for shape, location, and dimensions of concrete members being formed.
15. Observe condition of formed surfaces upon removal of formwork prior to repair of surface defects and observe repair of surface defects.
16. Observe curing procedures for conformance with specifications, record dates of concrete placement, start of preliminary curing, start of final curing, end of curing period.
17. Observe finish and finishing procedures for conformance with specifications.
18. 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.
19. Observe preparations for protection from hot weather, cold weather, sun, and rain, and preparations for curing.
20. Observe concrete mixing:
  - a. Monitor and record amount of water added at project site.
  - b. Observe minimum and maximum mixing times.
21. Where applicable, measure concrete flatwork for levelness and flatness as follows:
  - a. Perform Floor Tolerance Measurements  $F_F$  and  $F_L$  in accordance with ASTM E1155. Calculate the actual overall F- numbers using the inferior/superior area method.
  - b. Perform all floor tolerance measurements within 48 hours after slab installation and prior to removal of shoring and formwork.
  - c. Provide the Contractor and the Resident Engineer with the results of all profile tests, including a running tabulation of the overall  $F_F$  and  $F_L$  values for all slabs installed to date, within 72 hours after each slab installation.

22. For parking garage sloped floor surfaces: Test surfaces for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness. Use a sloped template.
  23. Observe installation and location of expansion joints, control joints, traffic topping membranes and joint sealants for conformance with drawings and specifications.
  24. Other inspections:
    - a. Grouting under base plates.
    - b. Grouting anchor bolts and reinforcing steel in hardened concrete.
  25. Furnish certified field test reports (duplicate) to Resident Engineer, Engineer of Record, Contractor, and Concrete Supplier. In test report, indicate the following information:
    - a. Project name and location.
    - b. Contractor and Concrete supplier's name.
    - c. Testing Agency's name, address, phone number, and technicians.
    - d. Date of testing.
    - e. Placement location within structure.
    - f. Weather conditions during placing.
    - g. Time of batching, testing, and discharge.
    - h. Maximum and minimum ambient temperature during placing.
    - i. Concrete mixture data.
  26. Report all nonconforming test results to Resident Engineer.
- C. Laboratory Tests of Field Samples:
1. Test compression test cylinders for strength in accordance with ASTM C39. For each test series, test two cylinders at 7 days and two cylinders at 28 days. Use remaining cylinders as a spare, tested as directed by Resident Engineer. Compile laboratory test reports as follows: Compressive strength test shall be result of two cylinders, except when one cylinder shows evidence of improper sampling, molding or testing, in which case it shall be discarded and strength of spare cylinder shall be used.
  2. Test rapid chloride permeability cylinders in accordance with ASTM C1202.
  3. Furnish certified test reports (duplicate) to Resident Engineer, Engineer of Record, Contractor, and Concrete Supplier. 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 (or slump flow for SCC), density (unit weight), and percent air.
  - d. Compressive strength of concrete in MPa (psi).
  - e. Weather conditions during placing.
  - f. Temperature of concrete in each test cylinder when test cylinder was molded.
  - g. Maximum and minimum ambient temperature during placing.
  - h. Ambient temperature when concrete sample in test cylinder was taken.
  - i. Date delivered to laboratory and date tested.
4. Monthly, submit a graph showing distribution of compressive strength test results and air content test results.
- D. Removal of residual curing compound: Provide a summary of testing to show adequate surface preparation for successful application of sealers, coatings, stains, pavement markings, and other finishes.

**3.8 REINFORCEMENT:**

- A. Review mill test reports furnished by Contractor.
- B. Provide tensile test and bend test results for reinforcing steel.
- C. Written report shall include, in addition to test results, heat number, manufacturer, type and grade of steel, and bar size.
- D. Perform tension tests of mechanical and welded splices (if used) in accordance with ASTM A370.
- E. Mechanical and chemical anchors: If necessary for purposes of determining tensile and/or shear capacity in questionable base material, testing shall be done prior to actual anchor installation. A maximum of five tension and/or shear tests shall be performed by manufacturer's engineer. Anchors shall be proof loaded in tension and/or shear to assure that working load capacity is within specified allowable load limit as published by manufacturer.

**3.9 PRECAST CONCRETE:**

- A. Inspection at Plant: Comply with PCI MNL 116 for testing requirements. Inspect forms, placement and concrete cover of reinforcing steel and tendons, placement and finishing of concrete, verification of concrete strength prior to tensioning, 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

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produced. In addition, for silica fume or high reactivity metakaolin concrete: When desired mix properties are achieved, two 12 in. x 12 in. x 4 in. thick slabs shall be prepared for each mixture with test samples taken by drilling four 4 in. diameter cores. Drilled cores shall be tested for rapid chloride permeability in accordance with Test Method ASTM C 1202.C. Test tendons for conformance with ASTM A416 and furnish report to Resident Engineer.

- D. Inspect members to insure that specification requirements for curing and finishes have been met.
- E. Observe erection of precast concrete members.
- F. Verify precast concrete connections conform to requirements of specifications, structural drawings, precast construction (shop) drawings.
- G. Welds: Visually inspect all welds.
  - 1. Double tee flange-to-flange connections: Test 5% of welds, if at discretion of Inspector, visual inspection inconclusive.
  - 2. All other welds: Test 25% of all field fillet welds and 5% of all shop welds.
  - 3. Testing: Penetrating dye or magnetic particle at Inspector discretion.
  - 4. One spot test per partial penetration weld using magnetic or ultrasonic testing.
- H. Bolted Connections: Visual inspection of all connections. Check proper torque with calibrated torque wrench at minimum of 2 bolts of every connection.

### **3.10 MASONRY:**

- A. Mortar Composition and Properties: ASTM C780.
- B. Grout Tests:
  - 1. Laboratory compressive strength test:
    - a. Comply with ASTM C1019.
    - b. Test one sample at 7 days and 2 samples at 28 days.
    - c. Perform test for each 230 m<sup>2</sup> (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 230 m<sup>2</sup> (2500 square feet) of wall area.
- D. Verify type, size, and location of reinforcement, connectors, structural elements, anchor bolts, and anchorages.

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- E. Observe construction of mortar joints.
- F. Verify grout space is clean.

### **3.11 STRUCTURAL STEEL:**

- A. General: Provide shop and field inspection and testing services to certify structural steel work is done in accordance with contract documents. Welding shall conform to AWS D1.1 Structural Welding Code.
- B. Prefabrication Inspection:
  - 1. Review design and shop detail drawings for size, length, type and location of all welds to be made.
  - 2. Approve welding procedure qualifications either by pre-qualification or by witnessing qualifications tests.
  - 3. Approve welder qualifications by certification or retesting.
  - 4. Approve procedure for control of distortion and shrinkage stresses.
  - 5. Approve procedures for welding in accordance with applicable sections of AWS D1.1.
- C. Fabrication and Erection:
  - 1. Weld Inspection:
    - a. Inspect welding equipment for capacity, maintenance and working condition.
    - b. Verify specified electrodes and handling and storage of electrodes in accordance with AWS D1.1.
    - c. Inspect preparation and assembly of materials to be welded for conformance with AWS D1.1.
    - d. Inspect preheating and interpass temperatures for conformance with AWS D1.1.
    - e. Measure 25 percent of fillet welds.
    - f. Welding Magnetic Particle Testing: Test in accordance with ASTM E709 for a minimum of:
      - 1) 20 percent of all shear plate fillet welds at random, final pass only.
      - 2) 100 percent of tension member fillet welds (i.e., hanger connection plates and other similar connections) for root and final passes.
    - g. Verify that correction of rejected welds are made in accordance with AWS D1.1.
    - h. Testing and inspection do not relieve the Contractor of the responsibility for providing materials and fabrication procedures in compliance with the specified requirements.

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## 2. Bolt Inspection:

- a. Inspect high-strength bolted connections in accordance AISC Specifications for Structural Joints Using ASTM A325 or A490 Bolts.
  - b. Verify material for high strength nuts, bolts, and washers.
  - c. Bolts installed by turn-of-nut tightening may be inspected with calibrated wrench when visual inspection was not performed during tightening.
  - d. Snug Tight Connections: Inspect 10 percent of connections verifying that plies of connected elements have been brought into snug contact.
  - e. Inspect field erected assemblies; verify locations of structural steel for plumbness, level, and alignment. Verify material conforms to specifications and drawings.
- D. Submit inspection reports, record of welders and their certification, and identification, and instances of noncompliance to Resident Engineer.

**3.12 TYPE OF TEST:**

Approximate Number of Tests Required

## A. Earthwork:

Laboratory Compaction Test, Soils:

|   |   |
|---|---|
| (ASTM D698)                                       | 2 |
| Field Density, Soils (AASHTO T191, T205, or T238) | 4 |
| Penetration Test, Soils                           | 2 |

## B. Landscaping:

|              |   |
|--------------|---|
| Topsoil Test | 4 |
|--------------|---|

## C. Aggregate Base:

|   |   |
|---|---|
| Laboratory Compaction, (ASTM D1557)           | 2 |
| Field Density, (ASTM D1556)                   | 4 |
| Aggregate, Base Course Gradation (AASHTO T27) | 1 |
| Wear (AASHTO T96)                             | 1 |
| Soundness (AASHTO T104)                       | 1 |

## D. Asphalt Concrete:

|                           |   |
|---------------------------|---|
| Field Density, ASTM D1188 | 4 |
|---------------------------|---|

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|   |                    |
|---|--------------------|
| Aggregate, Asphalt Concrete Gradation (AASHTO T27)  | 1                  |
| Wear (AASHTO T96)   |                    |
| Soundness (AASHTO T104)   | 1                  |
| E. Concrete (Assuming Base Bid Design):   |                    |
| Making and Curing Concrete Test Cylinders (ASTM C31)  | 480                |
| (garage)  |                    |
| Compressive Strength, Test Cylinders (ASTM C39)   | 480                |
| (garage)  |                    |
| Concrete Slump Test (ASTM C143)   | 360                |
| (garage)  |                    |
| Concrete Air Content Test (ASTM C173)   | 300                |
| (garage)  |                    |
| Rapid Chloride Permeability (ASTM C1202)  | 24                 |
| Flatness and Levelness Readings (ASTM E1155) (number of days)   | 2                  |
| F. Masonry:   |                    |
| Making and Curing Test Cubes (ASTM C109)  | 1                  |
| Compressive Strength, Test Cubes (ASTM C109)  | 1                  |
| Sampling and Testing Mortar, Comp. Strength (ASTM C780)   | 1                  |
| Sampling and Testing Grout, Comp. Strength (ASTM C1019)   | 1                  |
| Masonry Unit, Compressive Strength (ASTM C140)  | 1                  |
| G. Structural Steel:  |                    |
| Magnetic Particle Testing of Welds (ASTM E709) Unknown due to unpredictable number of welds by precast erector.   |                    |
|   | 28                 |
| L. Technical Personnel:   | (Minimum 6 months) |
| 1. Technicians to perform tests and inspection listed above. Laboratory will be equipped with concrete cylinder storage facilities, compression machine, cube molds, proctor molds, balances, scales, moisture ovens, slump cones, air meter, and all necessary equipment for compaction control. |                    |

- - - E N D - - -

**SECTION 01 57 19**  
**TEMPORARY ENVIRONMENTAL CONTROLS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

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

7. Sanitary Wastes:

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

**1.2 QUALITY CONTROL**

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

**1.3 REFERENCES**

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

**1.4 SUBMITTALS**

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

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

#### **1.5 PROTECTION OF ENVIRONMENTAL RESOURCES**

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

#### **TEMPORARY ENVIRONMENTAL CONTROLS**

- isolated areas within the general work area that are to be saved and protected. Protect monuments, works of art, and markers before construction operations begin. Convey to all personnel the purpose of marking and protecting all necessary objects.
2. Protection of Landscape: Protect trees, shrubs, vines, grasses, land forms, and other landscape features shown on the drawings to be preserved by marking, fencing, or using any other approved techniques.
    - a. Box and protect from damage existing trees and shrubs to remain on the construction site.
    - b. Immediately repair all damage to existing trees and shrubs by trimming, cleaning, and painting with antiseptic tree paint.
    - c. Do not store building materials or perform construction activities closer to existing trees or shrubs than the farthest extension of their limbs.
  3. Reduction of Exposure of Unprotected Erodible Soils: Plan and conduct earthwork to minimize the duration of exposure of unprotected soils. Clear areas in reasonably sized increments only as needed to use. Form earthwork to final grade as shown. Immediately protect side slopes and back slopes upon completion of rough grading.
  4. Temporary Protection of Disturbed Areas: Construct diversion ditches, benches, and berms to retard and divert runoff from the construction site to protected drainage areas approved under paragraph 208 of the Clean Water Act.
    - a. Reuse or conserve the collected topsoil sediment as directed by the COR. Topsoil use and requirements are specified in Section 31 20 00, EARTH MOVING.
    - b. Institute effluent quality monitoring programs as required by Federal, State, and local environmental agencies.
  5. Erosion and Sedimentation Control Devices: The erosion and sediment controls selected and maintained by the Contractor shall be such that water quality standards are not violated as a result of the Contractor's activities. Construct or install all temporary and permanent erosion and sedimentation control features shown on the Environmental Protection Plan. Maintain temporary erosion and sediment control measures such as berms, dikes, drains, sedimentation basins, grassing, and mulching, until permanent drainage and erosion control facilities are completed and operative.
  6. Manage borrow areas on Government property to minimize erosion and to prevent sediment from entering nearby water courses or lakes.

7. Manage and control spoil areas on Government property to limit spoil to areas shown on the Environmental Protection Plan and prevent erosion of soil or sediment from entering nearby water courses or lakes.
  8. Protect adjacent areas from despoilment by temporary excavations and embankments.
  9. Handle and dispose of solid wastes in such a manner that will prevent contamination of the environment. Place solid wastes (excluding clearing debris) in containers that are emptied on a regular schedule. Transport all solid waste off Government property and dispose of waste in compliance with Federal, State, and local requirements.
  10. Store chemical waste away from the work areas in corrosion resistant containers and dispose of waste in accordance with Federal, State, and local regulations.
  11. Handle discarded materials other than those included in the solid waste category as directed by the COR.
- C. Protection of Water Resources: Keep construction activities under surveillance, management, and control to avoid pollution of surface and ground waters and sewer systems. Implement management techniques to control water pollution by the listed construction activities that are included in this contract.
1. Washing and Curing Water: Do not allow wastewater directly derived from construction activities to enter water areas. Collect and place wastewater in retention ponds allowing the suspended material to settle, the pollutants to separate, or the water to evaporate.
  2. Control movement of materials and equipment at stream crossings during construction to prevent violation of water pollution control standards of the Federal, State, or local government.
  3. Monitor water areas affected by construction.
- D. Protection of Fish and Wildlife Resources: Keep construction activities under surveillance, management, and control to minimize interference with, disturbance of, or damage to fish and wildlife. Prior to beginning construction operations, list species that require specific attention along with measures for their protection.
- E. Protection of Air Resources: Keep construction activities under surveillance, management, and control to minimize pollution of air resources. Burning is not permitted on the job site. Keep activities, equipment, processes, and work operated or performed, in strict accordance with the State of Missouri and Federal emission and performance laws and standards. Maintain ambient air quality standards

## TEMPORARY ENVIRONMENTAL CONTROLS



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 8:00a.m. and 6:00p.m unless otherwise permitted by local ordinance or the COR. Repetitive impact noise on the property shall not exceed the following dB limitations:

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

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

#### TEMPORARY ENVIRONMENTAL CONTROLS

| 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,<br>STATIONARY | 80 | PNEUMATIC TOOLS    | 80 |
| PUMPS                 | 75 | BLASTING           | -- |
| GENERATORS            | 75 | SAWS               | 75 |
| COMPRESSORS           | 75 | VIBRATORS          | 75 |

- b. Use shields or other physical barriers to restrict noise transmission.
  - c. Provide soundproof housings or enclosures for noise-producing machinery.
  - d. Use efficient silencers on equipment air intakes.
  - e. Use efficient intake and exhaust mufflers on internal combustion engines that are maintained so equipment performs below noise levels specified.
  - f. Line hoppers and storage bins with sound deadening material.
  - g. Conduct truck loading, unloading, and hauling operations so that noise is kept to a minimum.
3. Measure sound level for noise exposure due to the construction at least once every five successive working days while work is being performed above 55 dB(A) noise level. Measure noise exposure at the property line or 15 m (50 feet) from the noise source, whichever is greater. Measure the sound levels on the A weighing network of a General Purpose sound level meter at slow response. To minimize the effect of reflective sound waves at buildings, take measurements at 900 to 1800 mm (three to six feet) in front of any building face. Submit the recorded information to the 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.

## TEMPORARY ENVIRONMENTAL CONTROLS

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

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**SECTION 01 74 19**  
**CONSTRUCTION WASTE MANAGEMENT**

**PART 1 - GENERAL****1.1 DESCRIPTION**

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

**1.2 RELATED WORK**

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

CONSTRUCTION WASTE MANAGEMENT

**1.3 QUALITY ASSURANCE**

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

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

#### **1.4 TERMINOLOGY**

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

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

#### **1.5 SUBMITTALS**

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES, furnish the following:
- B. Prepare and submit to the Resident Engineer a written demolition debris management plan. The plan shall include, but not be limited to, the following information:
  - 1. Procedures to be used for debris management.
  - 2. Techniques to be used to minimize waste generation.
  - 3. Analysis of the estimated job site waste to be generated:

#### CONSTRUCTION WASTE MANAGEMENT

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

#### **1.6 APPLICABLE PUBLICATIONS**

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

#### **1.7 RECORDS**

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



**PART 2 - PRODUCTS****2.1 MATERIALS**

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

**PART 3 - EXECUTION****3.1 COLLECTION**

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

**3.2 DISPOSAL**

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

**3.3 REPORT**

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

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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 as summarized in the VA Sustainable Design Manual.
- 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. By submitting a change or substitution of materials or processes, contractor must demonstrate its diligence in performing the level of investigation and comparison required under federal mandates and VA policies.

**1.2 RELATED WORK**

- A. Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS.
- B. Section 01 74 19 CONSTRUCTION WASTE MANAGEMENT.

**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

**SUSTAINABLE CONSTRUCTION REQUIREMENTS**

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/Resident Engineer and Architect.
- 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. Project Materials Cost Data Spreadsheet: Within 30 days after the Preconstruction Meeting provide a preliminary Project Materials Cost Data Spreadsheet. The Project Materials Cost Data Spreadsheet must be an electronic file and indicate all materials in Divisions 3 through 10, 31, and 32 used for Project (excluding labor costs and excluding all mechanical, electrical, and plumbing system components), and be

SUSTAINABLE CONSTRUCTION REQUIREMENTS

organized by specification section. The spreadsheet must include the following:

1. Identify each reused or salvaged material, its cost, and its replacement value.
2. Identify each recycled-content material, its post-consumer and pre-consumer recycled content as a percentage the product's weight, its cost, its combined recycled content value, defined as the sum of post-consumer recycled content value plus one-half of pre-consumer recycled content value, and total combined recycled content value for all materials as a percentage of total materials costs.
3. Identify each biobased material, its source, its cost, and total value of biobased materials as a percentage of total materials costs.

D. 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: Submittals for products to be installed or used included on the USDA BioPreferred program's product category lists. Data to include biobased content and source of biobased material; indicating name of manufacturer, cost of each 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 For applicable products and equipment, product documentation confirming Energy Star label and EPEAT certification.

## 1.6 APPLICABLE PUBLICATIONS

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

### SUSTAINABLE CONSTRUCTION REQUIREMENTS

- F. South Coast Air Quality Management District (SCAQMD) Rule 1168, July 1, 2005 and rule amendment date of January 7, 2005.
- G. 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).
- H. Federal Trade Commission Guides for the Use of Environmental Marketing Claims (16 CFR Part 260).
- I. ASHRAE Standard 52.2-2007.

## **PART 2 - PRODUCTS**

### **2.1 PERFORMANCE CRITERIA**

- A. 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. 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.

#### **SUSTAINABLE CONSTRUCTION REQUIREMENTS**

- 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.

## SUSTAINABLE CONSTRUCTION REQUIREMENTS

18) Wood Preservatives: 350 g/L.

19) Low-Solids Coatings: 120 g/L.

4. Composite wood and agrifiber products used within the weatherproofing membrane must contain no added urea-formaldehyde resins.
5. Laminating adhesives used to fabricate on-site and shop-applied composite wood and agrifiber assemblies must not contain added urea-formaldehyde.

B. Recycled Content:

1. Any product 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. Flowable fill.
  - d. Laminated paperboard.
  - e. Modular threshold ramps.
  - f. Nonpressure pipe.
  - g. Roofing materials.
  - h. Structural fiberboard.
  - i. Compost and fertilizer made from recovered organic materials.
  - j. Hydraulic mulch.
  - k. Lawn and garden edging.
  - l. Plastic lumber landscaping timbers and posts.

C. 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) Cleaners.
    - 2) Composite Panels.
    - 3) Corrosion Preventatives.
    - 4) Erosion Control Materials.
    - 5) Dust Suppressants.
    - 6) Fertilizers.

SUSTAINABLE CONSTRUCTION REQUIREMENTS



- 7) Glass Cleaners.
- 8) Hydraulic Fluids.
- 9) Industrial Cleaners.
- 10) Mulch and Compost Materials.
- 11) Multipurpose Cleaners.
- 12) Multipurpose Lubricants.
- 13) Plastic Insulating Foam.
- 14) Roof Coatings.
- 15) Wastewater Systems Coatings.
- 16) Wood and Concrete Sealers.

D. 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.

E. Materials, products, and equipment being installed which fall into a category covered by the Energy Star program must be Energy Star-labeled.

### **PART 3 - EXECUTION**

#### **3.1 FIELD QUALITY CONTROL**

A. Irrigation professionals must be certified under a WaterSense labeled certification program.

-----END-----

**SECTION 02 21 00  
SITE SURVEYS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

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

**1.2 DEFINITIONS**

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

**PART 2 - EXECUTION**

- A. The surveyor shall research available public records for all mapping, monumentation, plats, governmental surveys etc. that may pertain to the subject property. Research all applicable public utilities for substructure data such as sewers, storm drains, water lines, electrical conduits etc.
- B. The survey shall be performed on the ground in accordance with the current "Accuracy Standards for Land Title Surveys" as adopted, from time to time, by the American Congress on Surveying and Mapping, the National Society of Professional Surveyors, and the American Land Title Association.
- C. The surveyor, when applicable, shall consult with the CO to determine scale of plat or map and size of drawings.
- D. The surveyor shall furnish two sets of prints of the plat or map of survey and the electronic CADD file for 3D software. The sheets shall be numbered, the total number of sheets indicated and the match lines shall be shown on each sheet.
- E. On the plat or map, the survey boundary shall be drawn to a scale not larger than 1 inch = 30 feet (25 mm = 9 m), with the scale clearly indicated. A graphic scale, shown in feet or meters or both, shall be included. A north arrow shall be shown and when practicable, the plat or map of survey shall be oriented so that north is at the top of the drawing. Symbols or abbreviations used shall be identified on the face

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

F. The survey shall contain the following applicable information:

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

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

- lines, water, sewer, oil or gas pipelines on or across the surveyed property and on adjoining properties if they appear to affect the surveyed property, shall be located and noted. Surface indications, if any, or of underground easements and/or servitudes shall also be shown.
14. The character and location of all walls, buildings, fences, and other visible improvements within five feet of each side of the boundary lines shall be noted. Without expressing a legal opinion, physical evidence of all encroaching structural appurtenances and projections, such as fire escapes, bay windows, windows and doors that open out, flue pipes, stoops, eaves, cornices, areaways, stoops, trip, etc., by or on adjoining property or on abutting streets, on any easement or over setback lines shown by Record Documents shall be indicated with the extent of such encroachment or projection.
15. Driveways and alleys on or crossing the property must be shown. Where there is evidence of use by other than the occupants of the property, the surveyor must so indicate on the plat or map. Where driveways or alleys on adjoining properties encroach, in whole or in part, on the property being surveyed, the surveyor must so indicate on the plat or map with appropriate measurements.
16. Location, alignment and dimensions of all roads, curbs, walks, parking and paved areas abutting the subject land. Indicate road centerlines with true bearings and lengths by 50 foot stationing. Describe curves by designating the points of curvature and tangency by station. Include all curve data as well a location of radius and vertex points. Elevations on 50 foot (15 m) centers on centerline of roads, edges of roads and top and bottom of curbs.
17. As accurately as the evidence permits, the location of cemeteries and burial grounds disclosed in the process of researching title to the premises or observed in the process of performing the field work for the survey, shall be shown.
18. Ponds, lakes, springs, or rivers bordering on or running through the premises being surveyed shall be shown. When a property surveyed contains a natural water boundary, the surveyor shall measure the location of the boundary according to appropriate surveying methods and note on the plat or map the date of the measurement and the caveat that the boundary is subject to change due to natural causes

- and that it may or may not represent the actual location of the limit of title. When the surveyor is aware of changes in such boundaries, the extent of those changes shall be identified.
19. Contours at a minimum interval of 1 foot (305 mm). Base vertical control on the permanent (not assumed) National Geodetic Survey (NGS) or VA Medical Center Bench Mark. Note location, description and datum. Surveyor to establish three benchmarks on the property that are based on the NGS. Horizontal and vertical control to be provided on each control point.
  20. Identify and show if possible, setback, height, and floor space area restrictions of record or disclosed by applicable zoning or building codes (in addition to those recorded in subdivision maps). If none, so state.
  21. Exterior dimensions of all buildings at ground level. Show square footage of exterior footprint of all buildings at ground level and gross floor area of all buildings.
  22. Measured height of all buildings above grade at a defined location. If no defined location is provided, the point of measurement shall be shown.
  23. Elevations at each entrance to buildings, service docks, building corners, steps, ramps and grade slabs.
  24. Substantial, visible improvements (in addition to buildings) such as signs, parking areas, swimming pools, etc.
  25. Parking areas and, if striped, the striping and the type (eg. handicapped, motorcycle, regular, etc.) and number of parking spaces.
  26. Indication of access to a public way such as curb cuts and driveways.
  27. Location of utilities existing on or serving the surveyed property as determined by observed evidence together with plans and markings provided by utility companies, and other appropriate sources (with references as to the source of information. Locate and show all fire hydrants located within 500 feet of the subject property.
  28. Railroad tracks and sidings.
  29. Manholes, catch basins, valve vaults or other surface indications of subterranean uses together with depths or invert elevations, sizes, and materials of all pipes.

30. Wires and cables (including their function) crossing the survey premises, all poles on or within ten feet of the surveyed premises, and the dimensions of all cross-wires or overhangs affecting the surveyed premises.
31. Utility company installations on the surveyed premises.
32. Names of adjoining owners of platted lands together with zoning classification.
33. Observable evidence of earth moving work, building construction or building additions within recent months.
34. Any changes in street right-of-way lines either completed or proposed, and available from the controlling jurisdiction.  
Observable evidence of recent street or sidewalk construction or repairs.
35. Observable evidence of site use as a solid waste dump, sump or sanitary landfill.
36. All trees with a minimum diameter of 6" measured at 48" above the base of the tree. Perimeter outline only of thickly wooded areas with description of predominant vegetation.

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**SECTION 02 41 00  
DEMOLITION**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

- A. This section specifies demolition and removal of utilities as shown on drawings.

**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, EARTHWORK.
- 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 017419 CONSTRUCTION WASTE MANAGEMENT.
- G. Infectious Control: Section 01 35 26, SAFETY REQUIREMENTS, Article 1.12, INFECTION CONTROL.

**1.3 PROTECTION:**

- A. Perform demolition in such manner as to eliminate hazards to persons and property; to minimize interference with use of adjacent areas, utilities and structures or interruption of use of such utilities; and to provide free passage to and from such adjacent areas of structures. Comply with requirements of GENERAL CONDITIONS Article, ACCIDENT PREVENTION.
- B. Provide safeguards, including warning signs, barricades, temporary fences, warning lights, and other similar items that are required for protection of all personnel during demolition and removal operations. Comply with requirements of Section 01 00 00, GENERAL REQUIREMENTS, Article PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES AND IMPROVEMENTS.
- C. Maintain fences, barricades, lights, and other similar items around exposed excavations until such excavations have been completely filled.

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- D. In addition to previously listed fire and safety rules to be observed in performance of work, include following:
1. No wall or part of wall shall be permitted to fall outwardly from structures.
  2. Keep hydrants clear and accessible at all times. Prohibit debris from accumulating within a radius of 4500 mm (15 feet) of fire hydrants.
- E. Before beginning any demolition work, the Contractor shall survey the site and examine the drawings and specifications to determine the extent of the work. The contractor shall take necessary precautions to avoid damages to existing items to remain in place, to be reused, or to remain the property of the Medical Center; any damaged items shall be repaired or replaced as approved by the Resident Engineer. The Contractor shall coordinate the work of this section with all other work and shall construct and maintain shoring, bracing, and supports as required. The Contractor shall ensure that structural elements are not overloaded and shall be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under this contract. Do not overload structural elements. Provide new supports and reinforcement for existing construction weakened by demolition or removal works. Repairs, reinforcement, or structural replacement must have Resident Engineer's approval.
- F. The work shall comply with the requirements of Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.
- G. The work shall comply with the requirements of Section 01 35 26, SAFETY REQUIREMENTS.

#### **1.4 UTILITY SERVICES:**

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

#### **PART 2 - PRODUCTS (NOT USED)**

#### **PART 3 - EXECUTION**

##### **3.1 DEMOLITION:**

- A. Completely demolish and remove structures, including all appurtenances related or connected thereto, as noted below:
  1. As required for installation of new utility service lines.

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2. To full depth within an area defined by hypothetical lines located 1500 mm (5 feet) outside building lines of new structures.
- B. Debris, including brick, concrete, stone, metals and similar materials shall become property of Contractor and shall be disposed of by him daily, off the Medical Center to avoid accumulation at the demolition site. Materials that cannot be removed daily shall be stored in areas specified by the Resident Engineer. Break up concrete slabs below grade that do not require removal from present location into pieces not exceeding 600 mm (24 inches) square to permit drainage. Contractor shall dispose debris in compliance with applicable federal, state or local permits, rules and/or regulations.
- C. Remove and legally dispose of all materials, other than earth to remain as part of project work, from any trash dumps shown. Materials removed shall become property of contractor and shall be disposed of in compliance with applicable federal, state or local permits, rules and/or regulations. All materials in the indicated trash dump areas, including above surrounding grade and extending to a depth of 1500mm (5feet) below surrounding grade, shall be included as part of the lump sum compensation for the work of this section. Materials that are located beneath the surface of the surrounding ground more than 1500 mm (5 feet), or materials that are discovered to be hazardous, shall be handled as unforeseen. The removal of hazardous material shall be referred to Hazardous Materials specifications.
- D. Remove existing utilities as indicated or uncovered by work and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the Resident Engineer. When Utility lines are encountered that are not indicated on the drawings, the Resident Engineer shall be notified prior to further work in that area.

### **3.2 CLEAN-UP:**

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

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DEMOLITION

**SECTION 03 30 00  
CAST-IN-PLACE CONCRETE****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of Contract, including General Conditions and General Requirements Division 1 Specification Sections apply to this Section.

**1.2 SUMMARY**

- A. This Section specifies cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, finishes, and other miscellaneous items related to cast-in-place concrete.
- B. Cast-in-place concrete includes project requirements specified herein and on the drawings:
  - 1. Water/cementitious materials ratio: See General Notes on Drawings.
  - 2. Entrained air: See General Notes on Drawings.
  - 3. Water Reducing Admixture: See Part 2 Article "Admixtures."
  - 4. High strength: See General Notes on Drawings.
- C. Work in other Sections related to Cast-in-Place Concrete:
  - 1. Division 3 Section "Precast Structural Concrete."
  - 2. Division 7 Section "Traffic Coatings."
  - 3. Division 7 Section "Traffic Bearing Water Repellants."
  - 4. Division 7 Section "Expansion Joint Assemblies."
  - 5. Division 7 Section "Concrete Joint Sealants."
  - 6. Division 9 Section "Painting."
  - 7. Division 32 Section "Pavement Marking."

**1.3 DEFINITIONS**

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume.

**1.4 SUBMITTALS**

- A. Make submittals in accordance with requirements of Division 01.
- B. Submittals and Resubmittals: Engineer will review each of Contractor's shop drawings and/or submittal data the initial time and, should resubmittal be required, one additional time to verify that

reasons for resubmittal have been addressed by Contractor and corrections made. Resubmittal changes/revisions/corrections shall be circled. Engineer will review only circled items and will not be responsible for non-circled changes/revisions/corrections and additions. Should additional resubmittals be required, Contractor shall reimburse Owner for all costs incurred, including the cost of Engineer's services made necessary to review such additional resubmittals. Owner will in turn reimburse Engineer.

C. Requests For Information

1. RFI process shall not be used for requesting substitutions. Procedures for substitutions are clearly specified elsewhere in the contract documents.

D. Submit Product data for concrete component materials and other concrete related items, including, but not limited to:

1. Material Certificates: Signed by Manufacturer that each of the following items complies with requirements:
  - a. Cementitious materials and aggregates
  - b. Admixtures
  - c. Form materials and form-release agents
  - d. Steel reinforcement and accessories
  - e. Mechanical and chemical anchors
  - f. Epoxy coating
  - g. Fiber reinforcement
  - h. Waterstops
  - i. Joint filler
  - j. Curing materials
  - k. Floor and slab treatments
  - l. Bonding agents
  - m. Vapor retarders/reducer
  - n. Repair materials
2. Submit certification that curing compound or evaporation reducer, if used, is compatible with sealer specified in Division 7 Section "Traffic Bearing Water Repellants", traffic topping specified in Division 7 section "Traffic Coatings", sealant specified in Division 7 Sections "Joint Sealants" and "Concrete Joint Sealants", and expansion joint assemblies specified in Division 7 Section "Expansion Joint Assemblies."
3. Submit certification that curing compound and evaporation reducer is compatible with pavement markings specified in Division 9 Section "Painting."

E. Submit materials certificates in lieu of materials laboratory test reports when permitted by Engineer. Materials certificates shall be signed by manufacturer and Contractor, certifying that each material item complies with or exceeds specified requirements. Provide certification from admixture manufacturers that chloride content complies with specification requirements.

- F. Submit evidence of licensure in Missouri for professional [structural] engineer providing professional services as required for Contractor in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences and procedures.
1. Contractor's responsibilities include formwork, shoring and re-shoring procedures, and other work described in Article "Contractors Professional Services-Performance and Design Criteria", Article "Formwork", and Article "Shores and Re-shores".
- G. Submit concrete mixture proportions to Engineer for each concrete mixture. Submit alternate mixture proportions when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
1. Provide mixture proportions not less than four weeks before placing concrete and not less than one week before pre-installation conference (pre-concrete meeting).
  2. Proportion mixtures as defined in ACI 301 Section 4 header "Proportioning," Mixtures shall be proportioned by party other than Testing Agency responsible for testing Project concrete.
  3. Proportion mixtures to minimize effects of thermal and drying shrinkage. See Part 2 heading "Concrete Mixtures" header "Shrinkage" for drying shrinkage limit.
  4. Use mixture proportions submission form at end of this Section for each concrete mixture, which identifies the following:
    - a. Mixture Proportions Identification and use.
    - b. Method used for documentation of required average compressive strength, (ACI 301 Section 4 - *Field test data or Trial mixtures*).
    - c. Gradation of fine and coarse aggregates.
    - d. Proportions of all ingredients including all admixtures added either at time of batching or at job site.
    - e. Water/cementitious materials ratio.
    - f. Slump, ASTM C143.
    - g. Certification of the chloride content of admixtures.
    - h. Air Content:
      - 1) Of freshly mixed concrete by pressure method, ASTM C231, or volumetric method, ASTM C173.
      - 2) Of hardened concrete by microscopical determination, including parameters of air-void system, ASTM C457.
    - i. Freeze-thaw resistance, ASTM C457 and C666. If super-plasticized concrete cannot meet hardened air content requirements of Part 2, ASTM C666 laboratory test result of specimens with concrete mixture proportions similar to proposed mixture for project shall be submitted for review to Engineer. Report air void parameters (spacing and specific surface area in accordance with ASTM C457) (at point of placement) of specimens tested. Test specimens shall contain specified air system (within plus or minus 1.5 percent) and high-range water-reducer (superplasticizer) used in concrete

for project. Report relative durability factor of concrete for specimens tested in accordance with Procedure A of ASTM C666. Acceptable concrete durability factor greater than 90 percent ( $> 90\%$ ) at 300 test cycles. Relative durability factor of concrete containing superplasticizer greater than or equal to 80 percent ( $\geq 80\%$ ) compared with reference.

- j. Density (Unit weight) of concrete, ASTM C138.
  - k. Strength at 7 and 28 days, ASTM C39.
  - l. Water soluble chloride ion content of concrete: ASTM C 1218.
  - m. Rapid Chloride Permeability test results per ASTM C 1202.
  - n. Alkali-Aggregate Reactivity Resistance test results per ASTM C 1293, ASTM C 1260, or ASTM C 1567.
  - o. Certificate of analysis of coal fly ash or processed ultra fine fly ash: Comply with ASTM C618, Class C or F:
- H. Testing Agency: Promptly report all field concrete test results to Resident Engineer, Engineer, Contractor and Concrete Supplier. Include following information:
- 1. See Article "Quality Assurance."
  - 2. Density (unit weight) of concrete, ASTM C 138.
  - 3. Slump, ASTM C 143.
  - 4. Slump Flow, ASTM C 1611 (for SCC).
  - 5. Air content of freshly mixed concrete by pressure method, ASTM C 231 or volumetric method, ASTM C 173.
  - 6. Air content and parameters of air-void system, ASTM C 457.
  - 7. Concrete temperature at placement time. ASTM C 1064.
  - 8. Air temperature at placement time.
  - 9. Strength determined in accordance with ASTM C 39.
  - 10. Rapid Chloride Permeability Test of core samples in accordance with ASTM C 1202, as and when directed by Specification or Owner.
- I. Contractor: Submit grout temperature limitations with grout submittal.
- J. Submit current certification of welders.
- K. Submit shop drawings for steel reinforcement:
- 1. Prepare placing drawings that detail fabrication, bending, and placement of concrete reinforcement. 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. Comply with ACI SP-66, "ACI Detailing Manual." Include special reinforcement required for openings through concrete structures, elevations of all walls and columns with locations of all splices and couplers.
- L. Submit samples of materials as requested by Engineer, including names, sources, and descriptions as follows:
- 1. Normal weight aggregates.
  - 2. Fibrous reinforcement.
  - 3. Reglets.

4. Waterstops.
5. Vapor retarder.

- M. Submit laboratory test reports for concrete materials and mixtures.
- N. Submit Minutes of concrete pre-installation conference.

#### **1.5 CONTRACTOR'S PROFESSIONAL SERVICES - PERFORMANCE AND DESIGN CRITERIA**

- A. Provide professional services for temporary conditions during construction and portions of the Work required to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. Specific requirements and criteria include, but are not limited to the following:
1. Design, erect, shore, brace, and maintain formwork, according to ACI 301 and ACI 347 to support vertical, lateral, static and dynamic loads, and construction loads that might be applied, until concrete structure can support such loads. The contractor is responsible for layout and design, reviews, approvals, and inspections.
  2. Design formwork, shoring, bracing, and other conditions for structural requirements and stability during construction and until final structure is completed and accepted.
    - a. Comply with ACI 347.2 for design, installation, and removal of shoring and reshoring.
    - b. Superimposed loads to the concrete structure, slab-on-grade, and soil shall be less than the design loads as shown on Drawings.

#### **1.6 QUALITY ASSURANCE**

- A. Installer Qualifications: An experienced installer who has completed concrete work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Manufacturer Qualification: An experienced supplier who is experienced in manufacturing ready-mixed concrete products complying with ASTM C94 requirement for production facilities and equipment. Manufacturer shall also be certified according to the National Ready Mixed Concrete Association's Certifications of Ready Mixed Concrete Production Facilities.
- C. Codes and Standards: Comply with provisions of following codes, specifications, and standards, except where more stringent requirements are shown or specified:
1. ACI 301, "Specifications for Structural Concrete."
  2. ACI 318, "Building Code Requirements for Structural Concrete and Commentary."

3. ACI 117, "Standard Specifications for Tolerances for Concrete Construction and Materials."
  4. Concrete Reinforcing Steel Institute (CRSI), "Manual of Standard Practice."
- D. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in Missouri and who is experienced in providing professional engineering services of the kind indicated. See Article "Contractor's Professional Services Performance and Design Criteria".
- E. Materials and installed work may require retesting at any time during progress of work. Tests, including retesting of rejected materials for installed work, shall be done at Contractor's expense.
- F. At least 35 days prior to scheduled start of concrete construction, contractor shall conduct meeting to review proposed mixture proportions and methods and procedures to achieve required concrete quality. Contractor shall send pre-concrete conference agenda to all attendees 20 days prior to scheduled date of conference indicating review requirements. Representatives of each entity directly concerned with cast-in-place concrete shall attend conference, including, but not limited to, the following:
1. Contractor's superintendent.
  2. Agency (laboratory) responsible for concrete mixture proportions).
  3. Agency (laboratory) responsible for field quality control.
  4. Ready-mixed concrete producer.
  5. Concrete subcontractor.
  6. Primary admixture manufacturers.
  7. Engineer or Owner's representative.
  8. At the pre-concrete meeting the contractor shall provide a summary of concrete procedures to protect fresh concrete from rain.
- The minutes shall include a statement by the Concrete Contractor indicating that the proposed mixture proportions and placing/finishing/curing techniques can produce the concrete quality required by these specifications.
- G. Welders and welding procedures shall conform to requirements of AWS D1.4. Except where shown on Drawings, welding of reinforcing steel is prohibited unless accepted by Engineer in writing.
- H. Submit steel producer's certificates of mill analysis, tensile tests, and bend tests for reinforcing steel. Coordinate with welders and welding procedures.
- I. Epoxy coated reinforcement, ASTM A775 and A884:
1. Coating applicator shall have quality control program to assure that coated reinforcement comply with requirements of Specifications.



2. Submit proof of current certification for rebar coating plant from Concrete Reinforcing Steel Institute.
- J. Inspection of steel reinforcement is required in accordance with IBC Section 110. Inspections shall be conducted by an inspection agency employed by Contractor and approved by Resident Engineer. Inspector shall provide report in approved format to Resident Engineer with copy to Engineer and Contractor. Inspection agency has authority to reject reinforcing not meeting Contract Documents. Inspections for all reinforcing steel for conformance to shop drawings and Contract Documents shall be completed prior to concrete placement.
- K. Submit following information on Inspection of Reinforcement unless modified in writing by Resident Engineer.
1. Project name and location.
  2. Contractor's name.
  3. Inspection Agency's name, address, and phone number.
  4. Date and time of inspection.
  5. Inspection Agency technician's name.
  6. Fabricator's name.
  7. Weather data:
    - a. Air Temperatures.
    - b. Weather.
    - c. Wind speed.
  8. Inspection location within structure.
  9. Reinforcement inspection data (including but not limited to):
    - a. Bar size, spacing, cover, and grade.
    - b. Splices, bends, anchorages, welding.
    - c. Epoxy coating or galvanizing as required.
    - d. Support methods and construction sequencing.
  10. Diary of general progress of Work.
- L. Testing Agency Qualifications:
1. Independent agency, acceptable to Resident Engineer, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
  2. Testing laboratory shall submit documented proof of ability to perform required tests.
  3. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
- M. Testing Agency is responsible for conducting, monitoring and reporting results of all tests required under this Section. Testing Agency shall immediately report test results showing properties that do not conform to Project Specification requirements to General Contractor's authorized on-site representative and to Resident Engineer, and Engineer.

- N. Submit following Field Test information for Project Concrete unless modified in writing by Resident Engineer:
1. Project name and location.
  2. Contractor's name.
  3. Testing Agency's name, address, and phone number.
  4. Concrete supplier.
  5. Date of testing.
  6. Testing Agency technician's name (sampling and testing).
  7. Placement location within structure.
  8. Time of batching.
  9. Time of testing.
  10. Elapsed time from batching at plant to discharge from truck at site.
  11. Concrete mixture data (quantity and type):
    - a. Cement.
    - b. Fine aggregates.
    - c. Coarse aggregates.
    - d. Water.
    - e. Air entraining admixtures.
    - f. Water-reducing admixture and high-range water-reducing admixture.
    - g. Other admixtures.
    - h. Supplementary cementitious materials.
    - i. Micro-fibers or Macro-fibers.
  12. Weather data:
    - a. Air temperatures.
    - b. Weather.
    - c. Wind speed.
  13. Field test data:
    - a. Date, time and place of test.
    - b. Slump.
    - c. Concrete Temperature.
    - d. Slump flow (for SCC).
    - e. Air content.
    - f. Density (Unit weight).
  14. Compressive test data:
    - a. Cylinder number.
    - b. Age of concrete when tested.
    - c. Date and time of cylinder test.
    - d. Curing time (field and lab).
    - e. Cross-sectional area of cylinder.
    - f. Compressive strength.
    - g. Type of failure (at break).
- O. All concrete flatwork finishers on Project shall hold current ACI Concrete Flatwork Finisher certification. Submit certification for

each concrete flatwork finisher at Concrete Pre-construction Conference and obtain Engineer's written acceptance.

- P. Mockups: Before casting concrete, build mockups to verify selections made under sample submittals and to demonstrate typical joints, surface finish, texture, tolerances, and standard of workmanship. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
1. Build two acceptable test panels approximately 600 sq. ft. for flatwork in parking drive areas slab-on-grade. Submit a request for acceptance of the proposed location at the project site. See additional requirements for test panels in specification article "Finishing Floors and Slabs."
  2. Demonstrate curing, cleaning, and protecting of cast-in-place concrete, finishes, and control/construction joints, as applicable.
- Q. Coal fly ash, processed ultra fine fly ash, or slag supplier shall make available qualified individual, experienced in placement of fly ash or slag concrete, to aid Contractor. Qualification of supplier's representative shall be acceptable to Owner. Representative shall attend pre-construction meeting, and shall be present for all trial placements, initial startup and then as required by Owner.
- R. At all times during high-evaporation conditions, maintain adequate supply of evaporation reducer at site. Do not use evaporation reducer as finishing aid. See Part 3.
- S. Testing Agency: Identify those trucks of concrete supplier's which meet requirements of NRMCA Quality Control Manual. Permit only those trucks to deliver concrete to Project.

## 1.7 REFERENCES

- A. American Association of State Highway and Transportation Officials (AASHTO):
1. AASHTO, "Standard Specifications for Highway Bridges."
  2. AASHTO T 318, "Standard Method of Test for Water Content of Freshly Mixed Concrete Using Microwave Oven Drying."
- B. American Concrete Institute (ACI):
1. ACI 117, "Standard Specifications for Tolerances for Concrete Construction and Materials."
  2. ACI 214R, "Evaluation of Strength Test Results of Concrete."
  3. ACI 301, "Specifications for Structural Concrete."
  4. ACI 302.1R, "Guide for Concrete Floor and Slab Construction."
  5. ACI 305R, "Hot Weather Concreting."
  6. ACI 306.1, "Cold Weather Concreting."
  7. ACI 308R, "Guide to Curing Concrete."
  8. ACI 308.1, "Standard Specifications for Curing Concrete."

9. ACI 318, "Building Code Requirements for Structural Concrete & Commentary."
10. ACI 347, "Guide to Formwork for Concrete."
11. ACI 347.2 "Guide to Shoring/Reshoring of Concrete Multistory Buildings."
12. ACI 362.1, "Guide for the Design of Durable Parking Structures."
13. ACI SP15, "Field Reference Manual."

C. American Iron and Steel Institute (AISI):

1. AISI, "Specification for the Design of Cold-Formed Steel Structural Members."

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

1. ASTM A 36, "Standard Specification for Carbon Structural Steel."
2. ASTM A 185, "Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete Reinforcement."
3. ASTM A 497, "Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete Reinforcement."
4. ASTM A 615, "Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement."
5. ASTM A 706, "Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement."
6. ASTM A 775, "Standard Specification for Epoxy-Coated Steel Reinforcing Bars."
7. ASTM A 884, "Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement for Reinforcement."
8. ASTM A 934/A 934M, "Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars."
9. ASTM B 633, "Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel."
10. ASTM C 31, "Standard Practice of Making and Curing Concrete Test Specimens in the Field."
11. ASTM C 33, "Standard Specification for Concrete Aggregates."
12. ASTM C 39, "Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens."
13. ASTM C 94, "Standard Specification for Ready-Mixed Concrete."
14. ASTM C 109, "Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-mm Cube Specimens)."
15. ASTM C 138, "Standard Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete."
16. ASTM C 143, "Standard Test Method for Slump of Hydraulic Cement Concrete."
17. ASTM C 150, "Standard Specification for Portland Cement."
18. ASTM C 157, "Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete."
19. ASTM C 171, "Standard Specification for Sheet Materials for Curing Concrete."
20. ASTM C 172, "Standard Practice for Sampling Freshly Mixed Concrete."
21. ASTM C 173, "Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method."
22. ASTM C 231, "Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method."

23. ASTM C 260, "Standard Specification for Air-Entraining Admixtures for Concrete."
24. ASTM C 309, "Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete."
25. ASTM C 311, "Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use as a Mineral Admixture in Portland Cement Concrete."
26. ASTM C 330, "Standard Specification for Lightweight Aggregates for Structural Concrete."
27. ASTM C 457, "Standard Test Method for Microscopical Determination of Air-Void Content and Parameters of the Air-Void System in Hardened Concrete."
28. ASTM C 494, "Standard Specifications for Chemical Admixtures for Concrete."
29. ASTM C 567, "Standard Test Method for Determining the Density of Structural Lightweight Concrete."
30. ASTM C 595, "Standard Specification for Blended Hydraulic Cements."
31. ASTM C 618, "Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete."
32. ASTM C 666, "Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing."
33. ASTM C 672, "Standard Test Method for Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals."
34. ASTM C 989, "Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars."
35. ASTM C 1064/C 1064M "Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete."
36. ASTM C 1077, "Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation."
37. ASTM C 1116, "Standard Specification for Fiber-Reinforced Concrete and Shotcrete."
38. ASTM C 1202, "Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration."
39. ASTM C 1218, "Standard Test Method for Water Soluble Chloride Ion in Mortar and Concrete."
40. ASTM C 1240, "Standard Specification for Silica Fume Used in Cementitious Mixtures."
41. ASTM C 1260, "Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar Bar Method)."
42. ASTM C 1293, "Standard Test Method for Determination of Length Change of Concrete Due to Alkali-Silica Reaction."
43. ASTM C 1315, "Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete."
44. ASTM C 1567, "Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerate Mortar Bar Method)."
45. ASTM C 1602/C 1602M, "Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete."
46. ASTM C 1610/C 1610M, "Standard Test Method for Static Segregation of Self-Consolidating Concrete Using Column Technique."
47. ASTM C 1611/C 1611M, "Standard Test Method for Slump Flow of Self-Consolidating Concrete."

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48. ASTM C 1621/C 1621M, "Standard Test Method for Passing Ability of Self-Consolidating Concrete by J-Ring."
  49. ASTM D 448, "Standard Classification for Sizes of Aggregate for Road and Bridge Construction."
  50. ASTM D 3963/D 3963M, "Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Steel Reinforcing Bars."
  51. ASTM E 96/E 96M, "Standard Test Methods for Water Vapor Transmission of Materials."
  52. ASTM E 1643, "Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs."
  53. ASTM E 1745 "Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs."
  54. ASTM F1637 02, "Standard Practice for Safe Walking Surfaces."
- E. American Welding Society (AWS):
1. AWS D1.1, "Structural Welding Code-Steel."
  2. AWS D1.4, "Structural Welding Code-Reinforcing Steel."
- F. Concrete Reinforcing Steel Institute (CRSI):
1. CRSI MSP, "Manual of Standard Practice."
- G. US Army Corps of Engineers (CE):
1. CE CRD-C 513 "Specifications for Rubber Waterstops."
  2. CE CRD-C 572 "Specifications for Polyvinyl Chloride Waterstops."
  3. CE CRD-C 662 "Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials, Lithium Nitrate Admixture and Aggregate (Accelerated Mortar Bar Method.)"
- H. Prestressed Concrete Institute (PCI):
1. PCI MNL 116, "Manual for Quality Control for Plants and Production of Precast Prestressed Concrete Products."
  2. PCI MNL 117, "Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products."
  3. PCI MNL 120, "Design Handbook Precast Prestressed Concrete."
  4. PCI MNL 122, "Architectural Precast Design Handbook."
  5. PCI MNL 129, "Parking Structures-Recommended Practice for Design and Construction."
  6. PCI MNL 135, "Tolerances for Precast and Prestressed Concrete Construction."
  7. PCI "Code of Standard Practice for Precast Concrete."
- I. Contractor shall have following ACI publications at Project construction site:
1. ACI SP-15, "Field Reference Manual: Standard Specifications for Structural Concrete ACI 301 with selected ACI References."
  2. ACI 302.1R, "Guide for Concrete Floor and Slab Construction."
  3. ACI 305R, "Hot Weather Concreting."
  4. ACI 306.1, "Cold Weather Concreting."

## J. Accessibility Requirements:

1. "Americans with Disabilities - Act Accessibility Guidelines for Buildings and Facilities", as published by U.S. Architectural & Transportation Barriers Compliance Board, 1331 F Street, N.W., Suite 1000, Washington, DC 20004-1111, 1-800-872-2253, <http://www.access-board.gov/adaag/ADAAG.pdf>

## K. International Code Council (ICC):

1. IBC, "International Building Code 2012
2. IPMC, "International Property Maintenance Code."
3. IFC, "International Fire Code."

**1.8 DELIVERY, STORAGE, AND HANDLING**

- A. Store all formwork and formwork materials clear of ground, protected, to preclude damage.
- B. Deliver reinforcement to Project site bundled, tagged and marked. Use metal tags indicating bar size, lengths, and other information corresponding to markings shown on placement diagrams.
- C. Store concrete reinforcement materials at site to prevent damage and accumulation of dirt or excessive rust.
- D. Avoid damaging coatings on epoxy coated reinforcement:
  1. Contact areas of handling and hoisting systems shall be padded or be made of nylon or other acceptable material.
  2. Use spreader bars to lift bundles of coated bars to prevent bar-to-bar abrasion.
  3. Pad bundling bands or fabricate of nylon or other acceptable material.
  4. Store coated bars on padded or wooden cribbing.
  5. Do not drag coated bars.
  6. After placement, restrict traffic on coated bars to prevent damage.
  7. Repair damaged epoxy coatings according to ASTM D 3963.
- E. Concrete transported by truck mixer or agitator shall be completely discharged within one and one half-hours (one hour for hot weather concreting) after water has been added to cement or cement has been added to aggregates. Schedule deliveries to allow for delays due to weather, traffic, etc.

**PART 2 - PRODUCTS****2.1 FORM MATERIALS**

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
  - 1. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
    - a. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.
  - 1. Corrugated concrete form material providing temporary support of concrete walls or beams and slabs above expansive soils.
  - 2. Products include all corrugated cardboard void forms that temporarily support concrete walls, grade beams, structural concrete slabs and top portion of concrete piers; includes filling the circular section where required.
    - a. Related accessory products include seam caps, end caps and protective cover boards or any other product to maintain above general products.
    - b. Submit all product data and manufacturer's installation instructions under provisions of this Section, based on the design loads specified in contract documents and depth and width indicated.
- D. Form Coatings: Provide commercial formulation form-coating compounds with a maximum VOC of 350 grams/liter that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces, including but not limited to water-curing, curing compound, stains or paints.
- E. Form Ties: Factory - fabricated, adjustable-length, removable or snap-off metal form ties, designed to prevent form deflection and to prevent spalling concrete upon removal. Provide units that will leave no metal closer than 1.5 in. to exposed surface.
  - 1. Provide ties that, when removed, will leave holes not larger than 1 in. diameter in concrete surface.
- F. Chamfer strips: Wood, metal, PVC, or rubber strips. 0.75 in. by 0.75 in. min. unless noted otherwise.

## 2.2 STEEL REINFORCEMENT

- A. In the Bid, provide 2 additional tons of placed reinforcement bars or welded wire reinforcement for inclusion in Project as Engineer



directs. Return cost of unused portion to Owner at unit price stated on Bid Form. Submit to Engineer breakdown of use each month.

- B. Reinforcement Bars: ASTM A 615, deformed, yield strength: as noted on Drawings.
- C. Low-Alloy-Steel Reinforcing Bars: ASTM A 706, deformed.
- D. Epoxy-Coated Fabricated Reinforcing Bars: ASTM A775, and as follows:
  - 1. Steel Reinforcement: ASTM A 615, Grade 60, deformed bars.
  - 2. Steel Reinforcement: ASTM A 706, deformed bars.
- E. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.
  - 1. Welded wire reinforcement: provide in mats only. Roll stock prohibited.

### 2.3 REINFORCEMENT ACCESSORIES

- A. Bar supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from all plastic of greater compressive strength than concrete, and as follows:
  - 1. In manner acceptable to Resident Engineer solely, bar and welded wire reinforcement supports shall be color-coded to visually differentiate supports by height and shall be fabricated to resist overturning during construction operations.
  - 2. For slabs on ground, use all-plastic supports with sand plates or horizontal runners where base materials will not support chair legs. All supports shall have sufficient surface area in contact with ground so that they shall not allow clearance loss when reinforcement installed or concrete placed.
  - 3. For concrete surfaces exposed to view where bar supports contact forms, supports shall have minimal contact, shall not cause voids and shall not cause damage to surrounding concrete. Use all-plastic supports conforming to CRSI Class 1 protection requirements.
  - 4. Chairs shall be sized and spaced to prevent cover loss during construction operations.
  - 5. For epoxy-coated reinforcement, use all-plastic bar supports.
  - 6. Acceptable manufacturers:
    - a. Aztec Concrete Accessories, Inc.
    - b. General Technologies, Inc.
    - c. Accepted equivalent.
  - 7. For welded wire reinforcement, provide continuous bar supports spaced at 2 feet o.c., maximum."

- B. Epoxy Coating Materials for Reinforcement: ASTM A 775 and A 884:
1. Supplier shall be certified currently under CRSI Fusion Bonded Epoxy Coating Applicator Plant Certification Program.
  2. Provide one of following epoxy coatings for reinforcement and steel accessories as noted on Drawings:
    - a. "Scotchkote 413," 3M Company.
    - b. "Nap-Gard 7-2709," DuPont Powder Coatings, USA, Inc.
    - c. "Epoxiplate R346 or R349," Armstrong Products Company.
  3. Use patching material recommended by epoxy powder manufacturer, compatible with epoxy coating and inert in concrete. Acceptable:
    - a. "Scotchkote 413 PC," 3M Company.
    - b. "Armatec 110," Sika Corporation.
    - c. "MasterEmaco P 124," BASF Construction Chemicals, LLC.
    - d. "Duralprep AC," The Euclid Chemical Company.
- C. Epoxy Coating for Existing Exposed Non-prestressed Steel Reinforcement or Welded Wire Reinforcement:
1. Provide one of following epoxy coatings:
    - a. "Sikadur 32 Hi-Mod," Sika Chemical Corp.
    - b. "MasterEmaco ADH 326," BASF Construction Chemicals, LLC.
    - c. "Scotchkote 413 PC," 3M Company.
    - d. "Dural 452 Series," The Euclid Chemical Company.
    - e. "Resi-Bond (J-58)," Dayton Superior Corporation.
- D. For mechanical tension splices of reinforcement:
1. All splices to develop 125 percent of specified yield strength of bars, or of smaller bar in transition splices. Acceptable products:
    - a. Bar-Lock Rebar Coupler, by Dayton Superior.
    - b. Bar-Grip or Grip-Twist, by Barsplice Products, Inc.
    - c. Extender HRC 500 Series Coupler, by Headed Reinforcement Corp.
    - d. Splice Sleeve, by NMB.
    - e. LENTON Splices, by Erico.
- E. Compression splices: Mechanically coupled splices in accordance with ACI 318, Chapter 12.

## **2.4 CONCRETE MATERIALS**

- A. Ready Mixed Concrete: Obtain concrete from plant with current certification from:
1. Concrete Materials Engineering Council.
  2. Missouri Department of Transportation.

3. National Ready Mixed Concrete Association.
  4. Prestressed Concrete Institute
- B. Portland Cement (ACI 301, Section 4 header "Cementitious Materials"):
1. Portland cement, Type I, ASTM C 150. Use one cement supplier throughout project. No change in brand or supplier without prior written acceptance from Engineer.
  2. Portland cement, Type I/II, ASTM C 150. Where concrete is exposed to earth. Use one cement supplier throughout project. No change in brand or supplier without prior written acceptance from Engineer.
- C. Coal Fly Ash:
1. Permitted in all parts of structure.
  2. ASTM C 618, Class F.
  3. Testing, ASTM C311.
  4. Percentage of fly ash in Mixture Proportion shall be by weight, not by volume. Water/cement ratio will be calculated as water/cementitious (total cement and fly ash) ratio.
  5. Prohibited: Fly ash in same mix with Type IP blended cement.
  6. If strength or air content varies from value specified by more than specified tolerances, Engineer or designated representative shall reject that concrete.
  7. Submit all fly ash concrete Mixture Proportions per ACI 301.
- D. Slag - (Ground Granulated Blast-Furnace Slag - GG-BFS):
1. ASTM C 989, Grade 100 or higher.
  2. Percentage of GGBF slag in Mixture Proportion shall be by weight, not by volume. Water-cement ratio shall be calculated as water-cementitious (total Portland cement + GGBF slag) ratio.
  3. If strength or air content varies from value specified by more than specified tolerances, Engineer or designated representative shall reject that concrete.
  4. Submit all GGBF slag concrete mixture proportions per ACI 301.
- E. Normal Weight Aggregates (ACI 301, Section 4 header "Aggregates"):
1. Normal weight concrete aggregates:
    - a. Coarse aggregate: Crushed and graded limestone or approved equivalent conforming to ASTM C33 except as noted here, minimum class designations as listed below:
      - 1) Below grade construction and below frost line: Class 1S.
      - 2) Walls not exposed to public view: Class 3S.
      - 3) Walls exposed to public view: Class 5S.
      - 4) Slabs on ground: Class 4S.
      - 5) All other concrete: Class 5S.
    - b. No deleterious materials such as, but not limited to, chert or opaline.

- c. Fine aggregate: Natural sand conforming to ASTM C 33 and having preferred grading shown for normal weight aggregate in ACI 302.1R, Table 5.1.
  - d. Coarse Aggregate shall not contain crushed hydraulic-cement concrete.
- 2. Combined Aggregate Gradation: Well graded from coarsest to finest with not more than 18 percent and not less than 8 percent retained on an individual sieve, except that less than 8 percent may be retained on coarsest sieve and on No. 50 sieve, and less than 8 percent may be retained on sieves finer than No. 50.
  - 3. Coarse aggregate: Nominal maximum sizes indicated below, conforming to ASTM C 33, Table 2:
    - a. Footings/Foundations: Size number 57 or 357.
    - b. Toppings and washes less than 3 in. thick: Size number 7 or 67.
    - c. Slab on grade: Size number 57.
    - d. All other members: Size number 67.
  - 4. Chloride Ion Level: ASTM C 1218. Chloride ion content of cement, aggregates and all other ingredients: tested by laboratory making trial mixes.
- F. Water: Comply with ASTM C 1602.
- G. Storage of Materials (ACI 301, Section 4 header "Materials Storage and Handling").

## 2.5 ADMIXTURES

- A. Use water-reducing admixture, mid-range water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete as required for placement and workability.
- B. Use non-chloride accelerating admixture in concrete slabs placed at ambient temperatures below 50 deg. F as required for schedule.
- C. Use high-range water-reducing admixture (HRWR) in pumped concrete, and for concrete with water/cementitious ratio of less than or equal to 0.45. Use high-range or mid-range water-reducing admixtures in pumped concrete and normal or mid-range water reducing admixtures for concrete with water/cementitious ratios greater than 0.45.
- D. Self-consolidating concrete (SCC) may be used where placement due to either dense reinforcement or form design requires both a high level of workability (horizontal slump flow greater than 24 in. diameter) and the water/cementitious ratio is less than or equal to 0.45.
- E. Use air-entraining admixture in exterior exposed concrete unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having

total air content with a tolerance of plus or minus 1.5 percent within limits shown on Drawings.

- F. Only admixture manufacturers listed acceptable. Do not submit alternate manufacturers.
- G. Concrete supplier and manufacturer shall verify via trial mixes and certify compatibility (no adverse effect on workability, strength, durability, entrained air content, etc.) of all ingredients in each Mixture. Use admixtures in strict accordance with manufacturer's recommendations.
- H. Prohibited Admixtures: Calcium chloride or admixtures containing intentionally added chlorides shall not be used.
- I. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.
  - 1. Products: Subject to compliance with requirements, provide one of following:
    - a. "Air-Mix," "Eucon Air-Series" or "AEA-92," Euclid Chemical Co.
    - b. "Daravair Series" or "Darex Series," W.R. Grace & Co.
    - c. "Micro-Air," or "MB-VR," or "MBAE-90," BASF Construction Chemicals.
    - d. "Sika AEA Series," or "Sika AIR Series" Sika Corporation.
- J. Normal Water-Reducing Admixture: ASTM C 494, Type A.
  - 1. Products: Subject to compliance with requirements, provide one of following:
    - a. "Eucon Series," Euclid Chemical Co.
    - b. "WRDA Series," W.R. Grace & Co.
    - c. "Pozzolith Series," or "PolyHeed Series," BASF Construction Chemicals.
    - d. "Plastocrete Series", Sika Corporation.
- K. Mid Range Water-Reducing Admixture: ASTM C 494, Type A.
  - 1. Subject to compliance with requirements, provide one of following:
    - a. "Eucon MR" or "Eucon X-15 and X-20," Euclid Chemical Co.
    - b. "Daracem Series" or "MIRA Series," W.R. Grace & Co.
    - c. "PolyHeed Series," BASF Construction Chemicals.
    - d. "Sikaplast Series" or "Plastocrete Series", Sika Corporation.
- L. High Range Water-Reducing Admixture (Superplasticizer): ASTM C 494, Type F.
  - 1. Products: Subject to compliance with requirements, provide one of following:

- a. "Eucon 37" or "Plastol Series," Euclid Chemical Co.
  - b. "Daracem Series" or "ADVA Series," W.R. Grace & Co.
  - c. "Rheobuild 1000", "PS 1466" or "Glenium Series," BASF Construction Chemicals.
  - d. "Sikament Series" or "Sika ViscoCrete Series," Sika Corporation.
- M. High Range water reducing retarding (superplasticizer), ASTM C 494 Type G:
- 1. Products: Subject to compliance with requirements, provide one of following:
    - a. "Eucon 537 or RD2," Euclid Chemical Co.
    - b. "Daracem 100," W.R. Grace & Co.
    - c. "Sikament Series," Sika Corporation
- N. Non-Chloride, Non-Corrosive Water-Reducing, Accelerating Admixture: ASTM C 494, Type C or E.
- 1. Products: Subject to compliance with requirements, provide one of following:
    - a. "Eucon AcN-Series," "Accelguard 80," "Accelguard NCA," or "Accelguard 90," Euclid Chemical Co.
    - b. "DCI," "PolaraSet," "Lubricon NCA," "Daraset," or "Gilco," W.R. Grace & Co.
    - c. "Pozzutec 20+" or "Pozzolith NC 534," BASF Construction Chemicals.
    - d. "Sika Set NC," "Plastocrete 161FL", or "Sika Rapid-1," Sika Corporation.
- O. Water-Reducing or retarding Admixture: ASTM C 494, Type D or B.
- 1. Products: Subject to compliance with requirements, provide one of following:
    - a. "Eucon Retarder-75", "Eucon DS" or "Eucon W.O." Euclid Chemical Co.
    - b. "Daratard-17" or "Recover," W.R. Grace & Co.
    - c. "Pozzolith Series" or "Delvo Series," BASF Construction Chemicals.
    - d. "Sikatard Series," or "Plastiment Series" or "Plastocrete Series," Sika Corporation.
- P. Alkali-Silica Reaction Inhibiting Admixture.
- 1. Products:
    - a. "ASRx 30LN," BASF Construction Chemicals.
    - b. "Eucon Integral ARC," Euclid Chemical Co.
    - c. "Sika Control ASR", Sika Corporation.
    - d. "Rasir," W.R. Grace & Co.
    - e. "Impede LN," Premiere Concrete Admixtures.

2. Include water content in admixture when calculating water-to-cement ratio.
  3. Provide satisfactory CE CRD-C667 results with lithium admixture as defined in "Alkali-Aggregate Reactivity Resistance" paragraph below.
- Q. Corrosion Inhibiting Admixture capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. "Eucon CIA" or "Eucon BCN," Euclid Chemical Company.
    - b. "DCI" or "DCI-S," W.R. Grace.
    - c. "Rheocrete CNI," BASF Construction Chemicals.
    - d. "Sika CNI," Sika Corporation.
  2. Add at rate of 3 gal/cu yd of concrete, which shall inhibit corrosion to 9.9 lb of chloride ions per cu. yd. of concrete. Calcium Nitrite based corrosion inhibitor shall have a concentration of 30 percent, plus or minus 2 percent of solids content.
  3. Show calcium nitrite as an Add Alternate on Bid Form.

## **2.6 FIBER REINFORCEMENT**

- A. Micro-Fiber: Fibrillated polypropylene micro-fibers complying with ASTM C 1116, Type III, minimum 0.75 inches long.
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Fibrillated Micro-Fibers: Minimum dosage rate 1.5 pounds per cubic yard of concrete.
      - 1) "Fibermesh 300," Propex Concrete Systems.
      - 2) "Grace Fibers," W.R. Grace & Co., Inc.
      - 3) "MasterFiber F Series," BASF Construction Chemicals.
      - 4) "Sika Fiber PPF," Sika Corporation.
      - 5) "PSI Fiberstrand F," Euclid Chemical Co
- B. Do not change volume of water used in mix when fibers are used. Offset any slump loss due to addition of fibers by addition of superplasticizer.
- C. Conform to manufacturer's recommendations for quantity of fibers if higher than the minimum dosage rates.
- D. See Drawings for locations of allowable use.
- E. Fiber manufacturer or approved distributor: Provide services of qualified representative at pre-construction meeting, concrete pre-

installation meeting and first concrete placement containing fibers and as required thereafter.

## 2.7 WATERSTOPS

- A. Flexible Rubber Waterstops: CE CRD-C 513, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
  - 1. Profile: Flat, dumbbell without center bulb.
- B. Flexible PVC Waterstops: CE CRD-C 572, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
  - 1. Profile: Flat, dumbbell without center bulb.
- C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Rubber Waterstops:
    - a. Greenstreak.
    - b. Progress Unlimited Inc.
    - c. Williams Products, Inc.
  - 2. PVC Waterstops:
    - a. Greenstreak.
    - b. Meadows: W.R. Meadows, Inc.
    - c. Progress Unlimited Inc.
    - d. Sternson Group.

## 2.8 VAPOR RETARDERS

- A. Vapor Retarder: Provide vapor retarder which conforms to ASTM E 1745, Class A. The membrane shall have a water-vapor transmission rate less than or equal to 0.008 gr./ft<sup>2</sup>/hr when tested, in accordance with ASTM E96. Vapor retarder shall be no less than 15 mils thick. The vapor retarder shall be placed over prepared base material where indicated below slabs on ground.
  - 1. New ISO certified virgin resins, polyolefin based maximum.
  - 2. Available Product: Subject to compliance with requirements, a product that may be incorporated into the Work includes, but is not limited to "Griffolyn Vaporguard" by Reef Industries, Inc., Stego Wrap (15-Mil) Vapor Barrier by Stego Industries LLC, Perminator (15 Mil) Underground Vapor Retarder by W.R. Meadows or, Viper Vaporcheck II (15 mil) Vapor Retarder by Insulation Solutions Inc.
- B. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a No. 4 sieve and 10 to 30 percent passing a



No. 100 sieve; meeting deleterious substance limits of ASTM C 33 for fine aggregates.

- C. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

## 2.9 CURING MATERIALS

- A. Evaporation Reducer: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
1. Evaporation Retarder:
- a. Aquafilm; Conspec Marketing & Manufacturing Co., Inc.
  - b. Eucobar; Euclid Chemical Co.
  - c. E-Con; L&M Construction Chemicals, Inc.
  - d. MasterKure ER 50; BASF Construction Chemicals.
  - e. SikaFilm; Sika Corporation.
  - f. Sure-Film (J-74); Dayton Superior Corporation.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Curing Compound (VOC Compliant, less than 350 g/l): Comply with ASTM C 309, Type 1, Class A or B. Moisture loss shall be not more than 0.55 kg/m<sup>2</sup> when applied at 200 sq. ft/gal. Manufacturer's certification is required. Silicate based compounds prohibited.
1. Subject to project requirements provide one of the following products:
- a. "Kurez DR VOX" or "Kurez RC," Euclid Chemical Company.
  - b. "Clear Resin Cure J11W," Dayton Superior.
  - c. "MasterKure CC 200 WB" or "MasterKure CC 160 WB" BASF Construction Chemicals.
2. Additional requirements:
- a. With product submittal provide plan and procedures for removal of residual curing compound prior to application of sealers, coatings, stains, pavement markings and other finishes.
  - b. Provide a summary of testing to show adequate surface preparation for successful application of sealers, coatings, stains, pavement markings, and other finishes.

## 2.10 RELATED MATERIALS

- A. Bonding Additive: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- B. Epoxy-Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements, and as follows:
  - 1. Type II, non-load bearing, for bonding freshly mixed concrete to hardened concrete.
  - 2. Types I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
  - 3. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- C. Post-installed mechanical and adhesive anchors shall be manufactured by Hilti Fastening Systems, Tulsa Oklahoma, ITW Ramset/Red Head, Wood Dale, IL, Simpson Anchor Systems, Columbus, OH, Powers Fasteners, Brewster, NY, or accepted equivalent. Anchor bolt composition shall be from one or more of carbon steel and stainless steel, lead, Zamac alloy, nylon, plastic, polypropylene, and jute fiber.
  - 1. Strength of anchors shall comply with ACI 318-11 Appendix D, and ACI 355.2 and ICC-ES-AC193 for mechanical anchors and ACI 355.4 and ICC-ES-AC308 for adhesive anchors.
  - 2. Carbon steel anchors shall be either zinc plated in accordance with ASTM B 633, or hot-dipped galvanized in accordance with ASTM A-153-78. Provide mill test reports and manufacturer's quality control certification upon Engineer's request.
  - 3. Stainless steel anchors shall be manufactured from ASTM A304, or A663 stainless steel. Provide mill test reports and manufacturer's quality control certification upon Engineer's request.
  - 4. Plastic, lead, or Zamac alloy anchors shall not be used for overhead applications. Chemical anchors shall not be used to resist pullout forces in overhead and wall installations unless proper consideration is given to fire conditions. For chemical anchors, consult with manufacturer's engineer.
  - 5. Safety Factors: Static loads 4:1 minimum. Static load safety factors shall be per manufacturer's published data. Critical load (vibratory, overhead, etc. or more) safety factors shall be 10:1 minimum. Chemical anchors are not permitted for critical loads and where resistance to direct sustained tension is required.
    - a. If necessary for purposes of determining tensile and/or shear capacity in questionable base material, testing shall be done prior to actual anchor installation. A maximum of five tension and/or shear tests shall be performed by manufacturer's engineer. Anchors shall be proof loaded in tension and/or shear to assure that working load capacity is within specified allowable load limit as published by manufacturer.
  - 6. Anchor spacing and edge distance per manufacturer's limits. Loading and cluster spacing shall be as established by minimum

industry standards for anchors, except as follows: Anchor loading, cluster spacing and edge distances shall be as published in manufacturer's literature. Consult with manufacturer's engineer for specific requirements.

7. Anchor installation shall be as required by manufacturers written instructions.

D. Inserts and Coil Rods:

1. Yield strength: 65,000 psi minimum.
2. Galvanizing: Where indicated, electrodeposited zinc coating, ASTM B 633, Service condition 1, Type III.
3. Epoxy coating: Where indicated.
4. Details shown on drawings are based on Dayton/Richmond Concrete Accessories, Inc. products and their respective capacities. Other products may be used only if contractor submits calculations, sealed by professional engineer or structural engineer licensed in Missouri, substantiating strength of connection with other product. Calculations are subject to Engineer's acceptance before fabrication is to proceed.

E. Joint Filler:

1. Joint filler in slabs and curbs: Asphalt impregnated fiber board; as shown on Drawings. Acceptable products:
  - a. "Flexcell," Knight-Celotex Corp.
  - b. "Fibre Expansion Joint," W.R. Meadows, Inc.
  - c. Or Engineer approved equivalent
2. Joint filler used vertically to isolate walls from columns or other walls: White molded polystyrene beadboard type.
3. Joint cover used to bridge gap between columns and grade walls, retaining walls, or basement walls: Minimum width: Gap width plus 4 in. For gaps over 3 in. wide, protect cover with protection board sized to span gap satisfactorily. Acceptable products:
  - a. "Sealtight Premoulded Membrane Vapor Seal," W.R. Meadows, Inc., Elgin, Illinois.
  - b. "Sealtight Melgard," W.R. Meadows, Inc., Elgin, Illinois and shall be applied according to manufacturer's instructions.
  - c. Or Engineer approved equivalent

F. Slide Bearing System at Expansion Joints:

1. Provide slide bearing system as shown and detailed on Drawings:
  - a. Beam and double tee bearings shall be reinforced PTFE: 100 percent virgin tetrafluoroethylene polymer and ground glass fiber reinforcing aggregate, prebonded to stainless steel and/or preformed fabric (Section "Plant Precast Structural Concrete," Part 2 Article "Materials," paragraph "Bearing Pads") bearing pads. Acceptable slide bearing systems:

- 1) "Fluorogold," Seismic Energy Products, Inc., Athens, TX.
  - 2) "Balco," Balco, Inc., Wichita, Kansas.
  - 3) "Alert 15175 Shock Pads with TFE," Alert Manufacturing and Supply Co. Chicago, Illinois.
  - 4) "Dura-Slide," Tobi Engineering, Inc., Elk Grove Village, Illinois.
  - 5) "Dynalon Slide Bearings with Masticord," JVI, Inc., Skokie Illinois.
- b. Slab and plank bearings shall be ultrahigh molecular weight, high-density polyethylene resin: Acceptable material:
- 1) "Korolath PE," Korolath Corporation, Hudson, Mass.
  - 2) "Tivar-1000," Poly-Hi/Menasha Corporation, Fort Wayne, Indiana.
  - 3) "UHMW Econ-o-Shim," Deslausiers, Inc., Bellwood IL.
2. Backing materials for reinforced PTFE slide bearing systems as shown on Drawings:
- a. Galvanized steel.
  - b. Stainless steel.
  - c. Reinforced elastomer, having durometer hardness of 90 +/- 5 and meeting requirements of Article 2.10.3(L) of AASHTO Standard Specifications for Highway Bridges (1983).

## 2.11 REPAIR MATERIALS

### A. Acceptable repair materials:

1. Extended Open Time Epoxy Bonding Agent: Three-component, water based, epoxy modified Portland cement bonding agent and corrosion inhibitor coating providing the recommended Manufacturer's open time in which to apply repair mortar. Product shall be capable of achieving bond strength of 2,700 psi per ASTM C 882.
  - a. "Duralprep A.C.", by The Euclid Chemical Company, Cleveland, OH.
  - b. "MasterEmaco P 124," by BASF Construction Chemicals, Shakopee, MN.
  - c. "Sika Armatex 110 EpoCem", by Sika Corporation, Lyndhurst, NJ.
  - d. "Planibond 3-C" or "Mapefer 1K", by Mapei Corporation, Deerfield Beach, FL.
2. Epoxy Adhesive: 2 or 3 component, 100 percent solids, 100 percent reactive compound suitable for use on dry or damp surfaces:
  - a. "Euco #452 Epoxy Series" or "Dural Series," by The Euclid Chemical Company, Cleveland, OH
  - b. "MasterEmaco P 124," or "MasterEmaco ADH 326," by BASF Construction Chemicals, Shakopee, MN.
  - c. "Sikadur 32 Hi-Mod LPL" by Sika Corporation, Lyndhurst, NJ.

3. Trowel Applied Repair Mortar: Shall be prepackaged polymer-modified cementitious repair mortar capable of vertical/overhead application by trowel achieving a minimum 3,000 psi compressive strength at 7 days and 5,000 psi compressive strength at 28 days per ASTM C 109 as certified by manufacturer. All patches shall be squared or rectangular in shape with  $\frac{1}{2}$ " deep sawcut edges, except at locations of reinforcement or tendons. Minimum repair thickness shall be  $\frac{1}{2}$ " unless specified greater by the manufacturer and maximum lift thickness according to manufacturer requirements.
  - a. "MasterEmaco N 300 CI," "MasterEmaco T 310 CI," "MasterEmaco N 350 CI," "MasterEmaco N 427," "MasterEmaco N 426," "MasterEmaco N 400 RS or MasterEmaco N 400," by BASF Construction Chemicals, Shakopee, MN.
  - b. "Duraltop Gel", "Speedcrete PM", or "Verticoat", by The Euclid Chemical Company, Cleveland, OH.
  - c. "SikaRepair 223 with Latex R", "SikaRepair SHB with Latex R", or SikaRepair SHA with Latex R", by Sika Corporation, Lyndhurst, NJ.
  - d. "Planitop 23" by MAPEI Corporation, Deerfield, FL.
4. Horizontal Repair Mortar: Shall be prepackaged polymer-modified, cementitious repair mortar capable of horizontal, pour and screed, form and pour, partial depth, partial and full depth, or full depth applications. Material shall achieve a minimum 3,000 psi compressive strength at 7 days and 5,000 psi compressive strength at 28 days per ASTM C109 if neat and ASTM C39 if extended as certified by manufacturer. Manufacturer shall submit volume and size of SSD aggregate used for mix extension. All patches shall be square or rectangular in shape with  $\frac{1}{2}$ " deep saw cut edges, except at locations of reinforcement or tendons. Minimum thickness shall be  $\frac{1}{2}$ " and maximum thickness of placement according to manufacturer requirements.
  - a. "Duraltop Flowable Mortar", by The Euclid Chemical Company, Cleveland, OH.
  - b. "MasterEmaco S 466 CI," or "MasterEmaco T 310 CI," by BASF Construction Chemicals, Shakopee, MN.
  - c. "SikaTop 111 Plus", "Sikatop 122 Plus", or Sika Repair 222 with Latex R", by Sika Corporation, Lyndhurst, NJ.
  - d. "LS-S6 or S10" or "LM-S6 or S10", by King Packaged Materials Company, Burlington, ON.
  - e. "Topcem Premix with Planitop AC", by MAPEI Corporation, Deerfield Beach, FL.
5. Immediate upon conclusion of finishing operation cure concrete in accordance with ACI 308 for duration of at least seven days by moisture curing or moisture retaining covering. Provide additional wet curing immediately following initial curing and as necessary before concrete has dried.
  - a. Continue method used in initial curing.
  - b. Material conforming to ASTM C171.

- c. Other moisture retaining covering as approved by Engineer.
- d. During initial and final curing periods maintain concrete above 50°.
- e. Prevent rapid drying at end of curing period.

## 2.12 CONCRETE MIXTURES

- A. Proportion mixtures determined by either laboratory trial mix or field test data bases, as follows:
  - 1. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.
  - 2. Provide different mixtures as the season warrants, as well as each type and strength of concrete or for different placing methods.
- B. Use a qualified independent testing agency for preparing and reporting proposed Mixture Proportions for the laboratory trial mix basis.
- C. Requirements for normal-weight concrete mix are shown on Drawings:
  - 1. Compressive strength
  - 2. Slump
  - 3. Water-cementitious materials ratio
  - 4. Air content
- D. Supplementary cementitious materials: For concrete exposed to deicers, limit percentage, by weight, of cementitious materials according to ACI 318 requirements.
- E. Air Entrainment:
  - 1. See General Notes on Drawings for total average air content (percent by volume).
  - 2. Average air content shall exceed value stated in General Notes on Drawings.
  - 3. Permissible variation for any one test result from specified average total air content: plus or minus 1.5 percent.
  - 4. Hardened concrete shall have an air void spacing factor of 0.0080 in. maximum. Specific surface (surface area of air voids) shall be 600 in<sup>2</sup> per cu in. of air-void volume, or greater. Concrete mixes not meeting these values as determined by ASTM C 457 may require adjustments unless accepted in writing by Engineer. Refer to Part 1 Article "Submittals."
- F. Chloride Ion Content of Mixture:
  - 1. Water soluble chloride ion content of concrete shall not exceed 0.06 percent by weight of cement for pre-stressed concrete and 0.15 percent for reinforced concrete. (ACI 318 Chapter 4 Table 4.4.1 "Maximum Chloride Ion Content for Corrosion Protection of Reinforcement") Test to determine chloride ion content shall conform to ASTM C 1218.

2. Concrete chloride ion content shall be determined by Testing Agency prior to placement. Cast samples from current production of concrete mix proposed for superstructure.
  3. Concrete not meeting the requirements of paragraph "Water soluble chloride ion content of concrete..." above, shall contain appropriate amount of calcium nitrite. Concrete supplier shall provide laboratory test results showing the amount of excess chloride ion content in the concrete mixture contributed by the aggregates. For each pound of chloride ion in excess of the amount allowed, mix shall contain calcium nitrite (30 percent, plus or minus 2 percent, solids content) on one-to-one basis (one gallon of calcium nitrite for one lb. of excess chloride ion). Calcium nitrite used to offset chloride ions is in addition to calcium nitrite used as a corrosion inhibitor. Maximum of 1.5 lb. of chloride ion per cubic yard may be offset in this manner.
- G. Alkali-Aggregate Reactivity Resistance: Provide one of the following:
1. Total equivalent alkali content of mixture less than 5 lb. /cu. yd.
  2. ASTM C1293: Expansion less than 0.04 % after 1 year for each of the aggregates (both coarse and fine) in the proposed concrete mixture. This data shall be less than 1 year old.
  3. ASTM C1260 or AASHTO T303: Expansion less than 0.1 % after 14 days for each of the aggregates (both coarse and fine) in the proposed concrete mixture.
  4. ASTM C1567: Expansion less than 0.1 % after 14 days with each of the aggregates (both coarse and fine) and the supplementary cementing materials (both source and quantity) of the proposed concrete mixture design. Alternatively, if satisfactory ASTM C1260 or AASHTO T303 test results can be provided for one of the aggregates that are being used, ASTM C1567 testing does not need to be provided for that aggregate.
  5. CE CRD-C662: Expansion less than 0.1 % after 28 days with the each of the aggregates (both coarse and fine), the supplementary cementing materials (both source and quantity) of the proposed concrete mixture design and the lithium admixture source and dosage level of the proposed mixture design. Alternatively, if satisfactory ASTM C1260 or AASHTO T303 test results can be provided for one of the aggregates that are being used, CRD-C662 testing does not need to be provided for that aggregate.
- H. Admixtures: Use admixtures according to manufacturer's written instructions.
1. Consider using water-reducing admixture or high-range water-reducing admixture (Superplasticizers), OR admixtures that achieve self-consolidating concrete, as required, for placement, workability, finishing and when required, increased flowability.
  2. Consider using water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
  3. Consider using high range water-reducing admixture in pumped concrete, concrete for parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio of 0.45 or less. Use normal or mid-range water

reducing admixture for concrete with water-cementitious materials ratio greater than 0.45.

- I. When desired mixture properties are achieved, two 12 in. x 12 in. x 4 in. thick slabs shall be prepared for each mixture with test samples taken by drilling four 4 in. diameter cores. Drilled cores shall be tested for rapid chloride permeability in accordance with Test Method ASTM C 1202. Slab shall be moist cured for 28 days and cores removed and kept at 50% relative humidity until testing at 35 to 42 days. In lieu of drilled cores it is permissible to make and cure 4 in. x 8 in. cylinder specimens in accordance with ASTM C 31. Concrete mixture submitted shall have an average chloride permeability result of less than 2000 coulombs for four cores tested, with no single test result exceeding 2300 coulombs. If samples fail to meet test requirements, repeat with modified mixtures until a mixture does meet test requirements and Engineer accepts it in writing.
- J. When concrete mixture contains calcium nitrite admixture, (or other ionic salts that affect the chloride permeability test), perform rapid chloride permeability test for submitted mixture and for control sample. Control sample shall have the same mixture and water-cementitious materials ratio as submitted mixture, except calcium nitrite admixture shall not be used.
- K. Slump (ACI 301, Part 4 header "Slump"):
  1. Maximum slump for concrete is indicated on Drawings. Where field conditions require slump to exceed that shown, increased slump shall be obtained by use of high range water reducers (superplasticizers) only, and Contractor shall obtain written acceptance from Engineer who may require an adjustment to mix.
  2. All concrete containing high-range water-reducing admixture (superplasticizer) shall have a verified initial slump of 2- 3 in. Final slump after the addition of the superplasticizer shall be 6-9 in. as required by the contractor to properly place the concrete. Before permission for plant addition of superplasticizer to be granted by Engineer, fulfill following requirements:
    - a. Submit letter from testing laboratory which developed original mixture proportions, for each superplasticized mixture, certifying volume of mix water which will produce specified slump and water/cement ratio, taking into account aggregate moisture content.
    - b. Submit plant computer printout of mixture ingredients for each truckload of superplasticized concrete with delivery of that truckload. Mix water volume greater than that certified shall be cause for concrete rejection.
    - c. Over-retarding or crusting of flatwork surface: cause for concrete rejection.
    - d. Segregation or rapid slump loss (superplasticizer life) due to incompatibility or under-dosing: cause for concrete rejection.



- L. Engineer's acceptance of mixture proportions shall not relieve Contractor from responsibility for any variation from requirements of Contract Documents unless Contractor has in writing called Engineer's attention to each such variation at time of submission and Engineer has given written approval of each such variation.
- M. Adjustment to Concrete Mixtures: Adjustments to mixture proportions may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, as accepted by Engineer. Laboratory test data for revised mixture and strength results shall be submitted to and accepted by Engineer before using in work.

## **2.13 FABRICATING REINFORCEMENT**

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

## **2.14 CONCRETE MIXING**

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information. Truck mixing prohibited. Mix at plant.
  - 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
- B. Provide plant-printed batch ticket for each batch discharged and used in work, indicating project identification name and number, date, mixture identification number, date, time of batching, mixing time, quantity and details of materials, amount of water introduced and water permitted by plant to be added, if any.
- C. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94. Mix concrete materials in appropriate drum-type batch machine mixer.
  - 1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least one and one-half minutes, but not more than five minutes after ingredients are in mixer, before any part of batch is released.
  - 2. For mixer capacity larger than 1 cu. yd. increase mixing time by 15 seconds for each additional 1 cu. yd.
  - 3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, mixture identification number, date, time of batching, mixing time, quantity and details of materials, and amount of water added. Record approximate location of final placement in structure.

**2.15 TOOLS****A. Slab Jointing**

1. Concrete groovers: For tooled joints in concrete:
  - a. For concrete not exceeding 4 in. thickness, use groover with 1 in. deep v-cut bit, 0.5 in. surface width and 3/16 in. to 1/4 in. edge radius.
  - b. For concrete exceeding 4 in. thickness, use groover with 1.5 in. deep v-cut bit, 0.5 in. surface width and 3/16 in. to 1/4 in. edge radius.
2. Saw Cut Joints:
  - a. Acceptable for slab on grade only. Not allowed for topping slabs.
  - b. Acceptable tool: "Soff-Cut Saw Model 310" or "Model G2000," Soff-Cut International, Corona, CA.
    - 1) Cut joint as soon as concrete will support weight of operator and saw without deforming.
    - 2) Joint shall be 1 in. deep for concrete thickness of 4 in. or less. Joint shall be 1.5 in. deep for concrete exceeding 4 in. thickness. Do not cut reinforcement.
    - 3) Extend joint to adjacent vertical surface within 30 minutes of cutting.
    - 4) Retool or grind sawcut joint before installing sealant to provide equivalent dimensions, shape and volume as joint obtained by tooled joint. Surface width shall be 0.5 in. with 3/16 to 1/4 in. edge radius.
    - 5) All joints subject to acceptance by sealant installer. Rework rejected joints until acceptable to sealant installer.

**PART 3 - EXECUTION****3.1 FORMWORK**

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until concrete structure can support such loads and in accordance with Article 1.5 "Contractor's Professional Services - Performance and Design Criteria".
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117, except as modified below:
  1. Drilled Pier Caps and Pile Caps:

- a. Variation of center from specified plan location: 0.5 in.
  - b. Variation of bearing surface from specified location: Plus or minus 0.5 in.
  - c. Variation from specified dimensions in plan: Plus 2 in. minus 0 in.
  - d. Variation decrease from specified thickness: 0.5 in.
2. Footings:
- a. Footings other than those to receive masonry construction: Variation of bearing surface from specified elevation: Plus or minus 0.5 in.
  - b. Footings to Receive Masonry Construction:
    - 1) Variation of center from specified location in plan: Plus or minus 0.25 in. in any 10 ft but not to exceed plus or minus 0.5 in.
    - 2) Variation of bearing surfaces for specified elevation: Plus or minus 0.25 in. in any 10 ft but not to exceed plus or minus 0.5 in.
3. Piers, Columns, Walls, Beams, and Slabs:
- a. Variation in cross-sectional dimensions of piers, beams and columns and in thickness of walls and slabs: 12 in. or less: Plus 0.375 in., minus 0.25 in. Greater than 12 in.: Plus 0.5 in., minus 0.375 in.
  - b. Variation in elevation from specified elevation for piers, columns and walls: Plus or minus 0.5 in.
4. Anchor bolts: concrete contractor shall place anchor bolts within tolerances stated under heading "Anchor Bolts and Bearing Plates" of PCI "Code of Standard Practice for Precast Concrete."
- C. Void Forms:
- 1. Prepare ground surface on level plane.
  - 2. Protect all forms from moisture prior to concrete placement.
  - 3. Install all forms and accessories in accordance with manufacturer's recommendations.
  - 4. Protect all forms from puncture and moisture during concrete placement including accessories such as taped joints, seam pads and end caps.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
- 1. Install keyways, reglets, recesses, and the like, for easy removal.
  - 2. Kerf wood inserts for easy removal.
  - 3. Do not use rust-stained steel form-facing material.

- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete where indicated on drawings.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

### **3.2 EMBEDDED ITEMS**

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 1. Install anchor bolts, accurately located, to elevations required.
  - 2. Install reglets to receive top edge of foundation sheet waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
  - 3. Install dovetail anchor slots in concrete structures as indicated.

### **3.3 REMOVING AND REUSING FORMS**

- A. General: Formwork, for sides of beams, walls, columns, and similar parts of the Work, that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete provided concrete is hard enough to not be damaged by form-removal operations and provided curing and protection operations are maintained.

- B. Leave formwork for structural elements in place until concrete has achieved the following:
  - 1. At least 70 percent of 28-day design compressive strength.
- C. 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 for exposed surfaces. Apply new form-release agent.
- D. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

### **3.4 VAPOR RETARDER**

- A. Vapor Retarder: Place, protect, and repair vapor-retarder or vapor sheets according to ASTM E 1643 and manufacturer's written instructions. Provide vapor retarder under grade slab where indicated on the drawings.
- B. Fine-Graded Granular Material: Cover vapor retarder with fine-graded granular material, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch or minus  $\frac{3}{4}$  inch.
- C. Granular Fill: Cover vapor retarder with granular fill, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch or minus  $\frac{3}{4}$  inch.
  - 1. Place and compact a  $\frac{1}{2}$ -inch- thick layer of fine-graded granular material over granular fill.

### **3.5 STEEL REINFORCEMENT**

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
  - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain specified concrete cover. Do not tack weld crossing reinforcing bars.
  - 1. Shop- or field-weld reinforcement according to AWS D1.4, where indicated.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

- E. Install welded wire reinforcement in longest practicable lengths on continuous bar supports spaced at 2 ft o.c., maximum. Lap edges and ends of adjoining sheets per ACI 318 and as follows:
1. Length of overlap measured between outermost cross wires of each sheet shall not be less than one spacing of cross wires plus two inches nor less than one and one-half times the development length nor 6 in. minimum where development length is calculated per section 12.8 of ACI 318.
  2. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.
- F. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963.
1. Rest epoxy coated steel member supported from formwork on coated wire bar supports, or on bar supports made of dielectric material or other suitable material.
  2. Coat wire bar supports with dielectric material for minimum distance of 2 in. from point of contact with coated steel member.
  3. Fasten epoxy-coated steel members with nylon-, epoxy-, or plastic-coated tie wire, or other suitable material acceptable to Engineer.
  4. Mechanical connections, when required, shall be installed in accordance with splice device manufacturer's recommendations. Repair any damage to coating.
  5. All parts of mechanical connections on epoxy-coated steel, including steel splice sleeves, bolts, and nuts shall be coated with same material used for repair of coating damage.
  6. Repair all damage to epoxy coating to bars, welded wire reinforcement and all other epoxy coated items. Use a mirror to view undersides of all items for possible damage so it can be repaired.
  7. Do not cut epoxy-coated steel unless permitted by Engineer. When cut, coat ends with material used for repair of coating damage.
  8. All welding of epoxy-coated steel shall conform to AWS D1.4.
  9. Adequate ventilation shall be provided when welding epoxy-coated steel.
  10. After welding, repair coating damage as specified in Part 3 heading "Quality Control Testing During Construction."
- G. Splices:
1. Provide standard reinforcement splices by lapping ends, placing bars in contact, and tying tightly with wire. Comply with requirements of ACI 318 for minimum lap of spliced bars.
  2. For mechanical tension splices of reinforcement:
    - a. Column bar lengths shall not exceed 30 ft between splices. In any bar, no splices shall occur at any floor level.
    - b. Exercise care to assure that no reduction of cross-sectional area of reinforcement occurs.

- c. For all mechanical splices, perform splicing in strict accordance with manufacturer's requirements and instructions.
  - d. Stagger splices in adjacent bars.
  - e. Except where shown on Drawings, welding of reinforcement prohibited without prior written authorization by Engineer.
- 3. Compression splices: Mechanically coupled splices in accordance with ACI 318, Chapter 12.
  - 4. Welded wire reinforcement shall not extend through contraction joints.

### 3.6 JOINTS

#### A. Joints in Concrete (ACI 301, Section 5):

- 1. Construction, control and isolation joints are located and detailed on Drawings:
    - a. Tool joints at time of finishing. Tool: Part 2 Article "Tools."
    - b. Saw Cut Joints:
      - 1) Permitted in slab on grade only.
      - 2) Cut joint as soon as concrete will support weight of operator and saw without deforming.
      - 3) Joint shall be 1 in. deep for concrete thickness of 4 in. or less. Joint shall be 1.5 in. deep for concrete exceeding 4 in. thickness. Do not cut reinforcement.
      - 4) Extend joint to adjacent vertical surface within 30 minutes of cutting.
      - 5) Retool or grind saw cut joint before installing sealant to provide equivalent dimensions, shape, and volume as joint obtained by tooled joint. Surface width shall be 0.5 in. with 3/16 in. to 1/4 in. edge radius.
      - 6) All joints subject to acceptance by sealant installer. Rework rejected joints until acceptable to sealant installer.
    - c. Isolation joints: Interrupt structural continuity resulting from bond, reinforcement or keyway.
    - d. Construction and control joints in walls: Space joints at 20 ft on center maximum unless smaller spacing is shown on Drawings.
    - e. Construction or control joints in floor slabs on ground: Maximum slab area controlled by jointing 400 sq ft. Space joints at 20 ft on center maximum unless different spacing is shown on Drawings.
    - f. Coordinate configuration of tooled joints with control joint sealants.
- B. Provide keyways at least 1-1/2 in. deep in construction joints in walls and slabs. Accepted bulkheads designed for this purpose may be used for slabs.

- C. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints except as otherwise indicated. Do not continue reinforcement through sides of strip placements.
- D. Use bonding grout, containing the specified bonding admixture, on existing concrete surfaces that will be joined with fresh concrete.
- E. Contraction (Control) Joints in Slabs-on-Ground: Construct contraction joints in slabs-on-ground to form panels of patterns as shown.
  - 1. Tool contraction joints.
  - 2. If joint pattern not shown, provide joints not exceeding 20 ft in either direction and located to conform to bay spacing wherever possible (at column centerlines, half bays, third bays).
- F. Joint sealant material is specified in Division 7 Sections.

### **3.7 WATERSTOPS**

- A. Flexible Waterstops: Install in construction joints as indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of Work. Field-fabricate joints in waterstops according to manufacturer's written instructions.

### **3.8 CONCRETE PLACEMENT**

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement, unless approved by Engineer/Architect.
- C. Before placing concrete, water may be added at Project site, subject to limitations of ACI 301.
  - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mix.
- D. Check air content after any site addition of admixtures to increase slump.
- E. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation.



- F. Deposit concrete in forms in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Place each layer while preceding layer is still plastic, to avoid cold joints.
1. Consolidate placed concrete with mechanical vibrating equipment. Use plastic or rubber-tipped vibrators when concrete reinforcement is epoxy-coated.
  2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically (in thin slabs vibrator may be inserted at angle or horizontally to keep vibrator head completely immersed) inserted at uniformly spaced locations no farther than 1.5 times action radius so area visibly affected by vibrator overlaps adjacent previously vibrated area by 3-4 inches. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration (usually 5 to 15 seconds) of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- G. Deposit and consolidate concrete for toppings and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
1. Consolidate placed concrete with mechanical vibrating equipment. Use plastic or rubber-tipped vibrators when concrete reinforcement is epoxy-coated. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
  2. Maintain reinforcement in position on chairs during concrete placement.
  3. Screed slab surfaces with a straightedge or motor driven vibrating screed and strike off to correct elevations.
  4. Slope surfaces uniformly to drains where required.
  5. Begin initial floating using highway bull floats or darbies to form a uniform and open-textured surface plane, free of humps or hollows, before excess moisture or bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- H. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
  2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

3. Use only the specified non-corrosive accelerator. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mixture proportions.
- I. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows, when hot-weather conditions exist:
1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
  2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
  3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

### 3.9 FINISHING FORMED SURFACES

- A. As-Cast Finishes: As-cast concrete texture imparted by form-facing material in accordance with ACI 301 and as specified below in accordance with Class of Finish:
1. Rough Form Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched. Remove fins and other projections exceeding limits for class of surface specified.
    - a. Provide class C finish as described in ACI 347, for surfaces permanently concealed from public view, unless otherwise noted in the Contract Documents. Class C permits gradual or abrupt irregularities of 1/2 inch.
  2. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding limits for class of surface specified.
    - a. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, or painting.
    - b. Provide class B finish as described in ACI 347. Class B permits gradual or abrupt irregularities of 1/4 inch.
- B. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

- C. Mock-Up: Provide a full scale mock-up for all finishes exposed to view as described in article "Quality Assurance".

### 3.10 FINISHING FLOORS AND SLABS

- A. Flatwork in Parking and Drive Areas (BROOM Finish, ACI 301, Section 5 header "Broom or Belt Finish"):

1. Bullfloat immediately after screeding. Complete before any excess moisture or bleed water is present on surface (ACI 302.1R, Article 8.3.3). The use of power trowels is discouraged; however, if they are used the following applies:
  - a. Use minimal passes so as to not overwork the concrete.
  - b. At the contractor's expense a petrographic analysis will be required in each area where a power trowel is used to verify the air content at the slab surface is within specified limits.
2. After excess moisture or bleed water has disappeared and concrete has stiffened sufficiently to allow operation, give slab surfaces coarse transverse scored texture by drawing broom across surface. Texture shall be as accepted by Engineer from sample panels.
3. Finish tolerance: ACI 301, Paragraph 5.3.4.2 and ACI 117, paragraph 4.8.6: The gap at any point between the straightedge and the floor (and between the high spots) shall not exceed 0.5 in. In addition, floor surface shall not vary more than plus or minus 0.75 in. from elevation noted on Drawings anywhere on floor surface.
4. Before installation of flatwork and after submittal, review, and approval of concrete mixture proportions, Contractor shall fabricate two acceptable test panels simulating finishing techniques and final appearance to be expected and used on Project. Test panels shall be minimum of 20 ft. by 30 ft. in area and shall be reinforced and cast to thickness of typical parking and drive area wearing surface in Project. (Maximum thickness of test panels need not exceed 6 in.) Test panels shall be cast from concrete supplied by similar concrete batch, both immediately after addition of superplasticizer or water-reducing admixture, and at maximum allowed time for use of admixture-treated concrete in accordance with Specifications. Intent of test panels is to simulate both high and low workability mixes, with approximate slump at time of casting of test panels to be 6 in. and 3 in., respectively. Contractor shall finish panels following requirements of paragraphs above, and shall adjust finishing techniques to duplicate appearance of concrete surface of each panel. Finished panels (one or both) may be rejected by Engineer, in which case Contractor shall repeat procedure on rejected panel(s) until Engineer acceptance is obtained. Accepted test panels shall be cured in accordance with Specifications and may be incorporated into Project. Accepted test panels shall serve as basis for acceptance/rejection of final finished surfaces of all flatwork.

5. Finish all concrete slabs to proper elevations to ensure that all surface moisture will drain freely to floor drains, and that no puddle areas exist. Contractor shall bear cost of any corrections to provide for positive drainage.
- B. Flatwork in Enclosed, Finished Areas (Float Finish, ACI 301, Paragraph 5.3.4.2.b):
1. Give slab floated finish. Texture shall be as accepted by Engineer from sample panels.
  2. Finishing tolerance ACI 301, Section 5 header "Measuring Tolerances for Slabs" and ACI 117, paragraph 4.8.6: The gap at any point between the straightedge and the floor (and between the high spots) shall not exceed 0.5 in. In addition, floor surface shall not vary more than plus or minus 3/8 in. from elevation noted on Drawings anywhere on floor surface.
- C. Flatwork in Stairtowers, Lobbies, and Parking Garage floor subject to pedestrian traffic:
1. Concrete surfaces at all walking areas subject to pedestrian traffic shall provide a smooth, slip resistant walking surface for pedestrians with these minimum requirements:
    - a. Shall provide walking surfaces in accordance with ASTM - F 1637 Standard Practice for Safe Walking Surfaces and "Americans with Disabilities Act (ADA), Accessibility Guidelines (ADAAG)".
    - b. Adjoining walkway surfaces shall be flush and meet the following minimum requirements:
      - 1) Changes in level of less than ¼ inch in height may be without edge treatment as shown in ADA Figure 303.2 and on the Drawings.
      - 2) Changes in Level between ¼ inch and ½ inch in height shall be beveled with a slope no greater than 1:2 as shown in ADA Figure 303.3 and on the Drawings.
      - 3) Changes in level greater than ½ inch in height are not permitted unless they can be transitioned by means of a ramp with minimum requirements shown on the Drawings.
      - 4) Openings in floor or ground surfaces shall not allow passage of a sphere more than ½ inch diameter except as allowed for elevators and platform lifts as shown in ADA Figure 302.3 and on the Drawings.
    - c. Walkway surfaces shall provide a slip resistant surface.
      - 1) Concrete surfaces shall be troweled and finished to provide a slip resistant finish.
      - 2) Contractor shall provide sample area with slip resistant surface finish.

### 3.11 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still workable and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

### **3.12 CONCRETE PROTECTION AND CURING**

- A. General: Comply with ACI 308.1. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R for hot-weather protection during curing.
- B. Evaporation Reducer: Apply evaporation reducer to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft./h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing. Do not finish immediately after evaporation reducer applied. Wait until after (green, if Confilm used - pink, if Eucobar used) film disappears.
- C. Formed Surfaces: Cure formed concrete surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing by one or a combination of the following methods:
  - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
    - a. Tepid (within 20 deg F of concrete temperature) water.
    - b. Continuous water-fog spray.
    - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
  - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
  - 3. Curing Compound: After Moisture or Moisture-Retaining-Cover Curing, apply uniformly in continuous operation by power spray or

roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

- a. Apply two separate coats with first allowed to become tacky before applying second. Direction of second application shall be at right angles to direction of first.
  - b. Curing compound prohibited when concrete has specified water-cementitious materials ratio less than or equal to 0.40 or air temperature above 80 deg F. Use moist cure instead.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces, by one or a combination of the following methods:
1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
    - a. Tepid (within 20 deg F of concrete temperature) water.
    - b. Continuous water-fog spray.
    - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
  2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
    - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
    - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
    - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer recommends for use with floor coverings.
  3. Curing Compound: Where permitted, apply uniformly in continuous operation by power spray or roller immediately after final finishing and the absence of surface moisture, according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
    - a. Apply two separate coats with first allowed to become tacky before applying second. Direction of second application shall be at right angles to direction of first.

- b. Curing compound prohibited when concrete has specified water-cementitious ratio less than or equal to 0.40 or air temperature above 80 deg F. Use moist cure instead.

### 3.13 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Engineer/Architect. Remove and replace concrete that cannot be repaired and patched to Engineer/Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part Portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing. Use this repair procedure only with Engineer/Architect approval.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
  - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than ½ inch in any dimension in solid concrete but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with specified bonding agent. Fill and compact with specified patching mortar before specified bonding agent has dried. Fill form-tie voids with specified patching mortar or cone plugs secured in place with specified bonding agent.
  - 2. Repair defects on surfaces exposed to view by blending white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area on mockup, or if none, at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
  - 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Engineer/Architect.
  - 4. Repair isolated random cracks that have little movement and single holes not over 1 in. in diameter in accordance with procedures and materials specified in Division 7 Section "Concrete Joint Sealants." Receive Engineer's written acceptance of methods and materials selected prior to application.
    - a. Repair isolated random horizontal cracks less than 0.01 in. wide, using silane sealer product specified in Division 7 "Traffic Bearing Water Repellants"
    - b. Repair isolated random horizontal cracks 0.01 in. to less than 0.03 in. wide, using crack sealer product specified in Division 7 "Traffic Bearing Water Repellants."
    - c. Repair isolated random horizontal cracks 0.03 in. to 0.06 in. wide: route and seal with specified sealant product in Division 7 "Concrete Joint Sealants."

- d. Repair isolated random vertical cracks more than 0.01 in. wide, using epoxy injection product approved.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
1. Repair finished surfaces containing defects. Surface defects include spalls, pop-outs, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
  2. After concrete has cured at least 14 days, correct high areas by grinding.
  3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
  4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
  5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of  $\frac{1}{4}$  inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
  6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete or latex modified concrete as approved by the Engineer. Remove defective areas with clean, square cuts and expose steel reinforcement with at least  $\frac{3}{4}$  inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mix as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
  7. Repair single holes 1 inch or less in diameter with patching mortar. Cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
  8. Repair isolated random cracks that have little movement and single holes not over 1 in. in diameter in accordance with procedures and materials specified in Division 7 Section "Concrete Joint Sealants." Receive Engineer's written acceptance of methods and materials selected prior to application.



- a. Repair isolated random horizontal cracks less than 0.01 in. wide, using silane sealer product specified in Division 7 "Water Repellants"
  - b. Repair isolated random horizontal cracks 0.01 in. to less than 0.03 in. wide, using crack sealer product specified in Division 7 "Water Repellants."
  - c. Repair isolated random horizontal cracks 0.03 in. to 0.06 in. wide: route and seal with specified sealant product in Division 7 "Concrete Joint Sealants."
  - d. Repair isolated random vertical cracks more than 0.01 in. wide, using epoxy injection product approved.
- E. Perform structural repairs of concrete, subject to Engineer/Architect's approval, using epoxy adhesive and patching mortar, latex modified concrete or other materials as approved by the Engineer.
- F. Repair materials and installation not specified above may be used, subject to Engineer/Architect's approval.

### **3.14 FIELD QUALITY CONTROL**

- A. Contractor will employ a testing laboratory to perform tests and to submit test reports.
- B. Sample concrete in accordance with ASTM C 172.
- C. Epoxy Coated Material:
- 1. Perform field inspection of installed epoxy coated material under provisions of Division 1 Section "Quality Control."
  - 2. Repair all epoxy coating damage due to fabrication and handling, using a mirror to find any damage on undersides.
  - 3. Repair all damaged areas using manufacturer's recommended patching material and method.
  - 4. No damaged area shall be left uncorrected.
  - 5. Epoxy coated welded wire reinforcement with consistent visible holes in epoxy coating (particularly at mesh intersections): unacceptable. Remove from project.
- D. Temperature:
- 1. Test temperature of concrete in accordance with ASTM C 1064/C 1064M and ACI 301 each time cylinders are taken or as directed by the Engineer.
- E. Slump Test:
- 1. Conduct one slump test in accordance with ASTM C 143/C 143M per truck load of ready-mixed concrete delivered to Project at truck for superstructure concrete.
  - 2. Conduct slump test in accordance with ASTM C143/C 143M and ACI 301 for foundation concrete.

3. When high-range water-reducing admixture (superplasticizer) is used, initial slump must be verified by Testing Agency.

F. Slump Flow Test (SCC):

1. Conduct one slump flow test in accordance with ASTM C 1611/C 1611M per truck load of ready mixed concrete delivered to Project at truck for superstructure concrete.
2. Conduct slump flow test in accordance with ASTM C1611/C 1611M and ACI 301 for foundation concrete.

G. Air Content:

1. General Contractor: Coordinate all parties involved to produce conforming concrete.
2. Sample freshly-mixed concrete at point of final placement in accordance with ASTM C 172 and conduct one air content test in accordance with ASTM C 231 or ASTM C 173 for each truck of ready-mix, air entrained concrete delivered to Project. After good concrete quality control has been established and maintained as determined by Resident Engineer, test the first truck and every 20 m3 (25 cubic yards) thereafter each day.
3. Sample fresh concrete immediately following placement and screeding and conduct air content tests in accordance with ASTM C 231 or ASTM C 173 at rate of one for every 10 truck loads of ready-mix, air-entrained concrete delivered to Project. For small or half-loads, obtain Engineer's acceptance of procedure 2 weeks before situation arises.

H. Concrete Compressive Strength:

1. Make test cylinders in accordance with ASTM C 31 and test in accordance with ASTM C 39 as follows:
  - a. Take minimum of six for each 100 cu yd or fraction thereof, of each Mixture of concrete placed in any one day.
  - b. Additional cylinders shall be taken under conditions of cold weather concreting.
  - c. Testing Agency: Provide and maintain site cure box for cylinders.
2. Cover specimens properly, immediately after finishing. Protect outside surfaces of cardboard molds, if used, from contact with sources of water for first 24 hours after molding.
3. Cure test cylinders per ASTM C 31 as follows:
  - a. To verify compressive strength prior to form removal or for additional test cylinders required due to cold weather concreting conditions:
    - 1) Store test specimens on structure as near to point of sampling as possible and protect from elements in same manner as that given to portion of structure as specimen represents.

- 2) Transport to test laboratory no more than 4 hours before testing. Remove molds from specimens immediately before testing.
- b. To verify 28-day compressive strength:
  - 1) During first 24 hours after molding, store test specimens under conditions that maintain temperature immediately adjacent to specimens in range of 60 to 80 degrees F. and prevent loss of moisture from specimens.
  - 2) Remove test specimens from molds at end of 20 +/- 4 hours and store in moist condition at 73.4 +/- 3 degrees F until moment of test. Laboratory moist rooms shall meet requirements of ASTM C 511.
4. Compression test for concrete:
  - a. Test 2 cylinders at 7 days.
  - b. Test 2 cylinders at 28 days.
  - c. Hold 2 cylinders in reserve for use as Engineer/Architect directs.
5. Unless notified by Engineer, reserve cylinders may be discarded without being tested after 56 days.
- I. For chloride permeability, mold two 4 in. diameter cylinders for every 20,000 sq. ft. of topping or structural slab, unless directed otherwise by Engineer. Make and cure cylinders in accordance with ASTM C 31.
- J. Report all nonconforming test results to Engineer, Resident Engineer, and others on distribution lists via fax or email. Follow up with colored paper copies to flag the non-conformances.
- K. Monthly, submit a graph showing distribution of compressive strength test results and air content test results.

### **3.15 EVALUATION AND ACCEPTANCE OF CONCRETE**

- A. Concrete Compression test will be evaluated by Engineer in accordance with ACI 301. If number of tests conducted is inadequate for evaluation of concrete or test results for any type of concrete fail to meet specified strength requirements, core tests may be required as directed by Engineer. Air content and parameters of air-void system shall meet requirements of this Section.
- B. Core tests, when required, in accordance with ASTM C42 and ACI 301.
- C. Should tested hardened concrete meet Specifications, Owner will pay for coring and testing of hardened concrete. Should tested hardened concrete not meet Specifications or should concrete have to be tested because Contractor did not conform to Project specifications, Contractor shall pay for coring and testing of hardened concrete and for any corrective action required for unaccepted concrete.

**3.16 ACCEPTANCE OF STRUCTURE**

- A. Acceptance of completed concrete Work will be according to provisions of ACI 301.
- B. "RAPIDLOAD" testing is acceptable, by Structural Preservation Systems, Baltimore, MD.
- C. Concrete rejected due to entrained air content below specified limit will be accepted if any of following conditions are met:
  - 1. ASTM C 457: Three concrete specimens tested in accordance with ASTM C 457 meet air void parameters of Part 2.
  - 2. ASTM C 457: Three concrete specimens tested shall meet air void parameters of concrete reported and approved by Engineer in Part 1.
  - 3. ASTM C 666, Test Procedure A: Test three concrete specimens removed from structure Concrete specimens tested shall have durability characteristics similar to that reported in Part 1.

- - - E N D - - -

**CONCRETE MIXTURE PROPORTIONS SUBMITTAL FORM**

Mixture #  
Project Name:

|                               |                 |
|-------------------------------|-----------------|
| I. GENERAL INFORMATION:       |                 |
| Project:                      | City:           |
| General Contractor:           |                 |
| Concrete Supplier:            |                 |
| Mixture Identification No.:   | Concrete Grade: |
| Use (Describe) <sup>1</sup> : |                 |

<sup>1</sup> example: Footings, interior flatwork, floor slabs, topping, columns, etc.

|   |  |   |
|---|--|---|
| II. MIXTURE PROPORTIONING DATA:   |  |   |
| Proportioning Based on (Check only one):<br>Standard Deviation Analysis: ____ (see section VIII)<br>or Trial Mix Test Data: ____ (see Section IX) |  |   |
| Mixture Characteristics:<br>(see Mixtures in Drawings General Notes)  | Density: ____ pcf;                     | Air: ____ % specified   |
|   | Slump ____ in. before superplasticizer | Slump ____ in. after superplasticizer<br>Or<br>for SCC: Spread ____ in. |
|   | Strength: ____ psi (28 day);           |   |

\_\_\_\_\_  
WALKER SUBMITTAL STAMP

\_\_\_\_\_  
CONTRACTOR

\_\_\_\_\_  
SUBMITTAL STAMP

# CONCRETE MIXTURE PROPORTIONS SUBMITTAL FORM

Mixture #  
Project Name:

|   |             |                                      |
|---|-------------|--------------------------------------|
| III. MATERIALS:   |             |                                      |
| Aggregates: (size; type; source; gradation report; specification) |             |                                      |
| Coarse:   |             |                                      |
| Fine:   |             |                                      |
| Other Materials:  | <u>Type</u> | <u>Product-Manufacturer (Source)</u> |
| Cement:   |             |                                      |
| Flyash, slag, or other pozzolan:                                  |             |                                      |
| Silica Fume   |             |                                      |
| Processed Ultra Fine Fly Ash                                      |             |                                      |
| HRM   |             |                                      |
| Air Entraining Agent:   |             |                                      |
| Water Reducer   |             |                                      |
| High Range Water Reducer (HRWR / superplasticizer)                |             |                                      |
| Non-Corrosive Accelerator   |             |                                      |
| Retarder  |             |                                      |
| Fibers  |             |                                      |
| Other(s):   |             |                                      |

|                                     |                                      |  |
|-------------------------------------|--------------------------------------|--|
| IV. MIX PROPORTIONS <sup>(2)</sup>  |                                      |  |
|                                     | WEIGHT (lbs.) (per yd <sup>3</sup> ) | ABSOLUTE VOL. (cu. ft.) (per yd <sup>3</sup> ) |
| Cement:                             |                                      |  |
| Fine Aggregate: <sup>(3)</sup>      |                                      |  |
| Coarse Aggregate: <sup>(3)</sup>    |                                      |  |
| Flyash, slag, or other pozzolan:    |                                      |  |
| Silica Fume                         |                                      |  |
| Processes Ultra Fine Fly Ash        |                                      |  |
| HRM                                 |                                      |  |
| Water: <sup>(4)</sup> (gals. & lbs) |                                      |  |
| Entrained Air: (oz.)                |                                      |  |
| Fibers:                             |                                      |  |
| (Other) _____:                      |                                      |  |

|  |  |  |
|--|--|--|
| TOTALS:  |  |  |
| NOTES:   |  |  |
| <sup>(2)</sup> Mix proportions indicated shall be based on data used in section VII or IX.       |  |  |
| <sup>(3)</sup> Based on saturated surface dry weights of aggregates.                             |  |  |
| <sup>(4)</sup> Includes ALL WATER, including added water and free water contained on aggregates. |  |  |

# **CONCRETE MIXTURE PROPORTIONS SUBMITTAL FORM**

Mixture #  
Project Name:

|   |    |                               |  |
|---|----|-------------------------------|--|
| <b>V. RATIOS</b>  |    | <b>VI. SPECIFIC GRAVITIES</b> |  |
| Water <sup>(1)</sup>  | lb | Fine Aggregate:               |  |
| =   | =  | Coarse Aggregate:             |  |
| Cementitious Material <sup>(2)</sup>  | lb |                               |  |
| Fine Agg.   | lb |                               |  |
| =   | =  |                               |  |
| Total Agg.  | lb |                               |  |
| <b>NOTES:</b><br><sup>(1)</sup> Includes ALL water, including added water and free water contained on aggregates.<br><sup>(2)</sup> Cementitious materials include cement, fly ash, slag, silica fume, HRM, Processed Ultra Fine Fly Ash or other pozzolan. |    |                               |  |

|                                |          |                     |         |                 |  |
|--------------------------------|----------|---------------------|---------|-----------------|--|
| <b>VII. ADMIXTURES</b>         |          |                     |         |                 |  |
| Air Entraining Agent (A.E.A.): | ___ oz.  | per yd <sup>3</sup> | ___ oz. | per 100# cement |  |
| Superplasticizer               | ___ oz.  | per yd <sup>3</sup> | ___ oz. | per 100# cement |  |
| Water Reducer                  | ___ oz.  | per yd <sup>3</sup> | ___ oz. | per 100# cement |  |
| Non-corrosive Accelerator      | ___ oz.  | per yd <sup>3</sup> | ___ oz. | per 100# cement |  |
| Retarder                       | ___ oz.  | per yd <sup>3</sup> | ___ oz. | per 100# cement |  |
| Other                          | ___ oz.  | per yd <sup>3</sup> | ___ oz. | per 100# cement |  |
| Lithium Nitrate                | ___ gal. | per yd <sup>3</sup> |         |                 |  |

# CONCRETE MIXTURE PROPORTIONS SUBMITTAL FORM

Mixture #  
Project Name:

|   |  |   |            |
|---|--|---|------------|
| VIII. <u>STANDARD DEVIATION ANALYSIS:</u>   |  | <u>Yes</u>                                      | <u>N/A</u> |
| (Complete this section only if Mixture was developed using standard deviation analysis of previous project test results. If other method was used, check "N/A".)  |  |   |            |
| <u>Number of Tests Evaluated:</u><br>(One test is average of two cylinder breaks)   |  | <u>Standard Deviation:</u><br>(Single Group)    |            |
| <u>Attach copy of test data considered:</u>   |  | <u>Standard Deviation:</u><br>(Two Groups)      |            |
| Required average compressive strength: $f'_{cr} = f'_c + \underline{\hspace{2cm}}$ psi  |  |   |            |
| <p>NOTE:</p> <p>Mixture shall be proportioned in accordance with ACI 301 section 4.2.3 to achieve average compressive strength <math>f'_{cr}</math> equal to or greater than the larger of one of the following equations:</p> <p>(4.-3) <math>f'_{cr} = f'_c + 1.34ks</math> [<math>s</math>= calculated standard deviation]<br/> or<br/> (4-4) <math>f'_{cr} = f'_c + 2.33ks - 500</math><br/> or<br/> (4-5) <math>f'_{cr} = 0.9f'_c + 2.33ks</math> (for <math>f'_c &gt; 5,000</math> psi)</p> <p>(Refer to ACI 301 for required average when data are not available to establish standard deviation. For post-tensioning projects, see also special requirements for strength required to apply initial post-tensioning.)</p> |  |   |            |
| MIXTURE CHARACTERISTICS (As shown on drawings)  |  |   |            |
| Slump = <u>                    </u> in.   |  | Air Content = <u>                    </u> %     |            |
| Unit Wet Wt. = <u>                    </u> pcf  |  | Unit Dry Wt. = <u>                    </u> pcf  |            |
|   |  |   |            |
| MIXTURE CHARACTERISTICS (Based on proportioning data)   |  |   |            |
| Initial Slump = <u>                    </u> in.   |  | Final Slump <u>                    </u> in.     |            |
| Unit Wet Wt.= <u>                    </u> pcf.  |  | Unit Dry Wt. = <u>                    </u> pcf. |            |
| Air Content = <u>                    </u> %   |  |   |            |



# CONCRETE MIXTURE PROPORTIONS SUBMITTAL FORM

Mixture #  
Project Name:

|   |                               |                               |                               |
|---|-------------------------------|-------------------------------|-------------------------------|
| IX. <u>TRIAL MIXTURE TEST DATA:</u>   |                               | <u>Yes</u>                    | <u>N/A</u>                    |
| (Complete this section only if Mixture Proportion is based on data from trial test mixture(s) batched by testing agency or Contractor. If other method was used, check "N/A".)  |                               |                               |                               |
| <u>Age</u><br>(days)  | <u>Mix #1</u><br>(comp. str.) | <u>Mix #2</u><br>(comp. str.) | <u>Mix #3</u><br>(comp. str.) |
| <u>7</u>  |                               |                               |                               |
| <u>7</u>  |                               |                               |                               |
| <u>28</u>   |                               |                               |                               |
| <u>28</u>   |                               |                               |                               |
| <u>28</u>   |                               |                               |                               |
| <u>28</u> day average compressive strength, psi   |                               |                               |                               |
| <p>NOTE:</p> <p>Mixture shall be proportioned in accordance with ACI 301 section 4.2.3 to achieve average compressive strength <math>f'_{cr}</math> equal to or greater than the larger of one of the following equations:</p> <p>(Less than 3000) <math>f'_{cr} = f'_c + 1000</math><br/> or<br/> (3000 to 5000) <math>f'_{cr} = f'_c + 1200</math><br/> or<br/> (Over 5000) <math>f'_{cr} = 1.1f'_c + 700</math></p> <p>For post-tensioning projects, see also special requirements for strength required to apply initial post-tensioning.</p> |                               |                               |                               |
| MIXTURE CHARACTERISTICS (as shown on drawings)  |                               |                               |                               |
| Slump = _____ in.   |                               | Air Content = _____ %         |                               |
| Unit Wet Wt. = _____ pcf  |                               | Unit Dry Wt. = _____ pcf      |                               |
|   |                               |                               |                               |
| MIXTURE CHARACTERISTICS (Based on proportioning data)   |                               |                               |                               |
| Initial Slump = _____ in.   |                               | Final Slump _____ in.         |                               |
| Unit Wet Wt.= _____ pcf.  |                               | Unit Dry Wt. = _____ pcf.     |                               |
| Air Content = _____ %   |                               |                               |                               |

# **CONCRETE MIXTURE PROPORTIONS SUBMITTAL FORM**

Mixture #  
Project Name:

|   |                                   |  |
|---|-----------------------------------|--|
| <u>X. OTHER REQUIRED TESTS</u>                        |                                   |  |
| Water Soluble Chloride Ion Content of mix:            | _____ % (by weight of cement)     | ASTM C 1218  |
| Hardened Air Content (per ASTM C457):                 |                                   |  |
| Air content: _____ %                                  | Air void spacing Factor _____ in. | Specific surface: _____ in <sup>2</sup> /in <sup>3</sup> |
| Chloride Ion Content of Concrete Mixture: ASTM C 1218 |                                   |  |
| Shrinkage (Length Change, Average) per ASTM C157:     |                                   |  |
| _____ % @ 4 days                                      | _____ % @ 7 days                  | _____ % @ 14 days  |
| _____ % @ 21 days                                     | _____ % @ 28 days                 |  |

|                     |
|---------------------|
| <u>XI. Remarks:</u> |
|                     |
|                     |
|                     |

|   |
|---|
| Ready Mix Concrete Supplier Information |
| Name:                                   |
| Address:                                |
|   |
| Phone Number:                           |
| Date:                                   |
| Main Plant Location:                    |
| Miles from Project Site:                |
| Secondary or Backup Plant Location:     |
| Miles from Project Site:                |

My signature below certifies that I have read, understood, and will comply with the requirements of this Section.

Signature \_\_\_\_\_

Typed or Printed Name

**CONCRETE MIXTURE PROPORTIONS SUBMITTAL FORM**

**Mixture #**  
**Project Name:**

| REQUIRED ATTACHMENTS |  |
|----------------------|--|
|                      | Coarse aggregate grading report  |
|                      | Fine aggregate grading report  |
|                      | Concrete compressive strength data used for calculation of required average strength and for calculation of standard deviation     |
|                      | Chloride ion data and related calculations   |
|                      | Admixture compatibility certification letter   |
|                      | Shrinkage information per ASTM C157  |
|                      | ASTM C 457   |
|                      | Alkali Content Data and Calculations<br>OR<br>ASTM C1293, ASTM C1260, ASTM C 1567 or CE CRD-C662 Test report<br>for each aggregate |

**SECTION 03 41 00  
PRECAST STRUCTURAL CONCRETE****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. This Section includes plant-precast structural concrete units, including the following:
  - 1. Precast structural concrete units
  - 2. Solid slab units.
  - 3. Long-span units.
  - 4. Structural framing units
  - 5. Precast structural concrete with architectural finishes.
- B. Related Sections include the following:
  - 1. Division 03 Section "Cast-in-Place Concrete."
  - 2. Division 07 Section "Concrete Joint Sealants."
  - 3. Division 07 Section "Traffic Coatings."
  - 4. Division 07 Section "Traffic Bearing Water Repellents."
  - 5. Division 07 Section "Expansion Joint Assemblies."

**1.3 SYSTEM DESCRIPTION**

- A. System described here is intended to perform in ACI 362.1R-97 zone III environment without long-term corrosion or other distress. If maintained per manufacturer's recommendations, system is expected to function satisfactorily for 40 years.
- B. Drawings show precast member sizes assumed and used as basis for Architectural Drawings and Details and foundation design. Alternate member sizes will be accepted only if structurally required and if of no significant effect on foundations or architecture.
- C. Design structural reinforcement required to resist handling and erection stresses.
- D. See Drawings for:
  - 1. Precast concrete member load requirements.
  - 2. Minimum entrained air.
  - 3. Minimum compressive strength.
  - 4. Maximum water cementitious materials ratio.

- E. **All** precast concrete pieces require design by precast concrete manufacturer, unless noted otherwise on Drawings.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated, per Section "Cast-in-Place Concrete."
- B. Concrete Mixture Proportions: Submit concrete mixture proportions for each concrete mixture in accordance with Section "Cast-In-Place Concrete."
- C. Shop Drawings: Detail fabrication and installation of precast structural concrete units. Indicate member locations, plans, elevations, dimensions, shapes, cross sections, openings, and types of reinforcement, including special reinforcement.
1. Indicate welded connections by AWS standard symbols. Detail loose and cast-in hardware, inserts, connections, and joints, including accessories.
  2. Indicate locations and details of anchorage devices to be embedded in other construction.
  3. Instead of submitting shop drawings for all piece marks, precaster shall submit shop drawings for typical pieces only along with reinforcing detail drawing for corresponding calculations.
  4. Comprehensive engineering analysis signed and sealed by the qualified professional engineer responsible for its preparation.
    - a. Include calculated fire-resistance analysis.
    - b. Include a summary of the design criteria.
    - c. Where used in design of double tees, submit current test results substantiating that minimum shear reinforcing per ACI 318-08, Section 11.4.6.2 is permitted to be waived. (This testing does not waive the minimum stem reinforcing specified for this project in specification article "Performance Requirements").
  5. Provide engineering analysis summary for the precast concrete structural loading that is applied to the foundations:
    - a. Locate and identify all loads that the precast concrete applies to the foundation system. Include vertical and lateral load reactions and graphically key the reactions to the plan and elevation drawings for engineer's use in verifying foundation design criteria.
    - b. Schedule the submittal of precast concrete structural loading reactions on the General Contractor's project schedule.
    - c. Changes to the foundation loading or reinforcing shown on the drawings, if any, shall be considered an alternate and shall be in accordance with Article 1.10 "Alternates".
    - d. Changes to the foundation loading not identified as alternates, shall be the responsibility of the contractor. Changes to the foundation reinforcing or embeds shall be the responsibility of the Contractor. Costs from changes that

result in redesign, repair or construction changes shall be borne by the Contractor.

- D. Repair/Alteration documents: After submission of shop drawings any repairs, alterations or modifications shall be submitted by the precaster for review. All repair/alteration documents shall bear the seal and signature of qualified registered professional Engineer licensed to perform work in Missouri.
- E. Samples: For each type of finish indicated on exposed surfaces of precast structural concrete units, in sets of 3, illustrating quality of finishes, colors, and textures; approximately 12 by 12 by 2 inches.
- F. Samples of bearing pads.
- G. Welding Certificates: Copies of certificates for welding procedures and personnel.
- H. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of engineer/architects and owners, and other information specified.
- I. Material Certificates: Signed by Manufacturer that each of the following items conforms to requirements.
  - 1. Concrete materials.
  - 2. Reinforcing materials and prestressing tendons.
  - 3. Admixtures.
  - 4. Bearing pads.
- J. Post-Tensioning System (if used) Product Data and Testing: For each product as indicated.
  - 1. Corrosion Inhibiting Coating: Type and chemical analysis.
  - 2. Sheathing: Type, material, density and thickness.
  - 3. Anchorage Device: Type, material and size.
  - 4. Coupler Device: Type, material and size.
  - 5. Pocket Former: Type, material and size.
  - 6. Sheathing Repair Tape: Type, material and width.
  - 7. Encapsulation System: Type and materials.
  - 8. Mill test reports for each coil or pack of strand used on Project.
  - 9. Stressing Records: Same day as stressing operation.
  - 10. Test and Evaluation Reports: Indicating compliance with the following requirements:
    - a. Tests required by ACI 301, Section "Post-Tensioned Concrete."
    - b. Hydrostatic tests required by ACI 423.7 for "Anchorage and couplers in aggressive environments."
    - c. Relaxation loss tests required by ACI 423.7 for low relaxation prestressing steel.

- K. Proof of certification of precast concrete supplier's plant under Prestressed Concrete Institute plant certification program and by International Building Code (IBC) before award of contract.
- L. Letter of Qualification, furnished by Precast/Prestressed Concrete Institute confirming that erector is fully qualified in Structure Category S2.
- M. Proof of precast erector qualification under PCI Certified Erector Program.
- N. Proof of precaster erector's superintendent's qualification as Certified Field Auditor.
- O. Submittals and Resubmittals: Engineer will review each of Contractor's shop drawings and/or submittal data the initial time and, should resubmittal be required, one additional time to verify that reasons for resubmittal have been addressed by Contractor and corrections made. Resubmittal changes/revisions/corrections shall be circled. Engineer will review only circled items and will not be responsible for non-circled changes/revisions/corrections and additions. Should additional resubmittals be required, Contractor shall reimburse Owner for all costs incurred, including the cost of Engineer's services made necessary to review such additional resubmittals. Owner will in turn reimburse Engineer.
- P. Sample Panel: Architectural precast concrete fabricator shall make three-ft square samples for finish selection only. If rejected, another set of samples shall be made for review, until acceptable sample is made. After acceptance of finish sample, architectural precast concrete fabricator shall make one full height by 6 ft wide sample panel of each exterior spandrel, designated "architectural precast concrete" on Drawings. Sample panels will be reviewed at precast plant by Engineer/Architect. If rejected, another set of sample panels shall be made for review, until acceptable samples are made. If accepted, sample panels shall be held at plant until production is complete, then shipped to site and held there until completion and acceptance of Project, when Contractor shall remove it from site.
- Q. Samples for each thin brick unit required, including special shapes, showing the full range of colors, textures, and dimensions expected.
  - 1. Grout Samples for Initial Selection: Color charts consisting of actual sections of grout showing the manufacturer's full range of colors.

#### **1.5 PERFORMANCE REQUIREMENTS**

- A. Parking structure contract drawings are based on performance type design for precast superstructure. An integral part of this project is preparation of final design drawings. Design calculations and shop drawings as required in accordance with this Section, and specifications necessary for fabrication and construction of all

precast concrete pieces and required accessories in accordance with all code and engineering requirements.

- B. Design Drawings and Specifications: Precast supplier shall employ qualified registered professional Engineer/Architect, licensed in Missouri to perform such design and acceptable to Engineer/Architect. Such design shall meet criteria established in these documents. This professional (hereinafter referred to as Designer) shall prepare and seal final structural design drawings, design calculations, shop drawings, and specifications (hereinafter referred to as Design Documents) submitted to Engineer/Architect for review. Designer shall be responsible for structural design for Project and will be required to submit design calculations and shop drawings to Engineer/Architect for review prior to any fabrication and construction for Project. For those pieces for which Designer has design responsibility, Designer shall also prepare and seal drawings and calculations for submittal to proper governing authorities as required.
- C. Submission of Final Design Documents: Precast supplier shall submit final Design Documents to Engineer/Architect for review in ample time to allow such review before proceeding with any fabrication or construction. These Design Documents, prepared and sealed by Designer, may be submitted in "stages" to allow for phased construction. These Design Documents shall be completed in every detail necessary for fabrication and construction of Project, complying with design intent and requirements of Contract Documents. See Division 01 Section "Submittals" for Shop Drawings. These shop drawings shall neither be prepared nor be submitted to Engineer/Architect for review until after design drawings, design calculations, and specifications have been accepted by Engineer/Architect. Upon review, Engineer/Architect's written remark "No Exception Taken" shall mean that item, design drawings, calculation, or specification has been accepted for the design intent.
- D. Designer's Insurance and Certificate: Designer will be required to furnish Owner a Certificate of Professional Liability Insurance in minimum amount of \$2,000,000 per claim. All Design Documents prepared by Designer shall be certified (bear seal and signature of Designer registered in Missouri before they are submitted for review).
- E. Minimum Durability Design Requirements:
1. Double tee flange connectors and anchorages: Stainless steel alloy A304 or alloy 201-LN.
  2. Galvanize entire assembly of all connection hardware and end bearing plate assemblies (excluding double tee flange connectors). Touch up galvanizing with Z.R.C. and epoxy coating with epoxy coating patching material after field welds are made.
    - a. Take all necessary precautions to prevent embrittlement of hot-dip galvanized assemblies. (Refer to ASTM A143 and A767).



3. Provide extra reinforcing around all openings, including door openings: 2 #5 bars all 4 sides of each opening and extend 2 ft beyond corners or opening. Add 2 #5 bars 4 ft long as diagonal bars at each corner.
4. Coil Rods: Provide 0.75 in. diameter by 2 ft 6 in. minimum coil rods and inserts at following locations as minimum unless other method(s) accepted in writing by Engineer:
  - a. Typical Exterior Columns: Minimum of 2 per column into topping pour, 1 in each column face parallel to spandrel.
  - b. Corner Columns: Minimum of 2 per column into topping pour, 1 in. each interior column face.
  - c. Exterior Spandrels: Minimum of 1 at each double tee stem in load bearing spandrels and minimum of 1 every 4 ft on center for non-loading bearing spandrels into topping pour.
  - d. "Shear Wall": Minimum of 1 at each double tee stem into topping pour.
5. Diaphragm Reinforcing: Cast-in-place concrete topping contractor to provide minimum of 3 #4 continuous epoxy coated bars at perimeter of all floor diaphragms cast into topping pour unless alternate reinforcing shown on Drawing.

F. General Design Criteria:

1. Unless noted otherwise, all design shall be in accordance with governing codes, standards and references listed in Drawing General Notes and in this Section.
2. Maximum self-weights (using normal weight concrete for all pieces) and minimum concrete strengths shall be per sections shown, Drawing General Notes and as noted herein.
3. Pieces shall be designed considering all vertical loads, lateral loads due to wind, seismic, temperature differentials, shrinkage, shortening, and effects due to prestressing.
4. All precast surfaces to receive cast-in-place concrete topping shall be rough to allow proper bond per ACI 318, Section 17.5.
5. All pieces shall have fire ratings as specified in Drawing General Notes.
6. Ultimate design capacity of inserts, coil rods, and coil bolts in tension shall not be greater than 90% of yield capacity of weakest piece.
7. Minimum concrete cover of reinforcement, prestressing strands, etc. shall be based on ACI 318, Sections 7.7.3 a. Concrete cover at top of members shall be 1-1/2 inches consistent with ACI-362.1R-97(02), "Guide For The Design Of Durable Parking Structures
8. Water/cement ratio for all pieces shall be  $\leq 0.40$ .
9. See heading "Precast System Design Criteria" for additional piece design criteria.

G. Precast System Design Criteria:

1. Double Tees:

- a. Design shall include type, number, and location of strands, flange reinforcement, shear reinforcement, cast-in-place concrete topping reinforcement, end bearing plate and confinement reinforcement. Prestress in accordance with provisions of this Specification and referenced standards, codes, etc. Entire assembly of end bearing plates shall be hot dipped galvanized.
  - b. Design flanges to support design dead load and either uniform (design) live load or 3000 lb concentrated wheel live load acting on area  $4 \frac{1}{2}" \times 4 \frac{1}{2}"$  (located to produce maximum stress condition), whichever provides greater stresses.
  - c. Where permitted by Governing Code, live loads may be reduced. Double tees may be designed as Class U or Class T according to ACI 318, Sections 18.3 and 18.4.
  - d. Live load deflections shall meet requirements of ACI 318 Table 9.5 (b). Total dead load plus live load deflection, including long term effects, shall not adversely affect drainage.
  - e. As determined by project conditions, design as "restrained" or "unrestrained" pieces for purposes of fire rating requirements. Use ASTM E119, Appendix X3 and Table X3.1 to determine restraint conditions. Minimum cover of reinforcement, prestressing strands, etc., and other fire rating design criteria shall be based on this premise.
  - f. Surface to receive topping shall be rough to allow proper bond per ACI 318, Section 17.5
  - g. Flange connections shall be stainless steel alloy A304 or 201-LN "Vector Connector" by JVI, Inc., or accepted equal.
  - h. Shear reinforcement consisting of stem mesh shall be provided 5'-0" minimum in each stem at each end but not less than required by design.
2. Beams: Exterior and Interior "L" (or with button haunches), Inverted Tee, Exterior and Interior Pocketed, and Spandrel (Non-Load Bearing):
- a. Design shall include type, number, and location of longitudinal reinforcement, shear and torsion reinforcement, end bearing plates and confinement reinforcement, connection requirements, and ledge reinforcement. Ledge reinforcement shall be designed per PCI Design Handbook, current Edition, Section 4.5. Continuity shall be maintained between both faces of reinforcement at ends of pieces. Inverted tee beams and L-beams may be designed as composite sections, but overhanging flanges shall not be considered as part of the effective section, except in fully topped precast design.
  - b. Bumper loads shall be as noted in Drawing General Notes.
  - c. Where permitted by Governing Code, live loads may be reduced. Prestressed beams may be designed as Class U or Class T according to ACI 318, Sections 18.3 and 18.4 except beams exposed to weather, such as spandrel beams, shall be designed as Class U.
  - d. Live load deflections shall meet requirements of ACI 318 Table 9.5 (b). Total dead load plus live load deflection, including long term effects, shall not adversely affect drainage.

- e. Torsion design shall be per PCI Design Handbook, current Edition, Section 4.4 and ACI 318.
- f. Skew ends of beams as required for sloping bays.
- g. Prestress all pocketed beams.
- h. Pocketed beams shall be 9 in. thick, minimum, with not less than 3 in. concrete thickness behind the pocket, unless beam exterior will receive a permanent coating that can conceal potential "shadow" at pocket. No reduction of 3 in. thickness permitted. If reveals are behind pockets, thicken beam to maintain 3 in. thickness.
- i. Pocket dimensions in pocketed beams: Width: (double tee stem width +4 in.), minimum. Depth  $\leq$  (double tee stem depth + 2 in.).

3. Columns:

- a. Design shall include number and location of vertical reinforcement, vertical reinforcement splices, shear reinforcement, concrete haunch design, including bearing plates and anchor bolts at foundation. Where pieces are prestressed, minimum ties shall be provided per ACI 318, Section 7.10.5, not Chapter 18.
- b. Pockets shall be sloped as required for beam bearings.
- c. All columns shall be continuous full height. Splice locations, if required, shall be acceptable to Engineer/Architect.

4. Connections:

- a. Connections shown on Contract Drawings are minimum and are intended to establish standard of performance. Engineer/Architect reserves right to accept or reject alternate details. Design as necessary to transfer gravity loads, lateral loads, torsion forces and forces due to volume change effects. Design shall meet or exceed PCI recommendations.
- b. Use minimum additional load factor of 1.2 for design of **all** superstructure connections. Connections are any elements that mechanically tie separate members together. Column haunches, beam and tee end bearing plates, etc. are considered part of member design and not subject to the additional load factor. Restraint developed by friction between bearing pads and connection pieces shall not be considered to contribute to connection. Positive connections shall be made by welds, bolts, or cast-in-place reinforcement. Design in accordance with "PCI Design Handbook - Precast Prestressed Concrete," Seventh Edition.
- c. Bearing pads shall be provided by precast subcontractor as shown on Contract Drawings. Refer to Part 2 Article "Bearing Pads" for additional information.
- d. Beam to column bearing pads shall not extend under beam ledge unless ledge is designed for bearing or recessed to prevent bearing.
- e. Design column and wall base plates and shims so that base plate grouting is not needed prior to erection of pieces supported by column or wall.

- f. Provide continuous reinforcing bars, as shown on the drawings or two #4 bars minimum, immediately above and below inserts resisting bumper loading.

#### 1.6 QUALITY ASSURANCE

- A. "Engineer/Architect" in this Section is defined as Structural Engineer/Architect of Record.
- B. Installer (Erector) Qualifications: Precast concrete erector shall be fully qualified in Structure Category S2 by Precast/Prestressed Concrete Institute prior to beginning work.
- C. Fabricator Qualifications: A firm that complies with the following requirements and is experienced in manufacturing precast structural concrete units similar to those indicated for this Project and with a record of successful in-service performance.
  - 1. Contractor assumes responsibility for engineering precast structural concrete units to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
  - 2. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in Missouri and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of precast structural concrete that are similar to those indicated for this Project in material, design, and extent.
  - 3. Participates in PCI's Plant Certification program and is designated a PCI-certified plant for Group C, Commercial (Structural) - Category C3 or C4.
  - 4. Participates in PCI's Plant Certification program and is designated a PCI-certified plant for Group CA, Commercial Products with an Architectural Finish - Category CA3 or CA4.
  - 5. Has sufficient production capacity to produce required units without delaying the Work.
- D. Design Standards: Comply with ACI 318 and the design recommendations of PCI MNL 120, "PCI Design Handbook--Precast and Prestressed Concrete."
- E. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and camber and dimensional tolerances for types of units required, comply with PCI MNL 116, "Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products."
  - 1. Element tolerances and erection tolerances shall comply with PCI MNL 135-00 "Tolerances for Precast Prestressed Concrete Construction".
  - 2. The Precast Concrete fabricator shall identify and coordinate specific project tolerance requirements and interfacing

- tolerances associated with other materials or systems which interface with the precast.
3. Elemental and erection tolerances for Group CA - Commercial Products with an Architectural Finish shall comply with PCI MNL 135-00 "Tolerances for Precast Prestressed Concrete Construction".
- F. Product Options: Drawings indicate size, profiles, and dimensional requirements of precast concrete units and are based on the specific types of units indicated. Other fabricators' precast concrete units complying with requirements may be considered. Refer to Division 01 Section "Product Substitutions Procedures."
- G. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel"; and AWS D1.4, "Structural Welding Code--Reinforcing Steel."
- H. Calculated Fire Resistance: Where fire-rated units or assemblies are indicated, calculate fire resistance according to PCI MNL 124, "Design for Fire Resistance of Precast Prestressed Concrete" and in a manner acceptable to authorities having jurisdiction.
- I. Mockups: Before installing precast structural concrete units, build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Manufacture mockups to comply with the following requirements, using materials indicated for the completed Work:
1. Manufacture mockups in the location and of the size indicated or, if not indicated, as directed by Engineer/Architect.
  2. Sample Panel: Precast concrete fabricator shall make 3-ft sq. samples for finish selection only. If rejected, another set of samples shall be made for review, until acceptable sample is made. After acceptance of finish sample, precast concrete fabricator shall make 2 full height by 6 ft wide sample panels of exterior beam(s) designated "architectural precast concrete" on Drawings. Sample panel will be reviewed at precast plant by Engineer/Architect. If rejected, another set of sample panels shall be made for review, until acceptable sample is made. If accepted, sample panel shall be held at plant until production is complete, then shipped to site (if required) and held there until completion and acceptance of project, when Contractor shall remove it from site.
  3. Notify Engineer/Architect seven days in advance of dates and times when mockups will be constructed.
  4. Obtain Engineer/Architect's approval of mockups before starting fabrication.
  5. At precaster's plant, maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
  6. Demolish and remove mockups when directed.
- J. Concrete Testing:

1. Perform and pay for compression tests for all precast concrete work with in-house Quality Control personnel. Testing is subject to observation by Testing Agency hired by Contractor at the direction of the Owner. Use certificated test equipment. Unless otherwise specified, conform with PCI MNL 116.
  2. Precast Structural Concrete Testing: Sample, test and report concrete in accordance with PCI MNL 116, with following exceptions:
    - a. Testing of concrete PCI MNL 116 section 6.2 shall comply with requirements of ACI 318 - 2008, Chapter 5 - Concrete Quality, Mixing and Placing.
    - b. Required concrete testing shall be performed by qualified technicians. Technicians in charge of sampling concrete; testing for slump, unit weight, yield, air content, temperature; and making and curing test specimens shall be certified in accordance with the requirements of ACI Concrete Field Testing Technician-Grade 1 Certification Program, or the requirements of ASTM C 1077; or an equivalent program.
    - c. Precast supplier shall conduct production testing and monitor testing reports and records to ensure consistency with suppliers reported data and compliance with project requirements.
    - d. Precast supplier shall identify non-compliant testing and non-compliant testing reports shall be promptly distributed to the Resident Engineer, Engineer, registered design professional responsible for the design, contractor, and appropriate subcontractors, appropriate suppliers.
      - 1) Distribute reports to allow timely identification of either compliance or the need for corrective action.
      - 2) Evaluation and acceptance of concrete shall comply with ACI 318 - 08 section 5.6.
      - 3) Evaluation and acceptance of non-compliant tests for concrete entrained air content below specified limit will be accepted if one of following conditions are met:
        - a) ASTM C 457: Three concrete specimens tested in accordance with ASTM C 457 meet the following hardened air void parameters: air void spacing factor of 0.0080 in. maximum and specific surface (surface area of air voids) shall be 600 in<sup>2</sup> per cu in. of air-void volume, or greater.
        - b) ASTM C 457: Three concrete specimens tested shall meet air void parameters of approved concrete mixture submittal from Part 1.
        - c) ASTM C 666, Test Procedure A: Test three concrete specimens removed from structure. Concrete specimens tested shall have durability characteristics similar to that reported in approved concrete mixture submittal from Part 1.
- K. Precaster shall provide casting schedule to Engineer/Architect with first shop drawings submittal. Precaster shall notify Engineer/Architect 48 hours in advance of casting of each piece type (tees, L-beams, spandrel beams, inverted tee beams, columns, wall panels, or other pieces) so that Engineer/Architect may review

reinforcement fabrication at precaster's plant before casting. Engineer/Architect may request notification for specific piece marks.

- L. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

## 1.7 REFERENCES

- A. American Association of State Highway and Transportation Officials (AAASHTO):

- 1. AASHTO M251, "Plain and Laminated Elastomeric Bridge Bearings."

- B. American Concrete Institute (ACI):

- 1. ACI 301, "Standard Specifications for Structural Concrete."
  - 2. ACI 305R, "Hot Weather Concreting" Recommendations, not specifications.
  - 3. ACI 306.1, "Standard Specifications for Cold Weather Concreting."
  - 4. ACI 318, "Building Code Requirements for Structural Concrete."
  - 5. ACI 362.1R-97, "Guide for the Design of Durable Parking Structures." Recommendations, not specifications.

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

- 1. ASTM A36, "Specification for Structural Steel."
  - 2. ASTM A108, "Standard Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality."
  - 3. ASTM A123, "Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products."
  - 4. ASTM A143, "Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement." (Annual Book of ASTM Standards, Vol. 01.06).
  - 5. ASTM A164, "Specification for Electrodeposited Coatings of Zinc on Steel."
  - 6. ASTM A167, "Specification for Stainless and Heat Resistant Chromium Nickel Steel Plate, Sheets, and Strips (A304)."
  - 7. ASTM A184 "Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement."
  - 8. ASTM A185, "Specification for Welded Deformed Steel Wire Fabric for Concrete Reinforcement."
  - 9. ASTM A276, "Standard Specification for Stainless Steel Bars and Shapes."
  - 10. ASTM A307, "Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength."
  - 11. ASTM A386, "Specification for Zinc Coating (Hot-Dip) on Assembled Steel Products."
  - 12. ASTM A416, "Specification for Uncoated Seven-Wire Stress-Relieved Steel Strand for Prestressed Concrete."
  - 13. ASTM A480, "Standard Specification for Stainless Steel - General Requirements."

14. ASTM A496, "Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement."
15. ASTM A497, "Specification for Welded Deformed Steel Wire Fabric for Concrete Reinforcement."
16. ASTM A500, "Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing Rounds and Shapes."
17. ASTM A615, "Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement."
18. ASTM A666, "Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar."
19. ASTM A706, "Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement."
20. ASTM A767, "Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement."
21. ASTM A775, "Specification for Epoxy-Coated Reinforcing Steel Bars."
22. ASTM A884, "Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement for Reinforcement."
23. ASTM A934, "Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars."
24. ASTM B633, "Specification for Electrodeposited Coatings of Zinc on Iron and Steel."
25. ASTM C42, "Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete."
26. ASTM C144, "Standard Specification for Aggregate for Masonry Mortar."
27. ASTM C150, "Specification for Portland Cement."
28. ASTM C173, "Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method."
29. ASTM C231, "Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method."
30. ASTM C265, "Standard Test Method for Calcium Sulfate in Hydrated Portland Cement Mortar."
31. ASTM C457, "Practice for Microscopical Determination of Air-Void Content and Parameters of the Air-Void System in Hardened Concrete."
32. ASTM C881, "Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete."
33. ASTM C1107, "Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)."
34. ASTM D412, "Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension."
35. ASTM E119, "Standard Test Methods for Fire Tests of Building Construction and Materials."
36. ASTM F593, "Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs."
37. ASTM F1554-07a Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength
38. ASTM F1637 02 Standard Practice for Safe Walking Surfaces.

D. American Welding Society (AWS):

1. AWS D1.1, "Structural Welding Code-Steel."
2. AWS D1.4, "Structural Welding Code-Reinforcing Steel."
3. AWS D19.0, "Welding Zinc-Coated Steel."



4. AWS C2.2, "Recommended Practices for Metallizing with Aluminum and Zinc for Protection of Iron and Steel."
- E. Concrete Reinforcing Steel Institute (CRSI):
  1. CRSI MSP, "Manual of Standard Practice."
- F. Prestressed Concrete Institute (PCI):
  1. PCI MNL 116, "Manual for Quality Control from Plants and Production of Precast Prestressed Concrete Products."
  2. PCI MNL 120, "Design Handbook Precast Prestressed Concrete." Recommendations, not specifications.
  3. PCI MNL 129, "Parking Structures - Recommended Practice for Design and Construction." Recommendations, not specifications.
  4. PCI MNL 135, "Tolerance Manual for Precast and Prestressed Concrete Construction."

#### **1.8 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver precast structural concrete units to Project site in such quantities and at such times to ensure continuity of installation. Store units at Project site to prevent cracking, distorting, warping, staining, or other physical damage, and so markings are visible.
- B. Lift and support units only at designated lifting and supporting points as shown on Shop Drawings.

#### **1.9 SEQUENCING**

- A. Furnish anchorage items to be embedded in other construction without delaying the Work. Provide setting diagrams, templates, instructions, and directions, as required, for installation.
- B. Contractor shall coordinate manufacturing, delivery and erection schedules.
- C. Allow adequate time for curing of precast pieces prior to erection as required by Part 3.

#### **1.10 ALTERNATIVES**

- A. Alternate structural systems, if proposed, shall conform in basic concept to drawings as detailed. Structure shall be totally precast. Column sizes and locations shall remain as shown, and all clearances shall be provided as shown on Drawings. See heading "Performance Requirements" for additional requirements.
- B. Precast contractor shall be required to employ or have on staff qualified professional, legally licensed structural Engineer/Architect in Missouri (referred to as Designer), to perform design of any alternates to Engineer/Architect's design of precast superstructure.

Designer will be requested to submit calculations for such alternate to Engineer/Architect's design to Engineer/Architect for review before any fabrication and construction for Project. Designer shall also prepare and seal drawings and calculations for pieces for which it has design responsibility, for submittal to proper governing authorities as required. See heading "Performance Requirements" for further requirements.

- C. All drawings (including Shop Drawings and other drawings), calculations and specifications prepared by Designer shall bear seal and signature of Designer before submittal for review. See heading "Performance Requirements" for further requirements.
- D. Drawings showing construction details for any alternate must be submitted with Bid to Engineer/Architect for review before alternates will be considered. At time of bidding, submittals shall include sufficient detail to show all deviations from Contract Documents and shall include listing of all deviations and add or deduct cost associated with each change.
- E. Cost to Owner for engineering and computer fees and any increased construction cost resulting from need to review and accommodate in finished Work such precast superstructure alternates shall be borne by Contractor.

#### **1.11 CONSTRUCTION WARRANTY**

- A. Construction Warranty: Installer shall warranty their installation of Precast Structural Concrete for a period of one (1) year from date of installation and final acceptance by the Government in accordance with the FAR clause 52.246-21, "Warranty of Construction."

#### **1.12 PRODUCT WARRANTY**

- A. Provide warranty similar to sample below.
- B. Sample:
  - 1. Manufacturer warrants that all materials furnished have been manufactured in accordance with the specifications for this project. Manufacturer further warrants that if erection of said material is to be performed by those subject to his control and direction, work will be completed in accordance with the same specifications.
  - 2. In no event shall manufacturer be held responsible for any damages, liability or costs of any kind or nature occasioned by or arising out of the actions or omissions of others, or for work, including design, done by others; or for material manufactured, supplied or installed by others; or for inadequate construction of foundations, bearing walls, or other units to which materials furnished by the precast manufacturer are attached or affixed.

3. Period of this warranty shall be 5 years beginning at date of beneficial occupancy and final acceptance by the Government. Should any defect [other than hairline cracks: defined as not more than 0.006 in. wide] be discovered after acceptance and occupancy of Project, which can be directly attributed to defect in product material or workmanship not evident at time of initial occupancy, then precast manufacturer shall, upon written notice, correct defects or replace products without expense to Owner, Engineer/Architect or General Contractor. In sole judgment of Engineer/Architect, any defects resulting from issues outlined in paragraph above, or resulting from normal wear and tear, product color changes or improper maintenance procedures are not considered responsibility of precast manufacturer.

#### **1.13 PRECASTER REPAIR WARRANTY**

- A. Manufacturer to furnish Owner with written total responsibility guarantee that repairs will be free of defects, water penetration and deterioration related to repair design, workmanship or material deficiency.
- B. Warranty period shall be 5 years commencing with date of acceptance of repair by the Government.
- C. Perform any repair under this warranty at no cost to Owner.
- D. Before construction, provide Engineer/Architect with sample of final warranty. Guarantee shall be provided by precaster.

### **PART 2 - PRODUCTS**

#### **2.1 FABRICATORS**

- A. Fabricators: Subject to compliance with requirements, provide products by one of the following:
  1. St. Louis Prestress, Inc.
  2. Coreslab Structures.
  3. Prestressed Casting Co.

#### **2.2 MOLD MATERIALS**

- A. Molds: Provide molds and, where required, form-facing materials of metal, plastic, wood, or another material that is non-reactive with concrete and dimensionally stable to produce continuous and true precast concrete surfaces within fabrication tolerances and suitable for required finishes.
- B. Connection Blockouts, Covers, Sleeves, Caps:

1. Acceptable manufacturer: High Concrete Accessories, Denver, PA 17517, (800) 508-2583
  2. Products:
    - a. "Grouted Connection Tube."
    - b. "Swift-Lift Cover."
    - c. "Double Tee Stem Blockout."
    - d. "Spandrel to Column Connector Sleeve and Closure Cap."
  3. Substitutions: None.
- C. Form Liner for application to Spandrel Panels (reference architectural drawings):
1. Provide form liner meeting the following requirements:
    - a. Fluted Rib design.
    - b. Part size: 6 inch coverage, length up to 40 feet.
    - c. Maximum depth: 0.5 inch.
    - d. On Center: 1.5 inch.
    - e. Peak: 0.5 inch.
    - f. Valley: 0.5 inch.
    - g. Draft: 0.25 inch.
  2. Submit the following in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
    - a. Sample panel: Submit a 24 inch x 24 inch sample of the form liner pattern.
    - b. Shop drawings: Plan, elevation, and detail showing overall pattern, joint locations, form tie locations, end locations, and other special conditions.
    - c. Samples: Form ties, samples, and description, showing method of break-back when forms are removed.
  3. Mockup: Build on site 30 days prior to commencing work, using same materials, methods and work force that will be used for the project. Mockup may be incorporated as part of the project with prior approval from the owner/architect.
    - a. Size: 16 sq. ft. or larger if needed to adequately illustrate the pattern and texture selected.
    - b. Include an area to demonstrate form liner butt joint and, if appropriate, continuation of pattern through construction joint.

### 2.3 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
- B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706, deformed.
- C. Epoxy-Coated Reinforcing Bars: ASTM A 775 or ASTM A 934, as follows:

1. Steel Reinforcement: ASTM A 615 or ASTM A 706, deformed.
- D. Hot-Dip Galvanized Reinforcing Bars (used in connection hardware and end bearing plate assemblies): ASTM A767.
- E. Steel Bar Mats: ASTM A 184, assembled with clips, as follows:
  1. Steel Reinforcement: ASTM A 615 Grade 60 or ASTM A 706 deformed bars.
- F. Epoxy-Coated-Steel Welded Wire Reinforcement (ECWWR): ASTM A 884, Class A coated, plain.
- G. Plain-Steel Welded Wire Reinforcement (WWR): ASTM A 185, fabricated from as-drawn steel wire into flat sheets.
- H. Structural Synthetic Fiber may be used in addition to WWR to provide resistance against cracking due to impact, temperature, and shrinkage; Fiber dosage designated herein.
- I. Supports: Manufacturer's bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to CRSI's "Manual of Standard Practice," PCI MNL 116, and as follows:
  1. For uncoated reinforcement, use CRSI Class 1 plastic-protected bar supports.
  2. For epoxy-coated reinforcement, use CRSI Class 1A epoxy-coated or other dielectric-polymer-coated wire bar supports.

## **2.4 PRESTRESSING TENDONS**

- A. Prestressing Strand: ASTM A 416, Grade 270, uncoated, 7-wire, low-relaxation strand, manufactured in USA.

## **2.5 POST-TENSIONING SYSTEM**

- A. Prestressing Strand: ASTM A416, Grade 270, uncoated, seven-wire, low-relaxation strand with minimum ultimate strength of 270 ksi.
  1. Manufactured by a single source.
  2. Strands manufactured outside United States subject to Engineer/Architect's approval based on evidence of satisfactory performance in the United States during the previous 5 years.
  3. Use of high stress bar system instead of strand system is not permitted unless accepted in writing by the Engineer.
  4. Conform to ACI 423.7 for relaxation loss requirements.
- B. Tendon Sheathing: Seamless and extruded high density polypropylene or seamless and extruded high density polyethylene with a specific gravity greater than 0.95 conforming to ACI 423.7.

1. Sufficient strength to withstand damage during fabrication, transport, installation, concrete placement and stressing.
  2. Minimum thickness of 50 mils (-0 mils +15 mils)
  3. Minimum inside diameter 0.03 inches greater than maximum strand diameter.
  4. Chemically stable without becoming brittle or softening over anticipated temperature range and service life of structure.
  5. Non-reactive with concrete, steel and corrosion inhibiting coating.
  6. Contrasting color of corrosion inhibiting coating to enhance visibility of damage. Black/dark colored sheathing is not acceptable.
  7. Annular space between sheathing and strand completely filled with corrosion inhibiting coating.
  8. Watertight including all connections and components over entire length.
- C. Tendon Anchor: Non-porous casting free of sand, blow holes, voids and other defects meeting the testing and material requirements of ACI 423.7.
1. Plastic coated bearing plates sized in accordance with ACI 423.7, unless certified test reports substantiate comparable or superior performance, for transfer at minimum stressing concrete strength.
  2. Capable of complying with PTI Guide Specification requirements for aggressive environments.
  3. Capable of developing at least 95% of the actual ultimate strength of tendon.
  4. Minimum wedge cavity opening of at least 0.19 inches larger than tendon diameter. Reaming of anchor wedge cavity is not permitted.
  5. Wedges capable of precluding failure of tendon due to notching or pinching effects during static and fatigue load tests stipulated in ACI 423.7.
  6. Provisions for a plastic cap which fits tightly and seals barrel end on stressing side of anchor.
  7. Provisions for a plastic sleeve which prevents moisture infiltration into anchor casting or tendon sheathing on bearing side of anchor.
- D. Coupler Assembly: Assembly of strands and wedges meeting the testing and material requirements of ACI 301.
1. Capable of complying with PTI Guide Specification requirements for aggressive environments.
  2. Capable of developing at least 95 percent of the ultimate strength of tendon.
  3. Wedges capable of precluding failure of tendon due to notching or pinching effects during static and fatigue load tests stipulated in ACI 423.7.
- E. Encapsulation System: Watertight encapsulation along the entire length of tendon, including anchorages and couplers, when subjected to hydrostatic testing required in ACI 423.7 for aggressive environments.

1. Sleeve: Translucent plastic with a positive mechanical connection to anchorages capable of resisting 100 lbs. pulling force. Minimum 10 inches long and 4 inches overlap with sheathing, completely filled with corrosion inhibiting coating.
2. Anchor Cap: Translucent plastic with a positive mechanical connection to anchorages capable of resisting 100 lbs. pulling force. At intermediate anchorages, open to allow passage of strand.
3. Subject to the requirements provide one of the following systems:
  - a. "Zero Void," General Technologies, Inc.
  - b. "Hayes Posi-Lock Plus," Hayes Industries, Ltd.
  - c. Accepted equivalent

## 2.6 POST-TENSIONING SYSTEM ACCESSORIES

- A. Pocket Formers: Capable of completely sealing wedge cavity from intrusion of concrete or cement slurry; sized to provide at least a 2 inch recess and allow access for cutting strand tail.
  1. If Zero Void encapsulation system in used, the "Zero Void Nail-Less Pocket Former" is required.
- B. Anchorage Fasteners: Stainless-steel ring nails. Subject to the requirements use one of the following:
  1. Clendenin Brothers, Baltimore, MD.
  2. Swan Secure Products, Baltimore, MD.
  3. R.J. Leahy Co., San Francisco, CA.
  4. Accepted equivalent.
- C. Sheathing Repair Tape: Elastic, self-adhesive, moisture-proof tape with a minimum width of 2 inches in contrasting color to tendon sheathing, and that is non-reactive with sheathing, corrosion inhibiting coating, or tendon. Subject to the requirements use one of the following:
  1. "3M Tape No. 226," 3M, St. Paul, MN.
  2. "Polyken 826," Berry Plastics Corp, Evansville, IN
  3. "Tyco Adhesives No. 398," Tyco Adhesives, Franklin, MA
- D. Sheathing Repair Material: For nicks and cuts less than 0.25 inches use one of the following:
  1. "Scotch-Weld DP-8005," by 3M
  2. Accepted equivalent
- E. Corrosion inhibiting coating: Capable of meeting the requirements of ACI 423.7. Subject to the requirements use one of the following
  1. "Greasrex K-218," ExxonMobil Oil Corp., Irving, TX.
  2. "Red-i PT Coating Grease," Lubricating Specialties Co., Pico Rivera, CA
  3. "Renolit PTG," Fuch's Lubricant Co., Harvey, IL

4. "Royal PT-1 and PT-2 Corrosion Inhibiting Grease," Troco Oil Co., Tulsa, OK
- F. Tendon supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening tendons in place. Use tendon supports capable of meeting the requirements in CRSI's "Manual of Standard Practice" and as follows:
1. Clearly marked to differentiate by height.
  2. Capable of resisting overturning during construction operations.
  3. Minimal contact with forms where concrete is exposed to view.
  4. Do not cause voids or damage to surrounding concrete.
  5. All-plastic supports conforming to CRSI Class 1 protection requirements and with a compressive strength higher than concrete.
  6. Acceptable manufacturers:
    - a. Dayton Superior Corporation
    - b. General Technologies, Inc.
    - c. Accepted equivalent

## **2.7 CONCRETE MATERIALS**

- A. Concrete: See Division 03 Section, "Cast-in-Place Concrete" except as specified here.
1. Portland Cement: ASTM C 150, Type I, II or III as acceptable to Engineer/Architect.

## **2.8 STEEL CONNECTION MATERIALS**

- A. Carbon-Steel Shapes and Plates: W-shapes: ASTM A 992. All other shapes and plates: ASTM A 36.
- B. Carbon-Steel Structural Tubing: ASTM A 1085.
- C. Carbon-Steel Headed Studs: ASTM A 108, Grade 1018 through Grade 1020, cold finished; AWS D1.1, Type A or B, with arc shields and with minimum mechanical properties of PCI MNL 116.
- D. Malleable Steel Castings: ASTM A 47.
- E. Deformed-Steel Wire or Bar Anchors: ASTM A 496 or ASTM A 706.
- F. Carbon-Steel Bolts and Studs: ASTM A 307, Grade A carbon-steel, hex-head bolts and studs; carbon-steel nuts; and flat, unhardened steel washers, ASTM F 844.
- G. Anchor Rods: ASTM F 1554, Grade 36 or Grade 55.
- H. Inserts and Coil Rods:
1. Provide sizes shown on Drawings.



2. Yield strength: 65,000 psi minimum.
3. Galvanizing: Electrodeposited zinc coating, ASTM B 633, Service Condition 1, Type III where indicated on Drawings.
4. Acceptable manufacturer, general:
  - a. Dayton/Richmond Concrete Accessories, Miamisburg, OH.
5. Acceptable manufacturer for multi-directional inserts: Connection Specialties, Inc. Boystown, NE.
- I. Finish: For exterior steel items, steel in exterior walls, and items indicated for galvanizing, apply zinc coating by hot-dip process according to ASTM A 123, after fabrication, and ASTM A 153, as applicable.
  1. Galvanizing Repair Paint: High-zinc-dust-content paint with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035A or SSPC-Paint 20: "ZRC Cold Galvanizing Compound," ZRC Worldwide, Marshfield, MA 02050.
- J. Shop-Primed Finish: Prepare surfaces of nongalvanized steel items, except those surfaces to be embedded in concrete, according to requirements in SSPC-SP 3 and shop-apply lead- and chromate-free, rust-inhibitive primer, complying with performance requirements in MPI 79 according to SSPC-PA 1.
- K. Welding Electrodes: Comply with AWS standards.
- L. Accessories: Provide clips, hangers, plastic shims, and other accessories required to install precast structural concrete units.

## **2.9 STAINLESS-STEEL CONNECTION MATERIALS**

- A. Stainless-Steel Plate: ASTM A 666, Type 304, of grade suitable for application.
- B. Stainless-Steel Bolts and Studs: ASTM F 593, alloy 304 or 316, hex-head bolts and studs; ASTM F 594, alloy 304 or 316, stainless-steel nuts; and flat, stainless-steel washers.
- C. Stainless-Steel Headed Studs: ASTM A 276, alloy 304 or 316, with minimum mechanical properties of PCI MNL 116.
- D. Electrodes for Welding Type 304 stainless-steel: E 308.
- E. Flange-to-flange field connection plates: ASTM A666, Type 304, or 201-LN of grade suitable for application.

## **2.10 BEARING PADS**

- A. Provide bearing pads for precast structural concrete units as follows:

1. Random-Oriented, Fiber-Reinforced Elastomeric Pads: Preformed, randomly oriented synthetic fibers set in elastomer. Surface hardness of 70 to 90 Shore A durometer.
  2. Cotton-Duck-Fabric-Reinforced Elastomeric Pads: Preformed, horizontally layered cotton-duck fabric bonded to an elastomer. Surface hardness of 80 to 100 Shore A durometer.
  3. Frictionless Pads: Tetrafluoroethylene, glass-fiber reinforced, bonded to stainless or mild-steel plate, or random-oriented-fiber-reinforced elastomeric pads; of type required for in-service stress.
  4. High-Density Plastic: Multimonomer, nonleaching, plastic strip.
- B. Beams: Horizontal bearing pads.
1. Cotton-Duck-Fabric-Reinforced Elastomeric Pads: Preformed, horizontally layered cotton-duck fabric bonded to an elastomer. Surface hardness of 80 to 100 Shore A durometer, unless noted otherwise on Drawings.
  2. Acceptable materials:
    - a. "Sorbtex," Voss Engineering Co., Chicago, IL.
    - b. "Capralon," JVI, Inc., Skokie, IL.
    - c. "Viblon," Korolath of New England, Inc. Hudson, MA.
- C. Double Tee Stems: Horizontal bearing pads:
1. Engineered random oriented fiber reinforced bearing pads. Acceptable Materials:
    - a. "Masticord," JVI, Inc., Skokie, IL.
    - b. "Fiberlast," Voss Engineering, Inc., Chicago, IL.
    - c. "Korolath R.O.F. Bearing Pads," Korolath of New England, Inc. Hudson, MA.
- D. Engineered random oriented fiber reinforced bearing pads may be substituted for beam bearing pads where engineering calculations demonstrate adequate capacity, and if accepted in writing by Engineer.
- E. Joints between precast pieces: Non-load bearing vertical spacers only:
1. Fiber impregnated elastomeric bearing pads.
  2. Durometer hardness 80 minimum.
  3. Acceptable materials:
    - a. "Vossco," Voss Engineering Co., Chicago, IL.
    - b. "Comcord," JVI, Inc., Skokie, IL.
- F. Hollow or solid core precast plank: Bearing strips: "Korolath," Koro Corp., Hudson, MA.
1. Bonding Adhesives:
    - a. Shim to Shim: "Bostik #3050."
    - b. Shim to Carbon Steel: "Bostik #3050."
    - c. Shim to Stainless Steel: "Bostik #3050."
    - d. Shim to Concrete: "Bostik #7087."

## G. Shims for bearing pads:

1. Galvanized or epoxy-coated ASTM A 36 steel. Do not stack steel shims more than 3 high. Tack weld multiple shims together on at least 2 faces or corners. Touch up galvanizing or epoxy coating damaged by welding. See Section "Cast-in-Place Concrete" for materials.
2. High-Density Plastic: A maximum of 1 plastic shim and a maximum of ½" in thickness may be used to adjust for field tolerances. Precaster shall submit certification of bearing capacity of plastic shim materials for approval prior to installation.

## H. Slide Bearing Systems at Expansion Joints:

1. Provide slide bearing systems as shown and detailed on Drawings:
  - a. Beam and double tee bearings shall be reinforced PTFE: 100% virgin tetrafluoroethylene polymer and ground glass fiber reinforcing aggregate, prebonded to stainless steel and/or preformed fabric (see paragraph "Bearing Pads" under heading "Connection Materials" above) bearing pads. Acceptable slide bearing systems:
    - 1) "Fluorogold," Seismic Energy Products, LP, Pine Brook, New Jersey.
    - 2) "Balco," Balco, Inc., Wichita, Kansas.
    - 3) "Dura-Slide," Tobi Engineering, Inc., Elk Grove Village, Illinois.
    - 4) "Dynalon Slide Bearings with Masticord," JVI, Inc., Skokie, Illinois.
  - b. Slab and plank bearing shall be ultrahigh molecular weight, high-density polyethylene resin: Acceptable material:
    - 1) "Korolath PE," Korolath Corporation, Hudson, Mass.
    - 2) "Tivar-100," Poly-Hi/Menasha Corporation, Fort Wayne, Indiana.
    - 3) "UHMW Econ-o-Shim," Deslausiers, Inc., Bellwood, IL.
2. Backing material for reinforced PTFE slide bearing systems as shown on Drawings:
  - a. Galvanized steel.
  - b. Stainless steel.
  - c. Reinforced elastomer, having durometer hardness of 90 plus or minus 5 and meeting requirements of Article 2.10.3(L) of AASHTO Standard Specifications for Highway Bridges (1983).

**2.11 GROUT MATERIALS**

- A. Sand-Cement Grout: Portland cement, ASTM C 150, Type I, and clean, natural sand, ASTM C 144. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and

hydration. Water-soluble chloride ion content less than 0.06 percent by weight of cement when tested according to ASTM C 1218.

- B. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107, of consistency suitable for application. Acceptable materials:

1. "Hi-Flow Grout" by The Euclid Chemical Company.
2. "Masterflow 928" by BASF.

Non-shrink dry-pack grout from these manufacturers may also be used in areas where flowing or fluid grout is not required.

- C. Epoxy Grout: ASTM C 881, 2-component epoxy resin, of type, grade, and class to suit requirements.
- D. Backer rod for grouted and sealed joints: Division 07 section, "Waterproofing System."

## **2.12 CONCRETE MIXTURES**

- A. Prepare concrete mixture proportions for each type and strength of concrete determined by either laboratory trial mix or field test data bases, as follows:
1. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.
  2. Proportion lightweight structural concrete according to ACI 211.2 and ACI 301.
- B. A qualified independent testing agency may be engaged by Fabricator for preparing and reporting proposed mixture proportions for the laboratory trial mix basis.
- C. Requirements for concrete mixture proportions are shown on Drawings:
1. Compressive strength
  2. Slump
  3. Water-cementitious materials ratio
  4. Air content
  5. Calculated Equilibrium Unit Weight: 115 lb/cu. ft. plus or minus 3 lb/cu. ft. as determined by ASTM C 567
- D. Cementitious Materials: For concrete exposed to deicers, limit percentage, by weight, of cementitious materials other than portland cement according to ACI 318 requirements.
- E. Supplementary Cementitious Materials: Limit percentage, by weight, of cementitious materials other than Portland cement in concrete as follows:
1. Fly Ash or other pozzolans conforming to ASTM C 618: 25 percent.

2. Slag conforming to ASTM C 989: 50 percent.

F. Air Entrainment:

1. See General Notes on Drawings for total average air content (percent by volume).
2. Average air content shall exceed value stated in General Notes on Drawings.
3. Permissible variation for any one test result from specified average total air content: plus or minus 1.5 percent
4. Hardened concrete shall have an air void spacing factor of 0.0080 in. maximum. Specific surface (surface area of air voids) shall be 600 in<sup>2</sup> per cu in. of air-void volume, or greater. Concrete mixes not meeting these values as determined by ASTM C 457 may require adjustments unless accepted in writing by Engineer. Refer to Part 1 Article "Submittals."

G. Chloride Ion Content of Mixture:

1. Water soluble chloride ion content of mix (including all constituents) shall not exceed 0.06% chloride ions by weight of cement for prestressed concrete and 0.15% for reinforced concrete. Test to determine chloride ion content shall conform to ASTM C 1218.
2. Concrete chloride ion content shall be determined by Testing Agency prior to placement. Cast samples from current production of concrete mix proposed for superstructure.
3. Concrete not meeting the requirements of paragraph "Water soluble chloride ion content of mix..." above, shall contain appropriate amount of calcium nitrite. Concrete supplier shall provide laboratory test results showing the amount of excess chloride ion content in the concrete mixture contributed by the aggregates. For each pound of chloride ion in excess of the amount allowed, mix shall contain calcium nitrite (30%, +/- 2%, solids content) on one-to-one basis (one gallon of calcium nitrite for one lb of excess chloride ion). Maximum of 1.5 lb of chloride ion per cubic yard may be offset in this manner.

H. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use high range water-reducing admixture in pumped concrete, concrete for parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio of 0.45 or less. Use normal or mid-range ASTM Type A water reducing admixture for concrete with water-cementitious materials ratio greater than 0.45.
4. Use corrosion-inhibiting admixture in concrete mixes where indicated.

5. Use polypropylene/polyethylene synthetic structural fiber in concrete mixes where indicated.
  6. Use shrinkage reducing admixture in concrete mixes where indicated.
- I. Lightweight Concrete: Proportion mix as specified. Proportion mixture to produce strength and modulus of elasticity as noted on drawings, with a splitting tensile strength factor (Fct) of not less than 5.5 for 3,000-psi concrete and a dry weight of not less than 95 lb or more than 110 lb after 28 days. Limit shrinkage to 0.03% at 28 days.
  - J. Rapid Chloride Permeability: When desired mix properties are achieved, two 12 in. x 12 in. x 4 in. thick slabs shall be prepared for each mixture with test samples taken by drilling four 4 in. diameter cores. Drilled cores shall be tested for rapid chloride permeability in accordance with Test Method ASTM C 1202. Slab shall be moist cured for 28 days and cores removed and kept at 50% relative humidity until testing at 35 to 42 days. In lieu of drilled cores it is permissible to mold 4 in. x 8 in. cylinder specimens in accordance with ASTM C 31. Concrete mixture proportions submitted shall have an average chloride permeability result of less than 2000 coulombs for four cores tested, with no single test result exceeding 2300 coulombs. If samples fail to meet test requirements, repeat with modified mixtures until a mixture does meet test requirements and Engineer accepts it in writing.
  - K. Engineer's acceptance of mixture shall not relieve precast concrete fabricator from responsibility for any variation from requirements of Contract Documents unless precast concrete fabricator has in writing called Engineer's attention to each such variation at time of submission and Engineer has given written approval of each such variation.
  - L. Adjustment to Concrete Mixtures: Mixture proportion adjustments may be requested by precast concrete fabricator when characteristics of materials, job conditions, weather, test results, or other circumstances warrant. Laboratory test data for revised mixture proportions and strength results must be submitted to and accepted by Engineer before using in work.

## **2.13 FABRICATION**

- A. Formwork: Accurately construct forms, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes and for pretensioning and detensioning operations. Maintain formwork to provide completed precast concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances.
  1. Coat surfaces of forms with bond-breaking compound before reinforcement is placed. Provide commercial-formula, form-coating compounds that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments

- of concrete surfaces requiring bond or adhesion. Apply in compliance with manufacturer's written instructions.
2. Unless forms for precast, prestressed concrete units are stripped before detensioning, design forms so stresses are not induced in precast concrete units because of deformation or movement of concrete during detensioning.
- B. Built-in Anchorages: Accurately position built-in anchorage devices and secure to formwork. Locate anchorages where they do not affect position of main reinforcement or concrete placement. Do not relocate bearing plates in units unless accepted by Engineer/Architect [and specialty design engineer].
- C. Cast-in openings larger than 10 inches in diameter or 10 inches square according to Shop Drawings. Smaller holes may be field cut by trades requiring them, as accepted by Engineer/Architect, but shall not damage or spall the precast finish.
- D. Reinforcement: Comply with recommendations in CRSI's "Manual of Standard Practice" 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.
  2. Accurately position, support, and secure reinforcement against displacement by formwork, construction, or concrete-placement operations. Locate and support reinforcement by metal chairs, runners, bolsters, spacers, and hangers, as required.
  3. Place reinforcement to obtain the specified concrete cover. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. 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 and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.
- E. Prestress tendons for precast structural concrete units by either pretensioning or post-tensioning methods. Comply with PCI MNL 116.
1. Delay detensioning until concrete has reached at least 60 percent of its compressive strength as established by test cylinders cured under the same conditions as concrete.
  2. If concrete has been heat cured, detension while concrete is still warm and moist to avoid dimensional changes that may cause cracking or undesirable stresses.
  3. Detension pretensioned tendons either by gradually releasing tensioning jacks or by heat-cutting tendons, using a sequence and pattern to prevent shock or unbalanced loading.
- F. Un-bonded Post-tensioning Sheathing Inspection and Repair
1. Inspect sheathing for damage after installing tendons and before placing concrete.

2. Remove and replace tendons that have damaged encapsulation systems including sheathing tears or cuts over 10 percent of the length (damage need not be continuous), sheathing withdrawn from connecting sleeves, or connecting sleeves withdrawn from fixed end anchorages.
  3. Repair damaged areas by restoring corrosion inhibiting coating and repairing sheathing according to the following procedure to the satisfaction of the Engineer/Architect.
  4. Coat with corrosion inhibiting coating outside of sheathing for the length of damaged area plus 2 inches beyond each end of damage. For example, if sheathing tear is 6 inches long then corrosion inhibiting coated area will be 10 inches long, centered on tear.
  5. Install longitudinally slit sheathing around corrosion inhibiting coating area with the slit on the side opposite the tear. Extend slit sheathing 2 inches beyond corrosion inhibiting coating area at each end. For example, if corrosion inhibiting coating area is 10 inches long, then the slit sheathing will be 14 inches long, centered on tear.
  6. After removing corrosion inhibiting coating from the area to be taped, spirally wrap tape around slit sheathing to provide at least 2 layers of tape. Extend tape 2 inches beyond slit sheathing at each end. For example, if slit sheathing is 14 inches long, then taped area will be 18 inches long, centered on tear.
  7. Repair nick and cuts less than 0.25 inches long with sheathing repair material.
- G. Un-Bonded Post-Tension Tendon Finishing
1. Do not cut tendons or cover anchorages until stressing records reviewed and accepted by Engineer/Architect.
  2. Clean tendons, anchorages and pockets of corrosion inhibiting prior to cutting tendons.
  3. Cut tendon end between 0.5 inches and 0.75 inches from wedges. Leave tendon end clean and free of burrs. Use of oxyacetylene flame to cut tendon is not permitted. Use one of the following methods:
    - a. Plasma cutting.
    - b. Hydraulic shears.
  4. Make tendon ends accessible for inspection prior to and during cutting and grouting.
  5. Do not damage tendon, anchorage or concrete during the cutting and removal of the tendon.
- H. Mix concrete according to PCI MNL 116 and requirements in this Section. After concrete batching, no additional water may be added.
- I. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in precast concrete units. Comply with requirements in PCI MNL 116 for measuring, mixing, transporting, and placing concrete.
1. Place backup concrete mixture to ensure bond with face-mixture concrete.



- J. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items. Use equipment and procedures complying with PCI MNL 116.
- K. Comply with ACI 306.1 procedures for cold-weather concrete placement.
- L. Comply with ACI 305R recommendations for hot-weather concrete placement.
- M. Identify pickup points of precast concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint casting date on each precast concrete unit so that it will not show in finished structure.
- N. Cure concrete, according to requirements in PCI MNL 116, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture. Limit concrete temperature to 140° F during accelerated curing unless test data is submitted that cement is not subject to delayed ettringite formation (DEF).
- O. For protection against corrosion, coat exposed ends of prestressing strands in all prestressed pieces with BASF "MasterSeal 610, 614, or 615," or accepted equivalent.
- P. Locate lift loops and erection inserts so as not to be visible in completed construction. Provide all lift loops and erection inserts with 1.5 in. minimum concrete or grout cover in completed construction. Any lift loops or erection inserts that must be located in areas that will be exposed to public view in completed construction or are in elevator shafts shall be recessed and patched with:
  - 1. Minimum of 1.5 in. drypack, latex modified concrete grout to match surrounding concrete.
- Q. Galvanize entire assembly of all inserts, angles and other cast-in-steel devices exposed on surface of precast concrete where shown on Drawings.
- R. Permit access by Engineer/Architect, Owner, and Owner's representatives to all parts of manufacturing facility.
- S. Mark each piece of precast concrete for identification and date of casting recorded. Marks shall not be visible after erection and completion of Work.

## **2.14 FABRICATION TOLERANCES**

- A. Fabricate precast concrete structural units straight and true size and shape with exposed edges and corners precise and true so each finished unit complies with PCI MNL 116 for product dimension tolerances as well as position tolerances for cast in items.

**2.15 FINISHES**

- A. Structural Precast Concrete: Provide finishes in accordance with MNL-116 and as follows:
  - 1. Formed surfaces: Fill air pockets and holes over 0.25 in. in diameter with sand-cement paste and grind smooth all form offsets or fins over 0.125 in.
  - 2. Columns, unformed surfaces: face toward inside of parking structure.
  - 3. All precast surfaces to receive a cast-in-place concrete topping shall be transverse raked to 0.25 in. depth minimum to insure bond of topping.
  - 4. Spandrel beams:
    - a. Interior face: textured finish per accepted sample.
    - b. Exterior face, ends, bottom and top; per accepted sample.
  - 5. Double tees:
    - a. Tee areas with cast-in-place concrete topping: Top surface shall be transverse raked to 0.25 in. depth minimum to insure bond of topping.
  - 6. Wall panels:
    - a. Stair walls, interior faces: steel trowel finish.
    - b. Shear walls, interior faces: steel trowel finish.
  - 7. Stair treads and Landings:
    - a. Horizontal surfaces in final orientation shall have slip resistant finish.

**2.16 SOURCE QUALITY CONTROL**

- A. Owner may direct Contractor to employ an independent testing agency to evaluate precast structural concrete fabricator's quality-control and testing methods.
  - 1. Allow Contractor's testing agency access to material storage areas, concrete production equipment, concrete placement, and curing facilities. Cooperate with Contractor's testing agency and provide samples of materials and concrete mixes as may be requested for additional testing and evaluation.
- B. Quality-Control Testing: Test and inspect precast concrete according to PCI MNL 116 requirements.
- C. Precast concrete units will be considered deficient if units fail to comply with PCI MNL 116 requirements, including the following:
  - 1. Units fail to comply with compressive-strength test requirements.

2. Units fail to comply with entrained air content test requirements.
  3. Reinforcement and prestressed tendons of units do not comply with fabrication requirements.
  4. Concrete curing and protection of units against extremes in temperature fail to comply with requirements.
  5. Units are damaged during handling and erecting.
- D. Testing: If there is evidence that the strength of precast concrete units may be deficient or may not comply with PCI MNL 116 requirements, Contractor will employ an independent testing agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to ASTM C 42.
1. A minimum of three representative cores will be taken from units of suspect strength, from locations directed by Engineer/Architect.
  2. Cores will be tested, after immersion in water, in a wet condition per ACI 301 if units will be wet under service conditions.
  3. Cores will be tested in an air-dry condition per ACI 301 if units will be dry under service conditions.
  4. Strength of concrete for each series of 3 cores will be considered satisfactory if the average compressive strength is equal to at least 85 percent of the 28-day design compressive strength and no single core is less than 75 percent of the 28-day design compressive strength.
  5. Test results will be made in writing on the same day that tests are performed, with copies to Resident Engineer, Engineer/Architect, Contractor, and precast concrete fabricator. Test reports will include the following:
    - a. Project identification name and number.
    - b. Date when tests were performed.
    - c. Name of precast concrete fabricator.
    - d. Name of concrete testing agency.
    - e. Identification letter, name, and type of precast concrete unit or units represented by core tests; design compressive strength; type of break; compressive strength at break, corrected for length-diameter ratio; and direction of applied load to core in relation to horizontal plane of concrete as placed.
- E. Patching: If core test results are satisfactory and precast concrete units comply with requirements, clean and dampen core holes and solidly fill with precast concrete mix that has no coarse aggregate, and finish to match adjacent precast concrete surfaces.
- F. Dimensional Tolerances: Units with dimensions smaller or larger than required and not complying with tolerance limits may be subject to additional testing.
1. Precast concrete units with dimensions larger than required will be rejected if the 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 comply with construction conditions.

- G. Precaster's Quality Control inspector shall inspect all pieces immediately after pieces have received final finish.
- H. Pieces shall be inspected and defects numbered on back of control tags attached to the back of each piece according to the following system:
  - 1. Foreign material in face.
  - 2. Bug holes.
  - 3. Rough or chipped edges.
  - 4. Cold joints.
  - 5. Form Lines.
  - 6. Cornice details.
  - 7. Uniformity of finish.
  - 8. Uniformity of retarder.
  - 9. Finish at retarder surround.
  - 10. Finish on return surfaces.
- I. Precaster's finishers shall correct defects in precaster's plant or yard. As defects corrected, finishers shall write an "f" next to the corresponding defect number on the back of the piece control tag.
- J. As pieces loaded for shipment, precaster's Quality Control inspector shall reinspect pieces to verify completion of corrections and place and "x" after the letter "f" for each item verified and initial the piece for final approval. Pieces with uncorrected defects shall not be shipped.
- K. Defective Work: Precast concrete units that do not comply with requirements, including strength, manufacturing tolerances, and finishes, are unacceptable. Replace with precast concrete units that comply with requirements.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine substrates and conditions for compliance with requirements for installation tolerances, true and level bearing surfaces, and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.2 INSTALLATION**

- A. Bearing Pads: Install bearing pads as precast concrete units are being erected. Set pads on true, level, and uniform bearing surfaces and maintain in correct position until precast concrete units are placed.

- B. Install precast structural concrete. Shore and brace precast concrete units to maintain location, stability, and alignment until permanent connections are installed.
- C. Welding: Perform welding in compliance with AWS D1.1 and AWS D1.4, with qualified welders.
  - 1. Protect precast concrete units and bearing pads from damage by field welding or cutting operations and provide noncombustible shields as required.
  - 2. Repair damaged metal surfaces by cleaning and applying a coat of galvanized repair paint to galvanized surfaces.
  - 3. Repair damaged metal surfaces by cleaning and repriming damaged painted surfaces.
- D. Fasteners: Do not use drilled or powder-actuated fasteners for attaching accessory items to precast, prestressed concrete units unless accepted by Engineer/Architect.
- E. Erection Tolerances: Install precast concrete units level, plumb, square, and true, and in alignment without exceeding the recommended erection tolerances of PCI MNL 127, "Recommended Practice for Erection of Precast Concrete."
  - 1. Structure shall be brought within tolerances and tolerances for deviation from plumb shall be checked by General Contractor-employed Missouri Registered Surveyor before placement of any cast-in-place concrete on superstructure.
  - 2. Variations between adjacent slab members shall comply with the requirements for walking surfaces in article "Field Quality Control"
- F. Grouting Connections and Joints: After precast concrete units have been placed and secured, grout open spaces at keyways, connections, and joints as follows:
  - 1. Provide forms or other method to retain grout in place until hard enough to support itself. Where required, pack spaces with non-shrink, dry-pack grout material, tamping until voids are completely filled. Place grout to finish smooth, level, and plumb with adjacent concrete surfaces. Keep grouted joints damp for not less than 24 hours after initial set. Promptly remove grout material from exposed surfaces before it hardens.

### **3.3 FIELD QUALITY CONTROL**

- A. As pieces arrive at jobsite, General Contractor's Quality Control inspector shall check the production control tag for each piece to verify that the piece is complete and correct.
- B. Any defective Work that cannot be repaired to satisfaction of Engineer/Architect, whether found at site or at shop at any time before completion and acceptance of Project, will be rejected

regardless of previous reviews and shall be remade or reconstructed to satisfaction of Engineer/Architect. However, finishes accepted at shop will not be rejected at site.

- C. Improperly located bearing pads or those of incorrect material will not be accepted by Engineer/Architect and shall be relocated or modified at expense of Contractor, no matter when rejected.
- D. Performance Requirements:
1. Conduct inspections, perform testing, and make repairs or replace unsatisfactory precast pieces as required.
  2. Limitations as to amount of patching which will be permitted is subject to acceptance of Engineer/Architect.
  3. In-place precast pieces may be rejected for any 1 of following:
    - a. Exceeding specified installation tolerances.
    - b. Damaged during construction operations.
    - c. Exposed-to-view surfaces which develop surface finish deficiencies.
    - d. Other defects as listed in PCI MNL-116.
  4. Walking Surfaces: walking areas subject to pedestrian traffic shall be slip resistant.
  5. Repair isolated random cracks that have little movement and single holes not over 1 in. in diameter in accordance with manufacturer's requirements. As a minimum, manufacturer requirements shall be submitted for record and address the procedures and materials specified in Division 07 Sections "Traffic Bearing Water Repellants" and "Concrete Joint Sealants." Receive Engineer's written acceptance of materials selected prior to application.
    - a. Repair isolated random horizontal cracks less than 0.01 in. wide, using silane sealer product specified in Section 071900 "Traffic Bearing Water Repellants."
    - b. Repair isolated random horizontal cracks 0.01 in. to less than 0.03 in. wide, using crack sealer product specified in Section 071900 "Traffic Bearing Water Repellants."
    - c. Repair isolated random horizontal cracks 0.03 in. to 0.06 in. wide: route and seal with specified sealant product in Section 079233 "Concrete Joint Sealants."
    - d. Repair isolated random vertical cracks more than 0.01 in. wide, using epoxy injection product submitted and approved.
  6. Repairs and repaired pieces shall be subject to 5 yr warranty provided by precaster. See Part 1 heading "Repair Warranty."
  7. Repairs and repaired pieces shall have documented design. See Part 1 heading "Submittals."
- E. Welds and high-strength bolt connections are subject to inspection and testing by Testing Agency. As minimum, following testing shall be performed:
1. Welds: Visually inspect all welds.

- a. Double tee flange-to-flange connections: Test 5% of welds, if at discretion of Inspector, visual inspection inconclusive.
  - b. All other welds: Test 25% of all field fillet welds and 5% of all shop welds.
  - c. Testing: Penetrating dye or magnetic particle at Inspector discretion.
  - d. One spot test per partial penetration weld using magnetic or ultrasonic testing.
2. Bolted Connections: Visual inspection of all connections. Check proper torque with calibrated torque wrench at minimum of 2 bolts of every connection.
- F. Testing Agency has authority to reject materials, welds, and connections not meeting Specifications.

### 3.4 CLEANING

- A. Clean exposed surfaces of precast concrete units after erection to remove weld marks, other markings, dirt, and stains.
1. Wash and rinse according to precast concrete fabricator's written 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.
  3. At completion of Work or at such times as directed by Engineer/Architect, remove all rejected and surplus material, rubbish or apparatus from premises and deliver Work to Engineer/Architect's satisfaction.

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**SECTION 04 20 10**  
**UNIT MASONRY**

**PART 1 - GENERAL**

1.1 Section Requirements

- A. Comply with ACI 530.1/ASCE 6/TMS 602.

1.2 SUBMITTALS

- A. Product data: From each type of product.
- B. Shop Drawings for Reinforcing Steel: Detailing bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315.

**PART 2 - PRODUCTS**

**2.1 MASONRY UNITS**

- A. Concrete Masonry Units: ASTM C 90; Weight Classification Normal Weight Type I, moisture-controlled units.
  - 1. Special shapes for lintels, corners, jambs, sash, control joints, and other special conditions.
  - 2. Square-edged units for outside corners, unless otherwise indicated.

**2.2 MORTAR**

- A. Mortar: ASTM C 270, Proportion Specification.
  - 1. Do not use calcium chloride in mortar.
  - 2. For non-load-bearing walls use Type N.

**2.3 JOINT REINFORCEMENT, TIES, AND ANCHORS**

- A. Provide joint reinforcement formed from galvanized carbon-steel wire, ASTM A 641, Class 1.
  - 1. Wire Diameter for Side Rods 0.1483 inch.
  - 2. Wire Diameter for Cross Rods: 0.1483 inch.
  - 3. For single-wythe masonry, provide truss design.

**PART 3 - EXECUTION**



**3.1 INSTALLATION, GENERAL**

- A. Cut masonry units with motor-driven saws. Install cut units with cut surfaces and, where possible, cut edges concealed.
- B. Mix units for exposed unit masonry from several pallets or cubes as they are placed to produce uniform blend of colors and textures.
- C. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.
- D. Stopping and Resuming Work: In each course, rack back units; do not tooth.
- E. Fill cores in hollow concrete masonry units with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.
- F. Build non-load-bearing interior partitions full height and install compressible filler in joint between top of partition and underside of structure above.
- G. Tool exposed joints slightly concave when thumbprint hard, unless otherwise indicated.
- H. Keep cavities clean of mortar droppings and other materials during construction. Strike joints facing cavities flush.

**3.2 LINTELS**

- A. Install steel lintels where indicated.
- B. Masonry lintels where shown. Precast lintels made from concrete matching concrete masonry units in color, texture, and compressive strength and with reinforcement bars indicated or required to support loads indicated.
- C. Minimum bearing of 8 inches (200 mm) at each jamb, unless otherwise indicated.

**3.3 FLASHING AND WEEP HOLES**

- A. Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to the downward flow of water in the wall, and where indicated.
- B. Place through-wall flashing on sloping bed of mortar and cover with mortar. Seal penetrations in flashing before covering with mortar.
  - 1. Extend flashing 4 inches (100 mm) into masonry at each end and turn up 2 inches (50 mm) to form a pan.

- C. Trim wicking material used in weep holes flush with outside face of wall after mortar has set.

### **3.4 FIELD QUALITY CONTROL**

- A. Contractor will engage a qualified independent testing agency to perform the following tests for each 2500 sq. ft. (230 sq. m) of wall area or portion thereof.
  - 1. Mortar Properties: ASTM C 270.
  - 2. Mortar Composition and Properties: ASTM C 780.
  - 3. Grout: ASTM C 1019.
  - 4. Masonry Unit: ASTM C 140.

### **3.5 CLEANING**

- A. Clean stone masonry veneer as work progresses. Remove mortar fins and smears before tooling joints.
- B. Final Cleaning: After mortar is thoroughly set and cured, remove large mortar particles and scrub unit masonry.
  - 1. Wet wall surfaces with water, apply cleaner, then remove cleaner by rinsing thoroughly with clear water.

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**SECTION 05 50 10**  
**METAL FABRICATIONS****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:
1. Hollow structural steel tubes for bracing store front or curtain wall window systems.
  2. Steel shapes for supporting elevator door sills.
  3. Metal ladders.
  4. Structural-steel door frames.
  5. Metal bollards.
  6. Pipe guards.
  7. Loose bearing and leveling plates for applications where they are not specified in other Sections.
  8. Stainless steel handrails and guard rails provided at exterior ramps, stairs, and for fall protection on the site.
  9. Steel tube handrails and guard rails provided at parking garage stair towers.
  10. Metal stair nosings at parking garage stair towers.
- B. Products furnished, but not installed, under this Section:
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.
- C. Related Sections:
1. Division 3 Section "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts and other items cast into concrete.
  2. Division 4 Section "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.

**1.3 PERFORMANCE REQUIREMENTS**

- 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.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

#### 1.4 SUBMITTALS

- A. Product Data: For the following:
  1. Non-slip aggregates and -aggregate surface finishes.
  2. Metal nosings and treads.
  3. Paint products.
  4. Grout.
- B. Shop Drawings: Show fabrication and installation details for metal fabrications.
  1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
- C. Samples for Verification: For each type and finish of extruded nosing.
- D. Mill Certificates: Signed by manufacturers certifying that products furnished comply with requirements.
- E. Welding certificates.
- F. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

#### 1.5 QUALITY ASSURANCE

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

#### 1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

#### 1.7 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.

## **PART 2 - PRODUCTS**

### **2.1 METALS, GENERAL**

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

### **2.2 FERROUS METALS**

- A. Steel Plates, Channels, Angles, and Bars: ASTM A 36/A 36M.
- B. W-Shapes: ASTM A 992/A 992M.
- C. Stainless-Steel Bars and Shapes: ASTM A 276
- D. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
- E. Rolled-Stainless-Steel Floor Plate: ASTM A 793.
- F. Hollow Structural Steel Sections: ASTM A 1085, cold-formed steel tubing.
- G. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless otherwise indicated.
- H. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

### **2.3 NONFERROUS METALS**

- A. Aluminum Plate and Sheet: ASTM B 209 (ASTM B 209M), Alloy 6061-T6.
- B. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T6.
- C. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.
- D. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

### **2.4 FASTENERS**

- A. 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 (ASTM F 1941M),

Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

1. Provide stainless-steel fasteners for fastening aluminum.
  2. Provide stainless-steel fasteners for fastening stainless steel.
  3. Provide stainless-steel fasteners for fastening nickel silver.
  4. Provide bronze fasteners for fastening bronze.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 325, Type 3 (ASTM A 325M, Type 3); with hex nuts, ASTM A 563, Grade C3 (ASTM A 563M, Class 8S3); and, where indicated, flat washers.
- C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593 (ASTM F 738M); with hex nuts, ASTM F 594 (ASTM F 836M); and, where indicated, flat washers; Alloy Group 1 (A1)
- D. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- E. Eyebolts: ASTM A 489.
- F. Machine Screws: ASME B18.6.3 (ASME B18.6.7M).
- G. Lag Screws: ASME B18.2.1 (ASME B18.2.3.8M).
- H. Wood Screws: Flat head, ASME B18.6.1.
- I. Plain Washers: Round, ASME B18.22.1 (ASME B18.22M).
- J. Lock Washers: Helical, spring type, ASME B18.21.1 (ASME B18.21.2M).
- K. 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.
- L. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.
- M. Post-Installed Anchors: Torque-controlled expansion anchors.
1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
  2. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 1 (A1)] stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

**METAL FABRICATIONS**

- N. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches (41 by 22 mm) by length indicated with anchor straps or studs not less than 3 inches (75 mm) long at not more than 8 inches (200 mm) o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

## **2.5 MISCELLANEOUS MATERIALS**

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Shop Primers: Provide primers that comply with Division 9 painting Sections.
- C. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- D. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- E. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- G. Non-shrink, Metallic Grout: Factory-packaged, ferrous-aggregate grout complying with ASTM C 1107, specifically recommended by manufacturer for heavy-duty loading applications.
- H. Non-shrink, Nonmetallic Grout: Factory-packaged, non-staining, non-corrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- I. Concrete: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete.

## **2.6 FABRICATION, GENERAL**

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
  - 1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches (3.2 by 38 mm), with a minimum 6-inch (150-mm) embedment and 2-inch (50-mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.

## **2.7 MISCELLANEOUS FRAMING AND SUPPORTS**

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
  - 1. Fabricate units from slotted channel framing where indicated.
  - 2. Furnish inserts for units installed after concrete is placed.



- C. Fabricate supports for operable partitions from continuous steel beams of sizes indicated with attached bearing plates, anchors, and braces as indicated. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.
- D. Galvanize miscellaneous framing and supports where indicated.

## **2.8 SHELF ANGLES**

- A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch (19-mm) bolts, spaced not more than 6 inches (150 mm) from ends and 24 inches (600 mm) o.c., unless otherwise indicated.
  - 1. Provide mitered and welded units at corners.
  - 2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches (50 mm) larger than expansion or control joint.
- B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.
- C. Galvanize shelf angles located in exterior walls.
- D. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

## **2.9 METAL LADDERS**

- A. General:
  - 1. Comply with ANSI A14.3 unless otherwise indicated.

## **2.10 METAL BOLLARDS**

- A. Fabricate metal bollards from Schedule 40 steel pipe.
  - 1. Cap bollards with 1/4-inch- (6.4-mm-) thick steel plate.
  - 2. Where bollards are indicated to receive controls for door operators, provide necessary cutouts for controls and holes for wire.
  - 3. Where bollards are indicated to receive light fixtures, provide necessary cutouts for fixtures and holes for wire.
- B. Fabricate bollards with steel baseplates for bolting to concrete slab. Use base plate thickness as indicated on the drawings, or 3/8" minimum, whichever is greater. Drill baseplates at all four corners for 3/4-inch (19-mm) anchor bolts.
  - 1. Where bollards are to be anchored to sloping concrete slabs, angle baseplates for plumb alignment of bollards.

- C. Unless noted otherwise on the drawings, fabricate sleeves for bollard anchorage from steel pipe with 1/4-inch- (6.4-mm-) thick steel plate welded to bottom of sleeve. Make sleeves not less than 8 inches (200 mm) deep and 3/4 inch (19 mm) larger than OD of bollard.
- D. Fabricate internal sleeves for removable bollards from Schedule 40 steel pipe or 1/4-inch (6.4-mm) wall-thickness steel tubing with an OD approximately 1/16 inch (1.5 mm) less than ID of bollards. Match drill sleeve and bollard for 3/4 inch (19 mm) steel machine bolt.
- E. Prime bollards with zinc-rich primer.

## **2.11 PIPE GUARDS**

- A. Unless noted otherwise on the drawings, fabricate pipe guards from 3/8-inch- (9.5-mm-) thick by 12-inch- (300-mm-) wide steel plate, bent to fit flat against the wall or column at both ends and to fit around pipe with 2-inch (50-mm) clearance between pipe and pipe guard. Drill each end for two 3/4-inch (19-mm) anchor bolts.
- B. Prime pipe guards with zinc-rich primer.

## **2.12 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. Galvanize plates.
- C. Prime plates with zinc-rich primer.

## **2.13 LOOSE STEEL LINTELS**

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.
- B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches (200 mm) unless otherwise indicated.
- C. Galvanize loose steel lintels located in exterior walls.
- D. Prime loose steel lintels located in exterior walls with zinc-rich primer.

## **2.14 STEEL WELD PLATES AND ANGLES**

- 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.

## **2.15 STAIR NOSINGS**

- A. Provide Non-Slip stair nosing, Style 801, cast aluminum, as manufactured by "American Safety Tread Co., Inc" or equal from the following manufacturers:
  - 1. Balco, Inc.
  - 2. Barry Pattern & Foundry Co., Inc.
  - 3. Granite State Casting Co.
  - 4. Safe-T-Metal Company, Inc.
  - 5. Wooster Products, Inc.

## **2.16 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.
- C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

## **2.17 STEEL AND IRON FINISHES**

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
  - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Shop prime iron and steel items [not indicated to be galvanized] unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
  - 1. Shop prime with primers specified in Division 9 painting Sections.
- C. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  - 1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  3. Items Indicated to Receive Primers Specified in Division 9 Section "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  4. Other Items: SSPC-SP 3, "Power Tool Cleaning."
- D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

## 2.18 RAILINGS

- A. In addition to the dead load design railing assembly to support live load specified.
- B. Fabrication General:
1. Provide continuous welded joints, dressed smooth and flush.
  2. Standard flush fittings, designed to be welded, may be used.
  3. Exposed threads will not be approved.
  4. Form handrail brackets to size and design shown.
  5. Exterior Post Anchors.
    - a. Fabricate tube or pipe sleeves with closed ends or plates as shown.
    - b. Where embed plates not shown or inserts interfere with reinforcing bars, provide flanged fittings welded or threaded to posts for securing to concrete with expansion bolts.
    - c. Provide heavy pattern sliding flange base plate with set screws at base of pipe or tube posts. Base plates are not required on pipe sleeves where ornamental railings occur.
  6. Interior Post Anchors:
    - a. Where embed plates not shown, provide flanged fittings for securing fixed posts to floor with expansion bolts, unless shown otherwise.
    - b. Weld or thread flanged fitting to posts at base.

- c. For securing removable posts to floor, provide close fitting sleeve insert or inverted flange base plate with stud bolts or rivets concrete anchor welded to the base plate.
- d. Provide sliding flange base plate on posts secured with set screws.
- e. Weld flange base plate to removable posts set in sleeves.

C. Handrails:

- 1. Close free ends of rail with flush metal caps welded in place except where flanges for securing to walls with bolts are shown.
- 2. Make provisions for attaching handrail brackets to wall, posts, and handrail as shown.

D. Steel Pipe Railings:

- 1. Fabricate of steel pipe with welded joints.
- 2. Number and space of rails as shown.
- 3. Space posts for railings not over 1800 mm (6 feet) on centers between end posts.
- 4. Form handrail brackets from malleable iron.
- 5. Fabricate removable sections with posts at end of section.
- 6. Removable Rails:

- a. Provide "U" shape brackets at each end to hold removable rail as shown. Use for top and bottom horizontal rail when rails are joined together with vertical members.
- b. Secure rail to brackets with 9 mm (3/8 inch) stainless steel through bolts and nuts at top rail only when rails joined with vertical members.
- c. Continuously weld brackets to post.
- d. Provide slotted bolt holes in rail bracket.
- e. Weld bolt heads flush with top of rail.

- f. Weld flanged fitting to post where posts are installed in sleeves.

7. Opening Guard Rails:

- a. Fabricate rails with flanged fitting at each end to fit between wall opening jambs.
- b. Design flange fittings for fastening with machine screws to steel plate anchored to jambs.
- c. Fabricate rails for floor openings for anchorage in sleeves.

E. Stainless Steel Railings:

- 1. Fabricate from 38 mm (1-1/2 inches) outside diameter stainless steel tubing, ASTM A269, having a wall thickness of 1.6 mm (0.065 inch).
- 2. Join sections by an internal connector to form hairline joints where field assembled.
- 3. Fabricate with continuous welded connections.
- 4. Fabricate brackets of stainless steel to design shown.
- 5. Fabricate stainless steel sleeves at least 150 mm (6 inches) deep having internal dimensions at least 13 mm (1/2 inch) greater than external dimensions of post.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION, GENERAL**

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  2. Obtain fusion without undercut or overlap.
  3. Remove welding flux immediately.
  4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
1. Cast Aluminum: Heavy coat of bituminous paint.
  2. Extruded Aluminum: Two coats of clear lacquer.

### **3.2 INSTALLING 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 "Installing Bearing and Leveling Plates" Article.
- D. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installing Bearing and Leveling Plates" Article.
1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

### **3.3 INSTALLING METAL BOLLARDS**

- A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.

1. Do not fill removable bollards with concrete.
- B. Anchor bollards in concrete. Fill annular space around bollard solidly with nonshrink, nonmetallic grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch (3 mm) toward bollard.
- C. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches (75 mm) above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.
- D. Fill un-capped bollards solidly with concrete, mounding top surface to shed water.

1. Do not fill removable bollards with concrete.

### **3.4 INSTALLING PIPE GUARDS**

- A. Provide pipe guards at exposed vertical pipes in parking garage where not protected by curbs or other barriers. Install by bolting to wall or column with expansion anchors. Provide a minimum of four 1/4-inch (19-mm) bolts at each pipe guard. Mount pipe guards with top edge 33 inches (660 mm) above driving surface.

### **3.5 INSTALLING NOSINGS, TREADS, AND THRESHOLDS**

- A. Center nosings on tread widths unless otherwise indicated.
- B. For nosings embedded in concrete steps or curbs, align nosings flush with riser faces and level with tread surfaces.
- C. Seal thresholds exposed to exterior with elastomeric sealant complying with Division 7 Section "Joint Sealants" to provide a watertight installation.

### **3.6 INSTALLING CAST-IRON WHEEL GUARDS**

- A. Anchor wheel guards to concrete or masonry construction to comply with manufacturer's written instructions. Fill cores solidly with concrete.

### **3.7 INSTALLING 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 non-metallic, in concealed locations where not exposed to moisture; use non-shrink, non-metallic grout in exposed locations unless otherwise indicated.
2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

### **3.8 RAILINGS**

#### **A. Steel Posts:**

1. Secure fixed posts to concrete with expansion bolts through flanged fittings except where embed plates or 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. Stainless Steel Railing:**

1. Install pipe sleeves in concrete formwork.
2. Set posts in sleeve and pour grout to surface on exterior locations and to within 6 mm (1/4 inch) of surface for interior locations except to where posts are required to be removable.
3. Apply beveled bead of urethane sealant over sleeve at post perimeter for exterior posts and flush with surface for interior posts as specified in Section 07 92 00, JOINT SEALANTS.

#### **C. Anchor to Walls:**

1. Anchor rails to concrete or solid masonry with machine screws through flanged fitting to steel plate.
  - a. Anchor steel plate to concrete or solid masonry with expansion bolts.
  - b. Anchor steel plate to hollow masonry with toggle bolts.

2. Anchor flanged fitting with toggle bolt to steel support in frame walls.

D. 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.

### 3.9 ADJUSTING AND CLEANING

- C. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.
- D. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 painting Sections.
- E. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

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**SECTION 06 10 00  
ROUGH CARPENTRY**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

- A. This section specifies plywood sheathing to be mounted in electrical room.

**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. Shop Drawings showing framing connection details, fasteners, connections and dimensions.
- C. Manufacturer's Literature and Data:
  - 1. Submit data for lumber, panels, hardware and adhesives.
  - 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.
- D. Manufacturer's certificate for unmarked lumber.

**1.4 PRODUCT DELIVERY, STORAGE AND HANDLING:**

- A. Stack plywood and other board products so as to prevent warping.
- B. 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.

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**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
- C. 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
- D. American Plywood Association (APA):  
E30-11.....Engineered Wood Construction Guide
- E. ASTM International (ASTM):  
A653/A653M-13.....Steel Sheet Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot Dip Process  
  
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  
F844-07a (R2013).....Washers, Steel, Plain (Flat) Unhardened for General Use  
F1667-13.....Nails, Spikes, and Staples
- F. American Wood Protection Association (AWPA):  
AWPA Book of Standards
- G. Commercial Item Description (CID):  
A-A-55615.....Shield, Expansion (Wood Screw and Lag Bolt Self Threading Anchors)
- H. Forest Stewardship Council (FSC):  
FSC-STD-01-001 (Ver. 4-0) FSC Principles and Criteria for Forest Stewardship
- I. Military Specification (Mil. Spec.):  
MIL-L-19140E.....Lumber and Plywood, Fire-Retardant Treated

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## J. Environmental Protection Agency (EPA):

40 CFR 59(2014).....National Volatile Organic Compound Emission  
Standards for Consumer and Commercial Products

## K. U.S. Department of Commerce Product Standard (PS)

PS 1-95.....Construction and Industrial Plywood

PS 20-10.....American Softwood Lumber Standard

**PART 2 - PRODUCTS****2.1 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.

**2.2 ROUGH HARDWARE AND ADHESIVES:**

A. Anchor Bolts:

1. ASME B18.2.1 and ASME B18.2.2 galvanized, 13 mm (1/2 inch) unless shown otherwise.

2. Extend at least 203 mm (8 inches) into masonry or concrete with ends bent 50 mm (2 inches).

B. Miscellaneous Bolts: Expansion Bolts: C1D A-A-55615; lag bolt, long enough to extend at least 65 mm (2-1/2 inches) into masonry or concrete. Provide 13 mm (1/2 inch) bolt unless shown otherwise.

C. Washers

1. ASTM F844.

2. Provide zinc or cadmium coated steel or cast iron for washers exposed to weather.

D. Screws:

1. Wood to Wood: ASME B18.6.1 or ASTM C1002.

2. Wood to Steel: ASTM C954, or ASTM C1002.

E. Nails:

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1. Size and type best suited for purpose unless noted otherwise.  
Provide aluminum-alloy nails, plated nails, or zinc-coated nails, for nailing wood work exposed to weather and on roof blocking.
2. ASTM F1667:
  - a. Common: Type I, Style 10.
  - b. Concrete: Type I, Style 11.
  - c. Barbed: Type I, Style 26.
  - d. Underlayment: Type I, Style 25.
  - e. Masonry: Type I, Style 27.
  - f. Provide special nails designed for use with ties, strap anchors, framing connectors, joists hangers, and similar items. Nails not less than 32 mm (1-1/4 inches) long, 8d and deformed or annular ring shank.

F. Adhesives:

1. Adhesives to have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, (EPA Method 24).

**PART 3 - EXECUTION**

**3.1 INSTALLATION OF FRAMING AND 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 or structural use panels.

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 and subflooring, 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:

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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.
7. Installation of Timber Connectors:
  - a. Conform to applicable requirements of the AFPA NDS.
  - b. Fit wood to connectors and drill holes for fasteners so wood is not split.
- C. Set sills or plates level in full bed of mortar on masonry or concrete walls.
  1. Space anchor bolts 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. Sheathing:

1. Provide plywood or structural-use panels for sheathing.
2. Lay panels with joints staggered, with edge and ends 3 mm (1/8 inch) apart and nailed over bearings as specified.
3. Set nails not less than 9 mm (3/8 inch) from edges.

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**SECTION 07 11 13  
BITUMINOUS DAMPPROOFING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

A. Section Includes:

1. Bituminous dampproofing on concrete and masonry surfaces.

**1.2 RELATED REQUIREMENTS**

A. Concrete: Section 03 00 00, CAST-IN-PLACE CONCRETE.

B. Masonry Surfaces Bellow Grade: Section 04 20 10, UNIT MASONRY.

**1.3 APPLICABLE PUBLICATIONS**

A. Comply with references to extent specified in this section.

B. ASTM International (ASTM):

1. C578-15 - Rigid, Cellular Polystyrene Thermal insulation.
2. D226/D226M-09 - Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
3. D449/D449M-03(2014)e1 - Asphalt Used in Dampproofing and Waterproofing.
4. D1227-13 - Emulsified Asphalt Used as a Protective Coating for Roofing.
5. D6380/D6380M-03(2013)e1 - Asphalt Roll Roofing (Organic Felt).
6. D6506-01(2009) - 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.

**1.5 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.

**1.6 STORAGE AND HANDLING**

- A. Store products indoors in dry, weathertight conditioned facility.

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- B. Protect products from damage during handling and construction operations.

#### **1.7 WARRANTY**

- A. Construction Warranty: Installer shall warranty their installation of dampproofing for a period of one (1) year from date of installation and final acceptance by the Government in accordance with the 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.

#### **2.3 ACCESSORIES**

- A. Asphalt Saturated Felt: ASTM D226/D226M, Type I, 7 kg (15 pound).
- B. Protection Course: ASTM D6506, 3 mm (1/8 inch) thick, semi-rigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners.

### **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 substrates. Remove contaminants capable of affecting subsequently installed product's performance.
- D. Remove free water; surfaces may remain damp.

#### **3.2 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.

#### **3.3 DAMPPROOFING INSTALLATION**

- A. Applications:

1. Apply to surfaces where indicated on drawings.
- B. Apply dampproofing at 1 L/sq. m (2-1/2 gal. per 100 sq. ft.), minimum, each coat.
  1. Allow 24 hours drying time between coats.
- C. Adhere protection course to conceal dampproofing before backfilling.

**3.4 PROTECTION**

- A. Protect dampproofing and protection course from construction operations.
- B. Repair damage.

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**SECTION 07 18 00  
TRAFFIC COATINGS****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. A single installer shall be responsible for providing complete water proofing system including all products specified in the following Sections:
  - 1. Division 07 Section, "Traffic Coatings"
  - 2. Division 07 Section, "Traffic Bearing Water Repellents"
  - 3. Division 07 Section, "Concrete Joint Sealants"
  - 4. Division 07 Section, "Expansion Joint Assemblies"
- B. This Section includes traffic coating: Fluid applied, waterproofing, traffic-bearing elastomeric membrane with integral wearing surface, where the surface to which membrane is to be applied is one or more of the following:
  - 1. Over occupied space.
- C. Materials shall be compatible with materials or related Work with which they come into contact, and with materials covered by this Section.
- D. Related Sections: Following Sections contain requirements that relate to this Section.
  - 1. Division 03 Section, "Cast-in-Place Concrete."
  - 2. Division 03 Section, "Precast Structural Concrete."
  - 3. Division 03 Section, "Precast Architectural Concrete."
  - 4. Division 07 Section, "Traffic Bearing Water Repellents"
  - 5. Division 07 Section, "Concrete Joint Sealants"
  - 6. Division 07 Section, "Expansion Joint Assemblies"
  - 7. Division 32 Section, "Pavement Markings."

**1.3 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Materials shall be compatible with materials or related Work with which they come into contact, and with materials covered by this Section.

2. Distribute reviewed submittals to all others whose Work is related.
- B. Pre-installation Conference: Meet at project site well in advance of time scheduled for Work to proceed to review requirements for Work and conditions that could interfere with successful coating performance. Require every party concerned with coating Work, or required to coordinate with it or protect it thereafter, to attend. Include manufacturer's technical representative and warranty officer.
- C. Make submittals in accordance with requirements of Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each system indicated at least 60 days prior to application.
  1. Product description, technical data, appropriate applications and limitations.
  2. Primer type and application rate
  3. Material, and wet mils required to obtain specified dry thickness for each coat.
  4. Type, gradation and aggregate loading required within each coat.
- B. Samples:
  1. One 4 in. by 4 in. stepped sample showing each component for each system indicated.
- C. Sample Warranty: For each system indicated.

#### 1.5 INFORMATION SUBMITTALS

- A. Certificates
  1. Certification that products and installation comply with applicable federal, state of Missouri, and local EPA, OSHA and VOC requirements regarding health and safety hazards.
  2. Evidence of applicator's being certified by manufacturer. Evidence shall include complete copy of manufacturer's licensing/certification document, spelling out repair responsibility for warranty claims.
  3. Certification from the Manufacturer that finishes as specified are acceptable for system to be installed at least 1 month before placement of any concrete which will receive traffic coating.
  4. Certification stating static coefficient of friction meets minimum requirements of Americans with Disabilities Act (ADA).
  5. Certification stating materials have been tested and listed for UL 790 Class "A" rated materials/system by UL for traffic coating application specified on project. Containers shall bear UL labels.
  6. Certification from manufacturer confirming compatibility with existing underlying coatings and/or substrate.

## B. Manufacturer's Instructions: for each system indicated.

1. Crack treatment and surface preparation method and acceptance criteria.
2. Method of application of each coat.
3. Maximum and minimum allowable times between coats.
4. Final cure time before resumption of parking and/or paint striping.
5. Any other special instructions required to ensure proper installation.

## C. Field Quality Control:

1. Quality Control Plan as defined in Part 3.
2. Two copies each of manufacturer's technical representative's log for each visit.
3. Testing agency field reports.

## D. Qualification Statements

1. Manufacturer's qualifications as defined in the "Quality Assurance" article.
2. Installer's qualifications as defined in the "Quality Assurance" article.
3. Signed statement from applicator certifying that applicator has read, understood, and shall comply with all requirements of this Section.

**1.6 CLOSEOUT SUBMITTALS**

- A. Three copies of System Maintenance Manual.
- B. Five copies of snow removal guidelines for areas covered by Warranty.
- C. Final executed Warranty.

**1.7 QUALITY ASSURANCE**

- A. Manufacturer's Qualifications: Owner retains right to reject any manufacturer.
  1. Evidence of acceptable previous work on WALKER-designed projects. If none, so state.
  2. Evidence of financial stability acceptable to Engineer/Architect.
  3. Listing of 20 or more projects completed with submitted system, to include:
    - a. Name and location of project.
    - b. Type of system applied.
    - c. On-Site contact with phone number.

- B. Manufacturer's technical representative, acceptable to Engineer/Architect, shall be on site during surface preparation and initial stages of installation.
- C. Installer's Qualifications: Owner retains right to reject any manufacturer.
  - 1. Evidence of compliance with Summary article paragraph "A single installer. . ."
  - 2. Evidence that installer has successfully performed or has qualified staff who have successfully performed at least 5 verifiable years of installations similar to those involved in this Contract, and minimum 10 projects with submitted system.
  - 3. Listing of 5 or more installations in climate and size similar to this Project performed by installer's superintendent.
- D. Testing Agency: Independent testing laboratory employed by Contractor and acceptable to Engineer/Architect.
- E. Certifications
  - 1. Traffic Coating shall satisfy the current National Volatile Organic Compound (VOC) Emission Standards for Architectural Coatings.
  - 2. Licensing/certification document from manufacturer that confirms system installer is a licensed/certified applicator for the manufacturer and is legally licensed to perform work in the state of Missouri.
  - 3. Licensing/certification agreement shall include following information:
    - a. Applicator's financial responsibility for warranty burden under agreement terms.
    - b. Manufacturer's financial responsibility for warranty burden under agreement terms.
    - c. Process for dispute settlement between manufacturer and applicator in case of system failures where cause is not evident or cannot be assigned.
    - d. Authorized signatures for both Applicator Company and Manufacturer.
    - e. Commencement date of agreement and expiration date (if applicable).

#### **1.8 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver all materials to site in original, unopened containers, bearing following information:
  - 1. Name of product.
  - 2. Name of manufacturer.
  - 3. Date of preparation.
  - 4. Lot or batch number.

- B. Store materials under cover and protect from weather. Replace packages or materials showing any signs of damage with new material at no additional cost to Owner.

#### 1.9 FIELD CONDITIONS

- A. Weather and Substrate Conditions: Proceed with work only when existing and forecast weather and temperature of concrete substrate will permit work in accordance with manufacturer's recommendations.

#### 1.10 WARRANTY

- A. System Manufacturer: Furnish Owner with written Warranty, detailing responsibilities of manufacturer and applicator with regard to warranty requirements. The warranty shall provide that system will be free of defects, water penetration and chemical damage related to system design, workmanship or material deficiency, consisting of:
  - 1. Any adhesive or cohesive failures.
  - 2. Spalling surfaces.
  - 3. Weathering.
  - 4. Surface crazing (does not apply to traffic coating protection course).
  - 5. Abrasion or tear failure resulting from normal traffic use.
  - 6. Failure to bridge cracks less than 0.0625 in. or cracks existing at time of traffic coating installation on double tees only.
- B. If material surface shows any of defects listed above, supply labor and material to repair all defective areas and to repaint all damaged line stripes.
- C. Construction Warranty: Installer shall warranty their installation of traffic coating for a period of one (1) year from date of installation and final acceptance by the Government in accordance with the FAR clause 52.246-21, "Warranty of Construction".
- D. Manufacturer Warranty: Manufacturer shall warranty their traffic coating for a minimum of five (5) years from the date of installation and final acceptance by the Government. Submit manufacturer warranty during the submittal process.
- E. Perform any repair under this warranty at no cost to Owner.
- F. Address the following in the terms of the Warranty: length of warranty, change in value of warranty - if any- based on length of remaining warranty period, transferability of warranty, responsibilities of each party, notification procedures, dispute resolution procedures, and limitations of liability for direct and consequential damages.
- G. Snowplows, vandalism, studded snow tires, and abnormally abrasive maintenance equipment are not normal traffic use and are exempted from warranty.



**PART 2 - PRODUCTS****2.1 MANUFACTURERS**

- A. Manufacturer: Subject to compliance with requirements, provide products of 1 of following, only where specifically named in product category:
1. Advanced Polymer Technology (APT), Harmony, PA
  2. BASF Building Systems (BASF), Shakopee, MN
  3. Deneef Construction Chemicals (Deneef), Houston, TX.
  4. Lymtal International Inc. (Lymtal), Lake Orion, MI.
  5. Neogard Division of Jones-Blair Company (Neogard), Dallas, TX.
  6. Pacific Polymers, Inc. a Division of ITW (Pacific Polymers), Garden Grove, CA
  7. Poly-Carb Inc. (Poly-Carb), Twinsburg, OH.
  8. Polycoat Products Division of Amer. Polymers (Polycoat), Santa Fe Springs, CA.
  9. Pecora Corporation (Pecora), Harleysville, PA
  10. Sika Corporation (Sika), Lyndhurst, NJ.
  11. Technical Barrier Systems, Inc. (TBS), Oakville, Ontario.
  12. Tremco (Tremco), Cleveland, OH.

**2.2 MATERIALS, TRAFFIC COATING**

- A. Acceptable low odor coatings are listed below. One will be selected as an alternate. In bid form, list bid price for each coating listed below. Contract for coating will not necessarily be directed to lowest bid priced coating. Coatings shall be compatible with all other materials in this Section and related work.
1. Heavy Duty:
    - a. Autogard HD-48, Autogard E, Neogard.
    - b. Elasto-Deck 5000-HT, Pacific Polymers.
    - c. Iso-Flex 750U-HL HVT/760U-HL HVT Deck Coating System, LymTal.
    - d. Qualideck Heavy Vehicular (152/252/372/512), APT
    - e. Sikalastic 710/715, Sika.
    - f. MasterSeal Traffic 1500, BASF.
    - g. Vulkem 350/345/346/346 Deck Coating System, Tremco.
    - h. Kelmar TE Exposure 3, TBS.
    - i. Flexodeck Mark 170.2 Solvent Free Heavy Duty, Poly-Carb.
    - j. Poly-I-Gard 246HD, Polycoat.
  - B. Provide ultraviolet screening for all traffic coating placed on this project.
  - C. Finish top coat shall be colored grey.
  - D. Substitutions: **None** for this project.

**2.3 MATERIALS, CRACK SEALER**

- A. Repair for isolated random horizontal cracks 0.01 in. to 0.03 in. wide. Acceptable products:
  - 1. SikaPronto 19TF, Sika.
  - 2. Sikadur 55 SLV Epoxy Crack Healer/Sealer, Sika.
  - 3. Denedeck Crack Sealer, Deneef.
  - 4. Iso-Flex 609 Epoxy Crack Sealer, Lyntal.
  - 5. MasterSeal 630, BASF.

**PART 3 - EXECUTION****3.1 EXAMINATION**

- A. Examine surfaces to receive Work and report immediately in writing to Engineer/Architect any deficiencies in surface which render it unsuitable for proper execution of Work.
- B. Coordinate and verify that related Work meets following requirements before beginning surface preparation and application:
  - 1. Concrete surfaces are finished as acceptable for system to be installed. Correct all high points, ridges, and other defects in a manner acceptable to the Engineer/Architect.
  - 2. Curing compounds used on concrete surfaces are compatible with system to be installed.
  - 3. Concrete surfaces have completed proper curing period for system selected.
  - 4. Joint Sealants are compatible with traffic coatings.

**3.2 PREPARATION**

- A. Seal all openings to occupied space to prevent cleaning materials, solvents and fumes from infiltration. All protective measures and/or ventilating systems required to prevent infiltration are incidental to this Work.
- B. Acid etching is prohibited.
- C. Remove all laitance and surface contaminants, including oil, grease and dirt as specified by manufacturer's written recommendations.
- D. Before applying materials, apply system to small area to assure that it will adhere to substrate and joint sealants and dry properly and to evaluate appearance.
- E. All cracks on concrete surface shall be prepared in accordance with manufacturer's recommendations.
- F. Mask off adjoining surfaces not to receive traffic coating and mask off drains to prevent spillage and migration of liquid materials

outside membrane area. Provide neat/straight lines at termination of traffic coating.

### 3.3 INSTALLATION/APPLICATION

- A. Installation should include all of the following steps:
  - 1. Surface Preparation: Prepare concrete for system application.
  - 2. Crack/Construction/Control/Cove Joint Sealing: Detail for crack bridging.
  - 3. Primer Coat: Insure proper adhesion of membrane to substrate.
  - 4. Base Coat: Provide crack spanning in conjunction with Crack Detail noted above.
  - 5. Aggregate Coat - to hold aggregate in system, providing skid and wear close up resistance.
  - 6. Aggregate: Correct size, shape, hardness and amount necessary to insure proper skid and wear resistance.
  - 7. Top Coat: Lock aggregate into place, provide a maintainable surface and provide resistance to ponding water, UV degradation, color loss and chemical intrusion.
- B. Do all Work in accordance with manufacturer's written instructions and specifications including, but not limited to, moisture content of substrate, atmospheric conditions (including relative humidity and temperature), coverages, mil thicknesses and texture, and as shown on Drawings.
- C. A primer coat is required for all systems. No exception.
- D. Do not apply traffic coating material until concrete has been air dried at temperatures at or above 40°F for at least 30 days after curing period specified.
- E. Cease material installation under adverse weather conditions, or when temperatures are outside manufacturer's recommended limitations for installation, or when temperature of work area or substrate are below 40°F.
- F. All adjacent vertical surfaces shall be coated with traffic coating minimum of 4 in. above coated horizontal surface. Requirement includes, but is not limited to pipes, columns, walls, curbs (full height of vertical faces of all curbs) and islands.
- G. Complete all Work under this Section before painting line stripes.
- H. Clean off excess material and material smears adjacent to joints as work progresses using methods and materials approved by manufacturers.

### 3.4 FIELD QUALITY CONTROL

- A. Develop a quality control plan for assured specified uniform membrane thickness that utilizes grid system of sufficiently small size to designate coverage area of not more than 5 gallons at specified thickness. In addition, employ wet mil gauge to continuously monitor

thickness during application. Average specified wet mil thickness shall be maintained within grid during application with minimum thickness of not less than 80% of average acceptable thickness. Immediately apply more material to any area not maintaining these standards.

- B. Testing Agency employ wet mil gauge to periodically monitor thickness during application.

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**SECTION 07 19 00**  
**TRAFFIC BEARING WATER REPELLENTS**

**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. A single installer shall be responsible for providing complete water proofing system including all products specified in the following Sections:
1. Division 07 Section, "Traffic Coatings"
  2. Division 07 Section, "Traffic Bearing Water Repellents"
  3. Division 07 Section, "Concrete Joint Sealants"
  4. Division 07 Section, "Expansion Joint Assemblies"
- B. This Section includes penetrating concrete sealer on these surfaces:
1. Supported concrete floor and concrete roof surfaces including curbs, walks, islands and pour strips.
  2. Concrete stair treads and landings.
  3. Slab-on-grade within parking facility, including curbs, walks, and islands.
  4. Approach drives and adjoining sidewalks within construction limits.
- C. Related Sections: Following Sections contain requirements that relate to this Section.
1. Division 03 Section, "Cast-in-Place Concrete"
  2. Division 03 Section, "Precast Structural Concrete."
  3. Division 07 Section, "Traffic Coatings"
  4. Division 07 Section, "Concrete Joint Sealants"
  5. Division 07 Section, "Expansion Joint Assemblies"
  6. Division 32 Section, "Pavement Markings."

**1.3 REFERENCES**

- A. ASTM International (ASTM):
1. ASTM D6489, "Standard Test Method for Determining the Water Absorption of Hardened Concrete Treated with a Water Repellent Coating."

**1.4 ADMINISTRATIVE REQUIREMENTS**

TRAFFIC BEARING WATER REPELLENTS

## A. Coordination:

1. Materials shall be compatible with materials or related Work with which they come into contact, and with materials covered by this Section.
2. Distribute reviewed submittals to all others whose Work is related.

## B. Make submittals in accordance with requirements of Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

**1.5 ACTION SUBMITTALS**

## A. Product Data: For each type of product indicated at least 60 days prior to application.

1. Product description, technical data, appropriate applications, and limitations.
2. Areas and application rates of materials to be applied.
3. Proposed alternate application methods, if any.

**1.6 INFORMATION SUBMITTALS**

## A. Certificates

1. Certification that products and installation comply with applicable federal, state of Missouri, and local EPA, OSHA and VOC requirements regarding health and safety hazards.
2. Evidence of applicator's being certified by manufacturer. Evidence shall include complete copy of manufacturer's licensing/certification document, spelling out repair responsibility for warranty claims.

## B. Field Quality Control

1. ASTM D6489 Test Results
2. Two copies of manufacturer's technical representative's log for each visit.

## C. Qualification Statements

1. Manufacturer's qualifications as defined in the "Quality Assurance" article.
2. Installer's qualifications as defined in the "Quality Assurance" article.
3. Signed statement from applicator certifying that applicator has read, understood, and shall comply with all requirements of this Section.

**1.7 QUALITY ASSURANCE**

- A. Manufacturer's Qualifications: Owner retains right to reject any manufacturer.
1. Evidence of acceptable previous work on WALKER-designed projects. If none, so state.
  2. Evidence of financial stability acceptable to Engineer/Architect.
  3. Listing of 20 or more projects completed with submitted system, to include:
    - a. Name and location of project.
    - b. Type of system applied.
    - c. On-Site contact with phone number.
- B. Installer's Qualifications: Owner retains right to reject any installer.
1. Evidence of compliance with Summary article paragraph "A single installer. . ."
  2. Evidence that installer has successfully performed or has qualified staff who have successfully performed at least 5 verifiable years of installations similar to those involved in this Contract, and minimum 10 projects with submitted system.
  3. Listing of 5 or more installations in climate and size similar to this Project performed by installer's superintendent.
- C. Testing Agency: Independent testing laboratory employed by Contractor and acceptable to Engineer/Architect.
- D. Certifications
1. Sealer shall satisfy the current national and local Volatile Organic Compound (VOC) Emission Standards for Architectural Coatings.
  2. Licensing/certification document from system manufacturer that confirms system installer is a licensed/certified applicator for the manufacturer and is legally licensed to perform work in the state of Missouri.
  3. Licensing/certification agreement must provide following information:
    - a. Construction Warranty: Installer shall warranty their installation of traffic bearing water repellent for a period of one (1) year from date of installation and final acceptance by the Government in accordance with the FAR clause 52.246-21, "Warranty of Construction".
    - b. Applicator's financial responsibility for warranty burden under agreement terms.
    - c. Manufacturer's financial responsibility for warranty burden under agreement terms.
    - d. Process for dispute settlement between manufacturer and applicator in case of system failures where cause is not evident or cannot be assigned.
    - e. Officers' signatures for both Applicator Company and Manufacturer.

- f. Commencement date of agreement and expiration date (if applicable).

### **1.8 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver all materials to site in original, unopened containers, bearing following information:
1. Name of product.
  2. Name of manufacturer.
  3. Date of preparation.
  4. Lot or batch number.
- B. Store materials under cover and protect from weather. Replace packages or materials showing any signs of damage with new material at no additional cost to Owner.

### **1.9 FIELD CONDITIONS**

- A. Weather and Substrate Conditions: Do not proceed with application (except with written recommendation of manufacturer) under any of the following conditions:
1. Ambient temperature is less than 40° F.
  2. Substrate surfaces have cured for less than 1 month.
  3. Rain or temperatures below 40° F predicted for a period of 24 hours.
  4. Less than 24 hours after surfaces became wet.
  5. Substrate is frozen or surface temperature is less than 40° F.
  6. Wind velocities higher than manufacturer's specified limit to prevent solvent flash-off.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Manufacturer: Subject to compliance with requirements, provide products of one of following, only where specifically named in product category:
1. Advanced Chemical Technologies Inc. (ACT), Oklahoma City, OK.
  2. BASF Building Systems (BASF), Shakopee, MN.
  3. Deneef Construction Chemicals (Deneef), Houston, TX.
  4. Evonik Degussa Corporation (Evonik Degussa), Parsippany, NJ.
  5. Euclid Chemical Company (Euclid), Cleveland, OH.
  6. Lymtal International Inc. (Lymtal), Lake Orion, MI.
  7. Prosoco, Inc. (Prosoco), Lawrence, KS
  8. Sika Corporation (Sika), Lyndhurst, NJ.

### **2.2 MATERIALS, CONCRETE SEALER**

TRAFFIC BEARING WATER REPELLENTS



- A. Silane (40% solids, 600 g/L or less VOC):
  - 1. MasterProtect H 440 HZ, 125 sf/g, BASF.
  - 2. Iso-flex 618-40 VOC, 125sf/g, Lymtal.
  - 3. Protectosil Chem-Trete 40 VOC, 125 sf/g, Evonik Degussa.
  - 4. Sikagard 740W ,125 sf/g, Sika
  - 5. Sil-Act ATS-42, 125 sf/g, ACT.
- B. Silane (90% or greater solids, 400 g/L or less VOC):
  - 1. MaterProtect H 1000, 200 sf/g, BASF.
  - 2. Iso-Flex 618-100 CRS, 200 sf/g, Lymtal.
  - 3. Protectosil BHN, 200 sf/g, Evonik Degussa Corp.
  - 4. Sikagard 705L,200 sf/g, Sika.
  - 5. Sil-Act ATS-100 LV, 200 sf/g, ACT.
- C. Proposed substitutions: None for this project.

### **2.3 MATERIALS, CRACK SEALER**

- A. Repair for isolated random horizontal cracks 0.01 in. to 0.03 in. wide. Acceptable products:
  - 1. SikaPronto 19TF, Sika.
  - 2. Sikadur 55 SLV Epoxy Crack Healer/Sealer, Sika.
  - 3. MasterSeal 630, BASF.
  - 4. Denedeck Crack Sealer, Deneef.
  - 5. Iso-Flex 609 Epoxy Crack Sealer, Lymtal.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine surfaces to receive Work and report immediately in writing to Engineer/Architect any deficiencies in surface which render it unsuitable for proper execution of Work.
- B. Coordinate and verify that related Work meets following requirements before beginning surface preparation and application:
  - 1. Concrete surface finishes are acceptable for system to be installed.
  - 2. Curing compounds used on concrete surfaces are compatible with system to be installed.
  - 3. Concrete surfaces have completed proper curing period for system selected.
  - 4. Control joint and expansion joint Work is complete and has been accepted by Engineer/Architect.

### **3.2 PREPARATION**

TRAFFIC BEARING WATER REPELLENTS

- A. Seal all openings to occupied space to prevent cleaning materials, solvents and fumes from infiltration. All protective measures and/or ventilating systems required to prevent infiltration are incidental to this Work.
- B. Acid etching is prohibited.
- C. Repair or replace all sealant materials damaged by surface preparation operations.
- D. Sand blast clean all surfaces to be sealed as acceptable to sealer manufacturer before sealer application. Shot blasting is not recommended for new slabs that are water cured per ACI 308, Paragraph 2.2. Cleaning method and materials shall be sufficient to allow absorption criteria stated in Field Quality Control article to be met.
- E. Equipment used during floor slab cleaning shall not exceed height limitation of facility and shall not exceed 3,000 lb axle load or vehicle gross weight of 6,000 lb.
- F. Mask off adjoining surfaces not to receive sealer and mask off drains to prevent spillage and migration of liquid materials outside sealer area. Provide neat/straight lines at termination of sealer.

### **3.3 INSTALLATION/APPLICATION**

- A. Do all Work in accordance with manufacturer's written instructions and specifications including, but not limited to, moisture content of substrate, atmospheric conditions (including relative humidity and temperature), coverage, mil thickness and texture, and as shown on Drawings.
- B. Clean all surfaces affected by sealer material overspray and repair all damage caused by sealer material overspray to adjacent construction or property at no cost to Owner.
- C. Clean off excess material as work progresses using methods and materials approved by manufacturer.

### **3.4 FIELD QUALITY CONTROL**

- A. Install 3 trial sections of sealer to verify treated surface is not glazing as result of sealer application. If application of sealer causes glazing at trial section, contact sealer manufacturer to obtain written recommendations for solving problem. Do not proceed with sealer application following trial section applications until directed to do so in writing by Engineer/Architect.
- B. Testing Agency shall take a) 1 core from each trial section and b) 3 additional cores as directed by Engineer/Architect after sealer application to test for sealer effectiveness in accordance with ASTM D6489. Concrete core samples shall be taken 14 days after application of sealer. Report water absorption through top and bottom surfaces of

core. Sealer shall reduce water absorption by at least 85 percent when compared with the unsealed bottom surface.

**3.5 NON-CONFORMING WORK**

- A. Unsatisfactory Field Quality Control test results shall be grounds for rejection of sealer or sealer application rate. Perform sealer reapplication at no additional cost to Owner.

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**SECTION 07 21 13  
THERMAL INSULATION**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Thermal insulation.
    - a. Board or block insulation at foundation perimeter.

**1.2 RELATED REQUIREMENTS**

- A. Adhesives VOC Limits: Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.
- B. Safing Insulation: Section 07 84 00, FIRESTOPPING.

**1.3 APPLICABLE PUBLICATIONS**

- A. Comply with references to extent specified in this section.
- B. ASTM International (ASTM):
  - 1. C552-15 - Cellular Glass Thermal Insulation.
  - 2. C553-13 - Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
  - 3. C578-15 - Rigid, Cellular Polystyrene Thermal Insulation.
  - 4. C591-15 - Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
  - 5. C612-14 - Mineral Fiber Block and Board Thermal Insulation.
  - 6. C665-12 - Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
  - 7. D312/D312M-15 - Asphalt Used in Roofing.
  - 8. E84-15a - Surface Burning Characteristics of Building Materials.
  - 9. F1667-15 - Driven Fasteners: Nails, Spikes, and Staples.

**1.4 SUBMITTALS**

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submittal Drawings:
  - 1. Show insulation type, thickness, and R-value for each location.
- C. Manufacturer's Literature and Data:
  - 1. Description of each product.
  - 2. Adhesive indicating manufacturer recommendation for each application.
- D. Sustainable Construction Submittals:

THERMAL INSULATION

1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.
2. Low Pollutant-Emitting Materials:
  - a. Show volatile organic compound types and quantities.

#### **1.5 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.
- C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

#### **1.6 STORAGE AND HANDLING**

- A. Store products indoors in dry, weathertight facility.
- B. Protect products from damage during handling and construction operations.
- C. Protect foam plastic insulation from UV exposure.

#### **1.7 WARRANTY**

- A. Construction Warranty: Installer shall warranty their installation of thermal insulation work for a period of one (1) year from date of installation and final acceptance by the Government in accordance with the FAR clause 52.246-21, "Warranty of Construction".

### **PART 2 - PRODUCTS**

#### **2.1 INSULATION - GENERAL**

- A. Insulation Thickness:
  1. Provide thickness required by R-value shown on drawings.
  2. Provide thickness indicated when R-value is not shown on drawings.
- B. Insulation Types:
  1. Provide one insulation type for each application.
- C. Sustainable Construction Requirements:
  1. Insulation Recycled Content:
    - a. Polyisocyanurate/polyurethane rigid foam: 9 percent recovered material.
  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.

#### **THERMAL INSULATION**

**2.2 THERMAL INSULATION****A. Perimeter Insulation In Contact with Soil:**

1. Polystyrene Board: ASTM C578, Type IV, V, VI, VII, or IX.
2. Cellular Glass Block: ASTM C552, Type I or IV.

**2.3 ACCESSORIES****A. Fasteners:**

1. Staples or Nails: ASTM F1667, zinc-coated, size and type to suit application.
2. Screws: ASTM C954 or ASTM C1002, size and length to suit application with washer minimum 50 mm (2 inches) diameter.
3. Impaling Pins: Steel pins with head minimum 50 mm (2 inches) diameter.
  - a. Length: As required to extend beyond insulation and retain cap washer when washer is placed on pin.
  - b. Adhesive: Type recommended by manufacturer to suit application.

**B. Insulation Adhesive:**

1. Nonflammable type recommended by insulation manufacturer to suit application.

**C. Tape:**

1. Pressure sensitive adhesive on one face.

**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 substrates. Remove contaminants capable of affecting subsequently installed product's performance.

**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 insulation with vapor barrier facing the heated side, unless indicated otherwise.

THERMAL INSULATION

- C. Install board insulation with joints close and flush, in regular courses, and with end joints staggered.
- D. Fit insulation tight against adjoining construction and penetrations, unless indicated otherwise.

### **3.3 THERMAL INSULATION**

- A. Perimeter Insulation In Contact with Soil:
  - 1. Vertical insulation:
    - a. Fill joints of insulation with same material used for bonding.
    - b. Bond polystyrene board to surfaces with adhesive.
    - c. Bond cellular glass insulation to surfaces with hot asphalt or adhesive cement.
  - 2. Horizontal insulation under concrete floor slab:
    - a. Lay insulation boards and blocks horizontally on level, compacted and drained fill.
    - b. Extend insulation from foundation walls towards center of building minimum 600 mm (24 inches).
  - 3. corner.
- B. Floor Assemblies Above Unconditioned Spaces:
  - 1. Use impaling pins for attach insulation to underside of horizontal surfaces. Space fastenings as required to hold insulation in place and prevent sagging.
    - a. Bond insulation with adhesive when separate vapor retarder is used.

### **3.4 CLEANING**

- A. Remove excess adhesive before adhesive sets.

### **3.5 PROTECTION**

- A. Protect insulation from construction operations.
- B. Repair damage.

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THERMAL INSULATION

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

**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes:
- B. Roof and deck insulation, vapor retarder, and cover board on new concrete substrates ready to receive roofing or waterproofing membrane.

**1.2 RELATED REQUIREMENTS**

- A. Non-Flooring Adhesives and Sealants VOC Limits: Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.
- B. Wood Cants, Blocking, and Edge Strips: Section 06 10 00, ROUGH CARPENTRY.

**1.3 APPLICABLE PUBLICATIONS**

- A. Comply with references to extent specified in this section.
- B. American Society of Heating, Refrigeration and Air Conditioning (ASHRAE):
  - 1. Standard 90.1-13 - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- C. ASTM International (ASTM):
  - 1. C208-12 - Cellulosic Fiber Insulating Board.
  - 2. C552-15 - Cellular Glass Thermal Insulation.
  - 3. C1177/C1177M-13 - Glass Mat Gypsum Substrate for Use as Sheathing.
  - 4. C1278/C1278M-07a(2015) - Fiber-Reinforced Gypsum Panel.
  - 5. C1289-15 - Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
  - 6. D41/D41M-11 - Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.
  - 7. D312-06 - Asphalt Used in Roofing.
  - 8. D2178/D2178M-15 - Asphalt Glass Felt Used in Roofing and Waterproofing.
  - 9. D4586/D4586M-07(2012)e1 - Asphalt Roof Cement, Asbestos-Free.
  - 10. E84-15a - Surface Burning Characteristics of Building Materials.
  - 11. F1667-15 - Driven Fasteners: Nails, Spikes, and Staples.
- D. National Roofing Contractors Association (NRCA):
  - 1. Manual-15 - The NRCA Roofing Manual: Membrane Roof Systems.
- E. U.S. Department of Agriculture (USDA):

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1. USDA BioPreferred Program Catalog.
- F. UL LLC (UL):
  1. Listed - Online Certifications Directory.
- G. U.S. Department of Commerce National Institute of Standards and

#### **1.4 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.
- D. Samples:
  1. Roof insulation, each type.
  2. Fasteners, each type.
- E. 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 and agrifiber product contain no added urea formaldehyde.
- F. Qualifications: Substantiate qualifications meet specifications.
  1. Installer.

#### **1.5 QUALITY ASSURANCE**

- A. Installer Qualifications: Same installer as Division 07 roofing section installer.

#### **1.6 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.

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- D. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

#### **1.7 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.

#### **1.8 FIELD CONDITIONS**

- A. Environment:
  - 1. Install products when existing and forecasted weather permit installation according to manufacturer's instructions.

#### **1.9 WARRANTY**

- A. Construction warranty: installer shall warranty their installation of roof and deck insulation for a period of one (1) year from date of installation and final acceptance by the government in accordance with the 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. Overall Average R-Value: RSI-57 (R-33), minimum.
  - 2. Any Location R-Value: RSI-17 (R-10), minimum.
- 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.

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- 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](http://www.biopreferred.gov).

### **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.

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**C. Tapered Roof Insulation System:**

1. Fabricate of polyisocyanurate. Use only one insulation material for tapered sections. Use only factory-tapered insulation.
2. Cut to provide high and low points with crickets and slopes as shown.
3. Minimum thickness of tapered sections; 38 mm (1-1/2 inch).
4. Minimum slope 1/48 (1/4 inch per 12 inches).

**2.5 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.
- D. Cover Board:
  1. Glass-Mat, Water-Resistant Gypsum Roof Board: ASTM C1177/C1177M, 13 mm (1/2 inch) thick, factory primed.

**2.6 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. Nails: ASTM F1667; type to suit application.

**PART 3 - EXECUTION****3.1 EXAMINATION**

- A. Comply with requirements of Division 07 roofing section.

**3.2 PREPARATION**

- A. Examine and verify substrate suitability for product installation.
- B. Protect existing construction and completed work from damage.

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**3.3 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.

**3.4 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.

**3.5 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:

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1. Thickness of roof insulation shown on drawings is nominal. Provide thickness required to comply with specified thermal performance.
  2. When actual insulation thickness differs from drawings, coordinate alignment and location of roof drains, flashing, gravel stops, fascias and similar items.
  3. 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).
  4. 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.
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 bitumen or 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.
- 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.

### **3.6 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.

- - E N D - -

ROOF AND DECK INSULATION

**SECTION 07 52 16****STYRENE-BUTADIENE-STYRENE MODIFIED BITUMINOUS MEMBRANE ROOFING, HOT-APPLIED****PART 1 - GENERAL****1.1 DESCRIPTION:**

- A. This section specifies modified bituminous sheet roofing and base flashing installed using hot-applied asphalt on new construction with solar reflective granular coating.

**1.2 RELATED WORK:**

- A. General sustainable design documentation requirements: Section 01 81 13 SUSTAINABLE CONSTRUCTION REQUIREMENTS.
- B. Wood cants, blocking and wood edge strips: Section 06 10 00, ROUGH CARPENTRY.
- C. Roof Insulation under Membrane: Section 07 22 00, ROOF AND DECK INSULATION.
- D. Vapor barrier: Section 07 22 00, ROOF AND DECK INSULATION.
- E. Sheet metal components and wind uplift requirements for roof-edge design: Section 07 60 00, FLASHING AND SHEET METAL.

**1.3 APPLICABLE PUBLICATIONS:**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only. Editions of applicable publications current on date of issue of bidding documents apply unless otherwise indicated.
- B. American National Standards Institute/Single-Ply Roofing Institute (ANSI/SPRI):  
ANSI/SPRI ES-1-03.....Wind Design Standard for Edge Systems Used with  
Low Slope Roofing Systems
- C. American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI):  
ASCE/SEI-7-10.....Minimum Design Loads for Buildings and Other  
Structures
- D. Asphalt Roofing Manufacturers Association/National Roofing Contractors Association (ARMA/NRCA): Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing
- E. ASTM International (ASTM):

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C67-09.....Standard Test Methods for Sampling and Testing  
Brick and Structural Clay Tile

C140-09.....Standard Test Methods for Sampling and Testing  
Concrete Masonry Units and Related Units

C1370-00 (R2005).....Standard Test Method for Determining the  
Chemical Resistance of Aggregates for Use in  
Chemical-Resistant Sulfur Polymer Cement  
Concrete and Other Chemical-Resistant Polymer  
Concretes

D146-04.....Standard Test Methods for Sampling and Testing  
Bitumen-Saturated Felts and Woven Fabrics for  
Roofing and Waterproofing

D312-00 (R2006).....Standard Specification for Asphalt Used in  
Roofing

D1644-01 (R2006).....Standard Test Methods for Nonvolatile Content  
of Varnishes

D2523-00 (R2006).....Standard Practice for Testing Load-Strain  
Properties of Roofing Membranes

D3960-05.....Standard Practice for Determining Volatile  
Organic Compound (VOC) Content of Paints and  
Related Coatings

D4073-06.....Standard Test Method for Tensile-Tear Strength  
of Bituminous Roofing Membranes

D4263-83 (R2005).....Standard Test Method for Indicating Moisture in  
Concrete by the Plastic Sheet Method

D4586-07.....Asphalt Roof Cement, Asbestos Free

D4601-04.....Standard Specification for Asphalt-Coated Glass  
Fiber Base Sheet Used in Roofing

D4897-01.....Asphalt Coated Glass Fiber Venting Base Sheet  
Used in Roofing

D5147-07.....Standard Test Methods for Sampling and Testing  
Modified Bituminous Sheet Material

D5201-05 (R2010).....Standard Practice for Calculating Formulation  
Physical Constants of Paints and Coatings

D6162-00 (R2008).....Styrene Butadiene Styrene (SBS) Modified  
Bituminous Sheet Materials Using a Combination  
of Polyester and Glass Fiber Reinforcements

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D6163-00 (R2008).....Styrene Butadiene Styrene (SBS) Modified  
 Bituminous Sheet Materials Using Glass Fiber  
 Reinforcements

D6164-05.....Styrene Butadiene Styrene (SBS) Modified  
 Bituminous Sheet Materials Using Polyester  
 Reinforcements

D6511-06.....Standard Test Methods for Solvent Bearing  
 Bituminous Compounds

E108-10.....Standard Test Methods for Fire Tests of Roof  
 Coverings

F. American Society of Heating, Refrigeration, and Air Conditioning  
 Engineers (ASHRAE)

ASHRAE 90.1-2007.....Energy Standard for Buildings Except Low-Rise  
 Residential Buildings, Appendix f.

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

4450-89.....Approved Standard for Class 1 Insulated Steel  
 Deck Roofs

4470-10.....Approved Standard for Class 1 Roof Coverings

1-28-09.....Loss Prevention Data Sheet: Design Wind Loads.

1-29-09.....Loss Prevention Data Sheet: Above-Deck Roof  
 Components

1-49-09.....Loss Prevention Data Sheet: Perimeter Flashing

H. National Roofing Contractors Association: Roofing and Waterproofing  
 Manual

I. U.S. Department of Agriculture (USDA): USDA BioPreferred Catalog,  
[www.biopreferred.gov](http://www.biopreferred.gov)

J. U.S. Department of Energy (DoE): Roof Products Qualified Product List,  
[www.energystar.gov](http://www.energystar.gov)

#### 1.4 PERFORMANCE REQUIREMENTS

A. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.

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B. Roofing Membrane System Load-Strain Properties: Provide a roofing membrane identical to component systems that have been successfully tested by a qualified independent testing and inspecting agency to meet the following minimum load-strain properties at membrane failure when tested according to ASTM D2523:

1. Tensile strain at failure, at 0 deg F (-18 deg C): 600 lbf(2.67 kN) cross machine direction, minimum; 4.0 to 5.5 percent elongation at break.

C. Roofing System Energy Performance Requirements: Provide a roofing system identical to components that that have been successfully tested by a qualified independent testing and inspecting agency to meet the following requirements:

1. Energy Performance, Energy Star: Provide roofing system that is listed on DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.
2. Energy Performance, Aged: Provide roofing system with minimum three-year aged solar reflectance not less than 0.55 when tested in accordance with ASTM C1549 or ASTM E1918, and in addition, a minimum three-year-aged thermal emittance of 0.75 when tested in accordance with ASTM C1371 or ASTM E408.
  - a. Where tested aged values are not available for proposed product, submit calculations to adjust initial solar reflectance to demonstrate compliance as indicated in ASHRAE 90.1-2007 Addendum f.
  - b. Alternatively, provide roofing system with minimum three-year aged Solar Reflectance Index of not less than 64 when determined in accordance with the Solar Reflectance Index method in ASTM E1980 using a convection coefficient of 2.1 BTU/h-ft<sup>2</sup> (12 W/m<sup>2</sup>K).

#### **1.5 QUALITY CONTROL:**

A. Installer Qualifications:

1. Licensed or approved in writing by manufacturer to perform work under warranty requirements of this Section.
2. Employ full-time supervisors knowledgeable and experienced in roofing of similar types and scopes, and able to communicate with owner and workers.

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B. Inspector Qualifications: Inspection of work by third-party technical inspector or technical representative of manufacturer experienced in the installation and maintenance of the specified roofing system, qualified to perform roofing observation and inspection specified in Field Quality Control Article, to determine Installer's compliance with the requirements of this Project, and approved by the manufacturer to issue warranty certification. The Roofing Inspector shall be one of the following:

1. An authorized full-time technical employee of the manufacturer, not engaged in the sale of products.
2. An independent party certified as a Registered Roof Observer by the Roof Consultants Institute (RCI), retained by the Contractor or the Manufacturer and approved by the Manufacturer.

C. Product/Material Requirements:

1. Obtain products from single manufacturer or from sources recommended by manufacturer for use with roofing system and incorporated in manufacturer's warranty.
2. Provide manufacturer's label on each container or certification with each load of bulk bitumen, indicating Flash Point (FP), Finished Blowing Temperature (FBT), Softening Point (SP), Equiviscous Temperature (EVT).
3. Provide manufacturer's certification that field applied bituminous coatings and mastics, and field applied roof coatings comply with limits for Volatile Organic Compounds (VOC) per the National Volatile Organic Compound Emission Standards for Architectural Coatings pursuant to Section 183(e) of the Clean Air Act with limits as follows:
  - a. Bituminous Coatings and Mastics: 500 g/l (4.2 lb/gal.).
  - b. Roof Coatings: 250 g/l (2.1 lb/gal.).
4. 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](http://www.biopreferred.gov).

D. Roofing system design standard requirements:

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1. Recommendations of the NRCA "Roofing and Waterproofing Manual" applicable to modified bituminous sheet roofing for storage, handling and application.
  2. Recommendations of FM Approvals 1-49 Loss Prevention Data Sheet for Perimeter Flashings.
  3. Recommendations of ANSI/SPRI ES-1 for roof edge design.
  4. Roofing System Design: Provide roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE/SEI 7.
    - a. Corner Uplift Pressure: 150 lbf/sq. ft.).
    - b. Perimeter Uplift Pressure: 105 lbf/sq. ft.).
    - c. Field-of-Roof Uplift Pressure: 60 lbf/sq. ft.).
  5. FM Approvals Listing: Provide roofing membrane, base flashing, and component materials that comply with requirements in FM Approvals 4450 and FM Approvals 4470 as part of a roofing system and that are listed in FM Approvals "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals markings.
    - a. Fire/Windstorm Classification: Class 1A-90.
    - b. Hail Resistance: SH.
- E. Pre-Roofing Meeting:
1. Upon completion of roof deck installation and prior to any roofing application, hold a pre-roofing meeting arranged by the Contractor and attended by the Roofing Inspector, Material Manufacturers Technical Representative, Roofing Applicator, Contractor, and Resident Engineer.
  2. Discuss specific expectations and responsibilities, construction procedures, specification requirements, application, environmental conditions, job and surface readiness, material storage, and protection.
  3. Inspect roof deck at this time to:
    - a. Verify that work of other trades which penetrates roof deck is completed.
    - b. Determine adequacy of deck anchorage, presence of foreign material, moisture and unlevel surfaces, or other conditions that

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would prevent application of roofing system from commencing or cause a roof failure.

c. Examine samples and installation instructions of manufacturer.

#### **1.6 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, SAMPLES.
- B. Product Data:
  - 1. Asphalt and adhesive materials.
  - 2. Modified bituminous sheet roofing and flashing membrane.
  - 3. Roofing cement.
  - 4. Roof walkway.
  - 5. Fastening requirements.
  - 6. Application instructions.
- C. Samples:
  - 1. Nails and fasteners, each type.
- D. Shop Drawings: Include plans, sections, details, and attachments.
  - 1. Base flashings and terminations.
- E. Certificates:
  - 1. Indicating materials and method of application of roofing system meets requirements of FM Approvals "RoofNav" for specified fire/windstorm classification.
  - 2. Indicating compliance with load/strain properties requirement.
  - 3. Indicating compliance with energy performance requirement.
- F. Warranty: As specified.
- G. Documentation of supervisors' and inspectors' qualifications.
- H. Field reports of roofing inspector.
- I. Contract Close-out Submittals:
  - 1. Maintenance Manuals.
  - 2. Warranty signed by installer and manufacturer.

#### **1.7 DELIVERY, STORAGE AND MARKING:**

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

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**1.8 ENVIRONMENTAL REQUIREMENTS**

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.
- B. Environmental Controls: Refer to Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.

**1.9 WARRANTY:**

- A. Construction warranty: installer shall warranty their installation of SBS Modified Bituminous Membrane Roofing for a period of one (1) year from date of installation and final acceptance by the government in accordance with the far clause 52.246-21, "warranty of construction".
- B. Manufacturer Warranty: Submit manufacturer's written warranty for materials and installation for a minimum of ten (10) years from the date of installation and final acceptance by the Government. Submit manufacturer warranty during the submittal process.

**PART 2 - PRODUCTS****2.1 ADHESIVE AND ASPHALT MATERIALS:**

- A. General: Adhesive and sealant materials recommended by roofing system manufacturer for intended use, identical to materials utilized in approved listed roofing system, and compatible with roofing membrane.
  - 1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
  - 2. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
    - a. Multipurpose Construction Adhesives: 70 g/L.
    - b. Contact Adhesives: 80 g/L.
    - c. Other Adhesives: 250 g/L.
    - d. Nonmembrane Roof Sealants: 300 g/L.
    - e. Sealant Primers for Nonporous Substrates: 250 g/L.
    - f. Sealant Primers for Porous Substrates: 775 g/L.
- B. Water-Based Asphalt Primer: Water-based, polymer modified, asphalt primer with the following physical properties:
  - 1. Asbestos Content, EPA 600/R13/116: None.

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2. Non-Volatile Content, minimum, ASTM D 2823: 30 percent.
3. Volatile Organic Compounds (VOC), maximum, ASTM D 3960: 65 g/L.
- C. Asphalt: ASTM D312, Type III or IV for roof membrane.
- D. Cold-Applied Adhesive for membrane flashing: One-part, cold-applied adhesive specially formulated for compatibility and use with specified roofing membranes and flashings, with the following physical properties:
  1. Asbestos Content, EPA 600 R13/116: None.
  2. Volatile Organic Compounds (VOC), maximum, ASTM D 6511: <250 g/L.
  3. Nonvolatile Content, minimum, ASTM D 6511: 75 percent.
  4. Uniformity and Consistency, ASTM D 6511: Pass.
- E. Roof Cement: ASTM D4586, Type II.

## **2.2 MEMBRANE AND SHEET MATERIALS:**

- A. Membrane Materials, General: Provide combination of base, ply, and cap sheet materials that have been tested in combination and comply with load/strain properties performance requirement in Part 1 of this Section.
- B. Base Sheet: ASTM D 4601, Type II, nonperforated, asphalt-impregnated and coated glass-fiber sheet dusted with fine mineral surfacing on both sides, with the following properties:
  1. Breaking Strength, minimum, ASTM D 146: cross machine direction, 12.2 kN/m (70 lbf/in).
  2. Pliability, 12.7 mm (1/2 inch) radius bend, ASTM D 146: No failures.
- C. Membrane Ply Sheet: ASTM D6163, Grade S, Type II or III, glass-fiber-reinforced, SBS/SEBS-modified asphalt sheet, or ASTM D6162, Grade S, Type II or III, SBS/SEBS-modified asphalt sheet; smooth surfaced; suitable for application method specified, with the following minimum properties:
  1. Tensile Strength at 23 deg. C (73 deg. F), minimum, ASTM D 5147: cross machine direction, 21 kN/m (120 lbf/in).
  2. Tear Strength at 23 deg. C (73 deg. F), minimum, ASTM D 5147: cross machine direction 890 N (200 lbf).
  3. Elongation at 23 deg. C (73 deg. F), minimum, at 5 percent maximum load ASTM D 5147: cross machine direction, 40 percent.

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- D. Membrane Cap Sheet: ASTM D6163, Grade G, Type II, glass-fiber-reinforced, SBS/SEBS/SIS modified asphalt sheet; granular surfaced; and as follows:
1. Exterior Fire-Test Exposure, ASTM E108: Class A.
  2. Tensile Strength at 23 deg. C (73 deg. F), minimum, cross machine direction, ASTM D5147: 24 kN/m (140 lbf/in).
  3. Tear Strength at 23 deg. C (73 deg. F), minimum, cross machine direction, ASTM D5147: 880 N (200 lbf).
  4. Elongation at 23 deg. C (73 deg. F), minimum, cross machine direction, at 5 percent maximum load ASTM D5147: 40 percent.
  5. Low Temperature Flex, maximum, ASTM D5147: -31 deg. C (-25 deg. F).
- E. Base Flashing Backer Sheet: ASTM D4601, Type II, asphalt-impregnated and coated, glass-fiber sheet, dusted with fine mineral surfacing on both sides.
- F. Base Flashing Sheet: ASTM D6164, Grade G, Type II, polyester-reinforced, SBS-modified asphalt sheet; granular surfaced; Granule Color: White.

### **2.3 FASTENERS:**

- A. Roofing Fasteners: Factory-coated steel fasteners and metal or plastic plates, where applicable, meeting requirements of FM Approvals 4470, tested by fastener manufacturer for required pullout strength, and recommended by roofing manufacturer for application.
- B. Accessory Fasteners: Corrosion-resistant fasteners compatible with adjacent materials and recommended for application by manufacturer of component to be fastened.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION:**

- A. Examine substrates and conditions with roofing Installer and roofing inspector to verify compliance with project requirements and suitability to accept subsequent roofing work. Correct unsatisfactory conditions before proceeding with roofing work.
- B. Do not apply roofing if roof surface will be used for subsequent work platform, storage of materials, or staging or scaffolding will be erected thereon unless system is protected.

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### 3.2 PREPARATION

- A. Complete roof deck construction prior to commencing roofing work:
  - 1. Install curbs, blocking, edge strips, nailers, cants, and other components where insulation, roofing, and base flashing is attached to, in place ready to receive insulation and roofing.
  - 2. Complete deck and insulation to provide designed drainage to working **gutter and downspout.**
  - 3. Document installation of related materials to be concealed prior to installing roofing work.
- B. Dry out surfaces, including the flutes of metal deck that become wet from any cause during progress of the work before roofing work is resumed. Apply materials to dry substrates.
- C. Sweep decks to broom clean condition. Remove all dust, dirt or debris.
- D. Remove projections that might damage materials.
- E. Concrete Decks, except Insulating Concrete:
  - 1. Test concrete decks for moisture prior to application of roofing materials. Test for capillary moisture by plastic sheet method according to ASTM D4263.
  - 2. Test concrete decks for moisture by pouring one pint of hot bitumen at 204 degrees C (400 degrees F.) or EVT on deck at start of each day's Work and at start of each new roof area or plane. Do not proceed if test sample foams or can be easily (cleanly) stripped after cooling.
  - 3. Prime concrete decks, including precast units, with primer as specified. Keep primer back four inches from joints in precast units.
  - 4. Allow primer to dry before application of bitumen.

### 3.3 HEATING BITUMEN

- A. Heat the asphalt to the equiviscous temperature plus or minus -4 deg. C (25 deg. F) at the time of application:
  - 1. Do not heat asphalt greater than 38 deg. C (100 deg. F) above the equiviscous temperature.
  - 2. When the equiviscous temperature is not furnished by the asphalt manufacturer, do not heat asphalt above 275 deg. C (525 deg. F) for Type III and IV with temperature not less than 250 deg. C (475 deg. F) at time of application.

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- B. Do not heat bitumen above the flash point temperature.
- C. Provide heating kettles with a thermometer kept in operating condition. Attend kettle during heating to insure that the bitumens are heated within the temperatures specified.
- D. Use type III and Type IV asphalt between plies.
- E. Do not mix different type of asphalt in kettle.

### **3.4 TEMPORARY PROTECTION**

- A. Install temporary protection at the end of day's work and when work is halted for an indefinite period or work is stopped when precipitation is imminent. Comply with approved temporary protection plan.
- B. Install temporary cap flashing over the top of base flashings where permanent flashings are not in place to provide protection against moisture entering the roof system through or behind the base flashing. Securely anchor in place to prevent blow off and damage by construction activities.
  - 1. Glaze coat exposed surfaces of felts to seal within the bitumen coating. Do not leave felt surfaces or edges exposed.
- C. Provide for removal of water or drainage of water away from the work.
- D. Provide temporary protection over installed roofing by means of duckboard walkways, plywood platforms, or other materials, as approved by Resident Engineer, for roof areas that are to remain intact, and that are subject to foot traffic and damage. Provide notches in sleepers to permit free drainage.

### **3.5 INSTALLATION, GENERAL**

- A. FM Approvals Installation Standard: Install roofing membrane, base flashings, wood cants, blocking, curbs, and nailers, and component materials in compliance with requirements in FMG 4450 and FMG 4470 as part of a membrane roofing system as listed in FM Approval's "RoofNav" for fire/windstorm classification indicated. Comply with recommendations in FM Approvals' Loss Prevention Data Sheet 1-49, including requirements for wood nailers and cants.
- B. NRCA Installation Standard: Install roofing system in accordance with applicable NRCA Manual Plates and NRCA recommendations, including ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing"

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- C. Manufacturer Recommendations: Comply with roofing system manufacturer's written installation recommendations.
- D. Coordination with related work: Coordinate roof operations with roof insulation and sheet metal work so that insulation and flashings are installed concurrently to permit continuous roofing operations.
- E. Installation Conditions:
  - 1. Apply dry roofing materials. Apply roofing work over dry substrates and materials.
  - 2. Apply materials within temperature range and surface and ambient conditions recommended by manufacturer.
  - 3. Except for temporary protection, do not apply materials during damp or rainy weather, during excessive wind conditions, nor while moisture (dew, snow, ice, fog or frost) is present in any amount in or on the materials to be covered or installed:
    - a. Do not apply materials when the temperature is below 4 deg. C (40 deg. F).
    - b. Do not apply materials to substrate having temperature of 4 deg. C (40 deg. F) or less.

### **3.6 INSTALLATION OF MODIFIED BITUMEN MEMBRANE:**

- A. Primer: Apply primer to substrates where recommended by roofing manufacturer, in application quantities recommended by roofing manufacturer.
- B. Hot Roofing Asphalt: Apply hot roofing asphalt in quantities required, immediately followed by membrane materials embedded therein before bitumen cools below the application temperature limit.
  - 1. Do not apply more material than can be covered at one time except for glaze coats.
  - 2. Recoat cooled areas.
  - 3. Application rate between substrate and sheets: 7 to 11 Kg (15 to 25 pounds) per square.
  - 4. Application rate for glaze coats: 7 to 11 Kg (15 to 25 pounds).
- C. Membrane Sheets:
  - 1. Number of Plies: 2, minimum, including base sheet and cap sheet, and additional plies as required to meet load/strain properties specified in Part 1 of this Section.
  - 2. Commence the laying of sheets at the low points.

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3. Roll sheets into hot roofing asphalt brushing down to firmly embed, free of wrinkles, fish mouths, blisters, bubbles, voids, air pockets or other defects that prevent complete adhesion:
  4. Cut to fit closely around pipes, roof drains, bitumen stops, and similar roof projections.
  5. Lap sheets shingle fashion starting with starter strips at right angles to slope of roof.
  6. Laps for Top Sheet and Base Sheet:
    - a. Base sheet, lapped 75 mm (three inches).
    - b. Use 450 mm (18 inch) starting widths, lap top sheet 475 mm (19 inches).
    - c. Lap end joints of sheet 150 mm (six inches). Stagger end joints in relation to end joints in adjacent and proceeding plies.
- D. Roof edges and terminations:
1. Where nailers occur at roof edges under gravel stops or penetrations to receive metal base flashing, apply a continuous strip of underlayment over the nailers before the first ply sheet is applied. Strip shall be installed on top of venting base sheet if any.
  2. After membrane is installed, turn the underlayment back over the roofing, and secure in place with hot roofing asphalt before gravel stops or other metal flanges extending out onto the membrane are installed.
  3. Where cants occur at vertical surfaces, cut off roofing sheets two inches above top of cant strips, except at prefabricated curbs, scuttles and other roof accessories having integral cants, extend membrane over cant and up vertical surface to top of curb or nailer as shown.
  4. Where fascia-cant occurs at roof edges, extend membrane beyond outside cant face and cut off at outside after base flashing is installed.
  5. Where reglet occurs at vertical surfaces, extend plies roofing sheets up into reglet the full depth of the reglet.

### **3.7 BASE FLASHING:**

- A. Provide built-up base flashing over cants and as necessary to make work watertight.

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- B. Prime vertical surfaces of masonry and concrete with asphalt primer except where vented base sheet is required to provide edge venting.
- C. Apply flashing on top of roofing, up face of cant and up the face of the vertical surface, at least 200 mm (eight inches) above the roofing but not more than 350 mm (14 inches) above the roofing, generally full height beneath counter flashing or top of curb flashing.
  - 1. At fascia-cants, extend to top of cant and cut off at top of cant.
  - 2. At reglet, extend full depth into the reglet.
  - 3. Where venting base sheet is used with insulating concrete, do not seal edges of venting base sheet with bitumen; allow for venting.
- D. Use two plies of modified bituminous sheet.
  - 1. Extend the first ply 100 mm (four inches) out on the roofing, and the second ply 75 mm (three inches) beyond the first ply. Lap ends 75 mm (three inches) with joints broken 450 mm (18 inches) in each ply. Use smooth surface modified bituminous sheet for first ply.
  - 2. Use granular surfaced modified bitumen cap sheet.
- E. Set base flashing either in Type III or IV asphalt.
  - 1. Embed each sheet in asphalt so sheets do not touch.
  - 2. Set cap sheet in cold-applied adhesive with laps sealed with cold-applied adhesive.
  - 3. Except for venting roof edges, seal the top edge of the base flashing with roof cement.
- F. Except at metal fascia cants, secure top edge of base flashing with nails on a line approximately 25 mm (one inch) below top edge, spaced not more than 200 mm (eight inches) on center.
  - 1. Cover nail heads with roof cement.
  - 2. Cover the top of the base flashing with counterflashing as specified in Section 07 60 00, FLASHING AND SHEET METAL. At the fascia cants secure the top edge of the flashing with fascia compression clamp as specified in Section 07 60 00, FLASHING AND SHEET METAL.

### 3.8 STRIPPING:

- A. Coordinate to set flanges of metal flashing in roof cement on top sheet of the modified bituminous roofing and mailing to blocking with Section 07 60 00, FLASHING AND SHEET METAL.

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- B. Cover that portion of the horizontal flanges of metal base flashings, gravel stops, and other flanges extending out onto the roofing with modified bituminous sheet.
- C. Extend the sheet out on the roofing 150 mm six inches beyond the edge of the metal flange. Cut edge to fit tight against vertical members of flange.
- D. Prime flange before stripping, embed sheet in cold-applied adhesive.

### **3.9 FIELD QUALITY CONTROL:**

- A. Roofing Inspector: Contractor shall engage a qualified roofing inspector for a minimum of 5 full-time days on site to perform roof tests and inspections and to prepare start up, interim, and final reports. Roofing Inspector's quality assurance inspections shall comply with criteria established in ARMA/NRCA's "Quality Control Guidelines for the Application of Built-up Roofing."
- B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
  - 1. Notify Architect and Owner 48 hours in advance of date and time of inspection.
- C. Repair or remove and replace components of roofing work where test results or inspections indicate that they do not comply with specified requirements.
  - 1. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

### **3.10 PROTECTING AND CLEANING**

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

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STYRENE-BUTADIENE-STYRENE MODIFIED BITUMINOUS MEMBRANE ROOFING, HOT-APPLIED

**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. Flashing components of factory finished roofing and wall systems:  
Division 07 roofing and wall system sections.
- B. Joint Sealants: Section 07 92 00, JOINT SEALANTS.
- C. Color of factory coated exterior architectural metal and anodized aluminum items: Referenced elsewhere in this specification.
- D. Integral flashing components of manufactured roof specialties and accessories or equipment: Division 22, PLUMBING sections and Division 23 HVAC sections.
- E. Paint materials and application: Section 09 91 00, PAINTING.

**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
- C. American National Standards Institute/Single-Ply Roofing Institute (ANSI/SPRI):  
ANSI/SPRI ES-1-03.....Wind Design Standard for Edge Systems Used with  
Low Slope Roofing Systems
- D. American Architectural Manufacturers Association (AAMA):
- E. ASTM International (ASTM):  
A653/A653M-11.....Steel Sheet Zinc-Coated (Galvanized) or Zinc  
Alloy Coated (Galvanized) by the Hot- Dip  
Process  
B32-08.....Solder Metal

FLASHING AND SHEET METAL

- B209-10.....Aluminum and Aluminum-Alloy Sheet and Plate
- D173-03(R2011).....Bitumen-Saturated Cotton Fabrics Used in  
Roofing and Waterproofing
- D412-06(R2013).....Vulcanized Rubber and Thermoplastic Elastomers-  
Tension
- D1187-97(R2011).....Asphalt Base Emulsions for Use as Protective  
Coatings for Metal
- D1784-11.....Rigid Poly (Vinyl Chloride) (PVC) Compounds and  
Chlorinated Poly (Vinyl Chloride) (CPVC)  
Compounds
- D4586-07.....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 forces per FM Approvals 1-49:  
Reference structural drawings for Wind Design Criteria
- B. Wind Design Standard: Fabricate and install copings and roof-edge  
flashings tested per ANSI/SPRI ES-1 to resist design pressure indicated  
on Drawings.

#### 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

FLASHING AND SHEET METAL



- C. Manufacturer's Literature and Data: For all specified items, including but not limited to, the following:
1. Two-piece counterflashing (if required)
  2. Thru wall flashing (if required)
  3. Expansion joint cover, each type
  4. Nonreinforced, elastomeric sheeting (if required)
- 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 except alloy used for color anodized aluminum shall be as required to produce specified color. Alloy required to produce specified color shall have the same structural properties as alloy 3003-H14.
- C. Galvanized Sheet: ASTM, A653.

### **2.2 FLASHING ACCESSORIES**

- A. Solder: ASTM B32; flux type and alloy composition as required for use with metals to be soldered.
- B. Rosin Paper: Fed-Spec. UU-B-790, Type I, Grade D, Style 1b, Rosin-sized sheathing paper, weighing approximately 3 Kg/10 m<sup>2</sup> ( 6 lbs/100 sf).
- C. Bituminous Paint: ASTM D1187, Type I.
- D. Fasteners:
1. Use copper, copper alloy, bronze, brass, or stainless steel for copper and copper clad stainless steel, and stainless steel for stainless steel and aluminum alloy. Use galvanized steel or stainless steel for galvanized steel.
  2. Nails:
    - a. Minimum diameter for copper nails: 3 mm (0.109 inch).
    - b. Minimum diameter for aluminum nails 3 mm (0.105 inch).
    - c. Minimum diameter for stainless steel nails: 2 mm (0.095 inch) and annular threaded.
    - d. Length to provide not less than 22 mm (7/8 inch) penetration into anchorage.
  3. Rivets: Not less than 3 mm (1/8 inch) diameter.
  4. Expansion Shields: Fed Spec A-A-1925A.

#### **FLASHING AND SHEET METAL**

- E. Sealant: As specified in Section 07 92 00, JOINT SEALANTS for exterior locations.
- F. Insect Screening: ASTM D3656, 18 by 18 regular mesh.
- G. 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 aluminum or galvanized steel is specified with each item.

### **2.4 FABRICATION, GENERAL**

- A. Jointing:
  - 1. In general, stainless steel, except expansion and contraction joints, shall be locked and soldered.
  - 2. Jointing of 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.
  - 6. Soldering:
    - a. Pre tin both mating surfaces with solder for a width not less than 38 mm (1 1/2 inches) of 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.

#### **FLASHING AND SHEET METAL**

2. Space joints as shown or as specified.
3. Space expansion and contraction joints for 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 or 1.25 mm (0.050 inch) thick aluminum.
3. Use material compatible with sheet metal to be secured by the edge strip.
4. Fabricate in 3000 mm (10 feet) maximum lengths with not less than 19 mm (3/4 inch) loose lock into metal secured by edge strip.
5. Fabricate Strips for fascia anchorage to extend below the supporting 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 or 1.6 mm (0.0625 inch) thick aluminum.

FLASHING AND SHEET METAL

**E. Drips:**

1. Form drips at lower edge of sheet metal counter-flashings (cap flashings), fascias, gravel stops, wall copings, by folding edge back 13 mm (1/2 inch) and bending out 45 degrees from vertical to carry water away from the wall.
2. Form drip to provide hook to engage cleat or edge strip for fastening for not less than 19 mm (3/4 inch) loose lock where shown.

**F. Edges:**

1. Edges of flashings concealed in masonry joints opposite drain side shall be turned up 6 mm (1/4 inch) to form dam, unless otherwise specified or shown otherwise.
2. Finish exposed edges of flashing with a 6 mm (1/4 inch) hem formed by folding edge of flashing back on itself when not hooked to edge strip or cleat. Use 6 mm (1/4 inch) minimum penetration beyond wall face with drip for through-wall flashing exposed edge.
3. All metal roof edges shall meet requirements of IBC, current edition.

**G. Metal Options:**

1. Where options are permitted for different metals use only one metal throughout.
2. Stainless steel may be used in concealed locations for fasteners of other metals exposed to view.
3. Where copper gravel stops, copings and flashings will carry water onto cast stone, stone, or architectural concrete, or stainless steel.

**2.5 FINISHES**

- A. Use same finish on adjacent metal or components and exposed metal surfaces unless specified or shown otherwise.
- B. In accordance with NAAMM Metal Finishes Manual AMP 500, unless otherwise specified.
- C. Finish exposed metal surfaces as follows, unless specified otherwise:
  1. Stainless Steel: Finish No. 2B or 2D.
  2. Aluminum:
    - a. Clear Finish: AA-C22A41 medium matte, clear anodic coating, Class 1 Architectural, 18 mm (0.7 mils) thick.
  3. 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 and finish coat over a phosphate 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 or Stone Panels.
  - 1. Use plan flat sheet of stainless steel.
  - 2. Form exposed portions 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) 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 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 can not be inserted in vertical surface.
2. One piece fabricate upper edge folded double for 65 mm (2 1/2 inches) with top 19 mm (3/4 inch) bent out to form "V" joint sealant pocket with vertical surface. Perforate flat double area against vertical surface with horizontally slotted fastener holes at 400 mm (16 inch) centers between end holes. Option: One piece surface mounted counter-flashing (cap flashing) may be used. Fabricate as detailed on Plate 51 of SMACNA Architectural Sheet Metal Manual.
3. Two pieces: Fabricate upper edge to lock into surface mounted receiver. Fabricate receiver joint sealant pocket on upper edge and lower edge to receive counterflashing, with slotted fastener holes at 400 mm (16 inch) centers between upper and lower edge.

**F. Pipe Counterflashing:**

1. Form flashing for water-tight umbrella with upper portion against pipe to receive a draw band and upper edge to form a "V" joint sealant receiver approximately 19 mm (3/4 inch) deep.
2. Fabricate 100 mm (4 inch) over lap at end.
3. Fabricate draw band of same metal as counter flashing. Use 0.6 Kg (24 oz) copper or 0.33 mm (0.013 inch) thick stainless steel or copper coated stainless steel.
4. Use stainless steel bolt on draw band tightening assembly.
5. Vent pipe counter flashing may be fabricated to omit draw band and turn down 25 mm (one inch) inside vent pipe.

G. Where vented edge decks intersect vertical surfaces, form in one piece, shape to slope down to a point level with and in front of edge-set notched plank; then, down vertically, overlapping base flashing.

**2.8 GRAVEL STOPS****A. General:**

1. Fabricate in lengths not less than 2400 mm (8 feet) long and maximum of 3000 mm (10 feet).
2. Fabricate internal and external corners as one-piece with legs not less than 600 mm (2 feet) or more than 1200 mm (4 feet) long.
3. Fabricate roof flange not less than 100 mm (4 inches) wide.
4. Fabricate top edge to extend above roof not less than 25 mm (one inch) for embedded gravel aggregate and not less than 100 mm (4 inches) for loose laid ballast.
5. Fabricate lower edge outward at an angle of 45 degrees to form drip and as fascia or as counter flashing as shown:
  - a. Fabricate of one-piece material of suitable width for fascia height of 250 mm (10 inch) maximum or counterflashing lap of not less than 100 mm (4 inch) over base flashing.
  - b. Fabricate bottom edge of formed fascia to receive edge strip.
  - c. When fascia bottom edge forms counter flashing over roofing lap roofing not less than 150 mm (6 inches).

**B. Formed Flat Sheet Metal Gravel Stops and Fascia:**

1. Fabricate as shown of .05 mm (0.018 inch) thick stainless steel .
2. When fascia exceeds 150 mm (6 inches) in depth, form one or more horizontal stops not less than 13 mm (1/2 inch) high in the fascia.

3. Fabricate as two-piece fascia when fascia depth exceeds 250 mm (10 inches).
  4. At joint between ends of sheets, provide a concealed clip soldered or welded near one end of each sheet to hold the adjoining sheet in lapped position. The clip shall be approximately 100 mm (4 inches) wide and shall be the full depth of the fascia less 25 mm (one inch) at top and bottom. Clip shall be of the same thickness as the fascia.
  5. Provide edge strip as specified with lower hooked edge bent outward at an angle of 45 degrees.
- C. Formed (Corrugated Sheet) Sheet Metal Gravel Stops and Fascia:
1. Fabricate as shown of 0.4 mm (0.015 inch) thick stainless steel or 0.8 mm (0.032 inch) thick aluminum.
  2. Sheets shall have 2 mm (1/16 inch) deep corrugations either transversely or diagonally rolled into the sheet. Crimped sheets are not acceptable.
  3. Factory fabricate prepackaged system, complete with fastenings.
  4. Provide concealed flashing splice plate at joints not less than 150 mm (6 inches) long and continuous edge strip at lower edge of fascia made from same metal.
  5. Fabricate as two-piece fascia when fascia depth exceeds 175 mm (7 inches).

## 2.9 BITUMEN STOPS

- A. Fabricate bitumen stops for bituminous roofing edges for use with formed sheet metal gravel stops, pipe penetrations, and other penetrations through roof deck without a curb.
- B. Fabricate with 19 mm (3/4 inch) vertical legs and 75 mm (3 inch) horizontal legs.
- C. When used with gravel stop or metal base flashing use same metal for bitumen stop in thickness specified for concealed locations.

## 2.10 HANGING GUTTERS

- A. See drawings for gutter configuration.
- B. Fabricate gutters of not less than the following:
  1. 0.031 inch)thick stainless steel..
  2. 0.051 inch) thick aluminum..
- C. Fabricate hanging gutters in sections not less than 2400 mm (8 feet) long, except at ends of runs where shorter lengths are required.

### FLASHING AND SHEET METAL



- D. Gutter Bead: Stiffen outer edge of gutter by folding edge over approximately 19 mm (3/4 inch) toward roof and down approximately 19 mm (3/4 inch) unless shown otherwise.
- E. Gutter Spacers:
1. Fabricate of same material and thickness as gutter.
  2. Fabricate 25 mm (one inch) wide strap and fasten to gutters not over 900 mm (36 inches) on center.
  3. Turn back edge up 25 mm (one inch) and lap front edge over gutter bead.
  4. Rivet and solder to gutter except rivet and seal to aluminum.
- F. Outlet Tubes:
1. Form outlet tubes to connect gutters to conductors of same metal and thickness as gutters extend into the conductor 75 mm (3 inch). Flange upper end of outlet tube 13 mm (1/2 inch).
  2. Lock and solder longitudinal seam except use sealant in lieu of solder with aluminum.
  3. Seal aluminum tube to gutter and rivet to gutter.
  4. Fabricate basket strainers of same material as gutters.
- G. Gutter Brackets:
1. Fabricate of same metal as gutter. Use the following:
    - a. 3 by 40 mm (1/8 by 1 1/2 inch) stainless steel.
    - b. 6 by 25 mm (1/4 by 1 inch) aluminum.
  2. Fabricate to gutter profile as indicated on drawings.
  3. Drill two 5 mm (3/16 inch) diameter holes in anchor leg for countersunk flat head screws.

## 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 Plate 34, Design C for rectangular shapes and E for 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 REGLETS**

- A. Fabricate reglets of one of the following materials:
1. Stainless steel, not less than 0.3 mm (0.012 inch) thick.
  2. Plastic coated extruded aluminum, not less than 1.4 mm (0.055 inch) thick prefilled with butyl rubber sealer and complete with plastic wedges inserted at 1000 mm (40 inches) on centers.
- B. Fill open-type reglets with fiberboard or other suitable separator, to prevent crushing of the slot during installation.
- C. Bend edges of reglets for setting into concrete to an angle of not less than 45 degrees, and make wide enough to provide firm anchorage in the concrete.
- D. Fabricate reglets for building into horizontal masonry mortar joints not less than 19 mm (3/4 inch) deep, nor more than 25 mm (one inch) deep.
- E. Fabricate mitered corners, fittings, and special shapes as may be required by details.
- F. Reglets for concrete may be formed to receive flashing and have a 10 mm (3/8 inch), 45 degree snap lock.

**PART 3 - EXECUTION****3.1 INSTALLATION****A. General:**

1. Install flashing and sheet metal items as shown in Sheet Metal and Air Conditioning Contractors National Association, Inc., publication, ARCHITECTURAL SHEET METAL MANUAL, except as otherwise shown or specified.
2. Apply Sealant as specified in Section 07 92 00, JOINT SEALANTS.
3. Apply sheet metal and other flashing material to surfaces which are smooth, sound, clean, dry and free from defects that might affect the application.
4. Remove projections which would puncture the materials and fill holes and depressions with material compatible with the substrate. Cover holes or cracks in wood wider than 6 mm (1/4 inch) with sheet metal compatible with the roofing and flashing material used.
5. Coordinate with masonry work for the application of a skim coat of mortar to surfaces of unit masonry to receive flashing material before the application of flashing.
6. Apply a layer of 7 Kg (15 pound) saturated felt followed by a layer of rosin paper to wood surfaces to be covered with copper. Lap each ply 50 mm (2 inch) with the slope and nail with large headed copper nails.
7. Confine direct nailing of sheet metal to strips 300 mm (12 inch) or less wide. Nail flashing along one edge only. Space nail not over 100 mm (4 inches) on center unless specified otherwise.
8. Install bolts, rivets, and screws where indicated, specified, or required in accordance with the SMACNA Sheet Metal Manual. Space rivets at 75 mm (3 inch) on centers in two rows in a staggered position. Use neoprene washers under fastener heads when fastener head is exposed.
9. Coordinate with roofing work for the installation of metal base flashings and other metal items having roof flanges for anchorage and watertight installation.
10. Nail continuous cleats on 75 mm (3 inch) on centers in two rows in a staggered position.
11. Nail individual cleats with two nails and bend end tab over nail heads. Lock other end of cleat into hemmed edge.

## FLASHING AND SHEET METAL

12. Install flashings in conjunction with other trades so that flashings are inserted in other materials and joined together to provide a water tight installation.
13. Where required to prevent galvanic action between dissimilar metal isolate the contact areas of dissimilar metal with sheet lead, waterproof building paper, or a coat of bituminous paint.
14. Isolate aluminum in contact with dissimilar metals other than stainless steel, white bronze or other metal compatible with aluminum by:
  - a. Paint dissimilar metal with a prime coat of zinc-chromate or other suitable primer, followed by two coats of aluminum paint.
  - b. Paint dissimilar metal with a coat of bituminous paint.
  - c. Apply an approved caulking material between aluminum and dissimilar metal.
15. Paint aluminum in contact with or built into mortar, concrete, plaster, or other masonry materials with a coat of bituminous paint.
16. Paint aluminum in contact with absorptive materials that may become repeatedly wet with two coats of bituminous paint or two coats of aluminum paint.
17. Bitumen Stops:
  - a. Install bitumen stops for built-up roof opening penetrations through deck and at formed sheet metal gravel stops.
  - b. Nail leg of bitumen stop at 300 mm (12 inch) intervals to nailing strip at roof edge before roofing material is installed.

### **3.2 THROUGH-WALL FLASHING**

#### **A. General:**

1. Install continuous through-wall flashing between top of concrete foundation walls and bottom of masonry building walls; at top of concrete floors; under masonry, concrete, or stone copings and elsewhere as shown.
2. Where exposed portions are used as a counterflashings, lap base flashings at least 100 mm (4 inches) and use thickness of metal as specified for exposed locations.
3. Exposed edge of flashing may be formed as a receiver for two piece counter flashing as specified.
4. Terminate exterior edge beyond face of wall approximately 6 mm (1/4 inch) with drip edge where not part of counter flashing.

#### **FLASHING AND SHEET METAL**

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. 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.

E. 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.

F. 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.

G. 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 COUNTERFLASHING (CAP FLASHING OR HOODS)**

A. General:

1. Install counterflashing over and in conjunction with installation of base flashings, except as otherwise specified or shown.
2. Install counterflashing to lap base flashings not less than 100 mm (4 inch).
3. Install upper edge or top of counterflashing not less than 225 mm (9 inch) above top of the roofing.

4. Lap joints not less than 100 mm (4 inch). Stagger joints with relation to metal base flashing joints.
  5. Use surface applied counterflashing on existing surfaces and new work where not possible to integrate into item.
  6. When fastening to concrete or masonry, use screws driven in expansion shields set in concrete or masonry. Use screws to wood and sheet metal. Set fasteners in mortar joints of masonry work.
- B. One Piece Counterflashing:
1. Where flashing is installed at new masonry, coordinate to insure proper height, embed in mortar, and end lap.
  2. Where flashing is installed in reglet in concrete insert upper edge into reglet. Hold flashing in place with lead wedges spaced not more than 200 mm (8 inch) apart. Fill joint with sealant.
  3. Where flashing is surface mounted on flat surfaces.
    - a. When top edge is double folded anchor flat portion below sealant "V" joint with fasteners spaced not over 400 mm (16 inch) on center:
      - 1) Locate fasteners in masonry mortar joints.
      - 2) Use screws to sheet metal or wood.
    - b. Fill joint at top with sealant.
  4. Where flashing or hood is mounted on pipe.
    - a. Secure with draw band tight against pipe.
    - b. Set hood and secure to pipe with a one by 25 mm x 3 mm (1 x 1/8 inch) bolt on stainless steel draw band type clamp, or a stainless worm gear type clamp.
    - c. Completely fill joint at top with sealant.
- C. Two-Piece Counterflashing:
1. Where receiver is installed at new masonry coordinate to insure proper height, embed in mortar, and lap.
  2. Surface applied type receiver:
    - a. Secure to face construction in accordance, with manufacturers instructions.
    - b. Completely fill space at the top edge of receiver with sealant.
  3. Insert counter flashing in receiver in accordance with fabricator or manufacturer's instructions and to fit tight against base flashing.
- D. Where vented edge occur install so lower edge of counterflashing is against base flashing.

- E. When counter flashing is a component of other flashing install as shown.

### **3.4 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 on each section of reglet and securely hold in position until concrete or mortar are hardened:
  - 1. Coordinate reglets for anchorage into concrete with formwork construction.
  - 2. Coordinate reglets for masonry to locate horizontally into mortar joints.

### **3.5 GRAVEL STOPS**

- A. General:
  - 1. Install gravel stops and fascias with allowance for expansion at each joint; minimum of 6 mm (1/4 inch).
  - 2. Extend roof flange of gravel stop and splice plates not less than four inches out over roofing and nail or screw to wood nailers. Space fasteners on 75 mm (3 inch) centers in staggered pattern.
  - 3. Install continuous cleat for fascia drip edge. Secure with fasteners as close to lower edge as possible on 75 mm (3 inch) centers.
  - 4. Where ends of gravel stops and fascias abut a vertical wall, provide a watertight, flashed and sealant filled joint.
  - 5. Set flange in roof cement when installed over built-up roofing.
  - 6. Edge securement for low-slope roofs: Low-slope membrane roof systems metal edge securement, except gutters, shall be designed in accordance with ANSI/SPRI ES-1, except the basic wind speed shall be determined from Figure 1609, of IBC 2003.
- B. Sheet metal gravel stops and fascia:
  - 1. Install with end joints of splice plates sheets lapped three inches.
  - 2. Hook the lower edge of fascia into a continuous edge strip.
  - 3. Lock top section to bottom section for two piece fascia.

### **3.6 COPINGS**

- A. General:



1. On walls topped with a wood plank, install a continuous edge strip on the front and rear edge of the plank. Lock the coping to the edge strip with a 19 mm (3/4 inch) loose lock seam.
2. Where shown turn down roof side of coping and extend down over base flashing as specified for counter-flashing. Secure counter-flashing to lock strip in coping at continuous cleat.
3. Install ends adjoining existing construction so as to form space for installation of sealants. Sealant is specified in Section 07 92 00, JOINT SEALANTS.

B. Aluminum Coping:

1. Install with 6 mm (1/4 inch) joint between ends of coping sections.
2. Install joint covers, centered at each joint, and securely lock in place.

C. Stainless steel or prefinished galvanized steel copings:

1. Provide strip of coping over wall and below where ends of sheets meet. Join ends of sheets by a 19 mm (3/4 inch) locked and soldered seam, except at intervals of 9600 mm (32 feet), provide a 38 mm (1 1/2 inch) loose locked expansion joint filled with sealant or mastic.
2. At straight runs between 7200 mm (24 feet) and 19200 mm (64 feet) locate expansion joint at center.
3. At straight runs that exceed 9600 mm (32 feet) and form the leg of a corner locate the expansion joint not more than 4800 mm (16 feet) from the corner.

### 3.7 HANGING GUTTERS

- A. Hang gutters with high points equidistant from downspouts. Slope at not less than 1:200 (1/16 inch per foot).
- B. Lap joints, except for expansion joints, at least 25 mm (one inch) in the direction of flow. Rivet and seal or solder lapped joints.
- C. Support gutters in brackets spaced not more than 600 mm (24 inch) on centers, brackets attached to facial or wood nailer by at least two screws or nails.
  1. For copper or copper clad stainless steel gutters use brass or bronze brackets.
  2. For stainless steel gutters use stainless steel brackets.
  3. For aluminum gutters use aluminum brackets or stainless steel brackets.

- 4. Use brass or stainless steel screws.
- D. Secure brackets to gutters in such a manner as to allow free movement of gutter due to expansion and contraction.
- E. Outlet Tubes: Set bracket strainers loosely into gutter outlet tubes.

### **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.

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**SECTION 07 84 00  
FIRESTOPPING**

**PART 1 - GENERAL****1.1 DESCRIPTION:**

- A. Provide UL or equivalent approved firestopping system for the closures of openings in walls, floors, and roof decks against penetration of flame, heat, and smoke or gases in fire resistant rated construction.

**1.2 RELATED WORK:**

- A. Sustainable Design Requirements: Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.
- B. Expansion and seismic joint firestopping: Section 07 95 00, EXPANSION JOINT ASSEMBLIES.
- C. Sealants and application: Section 07 92 00, JOINT SEALANTS.

**1.3 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Sustainable Design Submittals, as described below:
  - 1. Volatile organic compounds per volume as specified in  
PART 2 - PRODUCTS
- C. Installer qualifications.
- D. Inspector qualifications.
- E. Manufacturers literature, data, and installation instructions for types of firestopping and smoke stopping used.
- F. List of FM, UL, or WH classification number of systems installed.
- G. Certified laboratory test reports for ASTM E814 tests for systems not listed by FM, UL, or WH proposed for use.
- H. Submit certificates from manufacturer attesting that firestopping materials comply with the specified requirements.

**1.4 DELIVERY AND STORAGE:**

- A. Deliver materials in their original unopened containers with manufacturer's name and product identification.
- B. Store in a location providing protection from damage and exposure to the elements.

**1.5 QUALITY ASSURANCE:**

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

- B. **Installer Qualifications:** A firm that has been approved by FM Global according to FM Global 4991 or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements." Submit qualification data.
- C. **Inspector Qualifications:** Contractor to engage a qualified inspector to perform inspections and final reports. The inspector to meet the criteria contained in ASTM E699 for agencies involved in quality assurance and to have a minimum of two years' experience in construction field inspections of firestopping systems, products, and assemblies. The inspector to be completely independent of, and divested from, the Contractor, the installer, the manufacturer, and the supplier of material or item being inspected. Submit inspector qualifications.

#### **1.6 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. ASTM International (ASTM):
- E84-14.....Surface Burning Characteristics of Building Materials
- E699-09.....Standard Practice for Evaluation of Agencies Involved in Testing, Quality Assurance, and Evaluating of Building Components
- E814-13a.....Fire Tests of Through-Penetration Fire Stops
- E2174-14.....Standard Practice for On-Site Inspection of Installed Firestops
- E2393-10a.....Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers
- C. FM Global (FM):
- Annual Issue Approval Guide Building Materials
- 4991-13.....Approval of Firestop Contractors
- D. Underwriters Laboratories, Inc. (UL):
- Annual Issue Building Materials Directory
- Annual Issue Fire Resistance Directory
- 723-10(2008).....Standard for Test for Surface Burning Characteristics of Building Materials
- 1479-04(R2014).....Fire Tests of Through-Penetration Firestops
- E. Intertek Testing Services - Warnock Hersey (ITS-WH):

FIRESTOPPING

## Annual Issue Certification Listings

## F. Environmental Protection Agency (EPA):

40 CFR 59(2014).....National Volatile Organic Compound Emission

Standards for Consumer and Commercial Products

**PART 2 - PRODUCTS****2.1 FIRESTOP SYSTEMS:**

- A. Provide either factory built (Firestop Devices) or field erected (through-Penetration Firestop Systems) to form a specific building system maintaining required integrity of the fire barrier and stop the passage of gases or smoke. Firestop systems to accommodate building movements without impairing their integrity.
- B. Through-penetration firestop systems and firestop devices tested in accordance with ASTM E814 or UL 1479 using the "F" or "T" rating to maintain the same rating and integrity as the fire barrier being sealed. "T" ratings are not required for penetrations smaller than or equal to 101 mm (4 in.) nominal pipe or 0.01 sq. m (16 sq. in.) in overall cross sectional area.
- C. Firestop sealants used for firestopping or smoke sealing to have the following properties:
  - 1. Contain no flammable or toxic solvents.
  - 2. Release no dangerous or flammable out gassing during the drying or curing of products.
  - 3. Water-resistant after drying or curing and unaffected by high humidity, condensation or transient water exposure.
  - 4. When installed in exposed areas, capable of being sanded and finished with similar surface treatments as used on the surrounding wall or floor surface.
  - 5. VOC Content: Firestopping sealants and sealant primers to comply with the following limits for VOC content when calculated according to 40 CFR 59, (EPA Method 24):
    - a. Sealants: 250 g/L.
    - b. Sealant Primers for Nonporous Substrates: 250 g/L.
    - c. Sealant Primers for Porous Substrates: 775 g/L.
- D. Firestopping system or devices used for penetrations by glass pipe, plastic pipe or conduits, unenclosed cables, or other non-metallic materials to have following properties:
  - 1. Classified for use with the particular type of penetrating material used.

## FIRESTOPPING

2. Penetrations containing loose electrical cables, computer data cables, and communications cables protected using firestopping systems that allow unrestricted cable changes without damage to the seal.
- E. Maximum flame spread of 25 and smoke development of 50 when tested in accordance with ASTM E84 or UL 723. Material to be an approved firestopping material as listed in UL Fire Resistance Directory or by a nationally recognized testing laboratory.
- F. FM, UL, or WH rated or tested by an approved laboratory in accordance with ASTM E814.
- G. Materials to be nontoxic and noncarcinogen at all stages of application or during fire conditions and to not contain hazardous chemicals. Provide firestop material that is free from Ethylene Glycol, PCB, MEK, and asbestos.
- H. For firestopping exposed to view, traffic, moisture, and physical damage, provide products that do not deteriorate when exposed to these conditions.
  1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
  2. For floor penetrations with annular spaces exceeding 101 mm (4 in.) or more in width and exposed to possible loading and traffic, provide firestop systems capable of supporting the floor loads involved either by installing floor plates or by other means acceptable to the firestop manufacturer.
  3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION:**

- A. Submit product data and installation instructions, as required by article, submittals, after an on-site examination of areas to receive firestopping.
- B. Examine substrates and conditions with installer present for compliance with requirements for opening configuration, penetrating items, substrates, and other conditions affecting performance of firestopping. Do not proceed with installation until unsatisfactory conditions have been corrected.

**3.2 PREPARATION:**

- A. Remove dirt, grease, oil, laitance and form-release agents from concrete, loose materials, or other substances that prevent adherence and bonding or application of the firestopping or smoke stopping materials.
- B. Remove insulation on insulated pipe for a distance of 150 mm (6 inches) on each side of the fire rated assembly prior to applying the firestopping materials unless the firestopping materials are tested and approved for use on insulated pipes.
- C. Prime substrates where required by joint firestopping system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- D. Masking Tape: Apply masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestopping materials. Remove tape as soon as it is possible to do so without disturbing seal of firestopping with substrates.

**3.3 INSTALLATION:**

- A. Do not begin firestopping work until the specified material data and installation instructions of the proposed firestopping systems have been submitted and approved.
- B. Install firestopping systems with smoke stopping in accordance with FM, UL, WH, or other approved system details and installation instructions.
- C. Install smoke stopping seals in smoke partitions.

**3.4 CLEAN-UP:**

- A. As work on each floor is completed, remove materials, litter, and debris.
- B. Clean up spills of liquid type materials.
- C. Clean off excess fill materials and sealants adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturers of firestopping products and of products in which opening and joints occur.
- D. Protect firestopping during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection,

FIRESTOPPING

damage or deterioration occurs, cut out and remove damaged or deteriorated firestopping immediately and install new materials to provide firestopping complying with specified requirements.

**3.5 INSPECTIONS AND ACCEPTANCE OF WORK:**

- A. Do not conceal or enclose firestop assemblies until inspection is complete and approved by the Contracting Officer Representative (COR).
- B. Furnish service of approved inspector to inspect firestopping in accordance with ASTM E2393 and ASTM E2174 for firestop inspection, and document inspection results. Submit written reports indicating locations of and types of penetrations and type of firestopping used at each location; type is to be recorded by UL listed printed numbers.

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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.

**1.2 RELATED WORK (INCLUDING BUT NOT LIMITED TO THE FOLLOWING):**

- A. Sustainable Design Requirements: Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.
- B. Sealing of Site Work Concrete Paving: Section 32 05 23, CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS.
- C. Masonry Control and Expansion Joint: Section 04 20 10, UNIT MASONRY.
- D. Firestopping Penetrations: Section 07 84 00, FIRESTOPPING.
- E. Glazing: Section 08 80 00, GLAZING.
- F. Glazed Aluminum Curtain Wall: Section 08 44 13, GLAZED ALUMINUM CURTAIN WALLS.
- G. 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.
- C. Product Testing: Obtain test results from a qualified testing agency based on testing current sealant formulations within a 12-month period.
1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021.
  2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C920, and where applicable, to other standard test methods.
  3. Test elastomeric joint sealants according to SWRI's Sealant Validation Program for compliance with requirements specified by

JOINT SEALANTS

- reference to ASTM C920 for adhesion and cohesion under cyclic movement, adhesion-in peel, and indentation hardness.
4. Test other joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.
- D. 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.
- E. 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.
- F. 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.

**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 SUBMITTALS:**

- A. Submit 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. Installer qualifications.
- D. Contractor certification.
- E. Manufacturer's installation instructions for each product used.
- F. Cured samples of exposed sealants for each color.
- G. Manufacturer's Literature and Data:
  1. Primers
  2. Sealing compound, each type, including compatibility when different sealants are in contact with each other.
- H. Manufacturer warranty.

**1.6 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.

**1.7 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).

**1.8 DEFINITIONS:**

- A. Definitions of terms in accordance with ASTM C717 and as specified.
- B. 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.

**1.9 WARRANTY:**

- A. Construction Warranty: Installer shall warranty their installation of joint sealant for a period of one (1) year from date of installation and final acceptance by the Government in accordance with the FAR clause 52.246-21, "Warranty of Construction".
- B. Manufacturer Warranty: Manufacturer shall warranty their sealant for a minimum of five (5) years from the date of installation and final acceptance by the Government. Submit manufacturer warranty during the submittal process.

**1.10 APPLICABLE PUBLICATIONS:**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. 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
- D412-06a (R2013).....Test Methods for Vulcanized Rubber and  
Thermoplastic Elastomers-Tension
- 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 SEALANTS:**

- A. EXTERIOR SEALANTS - GENERAL PURPOSE
1. ASTM C920 and ASTM D1850, polyurethane.
  2. Single or multiple component.
  3. Chemical curing.
  4. Non-staining, non-bleeding, non-sagging.
  5. Shore A hardness range: 20 to 35.
  6. Self-leveling Type-1 for horizontal applications.
  7. Non-sag Type-II for vertical surfaces.
  8. Elongation Capability: Plus or minus 50%.

## **JOINT SEALANTS**

10. Sealant manufacturer shall be responsible for determining compatibility of sealant for use in joints between the various construction materials and for recommending proper surface preparation including primer(s) if necessary.

B. EXTERIOR SEALANTS - PRECAST CONCRETE JOINTS

1. ASTM C920, Silicone.
2. Type S.
3. Class 25.
4. Grade NS.
5. Shore A hardness: 15.
6. Single component.
7. Chemical curing.
8. Non-staining, non-bleeding, non-sagging.
9. Type II for vertical applications.
10. Elongation Capability: Plus 100%, minus 50%.
11. Modulus at 25% extension, PSI: 15.
12. Life expectancy: 20+ years.
13. No primer required for adhesion to concrete.
14. Sealant manufacturer shall be responsible for determining compatibility of sealant for use in joints between the various construction materials and for recommending proper surface preparation including primer(s) if necessary.

C. EXTERIOR SEALANTS - CURTAIN WALL/STOREFRONT/WINDOW SYSTEM PERIMETER AND GLASS BUTT JOINTS

1. ASTM C920, Silicone.
2. Type S.
3. Class 25.
4. Grade NS.
5. Shore A hardness: 35.
6. Single component.
7. Chemical curing.
8. Non-staining, non-bleeding, non-sag
9. Type II for vertical applications.
10. Elongation capability: Plus 50%, minus 50%.
11. Modulus at 25% extension, PSI: 40.
12. Tensile Adhesion Strength, PSI: 80.

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13. Life expectancy: 20+ years.
14. No primer required for adhesion to anodized aluminum.
15. Sealants and joint fillers for joints within the curtain wall/storefront/window system construction shall be as recommended by manufacturer.
16. Sealant manufacturer shall be responsible for determining compatibility of sealant for use in joints between the various construction materials and for recommending proper surface preparation including primer(s) if necessary.

D. EXTERIOR SEALANTS - FOR USE AT CONCRETE PAVING

1. ASTM C920 and ASTM D1850, polyurethane.
2. Type I for horizontal applications.
3. Single or multiple component.
4. Chemical curing.
5. Shore A hardness range: 20 to 35.
6. Non-staining, non-bleeding.
7. Self-leveling.
8. Elongation capability: Plus or minus 25%.
9. Service temperature range: -20 degrees to +180 degrees F.

E. INTERIOR SEALANTS - GENERAL PURPOSE

1. ASTM C834-86, acrylic emulsion latex.
2. Single component.
3. Non-staining, non-bleeding, non-sagging.
4. Elongation capability: Plus or minus 7.5%.
5. Shore hardness range: 15 to 40.

F. INTERIOR SEALANTS - MILDEW RESISTANT

1. ASTM C920, silicone.
2. Single component.
3. Fungus resistant.
4. Chemical curing.
5. Shore A hardness: 25.
6. Non-staining, non-bleeding, non-sagging.
7. For use around all plumbing fixtures.

G. INTERIOR SEALANTS - EXPANDING FOAM

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1. ASTM E84, expanding urethane foam.
2. Single component.
3. Class I.
4. Free rise density: 1.6 to 2.0 lbs/cubic foot.
5. Closed cell content: Approximately 89% per ASTM D1940.
6. Shear strength: 5 to 8 psi.
7. Compressive strength: 10 to 14 psi.
8. Dimensional stability: 1 to 2%, -15 to 100 degrees C.
9. Water uptake: 6 to 7% by volume per ASTM D2127.
10. R-factor: 5 per inch thickness.
11. For sealing at piping and other miscellaneous penetrations through exterior walls.

#### H. INTERIOR SEALANTS - ACOUSTICAL SEALANT

1. Acoustical sealant: Specialty sealant as manufactured by United States Gypsum Co. or equal; for acoustically sealing the perimeter and openings in partitions.

#### I. EXTERIOR SEALANTS - FOR USE AT ROOFING

1. Sealants for TPO roofing shall be as recommended by the roofing system manufacturer.

### 2.2 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.

### 2.3 JOINT SEALANT BACKING:

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
  1. Type C: Closed-cell material with a surface skin.
- C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D1056 or synthetic rubber (ASTM C509),

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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.

#### **2.4 WEEPS:**

- A. Weep/Vent Products: Provide the following unless otherwise indicated or approved.

- 1. Round Plastic Tubing: Medium-density polyethylene, 10 mm (3/8-inch) OD by thickness of stone or masonry veneer.

#### **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.

#### **3.2 PREPARATIONS:**

- A. Prepare joints in accordance with manufacturer's instructions and SWRI (The Professionals' Guide).

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- 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.

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F. Take all necessary steps to prevent three sided adhesion of sealants.

### **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 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. Weeps: Place weep holes and vents in joints where moisture may accumulate, including at base of cavity walls, above shelf angles, at all flashing, and as indicated on construction documents.
1. Use round plastic tubing to form weep holes.
  2. Space weep holes formed from plastic tubing not more than 406 mm (16 inches) o.c.
  3. Trim tubing material used in weep holes flush with exterior wall face after sealant has set.
- C. For application of sealants, follow requirements of ASTM C1193 unless specified otherwise. Take all necessary steps to prevent three-sided adhesion of sealants.

### **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.

- - - E N D - - -

**SECTION 07 92 33  
CONCRETE JOINT SEALANTS****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. A single installer shall be responsible for providing complete water proofing system including all products specified in the following Sections:

1. Division 07 Section, "Concrete Joint Sealants"
2. Division 07 Section, "Traffic Coatings"
3. Division 07 Section, "Traffic Bearing Water Repellents"
4. Division 07 Section, "Expansion Joint Assemblies"

- B. This Section includes the following:

1. Exterior joints in the following horizontal traffic bearing surfaces:
  - a. Construction and control joints in cast-in-place concrete.
  - b. Control joints in slab-on-grade, slabs and topping slabs.
  - c. Joints between precast concrete units.
  - d. Perimeter of all floor drains.
  - e. Other joints as indicated on the Drawings.
2. Exterior joints in the following vertical and horizontal non-traffic surfaces:
  - a. Construction and control joints in cast-in-place concrete.
  - b. Joints between precast concrete units.
  - c. Cove joints at intersection of horizontal and vertical concrete.
  - d. Exterior horizontal joints between precast and cast-in-place concrete. Color to match precast concrete.
  - e. Vertical and horizontal joints between precast beams and columns at tiers exposed directly to weather. Color to match precast concrete.
  - f. Other joints as indicated on the Drawings.

- C. Related Sections: Following Sections contain requirements that relate to this Section.

1. Division 03 Section, "Cast-in-Place Concrete"
2. Division 03 Section, "Precast Structural Concrete."
3. Division 07 Section, "Traffic Coatings"

4. Division 07 Section, "Traffic Bearing Water Repellents"
5. Division 07 Section, "Expansion Joint Assemblies"
6. Division 32 Section, "Pavement Markings."

### 1.3 ADMINISTRATIVE REQUIREMENTS

#### A. Coordination:

1. Materials shall be compatible with materials or related Work with which they come into contact, and with materials covered by this Section.
2. Distribute reviewed submittals to all others whose Work is related.
3. Coordinate layout of joint system and approve methods for providing joints with precast concrete and concrete contractors.
4. Inspect site and precast plant before precast production to insure proper joint configuration.

#### B. Make submittals in accordance with requirements of Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

### 1.4 ACTION SUBMITTALS

#### A. Product Data: For each system indicated at least 60 days prior to application.

1. Product description, technical data, appropriate applications and limitations.
2. Primer type and application rate

#### B. Samples:

1. One for each system indicated.

#### C. Sample Warranty: For each system indicated.

### 1.5 INFORMATION SUBMITTALS

#### A. Certificates:

1. Evidence of installer's being certified by manufacturer. Evidence shall include complete copy of manufacturer's licensing/certification document, spelling out repair responsibility for warranty claims.
2. Certification from the Manufacturer that joint details as specified are acceptable for system to be installed at least 1 month before placement of any concrete which will receive joint sealant.

#### B. Field Quality Control:

1. Two copies each of manufacturer's technical representative's log for each visit.

2. Testing agency field and test reports.

C. Qualification Statements:

1. Manufacturer's qualifications as defined in the "Quality Assurance" article.
2. Installer's qualifications as defined in the "Quality Assurance" article.
3. Signed statement from applicator certifying that applicator has read, understood, and shall comply with all requirements of this Section.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Three copies of System Maintenance Manual.
- B. Five copies of snow removal guidelines for areas covered by Warranty.
- C. Final executed Warranty.

#### 1.7 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Owner retains right to reject any manufacturer.
  1. Evidence of acceptable previous work on WALKER-designed projects. If none, so state.
  2. Evidence of financial stability acceptable to Engineer/Architect.
  3. Listing of 20 or more projects completed with submitted system, to include:
    - a. Name and location of project.
    - b. Type of system applied.
    - c. On-Site contact with phone number.
- B. Manufacturer's technical representative, acceptable to Engineer/Architect, shall be on site during surface preparation and initial stages of installation.
- C. Installer's Qualifications: Owner retains right to reject any installer or subcontractor.
  1. Installer shall be legally licensed to perform work in the state of Missouri. Evidence of compliance with Summary article paragraph "A single installer. . ."
  2. Evidence that installer has successfully performed or has qualified staff who have successfully performed at least 5 verifiable years of installations similar to those involved in this Contract, and minimum 10 projects with submitted system.
  3. Listing of 5 or more installations in climate and size similar to this Project performed by installer's superintendent.
- D. Testing Agency: Independent testing laboratory employed by Contractor and acceptable to Engineer/Architect.



**E. Certifications:**

1. Licensing/certification document from system manufacturer that confirms system installer is a licensed/certified applicator for the manufacturer and is legally licensed to perform work in the state of Missouri.
2. Licensing/certification agreement shall include following information:
  - a. Applicator's financial responsibility for warranty burden under agreement terms.
  - b. Manufacturer's financial responsibility for warranty burden under agreement terms.
  - c. Process for dispute settlement between manufacturer and applicator in case of system failures where cause is not evident or cannot be assigned.
  - d. Authorized signatures for both Applicator Company and Manufacturer.
  - e. Commencement date of agreement and expiration date (if applicable).

**1.8 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver all materials to site in original, unopened containers, bearing following information:
  1. Name of product.
  2. Name of manufacturer.
  3. Date of preparation.
  4. Lot or batch number.
- B. Store materials under cover and protect from weather. Replace packages or materials showing any signs of damage with new material at no additional cost to Owner.

**1.9 FIELD CONDITIONS**

- A. Weather and Substrate Conditions: Proceed with work only when existing and forecast weather and temperature of concrete substrate will permit work in accordance with manufacturer's recommendations.

**1.10 WARRANTY**

- A. Manufacturer: Furnish Owner with written Warranty, detailing responsibilities of manufacturer and installer with regard to warranty requirements. The warranty shall provide that sealant will be free of defects, water penetration and chemical damage related to system design, workmanship or material deficiency, consisting of:
  1. Any adhesive or cohesive failures.
  2. Weathering.
  3. Abrasion or tear failure resulting from normal traffic use.

- B. If material surface shows any of defects listed above, supply labor and material to repair all defective areas and to repaint all damaged line stripes.
- C. Construction Warranty: Installer shall warranty their installation of joint sealer for a period of one (1) year from date of installation and final acceptance by the Government in accordance with the FAR clause 52.246-21, "Warranty of Construction".
- D. Manufacturer Warranty: Manufacturer shall warranty their joint sealer for a minimum of five (5) years from the date of installation and final acceptance by the Government. Submit manufacturer warranty during the submittal process.
- E. Perform any repair under this warranty at no cost to Owner.
- F. Address the following in the terms of the Warranty: length of warranty, change in value of warranty - if any- based on length of remaining warranty period, transferability of warranty, responsibilities of each party, notification procedures, dispute resolution procedures, and limitations of liability for direct and consequential damages.
- G. Snowplows, vandalism, and abnormally abrasive maintenance equipment are not normal traffic use and are exempted from warranty.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Manufacturer: Subject to compliance with requirements, provide products of 1 of following, only where specifically named in product category:
  - 1. BASF Building Systems (BASF), Shakopee, MN.
  - 2. Dow Corning Corp. (Dow Corning), Midland, MI.
  - 3. Lyntal International Inc. (Lyntal), Lake Orion, MI.
  - 4. Pecora Corporation (Pecora), Harleysville, PA.
  - 5. Sika Corporation (Sika), North Canton, OH.
  - 6. Tremco (Tremco), Cleveland, OH.

### **2.2 MATERIALS, JOINT SEALANT SYSTEM**

- A. Provide complete system of compatible materials designed by manufacturer to produce waterproof, traffic-bearing control joints as detailed on Drawings.
- B. Compounds used for sealants shall not stain masonry or concrete. Aluminum pigmented compounds not acceptable.
- C. Color of sealants shall match adjacent surfaces.
- D. Closed cell or reticulated backer rods: Acceptable products:

1. "Sof Rod," Nomaco Inc., 501 NMC Drive, Zebulon, NC 27597. (800) 345-7279 ext. 341.
  2. "ITP Soft Type Backer Rod," Industrial Thermo Polymers Limited, 2316 Delaware Ave., Suite 216, Buffalo, NY 14216. (800) 387-3847.
  3. "MasterSeal 921 Backer Rod," BASF.
- E. Bond breakers and fillers: as recommended by system manufacturer.
- F. Primers: as recommended by sealant manufacturer.
- G. Acceptable sealants are listed below. Sealants shall be compatible with all other materials in this Section and related work.
- H. Acceptable polyurethane control joint sealants (traffic bearing):
1. MasterSeal SL-2 or MasterSeal SL-2 SG, BASF.
  2. Iso-flex 880 GB or Iso-flex 881, Lymtal.
  3. Dynatrol II-SG or Urexpan NR 200, Pecora.
  4. Sikaflex-2c SL or Sikaflex-2c NS TG, Sika.
  5. THC-900/901, Vulkem 45SSL, Dymeric 240, Dymeric 240 FC or Dymonic 100, Tremco.
- I. Acceptable polyurethane vertical and cove joints sealants (non-traffic bearing):
1. Sikaflex-2c NS, Sika.
  2. MasterSeal NP-2, BASF.
  3. Dymeric 240/240FC Dymonic 100 or THC 901 (cove only), Tremco.
  4. Dynatred, Pecora.
  5. Iso-flex 881, Lymtal.
- J. Proposed Substitutions: **None** for this project.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine surfaces to receive Work and report immediately in writing to Engineer/Architect any deficiencies in surface which render it unsuitable for proper execution of Work.
- B. Coordinate and verify that related Work meets following requirements before beginning installation
1. Concrete surfaces are finished as acceptable for system to be installed.
  2. Curing compounds used on concrete surfaces are compatible with system to be installed.
  3. Concrete surfaces have completed proper curing period for system selected.

#### **3.2 PREPARATION**

- A. Seal all openings to occupied space to prevent cleaning materials, solvents and fumes from infiltration. All protective measures and/or ventilating systems required to prevent infiltration are incidental to this Work.
- B. Correct unsatisfactory conditions before installing sealant system.
- C. Acid etching is prohibited.
- D. Grind joint edges smooth and straight with beveled grinding wheel before sealing. All surfaces to receive sealant shall be dry and thoroughly cleaned of all loose particles, laitance, dirt, dust, oil, grease or other foreign matter. Obtain written approval of method from system manufacturer before beginning cleaning.
- E. Final preparation of joints shall be a sandblast with medium that removes dust and ground material from surfaces to receive sealant.
- F. Check preparation of substrate for adhesion of sealant.
- G. Prime and seal joints and protect as required until sealant is fully cured. A primer coat is required for all systems.

### **3.3 INSTALLATION/APPLICATION**

- A. Do all Work in strict accordance with manufacturer's written instructions and specifications including, but not limited to, moisture content of substrate, atmospheric conditions (including relative humidity and temperature), thicknesses and texture, and as shown on Drawings.
- B. Completely fill joint without sagging or smearing onto adjacent surfaces.
- C. Self-Leveling Sealants: Fill horizontal joints slightly recessed to avoid direct contact with wheel traffic.
- D. Non-Sag Sealants: Tool joints concave: Wet tooling not permitted.
- E. Clean off excess material and material smears adjacent to joints as work progresses using methods and materials approved by manufacturers.
- F. Cease material installation under adverse weather conditions, or when temperatures are outside manufacturer's recommended limitations for installation, or when temperature of work area or substrate are below 40°F.

### **3.4 FIELD QUALITY CONTROL**

- A. Contractor and Engineer/Architect will jointly determine which one of following 2 methods of sealant testing to verify sealant profile:
  - 1. Contractor, at Engineer/Architect's direction, shall cut out lesser of 1% of total lineal footage placed or total of 100

- lineal ft. of joint sealant at isolated/random locations (varying from in. to ft. of material) for Engineer/Architect and Manufacturer's Representative inspection of sealant profile.
2. Contractor, at Engineer/Architect's direction, shall install 3 trial joint sections of 20 ft each. Contractor shall cut out joint sections, as selected by Engineer/Architect, for Engineer/Architect and Manufacturer's Representative inspection. Additional isolated/random removals may be required where sealant appears deficient. Total cut out sealant shall not exceed lesser of 1% of total lineal footage placed or total of 100 lineal ft. of joint sealant at isolated/random locations (varying from in. to ft. of material) for Engineer/Architect and Manufacturer's Representative inspection of sealant profile.
- B. Repair all random joint sealant "cut out" sections at no cost to Owner.
- C. Testing Agency:
1. Check shore hardness per ASTM standard specified in sealant manufacturer's printed data.

- - - E N D - - -

**SECTION 07 95 00  
EXPANSION JOINT ASSEMBLIES****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. A single installer shall be responsible for providing complete water proofing system including all products specified in the following Sections:
  - 1. Division 07 Section, "Traffic Coatings"
  - 2. Division 07 Section, "Traffic Bearing Water Repellents"
  - 3. Division 07 Section, "Concrete Joint Sealants"
  - 4. Division 07 Section, "Expansion Joint Assemblies"
- B. This Section includes the following:
  - 1. Standard expansion joint systems:
    - a. Elastomeric concrete edged, extruded rubber joint system
  - 2. Vertical expansion joint systems
  - 3. Pedestrian rated hinged cover plate system
- C. Related Sections: The following Sections contain requirements that relate to this section:
  - 1. Division 03 Section, "Cast-in-Place Concrete"
  - 2. Division 03 Section, "Precast Structural Concrete."
  - 3. Division 07 Section, "Traffic Coatings"
  - 4. Division 07 Section, "Concrete Joint Sealants"
  - 5. Division 07 Section, "Traffic Bearing Water Repellants"
  - 6. Division 32 Section, "Pavement Markings."

**1.3 DEFINITIONS**

- A. Maximum Joint Width: Widest linear gap a joint system tolerates and in which it performs its designed function without damaging its functional capabilities.
- B. Minimum Joint Width: Narrowest linear gap a joint system tolerates and in which it performs its designed function without damaging its functional capabilities.

- C. 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. Movement capability is to include anticipated movements from concrete shrinkage, concrete shortening and creep from prestressing, cyclic thermal movements, and seismic movements.
- D. Nominal Joint Width: Width of linear opening specified in practice and in which joint system is installed.
- E. Nominal Form Width: Linear gap in joint system at time of forming or erection of structural elements bounding the expansion joint.
- F. Service Load Level: Defined level of load under which joint assembly remains elastic and fully functional.
- G. Fatigue Load Level: Defined level of load under which joint assembly remains elastic and fully functional, including all noise mitigation components, for the stated number of cycles.
- H. Collapse Load Level: Defined level of load under which joint assembly remains capable of bridging the gap, although plates may yield and components may break.

#### 1.4 ADMINISTRATIVE REQUIREMENTS

##### A. Coordination:

###### 1. General:

- a. Coordinate and furnish anchorages, setting drawings, and instructions for installing joint systems. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of joint systems.
- b. Coordinate requirements for transitions, tolerances, levelness, and plumbness to ensure the installed expansion joint system can perform with expected movement capabilities.
- c. Coordinate and assign responsibility for preparation of concrete surfaces adjacent to expansion joints.
- d. Expansion joint surface areas each side of joint gap shall have a vertical differential less than  $\frac{1}{4}$ " and meet requirements of expansion joint manufacturer.
- e. Minor surface defects shall be repaired according to manufacturer's recommendations. Repair materials shall be compatible with intended system materials and shall be approved by the Engineer prior to surface preparation and installation.
- f. Submit for approval repair products and procedures for all major defects. Repair description shall indicate materials, manufacturer's requirements, expected service life, and maintenance requirements. Take all precautions necessary to avoid damaging adjacent surfaces and embedded reinforcement. Contractor is responsible for any damages. Concrete repairs

shall be of rectangular configuration, with no feather-edged surfaces. Final surface preparation of all repairs shall be sandblasting, or approved equivalent.

- g. Coordinate layout of joint system and approval of methods for providing joints.

2. Joint Opening Width:

- a. Use temperature adjustment table to show that proposed joint system is capable of equal individual and combined movements in each direction when installed.
- b. Where installation temperature is other than specified temperature, perform calculations showing joint is capable of movement within design temperature range (Criteria on Drawings) for "other" temperature, and that design and installation follow manufacturer's recommendations.
- c. Expansion joint movement capability and the actual joint gap movement may not coincide. Construct actual joint gap in accordance with expansion design criteria.

3. Blockouts:

- a. Float expansion joint blockouts to remove all air pockets, voids and spalls caused by form work.
- b. Blockouts shall be plumb with maximum tolerance per Manufacturer or not more than 0.125 inches deviation in 12 inches. Noncompliant blockouts shall be considered major defects.
- c. Blockouts shall be straight and true with maximum tolerance per Manufacturer or not more than 0.250 inches deviation in 10 lineal feet. Noncompliant blockouts shall be considered major defects.

B. Preinstallation Meetings: Meet at project site well in advance of time scheduled for Work to proceed to review requirements for Work and conditions that could interfere with successful expansion joint system performance. Require every party concerned with concrete formwork, blockout, concrete placement, or others required to coordinate or protect the Work thereafter, to attend. Include Engineer of Record and manufacturer's technical representative and warranty officer.

C. Make submittals in accordance with requirements of Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

## 1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated:

- 1. Construction details, material descriptions, dimensions, and finishes.
- 2. Proposed method of preparation of concrete surface to receive expansion joint systems.
- 3. Proposed method and details for treatment of cracks, bugholes, or other potential concrete surface defects in areas to receive expansion joint systems.



4. Horizontal spacing between embedded metals and plates to allow for volume change due to thermal conditions.

B. Shop Drawings: For each type of product indicated:

1. Placement Drawings: Show project conditions including, but not limited to, line diagrams showing plans, elevations, sections, details, splices, blockout requirement, and terminations. Provide isometric or clearly detailed drawings depicting how components interconnect. Include reviewed and approved details from others whose work is related. Other information required to define joint placement or installation.
2. Joint System Schedule: Prepared by or under the supervision of the supplier. Include the following information in tabular form:
  - a. Manufacturer and model number for each joint system.
  - b. Joint system location cross-referenced to Drawings.
  - c. Form width.
  - d. Nominal joint width.
  - e. Movement capability.
  - f. Minimum and maximum joint width.
  - g. Classification as thermal or seismic.
  - h. Materials, colors, and finishes.
  - i. Product options.
  - j. Fire-resistance ratings.
3. Components and systems required to be designed by a professional engineer, shall bear such professional's written approval when submitted.

C. Samples:

1. Samples for each type of joint system indicated.
  - a. Submit 2 samples for each type. Full width by 6 inches (150 mm) long, for each system required.
2. Develop mockups of concrete surface preparation for review and to establish a control for the application.

D. Delegated Design Submittals:

1. Analysis indicating expansion joint system complies with expansion joint performance and design criteria of this specification and is suitable for use in conditions of this project. Provide a summary of design criteria used in design.

## 1.6 INFORMATIONAL SUBMITTALS

A. Certificates

1. Certification that products and installation comply with applicable federal, state of Missouri, and local EPA, OSHA and VOC requirements regarding health and safety hazards.

2. ADA Certification: Prior to installation, submit written certification from manufacturer indicating that expansion joints conform to Americans with Disabilities Accessibility Guidelines for Buildings and Facilities, as published by U.S. Architectural & Transportation Barriers Compliance Board, 1331 F Street, N.W., Suite 1000, Washington, DC 20004-1111. 1-800-872-2253.
  - a. Submit test reports from accredited laboratory attesting to joint systems' movement capability and ADA compliance.
  - b. Static coefficient of friction shall meet minimum requirements of Americans with Disabilities Act (ADA).
3. Signed statement from installer/applicator certifying that installer/applicator has read, understood, and shall comply with all requirements of this Section.
4. Signed statement from manufacturer's representative that they have read, understood, and shall comply with all requirements of this section.

B. Field Quality Control

1. Two copies each of manufacturer's technical representative's log for each visit.

C. Qualification Statements

1. Manufacturer's qualifications as defined in the "Quality Assurance" article within 60 days of project award.
2. Installer's qualifications as defined in the "Quality Assurance" article.
3. Evidence of manufacturer's certification of installer/applicator. Evidence shall include complete copy of manufacturer's licensing/certification document, spelling out repair responsibility for warranty claims.

**1.7 CLOSEOUT SUBMITTALS**

- A. Maintenance Contracts: 2 copies of Maintenance Program contracts.
- B. Operation and Maintenance Data
  1. Maintenance Manual: 3 copies of System Maintenance Manual.
  2. Five copies of snow removal guidelines for areas covered by warranty.
- C. Warranty Documentation: 2 executed copies of Labor and Material Warranty including all terms, conditions and maintenance requirements.

**1.8 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Owner retains right to reject any manufacturer.
  1. Evidence of acceptable previous work on WALKER-designed projects. If none, so state.

2. Copy of sample warranty that meets the requirements of the "Warranty" article in Section 1.
  3. Evidence of financial stability acceptable to Owner or Engineer/Architect.
  4. Evidence of compliance with "Single Installer" requirement.
- B. Installer Qualifications: An employer of workers, including superintendent for this project, trained and approved by manufacturer.
- C. Testing Agency: Independent testing laboratory employed by Contractor and acceptable to Engineer/Architect.
- D. Certifications
1. Provide reports to Owner detailing maintenance activities have been performed in accordance with written maintenance agreement for expansion joints.
  2. Materials shall be compatible with materials or related Work with which they come into contact and the related materials sections.
  3. Manufacturer/Applicator: Review and approve all details before construction. Confirm in writing to Owner.

#### **1.9 DELIVERY, STORAGE AND HANDLING**

- A. Deliver all materials to site in original, unopened containers, bearing following information:
1. Name of product.
  2. Name of manufacturer.
  3. Date of preparation.
  4. Lot or batch number.
- B. Store materials under cover and protect from weather. Replace packages or materials showing any signs of damage with new material at no additional cost to Owner.

#### **1.10 WARRANTY**

- A. Construction Warranty: Installer shall warranty their installation of expansion joint assemblies for a period of one (1) year from date of installation and final acceptance by the Government in accordance with the FAR clause 52.246-21, "Warranty of Construction".
- B. Manufacturer Warranty: Manufacturer shall warranty their expansion joint assemblies for a minimum of five (5) years from the date of installation and final acceptance by the Government. Submit manufacturer warranty during the submittal process.
- C. Installation Requirements: Include a written plan of construction and coordination requirements, to allow joint system installation to proceed with specified warranty, that specifically addresses the following:

1. Block out acceptance criteria.
  2. Surface preparation acceptance criteria.
  3. Crack, surface defect, and detailing recommendations.
  4. Method of protection of surrounding surfaces.
  5. Method of expansion joint system installation description.
  6. Primer type and application rate.
  7. Method of preparation of all glands and reinforced membranes.
  8. Temperature, humidity and other weather constraints. Specify substrate moisture testing criteria, if any.
  9. Final cure time before removal of protection, resumption of traffic, and/or paint striping.
  10. Any other special instructions required to ensure proper installation.
- D. Quality Service Requirements: Show evidence of licensed/approved installer. List of names, addresses and phone numbers, with copies of certification/approval agreement with each, satisfies requirement. Licensing/certification agreement shall include following information:
1. Installer's financial responsibility for warranty burden under agreement terms.
  2. Manufacturer's financial responsibility for warranty burden under agreement terms.
  3. Process for dispute settlement between manufacturer and installer in case of system failures where cause is not evident or cannot be assigned.
  4. Authorized signatures for both Installer Company and Manufacturer.
  5. Commencement date of agreement and expiration date (if applicable).
  6. Provide copy of contractor's field application quality control procedures.
- E. Detail responsibilities of General Contractor, manufacturer and installer with regard to warranty requirements, as outlined in the Manufacturer's warranty and related Licensing/Certification documents. Warranty shall provide that system shall be free of defects, water penetration and chemical damage related to system design, workmanship or material deficiency, consisting of:
1. Any water leakage through expansion joint system or leaking conditions of reinforced membrane, other waterproofing components, or glands.
  2. Any adhesive or cohesive failures of the system.
  3. Shifting of plates out of alignment due to system failure.
  4. Loose plates, anchor blocks, bolts.
  5. Metal to metal vibration causing noises during use.
  6. Metal to non-metal vibration causing noises during use.
  7. Tears, weathering, or degradation in gland from normal use.
  8. Expansion joint glands are considered defective if they buckle upwards beyond the level of the floor surface after installation or downward in excess of ½ inch below the floor surface.
- F. If expansion joint systems or components show any of defects listed above, supply labor and material to repair all defects at no cost to Owner.

**PART 2 - PRODUCTS****2.1 SYSTEM DESCRIPTION**

- A. A single Installer shall be responsible for providing complete expansion joint system. Obtain all joint systems through one source from a single manufacturer.
- B. Drawings indicate size, profiles, and dimensional requirements of joint systems and are schematic for systems indicated.
- C. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

**2.2 PERFORMANCE REQUIREMENTS**

- A. Intent of this section is to insure that installed expansion joints allow pedestrian and vehicular traffic to pass in a smooth, quiet fashion with minimal maintenance required over a period of not less than 10 years. Expansion joints shall not only function as structural bridging elements, but must also accommodate structural expansions/contractions and minimize water leakage.
- B. Provide design of expansion joint for preparation of final details for fabrication and construction of all concrete openings, expansion joint elements and required accessories.
- C. Expansion joint design shall meet or exceed all expected movements shown on drawings.
- D. Installation temperature range and estimated volume change movements are shown on drawings. Nominal form width shown on the drawings shall be adjusted for the ambient temperature at time of concrete placement and designer shall verify that width of joint at installation shall meet minimum installation requirements.
- E. Expansion joint systems shall be capable of resisting a differential vertical movement of ½ inch.
- F. Materials shall be supplied in lengths to minimize or eliminate the need to splice waterproofing components.
  - 1. Waterproofing materials directly exposed to vehicular traffic shall be supplied with no joints in vehicle drive aisles.
  - 2. All mitered splices shall be performed at the factory and provide sufficient gland length for butt splicing with field splicing equipment.
  - 3. All Santoprene butt to butt splices shall be heat welded.
  - 4. Butt to butt splices with other materials shall be per manufacturer's recommendations.

- G. Design system for passenger vehicles traveling at speeds normally expected within a parking structure.
- H. Walking Surfaces: Expansion joint assemblies at walking areas subject to pedestrian traffic shall provide a smooth, slip resistant walking surface for pedestrians with these minimum requirements:
1. Shall provide walking surfaces in accordance with ASTM - F 1637 Standard Practice for Safe Walking Surfaces.
  2. Shall be designed to comply with "Americans with Disabilities Act (ADA), Accessibility Guidelines (ADAAG)" and ICC A117.1. Americans with Disabilities Accessibility Guidelines for Buildings and Facilities, as published by U.S. Architectural & Transportation Barriers Compliance Board, 1331 F Street, N.W., Suite 1000, Washington, DC 20004-1111. 1-800-872-2253.
  3. Adjoining walkway surfaces shall be flush and meet the following minimum requirements:
    - a. Changes in level of less than  $\frac{1}{4}$  inch in height may be without edge treatment as shown in ADA Figure 303.2 and on the Drawings.
    - b. Changes in Level between  $\frac{1}{4}$  inch and  $\frac{1}{2}$  inch in height shall be beveled with a slope no greater than 1:2 as shown in ADA Figure 303.3 and on the Drawings.
    - c. Changes in level greater than  $\frac{1}{2}$  inch in height are not permitted unless they can be transitioned by means of a ramp as shown on Drawings.
    - d. Openings in floor or ground surfaces shall not allow passage of a sphere more than  $\frac{1}{2}$  inch diameter except as allowed for elevators and platform lifts as shown in ADA Figure 302.3 and on the Drawings.

## 2.3 MANUFACTURERS

- A. Subject to compliance with requirements, provide products from one of following manufacturers (listed in alphabetical order), only where specifically named in product categories:
1. Balco Inc., Wichita, KS (Balco).
  2. Construction Specialties, Inc., Muncy, PA (C/S).
  3. Dow Corning Corp., Midland, MI (Dow Corning).
  4. Emseal Joint Systems, Westborough, MA (Emseal).
  5. Erie Metal Specialties, Inc., Akron, NY (EMS).
  6. Lymtal International Inc. Lake Orion, MI (Lymtal).
  7. MM Systems Corporation, Atlanta, GA (MM).
  8. TechStar, Inc., Findlay, OH (TechStar).
  9. Tremco, Cleveland, OH (Tremco).
  10. Watson Bowman Acme Corporation, a Division of BASF Construction Chemicals NA, Amherst, NY (WBA).

## 2.4 PRODUCTS, STANDARD EXPANSION JOINT SYSTEMS

- A. Elastomeric concrete edged, extruded rubber expansion joint system.

1. DuraFlex Chambered Wing Seal CS and DCS Series, Balco.
  2. Iso-Flex Winged Joint System J Series, LymTal.
  3. Lokcrete Membrane System (LMS) Series, MM.
  4. Polycrete/Membrane System, Type CR Series, EMS.
  5. Thermaflex Membrane/Nosing System, Type TM and TCR Series, Emseal.
  6. Vulkem WF series Vehicular Expansion Joint System, Tremco.
  7. Wabo®Crete Membrane System ME Series, WBA.
  8. ZB 200/400 Series, C/S.
- B. Elastomeric concrete edged, extruded rubber expansion joint system, allowable at stair and elevator towers only. Must be used with a pedestrian cover plate at pedestrian openings. Cover plates are noted in 2.5 B.
1. Iso-Flex Winged Joint System K Series, LymTal.
  2. Lokcrete Membrane System (LSS) Series, MM.
  3. Polycrete/Membrane System, Type WM Series, EMS.
  4. Wabo®Crete Membrane System MM Series, WBA.
- C. Substitutions: **None** for this project.

## 2.5 PRODUCTS, OTHER

- A. Vertical compression joint sealants:
1. Elastoprene Compression Seals, ECS & VCS Series, MM.
  2. Iso-Flex Compression Seal, LymTal.
  3. Wabo®CompressionSeal, WBA.
- B. Pedestrian Rated Hinged Cover Plate System, aluminum and stainless steel plates that provide flexible cover plate across stair and elevator tower expansion joint openings:
1. Iso-Flex Hinged Cover Plate PD Series, LymTal.
  2. C/S Hinged Cover System, Model PD, PDW, C/S.
  3. Hinged Safety Cover System, HSC Series, MM.
  4. Wabo Safety Flex, SFP, with Molded Elastomeric Plate, WBA.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine surfaces and blockouts where expansion joint systems will be installed for installation tolerances and other conditions affecting performance of Work.
- B. Check elevations on each side of expansion joint gap to ensure flush slab-to-slab transition.

- C. Check anticipated or actual minimum and maximum joint openings. Compare to manufacturer's movement specifications and make joint sizing recommendations.
- D. Coordinate and verify that related Work meets following requirements:
  - 1. Check adhesion to substrates and recommend appropriate preparatory measures.
  - 2. Curing compounds used on concrete surfaces are compatible with Work to be installed.
  - 3. Concrete surfaces have completed proper curing period for system selected.
  - 4. Coordinate expansion joint system with other related Work before installation of expansion joint.
  - 5. Verify expansion joints are compatible with Joint Sealants and traffic toppings.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.
- F. Cease installation if expansion joint blockouts and/or openings exhibit cracked edges, voids or spalls. Repair with approved material prior to installation of expansion joint.
- G. Correct unsatisfactory conditions in manner acceptable to Manufacturer and Engineer before installing joint system.

### **3.2 PREPARATION**

- A. Prepare for installation of expansion joint systems in accordance with manufacturer's recommendations
- B. Surface Preparation:
  - 1. Acid etching: Prohibited.
  - 2. Prepare substrates according to joint system manufacturer's written instructions.
  - 3. Clean joints thoroughly in accordance with manufacturer's instructions to remove all laitance, unsound concrete and curing compounds which may interfere with adhesion.

### **3.3 INSTALLATION**

- A. Comply with manufacturer's written instructions for storing, handling, and installing joint assemblies and materials unless more stringent requirements are indicated.
- B. Proceed with work only when existing and forecast weather and temperature of concrete substrate will permit work in accordance with manufacturer's recommendations.
- C. Cease material installation under adverse weather conditions, or when temperatures are outside manufacturers recommended limitations for



installation, or when temperature of work area or substrate are below 40°F.

- D. Terminate exposed ends of joint assemblies with field- or factory-fabricated termination devices.
- E. Seal all openings to occupied spaces to prevent cleaning materials, solvents and fumes from infiltration. All protective measures and/or ventilating systems required to prevent infiltration are incidental to this Work.
- F. Clean off excess material and material smears adjacent to joints as work progresses using methods and materials approved by manufacturer.

### **3.4 FIELD QUALITY CONTROL**

- A. Field Tests and Inspections: Prior to opening to traffic, test joint seal for leaks by maintaining continuously wet for 12 hours. Repair leaks revealed by examination of seal underside. Repeat test and repairs until all leaks stopped for full 12 hours.
- B. Manufacturer Services: Provide qualified manufacturer's technical representative for periodic inspection of Work at critical time of the installation, including but not limited to pre-concrete formwork and placement site meetings, block out inspection, surface defect repair, surface preparation, metal work, expansion gland installation and waterproofing system installation.

### **3.5 PROTECTION**

- A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.
- B. Protect installation from damage by work of other Sections. Where necessary due to heavy construction traffic, remove and properly store cover plates or seals and install temporary protection over joints. Reinstall cover plates or seals prior to Substantial Completion of Work.

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**SECTION 08 11 13  
HOLLOW METAL DOORS AND FRAMES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies steel doors, steel frames and related components.
- B. Terms relating to steel doors and frames as defined in ANSI A123.1 and as specified.

**1.2 RELATED WORK**

- A. Frames fabricated of structural steel: Section 05 50 10, METAL FABRICATIONS.
- B. Door Hardware: Section 08 71 00, DOOR HARDWARE.

**1.3 TESTING**

- A. An independent testing laboratory shall perform testing.

**1.4 SUBMITTALS**

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

**1.5 SHIPMENT**

- A. Prior to shipment label each door and frame to show location, size, door swing and other pertinent information.
- B. Fasten temporary steel spreaders across the bottom of each door frame.

**1.6 STORAGE AND HANDLING**

- A. Store doors and frames at the site under cover.
- B. Protect from rust and damage during storage and erection until completion.

**1.7 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. Door and Hardware Institute (DHI):
  - A115 Series.....Steel Door and Frame Preparation for Hardware, Series A115.1 through A115.17 (Dates Vary)

## C. Steel Door Institute (SDI):

113-01 (R2006).....Thermal Transmittance of Steel Door and Frame  
Assemblies

128-09.....Acoustical Performance for Steel Door and Frame  
Assemblies

## D. American National Standard Institute:

A250.8-2003 (R2008).....Specifications for Standard Steel Doors and  
Frames

## E. American Society for Testing and Materials (ASTM):

A568/568-M-11.....Steel, Sheet, Carbon, and High-Strength, Low-  
alloy, Hot-Rolled and Cold-Rolled

A1008-10.....Steel, sheet, Cold-Rolled, Carbon, Structural,  
High Strength Low Alloy and High Strength Low  
Alloy with Improved Formability

B209/209M-10.....Aluminum and Aluminum-Alloy Sheet and Plate

B221/221M-12.....Aluminum and Aluminum-Alloy Extruded Bars,  
Rods, Wire, Profiles and Tubes

## F. The National Association Architectural Metal Manufacturers (NAAMM):

Metal Finishes Manual (AMP 500-06)

## G. National Fire Protection Association (NFPA):

80-13.....Fire Doors and Fire Windows

## H. Underwriters Laboratories, Inc. (UL):

Fire Resistance Directory

## I. Intertek Testing Services (ITS):

Certifications Listings...Latest Edition

## J. Factory Mutual System (FM):

Approval Guide

**PART 2 - PRODUCTS****2.1 MATERIALS**

A. Sheet Steel: ASTM A1008, cold-rolled for panels (face sheets) of doors.

B. Anchors, Fastenings and Accessories: Fastenings anchors, clips  
connecting members and sleeves from zinc coated steel.

C. Prime Paint: Paint that meets or exceeds the requirements of A250.8.

**2.2 FABRICATION GENERAL**

## A. GENERAL:

1. Follow ANSI A250.8 for fabrication of standard steel doors, except  
as specified otherwise. Doors to receive hardware specified in

Section 08 71 00, DOOR HARDWARE. Tolerances as per ANSI A250.8. Thickness, 44 mm (1-3/4 inches), unless otherwise shown.

2. Close top edge of exterior doors flush and seal to prevent water intrusion.
  3. When vertical steel stiffeners are used for core construction, fill spaces between stiffeners with mineral fiber insulation.
- B. Heavy Duty Doors: ANSI A250.8, Level 2, Full flush seamless design of size and design shown. Core construction types a, d, or f, for interior doors, and, types b, c, e, or f, for exterior doors.
- C. Fire Rated Doors (Labeled):
1. Conform to NFPA 80 when tested by Underwriters Laboratories, Inc., Inchcape Testing Services, or Factory Mutual for the class of door or door opening shown.
  2. Fire rated labels of metal, with raised or incised markings of approving laboratory shall be permanently attached to doors.
  3. Close top and vertical edges of doors flush. Vertical edges shall be seamless. Apply steel astragal to the meeting stile of the active leaf of pairs of fire rated doors, except where vertical rod exit devices are specified for both leaves swinging in the same direction.
  4. Construct fire rated doors in stairwell enclosures for maximum transmitted temperature rise of 230 °C (450 °F) above ambient temperature at end of 30 minutes of fire exposure when tested in accordance with ASTM E152.

### **2.3 METAL FRAMES**

A. General:

1. ANSI A250.8, 1.3 mm (0.053 inch) thick sheet steel, types and styles as shown or scheduled.
2. Frames for exterior doors: Fabricate from 1.7 mm (0.067 inch) thick galvanized steel conforming to ASTM A525.
3. Frames for labeled fire rated doors.
  - a. Comply with NFPA 80. Test by Underwriters Laboratories, Inc., Inchcape Testing Services, or Factory Mutual.
  - b. Fire rated labels of approving laboratory permanently attached to frames as evidence of conformance with these requirements.  
Provide labels of metal or engraved stamp, with raised or incised markings.
4. Knocked-down frames are not acceptable.

#### **HOLLOW METAL DOORS AND FRAMES**

## B. Reinforcement and Covers:

1. ANSI A250.8 for, minimum thickness of steel reinforcement welded to back of frames.
2. Provide mortar guards securely fastened to back of hardware reinforcements except on lead-lined frames.

## C. Frame Anchors:

## 1. Floor anchors:

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

## 2. Jamb anchors:

- a. Locate anchors on jambs near top and bottom of each frame, and at intermediate points not over 600 mm (24 inches) apart, except for fire rated frames space anchors as required by labeling authority.
- b. Form jamb anchors of not less than 1 mm (0.042 inch) thick steel unless otherwise specified.
- c. Anchors set in masonry: Use adjustable anchors designed for friction fit against the frame and for extension into the masonry not less than 250 mm (10 inches). Use one of following type:
  - 1) Wire loop type of 5 mm (3/16 inch) diameter wire.
  - 2) T-shape or strap and stirrup type of corrugated or perforated sheet steel.
- d. Anchors for frames set in prepared openings:
  - 1) Steel pipe spacers with 6 mm (1/4 inch) inside diameter welded to plate reinforcing at jamb stops or hat shaped formed strap spacers, 50 mm (2 inches) wide, welded to jamb near stop.

- 2) Drill jamb stop and strap spacers for 6 mm (1/4 inch) flat head bolts to pass thru frame and spacers.
- 3) Two piece frames: Subframe or rough buck drilled for 6 mm (1/4 inch) bolts.

## **2.4 SHOP PAINTING**

- A. ANSI A250.8.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Plumb, align and brace frames securely until permanent anchors are set.
  1. Use triangular bracing near each corner on both sides of frames with temporary wood spreaders at midpoint.
  2. Use wood spreaders at bottom of frame if the shipping spreader is removed.
  3. Protect frame from accidental abuse.
  4. Where construction will permit concealment, leave the shipping spreaders in place after installation, otherwise remove the spreaders after the frames are set and anchored.
  5. Remove wood spreaders and braces only after the walls are built and jamb anchors are secured.
- B. Floor Anchors:
  1. Anchor the bottom of door frames to floor with two 6 mm (1/4 inch) diameter expansion bolts. Use 9 mm (3/8 inch) bolts on lead lined frames.
  2. Power actuated drive pins may be used to secure frame anchors to concrete floors.
- C. Jamb Anchors:
  1. Anchors in masonry walls: Embed anchors in mortar. Fill space between frame and masonry wall with grout or mortar as walls are built.
  2. Coat frame back with a bituminous coating prior to lining of grout filling in masonry walls.
  3. Frames set in prepared openings of masonry or concrete: Expansion bolt to wall with 6 mm (1/4 inch) expansion bolts through spacers. Where subframes or rough bucks are used, 6 mm (1/4 inch) expansion bolts on 600 mm (24 inch) centers or power activated drive pins 600 mm (24 inches) on centers. Secure two piece frames to subframe or rough buck with machine screws on both faces.

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

**3.2 INSTALLATION OF DOORS AND APPLICATION OF HARDWARE**

- A. Install doors and hardware as specified in Section 08 71 00, DOOR HARDWARE.

- - - E N D - - -

**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: Unit system to include following:
    - a. Glass.
    - 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. Miscellaneous Metal Members: Section 05 50 10, METAL FABRICATIONS.
- C. Firestopping between Curtain Wall and Structure: Section 07 84 00, FIRESTOPPING.
  - 1. Sheet Metal Flashing and Trim: Section 07 60 00, FLASHING AND SHEET METAL.
- D. Joint Sealants: Section 07 92 00, JOINT SEALANTS.
- E. Glazing: Section 08 80 00, GLAZING.
- F. Finish Color: Referenced elsewhere in this specification.

**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 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. Manufacturers Professional Engineer Qualifications: A Professional Engineer who is legally qualified to practice in state where Project is located and who is experienced in providing engineering services of kind indicated. Engineering services are defined as those performed for installations of glazed aluminum curtain walls that are similar to those indicated for this Project in material, design, and extent.
- e. 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.
- f. 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.
- g. 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. Mockup:

- 1. Construct, at job site, full size typical wall unit which incorporates horizontal and vertical joints, framing, window units, panels, glazing, sealants, and other accessories as detailed and specified. Mock-up wall unit location, size and

GLAZED ALUMINUM CURTAIN WALLS

design are to be as indicated on construction documents. Orient mockup to be facing full sun when constructed. Mockup may be a portion of actual curtain wall installation with **prior approval** from architect.

2. Performance Test

- a. Conduct performance test of mockup after approval of visual aspects has been obtained. Testing is to be performed on mockup according to requirements in "Field Quality Control" Article.
- b. Refer to Performance Requirements and Field Quality Control Articles, this section, for testing requirements.

3. Approved Mock-up

- a. After completion and approval of performance test results of job site mockup, as directed by COR, approved mock-up panel is to be used as minimum standard of comparison for entire curtain wall system.

C. Pre-Installation Conference

1. Prior to starting installation of glazed curtain wall system schedule conference with 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, accessories, and mock-up. 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.
- Operation and Maintenance Manuals
- a. Submit cleaning and maintenance instructions.
- E. Samples: Not required for clear anodized finish.
- 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):
- 501.8-13.....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

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|                       |  |
|-----------------------|--|
| A193/A193M-14a.....   | Alloy-Steel and Stainless Steel Bolting<br>Materials for High Temperature Service                                    |
| A307-14.....          | Carbon Steel Bolts and Studs, 60,000 PSI<br>Tensile Strength   |
| B209-14.....          | Aluminum and Aluminum Alloy Sheet and Plate  |
| B209M-14.....         | Aluminum and Aluminum Alloy Sheet and Plate<br>(Metric)  |
| B211-12.....          | Aluminum and Aluminum Alloy Bar, Rod, Wire   |
| B211M-12.....         | Aluminum and Aluminum Alloy Bar, Rod, Wire<br>(Metric)   |
| B221-14.....          | Aluminum and Aluminum Alloy Extruded Bars,<br>Rods, Wire, Shapes and Tubes   |
| B221M-13.....         | Aluminum and Aluminum Alloy Extruded Bars,<br>Rods, Wire, Shapes and Tubes (Metric)                                  |
| B316/B316M-10.....    | Aluminum and Aluminum Alloy Rivet and Cold-<br>Heading, Wire, and Rods   |
| C578-14a.....         | Rigid Cellular Polystyrene Thermal Insulation  |
| C612-14.....          | Mineral Fiber Block and Board Thermal<br>Insulation  |
| C920-14a.....         | Elastomeric Joint Sealants   |
| C794-10.....          | Standard Test Method for Adhesion-In-Peel of<br>Elastomeric Joint Sealants.  |
| C1193-13.....         | Guide for Use of Joint Sealants  |
| C1363-11.....         | Thermal Performance of Building Materials and<br>Envelope Assemblies by Means of a Hot Box<br>Apparatus              |
| C1521-13.....         | Practice for Evaluating Adhesion of Installed<br>Weatherproofing   |
| D1037-12.....         | Evaluating the Properties of Wood-Base Fibers<br>and Particle Panel Materials  |
| E84-14.....           | Surface Burning Characteristics of Building<br>Materials   |
| E330/E330M-14.....    | Structural Performance of Exterior Windows,<br>Curtain Walls, and Doors by Uniform Static Air<br>Pressure Difference |
| E331-00 (R2009) ..... | Water Penetration of Exterior Windows, Curtain<br>Walls, and Doors By Uniform Static Air Pressure<br>Difference      |

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- E413-10.....Classification for Rating Sound Insulation
- 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. Steel Structures Painting Council (SSPC)  
Paint 25-97 (2004) .....Red Iron Oxide Raw Linseed Oil and Alkyd Primer  
(Without Lead and Chromate Pigments)
- 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: Installer shall warranty their installation of  
Curtain Wall System for a period of one (1) year from date of  
installation and final acceptance by the Government in accordance with  
the FAR clause 52.246-21, "Warranty of Construction".
- B. Manufacturer Warranty: Submit manufacturer's written warranty for  
materials, installation and weathertightness for a minimum of five (5)  
years from the date of installation and final acceptance by the  
Government. Submit manufacturer warranty during the submittal process.

## **PART 2 - PRODUCTS**

### **2.1 SYSTEM DESCRIPTION:**

- A. Design Requirements:

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1. Curtain Wall System: Tubular aluminum sections with thermal break condition supplementary support framing, factory prefinished, vision glass,; related flashings, anchorage and attachment devices.
  2. System Assembly: Shop unitized assembly.
  3. 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.
  4. 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 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 indicated on structural drawings.
  2. Seismic Loads: Design and size components to withstand seismic loads and sway displacement as calculated in accordance with structural drawings. 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).

6. Physical Security Mission Critical Facilities:

- a. Provide glazed aluminum curtain walls designed to meet or exceed the design and construction standards as provided in the Physical Security Design Manual for VA Facilities: Mission Critical Facilities.

- 1) Blast Resistance: Design level vehicle threat (W2) located at the standoff distance, but not greater than GP2.

**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. Sealants used inside the weatherproofing system are to have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, (EPA Method 24).
5. Comply with recommendations of sealant manufacturer for specific sealant selections.
6. 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.
7. 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 6.35 mm (1/4 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.

GLAZED ALUMINUM CURTAIN WALLS

- 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.

## **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. 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.
- D. Apply 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 structural silicone sealant according to field adhesion test method described in AAMA CW 13.



2. 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

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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 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. This Section includes commercial door hardware for the following:
  - 1. Swinging doors.
  - 2. Other doors to the extent indicated.
- B. Door hardware includes, but is not necessarily limited to, the following:
  - 1. Mechanical door hardware.
  - 2. Cylinders specified for doors in other sections.
- C. Related Sections:
  - 1. Division 08 Section "Hollow Metal Doors and Frames".
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
  - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
  - 2. ICC/IBC - International Building Code.
  - 3. NFPA 80 - Fire Doors and Windows.
  - 4. NFPA 101 - Life Safety Code.
  - 5. NFPA 105 - Installation of Smoke Door Assemblies.
  - 6. State Building Codes, Local Amendments.
- E. Standards: All hardware specified herein shall comply with the following industry standards:
  - 1. ANSI/BHMA Certified Product Standards - A156 Series
  - 2. UL10C - Positive Pressure Fire Tests of Door Assemblies

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### 1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
  - 1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
  - 2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
  - 3. Content: Include the following information:
    - a. Type, style, function, size, label, hand, and finish of each door hardware item.
    - b. Manufacturer of each item.
    - c. Fastenings and other pertinent information.
    - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
    - e. Explanation of abbreviations, symbols, and codes contained in schedule.
    - f. Mounting locations for door hardware.
    - g. Door and frame sizes and materials.
  - 4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

- C. Keying Schedule: Prepared under the supervision of the COR, separate schedule detailing final keying instructions for each lockset and cylinder in writing. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. COR to approve submitted keying schedule prior to the ordering of permanent cylinders.
- D. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals. The manual to include the name, address, and contact information of the manufacturers providing the hardware and their nearest service representatives. The final copies delivered after completion of the installation test to include "as built" modifications made during installation, checkout, and acceptance.
- E. Warranties and Maintenance: Special warranties and maintenance agreements specified in this Section.

#### **1.4 QUALITY ASSURANCE**

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Installer Qualifications: Installers, trained by the primary product manufacturers, with a minimum 5 years documented experience installing both standard and electrified builders hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying mechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor in good standing by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and COR concerning both standard door hardware and keying.

1. Scheduling Responsibility: Preparation of door hardware and keying schedules.
- D. Source Limitations: Obtain each type and variety of Door Hardware specified in this Section from a single source, qualified supplier unless otherwise indicated.
- E. Regulatory Requirements: Comply with NFPA 70, NFPA 80, NFPA 101 and ANSI A117.1 requirements and guidelines as directed in the model building code including, but not limited to, the following:
  1. Where indicated to comply with accessibility requirements, comply with Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG)," ANSI A117.1 as follows:
    - a. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
    - b. Door Closers: Comply with the following maximum opening-force requirements indicated:
      - 1) Interior Hinged Doors: 5 lbf applied perpendicular to door.
      - 2) Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
    - c. Thresholds: Not more than 1/2 inch high. Bevel raised thresholds with a slope of not more than 1:2.
  2. NFPA 101: Comply with the following for means of egress doors:
    - a. Latches, Locks, and Exit Devices: Not more than 15 lbf to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.
    - b. Thresholds: Not more than 1/2 inch high.
  3. Fire-Rated Door Assemblies: Provide door hardware for assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252 (neutral pressure at 40" above sill) or UL-10C.
    - a. Test Pressure: Positive pressure labeling.

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- F. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.
- G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
  - 1. Function of building, purpose of each area and degree of security required.
  - 2. Plans for existing and future key system expansion.
  - 3. Requirements for key control storage and software.
  - 4. Installation of permanent keys, cylinder cores and software.
  - 5. Address and requirements for delivery of keys.
- H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
  - 1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
  - 2. Inspect and discuss electrical roughing-in, and other preparatory work performed by other trades.
  - 3. Review sequence of operation narratives for each unique access controlled opening.
  - 4. Review and finalize construction schedule and verify availability of materials.
  - 5. Review the required inspecting, testing, commissioning, and demonstration procedures
- I. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

#### **1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not

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store electronic access control hardware, software or accessories at Project site without prior authorization.

- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to COR via registered mail or overnight package service. Instructions for delivery to the COR shall be established at the "Keying Conference".

#### **1.6 COORDINATION**

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.
- C. Door and Frame Preparation: Related Division 08 Sections (Steel, Aluminum and Wood) doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

#### **1.7 WARRANTY**

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship

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within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
  2. Faulty operation of the hardware.
  3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
  4. Electrical component defects and failures within the systems operation.
- C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.
- D. Special Warranty Periods:
1. Twenty five years for manual surface door closers.

## **1.8 MAINTENANCE SERVICE**

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.
- B. Continuing Service: Beginning at Substantial Completion, and running concurrent with the specified warranty period, provide continuous (6) months full maintenance including repair and replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door opening operation. Provide parts and supplies as used in the manufacture and installation of original products.

## **PART 2 - PRODUCTS**

### **2.1 SCHEDULED DOOR HARDWARE**

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
1. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

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- a. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
- B. Substitutions: Requests for substitution and product approval for inclusive mechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, COR, and their designated consultants.

## 2.2 HANGING DEVICES

- A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles as specified in the Door Hardware Sets.
  - 1. Quantity: Provide the following hinge quantity, unless otherwise indicated:
    - a. Two Hinges: For doors with heights up to 60 inches.
    - b. Three Hinges: For doors with heights 61 to 90 inches.
    - c. Four Hinges: For doors with heights 91 to 120 inches.
    - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
  - 2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
    - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
    - b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
  - 3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
    - a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
  - 4. Hinge Options: Comply with the following where indicated in the Hardware Sets or on Drawings:

a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the following applications:

- 1) Out-swinging exterior doors.
- 2) Out-swinging access controlled doors.
- 3) Out-swinging lockable doors.

5. Acceptable Manufacturers:

- a. Bommer Industries (BO).
- b. Hager Companies (HA).
- c. McKinney Products (MK).

### 2.3 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.

B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.

1. Acceptable Manufacturers:

- a. Stanley Best (BE).

C. Cylinders: Original manufacturer cylinders complying with the following:

1. Mortise Type: Threaded cylinders with rings and straight-or clover-type cam.
2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored-Lock Type: Cylinders with tailpieces to suit locks.
4. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
5. Keyway: Match Facility Standard.

D. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:

1. Interchangeable Cores: Core insert, removable by use of a special key; usable with other manufacturers' cylinders.

- E. Keying System: Each type of lock and cylinders to be factory keyed. Conduct specified "Keying Conference" to define and document keying system instructions and requirements. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by COR. Incorporate decisions made in keying conference, and as follows:
1. Existing System: Master key or grand master key locks to Owner's existing system.
- F. Key Quantity: Provide the following minimum number of keys:
1. Top Master Key: One (1)
  2. Change Keys per Cylinder: Two (2)
  3. Master Keys (per Master Key Group): Two (2)
  4. Grand Master Keys (per Grand Master Key Group): Two (2)
  5. Construction Keys (where required): Ten (10)
  6. Construction Control Keys (where required): Two (2)
  7. Permanent Control Keys (where required): Two (2)
- G. Construction Keying: Provide construction master keyed cylinders or temporary keyed construction cores where specified. Provide construction master keys in quantity as required by project Contractor. Replace construction cores with permanent cores. Furnish permanent cores for installation as directed under specified "Keying Conference".
- H. Key Registration List: Provide keying transcript list to the COR in the proper format for importing into key control software.
- I. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.
1. Acceptable Manufacturers:
    - a. Lund Equipment (LU).
    - b. MMF Industries (MM).
    - c. Telkee (TK).

## **2.4 MECHANICAL LOCKS AND LATCHING DEVICES**

- A. Cylindrical Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.2, Series 4000, Grade 1 certified cylindrical (bored) locksets furnished in the functions as specified in the Hardware Sets. Lock chassis fabricated of heavy gauge steel, zinc dichromate

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plated, with through-bolted application. Furnish with solid cast levers, standard 2 3/4" backset, and 1/2" (3/4" at rated paired openings) throw brass or stainless steel latchbolt. Locks are to be non-handed and fully field reversible.

1. Acceptable Manufacturers:

- a. Stanley Best (BE) - 9K Series.
- b. No Substitution - Facility Standard.

B. Lock Trim Design: As specified in Hardware Sets.

## 2.5 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

- 1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.

B. Standards: Comply with the following:

- 1. Strikes for Mortise Locks and Latches: BHMA A156.13.
- 2. Strikes for Bored Locks and Latches: BHMA A156.2.
- 3. Strikes for Auxiliary Deadlocks: BHMA A156.5.
- 4. Dustproof Strikes: BHMA A156.16.

## 2.6 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

- 1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.
- 2. Standards: Closers to comply with UL-10C and UBC 7-2 for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
- 3. Cycle Testing: Provide closers which have surpassed 10 million cycles in a test witnessed and verified by UL.

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4. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1.
  5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
    - a. Where closers are indicated to have mechanical dead-stop, provide heavy duty arms and brackets with an integral positive stop.
    - b. Where closers are indicated to have mechanical hold open, provide heavy duty units with an additional built-in mechanical holder assembly designed to hold open against normal wind and traffic conditions. Holder to be manually selectable to on-off position.
    - c. Where closers are indicated to have a cushion-type stop, provide heavy duty arms and brackets with spring stop mechanism to cushion door when opened to maximum degree.
    - d. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics. Provide drop plates or other accessories as required for proper mounting.
  6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates, and through-bolt or security type fasteners as specified in the door Hardware Sets.
- B. Door Closers, Surface Mounted (Large Body Cast Iron): ANSI/BHMA A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control.
1. Acceptable Manufacturers:
    - a. Corbin Russwin Hardware (RU) - DC8000 Series.
    - b. LCN Closers (LC) - 4040XP Series.
    - c. Norton Door Controls (NO) - 9500 Series.
    - d. Sargent Manufacturing (SA) - 281 Series.

**2.7 DOOR STOPS AND HOLDERS**

- A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.
- B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
  - 1. Acceptable Manufacturers:
    - a. Burns Manufacturing (BU).
    - b. Hiawatha, Inc. (HI).
    - c. Ives (IV).
    - d. Rockwood Manufacturing (RO).

**2.8 ARCHITECTURAL SEALS**

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.
- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
  - 1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
  - 1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and UBC 7-2, Fire Tests of Door Assemblies.

D. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

E. Acceptable Manufacturers:

1. Pemko Manufacturing (PE).
2. Reese Enterprises, Inc. (RS).
3. Zero International (ZE).

## **2.9 FABRICATION**

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

## **2.10 FINISHES**

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware.

DOOR HARDWARE



Proceed only after such discrepancies or conflicts have been resolved in writing.

### **3.2 PREPARATION**

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

### **3.3 INSTALLATION**

- A. Install each item of mechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
  - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
  - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
  - 2. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
  - 3. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
- D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the

work will not be delayed by hardware losses before and after installation.

### **3.4 FIELD QUALITY CONTROL**

- A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.

### **3.5 ADJUSTING**

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

### **3.6 CLEANING AND PROTECTION**

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. and provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

### **3.7 DEMONSTRATION**

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical door hardware.

### **3.8 DOOR HARDWARE SCHEDULE**

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the

DOOR HARDWARE

bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

B. Manufacturer's Abbreviations:

1. MK - McKinney
2. RO - Rockwood
3. BE - Stanley Security Solutions Inc (BE)
4. RU - Corbin Russwin
5. PE - Pemko

**Hardware Schedule**

**Set: 1.0**

Doors: 102, 103A, 104

Description: Elevator Control, Storage, Electrical (Rated)

|                                |                            |       |    |
|--------------------------------|----------------------------|-------|----|
| 3 Hinge                        | T4A3386 NRP 5" x 4-1/2"    | US32D | MK |
| 1 Cylindrical Lock (Storeroom) | 93K7D 15D S3               | 626   | BE |
| 1 Closer w/ Spring Stop        | DC8210 M54 A11             | 689   | RU |
| 1 Kickplate                    | K1050 10" x 2" LDW 4BE CSK | US32D | RO |
| 1 Threshold                    | 271A x Opening Width       |       | PE |
| 1 Gasketing                    | S88D (Head & Jambs)        |       | PE |

- - - END - - -

DOOR HARDWARE

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**SECTION 08 80 00  
GLAZING**

**PART 1 - GENERAL****1.1 DESCRIPTION:**

A. This section specifies the following:

1. Glass.

**1.2 RELATED WORK:**

A. Sustainable Design Requirements: Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

B. Factory glazed by manufacturer in following units:

1. Glazed Curtain Walls: Section 08 44 13, GLAZED ALUMINUM CURTAIN WALLS.
2. Junction and Switch Boxes: Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL 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.
3. Fire rated glazing assemblies: Mark in accordance with IBC.

**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;

GLAZING

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: As indicated on structural documents and in accordance with applicable code.
3. Wind Design Data: As indicated on construction documents and 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. Windborne-Debris-Impact Resistance: Comply with enhanced-protection testing requirements in ASTM E1996 for project wind zone when tested according to ASTM E1886, based upon testing of specimens not less than the size required for project and utilizing installation method identical to that specified for project.

1. Project Wind Zone: Reference structural drawings.
2. Large-Missile Test: For glazing located within 9.1 m (30 feet) of grade.
3. Small-Missile Test: For glazing located more than 9.1 m (30 feet) above grade.

D. 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:

### GLAZING

- 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 Certificates:
  - 1. Certificate on solar heat gain coefficient when value is specified.
  - 2. Certificate on "R" value when value is specified.
- D. Manufacturer Warranty.
- E. Manufacturer's Literature and Data:
  - 1. Glass, each kind required.
  - 2. Glazing cushion.
  - 3. Sealing compound.
- F. Samples:
  - 1. Size: 305 mm by 305 mm (12 inches by 12 inches).
  - 2. Tinted glass.
- G. 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

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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.

#### **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: Installer shall warranty their installation of glazing for a period of one (1) year from date of installation and final acceptance by the Government in accordance 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. 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(R2011).....Lock-Strip Gaskets
  - C716-06.....Installing Lock-Strip Gaskets and Infill  
Glazing Materials
  - C794-10.....Adhesion-in-Peel of Elastomeric Joint Sealants
  - C864-05(R2011).....Dense Elastomeric Compression Seal Gaskets,  
Setting Blocks, and Spacers
  - C920-14a.....Elastomeric Joint Sealants
  - C964-07(R2012).....Standard Guide for Lock-Strip Gasket Glazing

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- C1036-11(R2012).....Flat Glass
- C1048-12.....Heat-Treated Flat Glass-Kind HS, Kind FT Coated  
and Uncoated Glass.
- C1172-14.....Laminated Architectural Flat Glass
- C1376-10.....Pyrolytic and Vacuum Deposition Coatings on  
Flat Glass
- D635-10.....Rate of Burning and/or Extent and Time of  
Burning of Self-Supporting Plastic in a  
Horizontal Position
- E84-14.....Surface Burning Characteristics of Building  
Materials
- E119-14.....Standard Test Methods for Fire Test of Building  
Construction and Material
- E1300-12a.....Load Resistance of Glass in Buildings
- E1886-13a.....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
- F1233-08.....Standard Test Method for Security Glazing  
Materials and Systems
- F1642-12.....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. Intertek Testing Services - Warnock Hersey (ITS-WHI)
- J. National Fire Protection Association (NFPA):
- 80-16.....Fire Doors and Windows
- 252-12.....Fire Tests of Door Assemblies

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257-12.....Standard on Fire Test for Window and Glass  
Block Assemblies

K. National Fenestration Rating Council (NFRC)

L. Safety Glazing Certification Council (SGCC) 2012:  
Certified Products Directory (Issued Semi-Annually).

M. Underwriters Laboratories, Inc. (UL):

9-08(R2009).....Fire Tests of Window Assemblies

263-14.....Fire Tests of Building Construction and  
Materials

N. Unified Facilities Criteria (UFC):

4-010-01-03(R2007).....DOD Minimum Antiterrorism Standards for  
Buildings

O. U.S. Veterans Administration:

Physical Security Design Manual for VA Facilities (VAPSDG); Mission  
Critical Facilities

Architectural Design Manual for VA Facilities (VASDM)

P. 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 q3 and 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 Tempered Glass:
1. ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality q3.
- C. Tinted Tempered Glass.
1. ASTM C1048, Kind FT, Condition A, Type I, Class 2, Quality q3.

### **2.3 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.
- 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:

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- 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. Glazing Gaskets: ASTM C864:
- 1. Firm dense wedge shape for locking in sash.
  - 2. Soft, closed cell with locking key for sash key.
  - 3. Flanges may terminate above the glazing-beads or terminate flush with top of beads.
- F. Lock-Strip Glazing Gaskets: ASTM C542, shape, size, and mounting as indicated.
- G. Glazing Sealants: ASTM C920, silicone neutral cure:
- 1. Type S.
  - 2. Class 25 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).
- H. Color:
- 1. Color of glazing compounds, gaskets, and sealants used for aluminum color frames to match color of the finished aluminum and be non-staining.
  - 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 and operable sash, in a securely fixed or closed and locked position, until sealant, glazing compound, or putty has thoroughly set.
- F. Tempered Glass: Install with roller distortions in horizontal position unless otherwise directed.

### **3.4 INSTALLATION - DRY METHOD (TAPE AND GASKET SPLINE GLAZING):**

- A. Cut glazing tape or spline to length; install on glazing pane. Seal corners by butting and sealing junctions with butyl sealant.
- B. Place setting blocks at 1/4 points with edge block no more than 150 mm (6 inches) from corners.
- C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.
- D. Install removable stops without displacing glazing spline. Exert pressure for full continuous contact.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Trim protruding tape edge.

**3.5 INSTALLATION - INTERIOR WET METHOD (COMPOUND AND COMPOUND) :**

- A. Install glazing resting on setting blocks. Install applied stop and center pane by use of spacer shims at 600 mm (24 inch) centers, kept 6 mm (1/4 inch) below sight line.
- B. Locate and secure glazing pane using glazers' clips or spring wire clips.
- C. Fill gaps between glazing and stops with glazing compound until flush with sight line. Tool surface to straight line.

**3.6 REPLACEMENT AND CLEANING:**

- A. Clean new glass surfaces removing temporary labels, paint spots, and defacement after approval by COR.
- B. Replace cracked, broken, and imperfect glass, or glass which has been installed improperly.
- C. Leave glass, putty, and other setting material in clean, whole, and acceptable condition.

**3.7 PROTECTION:**

- A. Protect finished surfaces from damage during erection, and after completion of work. Strippable plastic coatings on colored anodized finish are not acceptable.

**3.8 MONOLITHIC GLASS SCHEDULE:**

- C. Glass Type MG #1: Tinted fully tempered float glass.
  - 1. Unit Thickness: 6 mm (0.23 inch).
  - 2. Tint Color: Gray to match tint of glass used in curtain wall at existing garage stairways.
  - 3. Visible Light Transmittance: 4 percent minimum.
  - 4. Solar Heat Gain Coefficient: 0.58 maximum.
  - 5. Safety glazing label required.

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**SECTION 09 91 00**  
**PAINTING**

**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 interior concrete block exposed to view.
7. Painting pipes, pipe coverings, conduit, ducts, insulation, hangers, supports and other mechanical and electrical items and equipment exposed to view.
8. Painting surfaces above, behind or below grilles, gratings, diffusers, louvers lighting fixtures, and the like, which are exposed to view through these items.
9. Painting includes shellacs, stains, varnishes, coatings specified, and striping or markers and identity markings.
10. Incidental painting and touching up as required to produce proper finish for painted surfaces, including touching up of factory finished items.
11. 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. Activity Hazard Analysis: Section 01 35 26, SAFETY REQUIREMENTS.
- B. Sustainable Design Requirements: Section 01 81 13, SUSTAINABLE DESIGN REQUIREMENTS.
- C. Shop prime painting of steel and ferrous metals: Division 05 - METALS, Division 08 - OPENINGS; Division 10 - SPECIALTIES;

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Division 11 - EQUIPMENT;; Division 21 - FIRE SUPPRESSION; Division 22 - PLUMBING; Division 23 - HEATING; VENTILATION AND AIR-CONDITIONING; Division 26 - ELECTRICAL; Division 27 - COMMUNICATIONS; and Division 28 - ELECTRONIC SAFETY AND SECURITY sections.

- D. Type of Finish, Color, and Gloss Level of Finish Coat: Reference drawings for finish schedule and color schedule key.
- E. Asphalt and concrete pavement marking: Section 32 17 23, PAVEMENT MARKINGS.

### 1.3 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Sustainable Design Submittals as described below:
  - 1. Volatile organic compounds per volume as specified in PART 2 - PRODUCTS.
- C. Painter qualifications.
- D. 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.
- E. 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. Attach labels to panel stating the following:
    - a. Federal Specification Number or manufacturers name and product number of paints used.
    - b. Product type and color.
    - c. Name of project.
  - 4. Strips showing not less than 50 mm (2 inch) wide strips of undercoats and 100 mm (4 inch) wide strip of finish coat.

### PAINTING

F. Sample of identity markers if used.

G. Manufacturers' Certificates indicating compliance with specified requirements:

1. Manufacturer's paint substituted for Federal Specification paints meets or exceeds performance of paint specified.
2. Epoxy coating.

#### **1.4 DELIVERY AND STORAGE:**

A. Deliver materials to site in manufacturer's sealed container marked to show following:

1. Name of manufacturer.
2. Product type.
3. Batch number.
4. Instructions for use.
5. Safety precautions.

B. In addition to manufacturer's label, provide a label legibly printed as following:

1. Federal Specification Number, where applicable, and name of material.
2. Surface upon which material is to be applied.
3. 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

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writing of any anticipated problems using the coating systems as specified with substrates primed by others.

**1.6 MOCK-UP PANEL:**

- A. In addition to the samples specified herein to be submitted for approval, apply in the field, at their final location, each type and color of approved paint materials, applied 3.05 m (10 feet) wide, floor to ceiling of wall surfaces, before proceeding with the remainder of the work, for approval by the COR. Paint mock-ups to include one (1) door and frame assembly.
- B. Finish and texture approved by COR will be used as a standard of quality and workmanship for remainder of work.
- C. Repaint individual areas which are not approved, as determined by the COR, until approval is received.

**1.7 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. Asbestos: Provide materials that do not contain asbestos.
  - 3. Chromate, Cadmium, Mercury, and Silica: Provide materials that do not contain zinc-chromate, strontium-chromate, Cadmium, mercury or mercury compounds or free crystalline silica.
  - 4. Human Carcinogens: Provide materials that do not contain any of the ACGIH-BKLT and ACGHI-DOC confirmed or suspected human carcinogens.
  - 5. Use high performance acrylic paints in place of alkyd paints.

**1.8 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 ACGIH-DOC, threshold limit values.

#### 1.9 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
  - 4.....Interior/ Exterior Latex Block Filler
  - 5.....Exterior Alkyd 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
  - 18.....Organic Zinc Rich Primer
  - 22.....Aluminum Paint, High Heat (up to 590° - 1100F)

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- |          |  |
|----------|--|
| 27.....  | Exterior / Interior Alkyd Floor Enamel, Gloss                |
| 31.....  | Polyurethane, Moisture Cured, Clear Gloss                    |
| 36.....  | Knot Sealer  |
| 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                                     |
| 101..... | Epoxy Anti-Corrosive Metal Primer                            |
| 108..... | High Build Epoxy Coating, Low Gloss                          |
| 114..... | Interior Latex, Gloss  |
| 119..... | Exterior Latex, High Gloss (acrylic)                         |
| 134..... | Galvanized Water Based Primer                                |
| 135..... | Non-Cementitious Galvanized Primer                           |

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- 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
- 163.....Exterior Water Based Semi-Gloss Light Industrial  
Coating, MPI Gloss Level 5

G. 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

H. Maple Flooring Manufacturer's Association (MFMA):

I. U.S. National Archives and Records Administration (NARA):

- 29 CFR 1910.1000.....Air Contaminants

J. 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 Content: For field applications that are inside the weatherproofing system, paints and coating to comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:
  - 1. Flat Paints and Coatings: 50 g/L.
  - 2. Non-flat Paints and Coatings: 150 g/L.
  - 3. Dry-Fog Coatings: 400 g/L.

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4. Primers, Sealers, and Undercoaters: 200 g/L.
5. Anticorrosive and Antirust Paints applied to Ferrous Metals: 250 g/L.
6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
7. Pretreatment Wash Primers: 420 g/L.
8. Shellacs, Clear: 730 g/L.
9. Shellacs, Pigmented: 550 g/L.

E. 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.

#### 1.4 Biobased Content

A. Paint products shall comply with following bio-based standards for biobased materials:

| Material Type                                    | Percent by Weight            |
|--|------------------------------|
| Interior Paint                                   | 20 percent biobased material |
| Interior Paint- Oil Based and Solvent Alkyd      | 67 percent biobased material |
| 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-Membrane Concrete Sealers | 11 percent biobased content  |
| 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.

### 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.

**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

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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.

B. 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.

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C. 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.

D. Masonry, Concrete, Cement Board, Cement Plaster and Stucco:

1. Clean and remove dust, dirt, oil, grease efflorescence, form release agents, laitance, and other deterrents to paint adhesion.
2. Use emulsion type cleaning agents to remove oil, grease, paint and similar products. Use of solvents, acid, or steam is not permitted.
3. Remove loose mortar in masonry work.
4. Replace mortar and fill open joints, holes, cracks and depressions with new mortar specified in Section 04 20 10, UNIT MASONRY. 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.

E. Gypsum Plaster and Gypsum Board:

1. Remove efflorescence, loose and chalking plaster or finishing materials.
2. Remove dust, dirt, and other deterrents to paint adhesion.
3. Fill holes, cracks, and other depressions with CID-A-A-1272A finished flush with adjacent surface, with texture to match texture of adjacent surface. Patch holes over 25 mm (1-inch) in diameter as specified in Section for plaster or gypsum board.

**3.5 PAINT PREPARATION:**

- A. Thoroughly mix painting materials to ensure uniformity of color, complete dispersion of pigment and uniform composition.

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- 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. Do not paint in closed position operable items such as access doors and panels, window sashes, overhead doors, and similar items except overhead roll-up doors and shutters.

### **3.7 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 face glazing of steel.
- E. Metals except boilers, incinerator stacks, and engine exhaust pipes:
  - 1. Steel and iron: MPI 942
  - 2. Zinc-coated steel and iron: MPI 134 (Waterborne Galvanized Primer) and MPI 135 (Non-Cementitious Galvanized Primer).
  - 3. Aluminum scheduled to be painted: MPI 95 (Fast Drying Metal Primer).

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4. Copper and copper alloys scheduled to be painted: MPI 95 (Fast Drying Metal Primer).
5. Machinery not factory finished: MPI 9 (Exterior Alkyd Enamel).
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).
- F. Concrete Masonry Units except glazed or integrally colored and decorative units:
  1. MPI 4 (Block Filler) on interior surfaces.
  2. Prime exterior surface as specified for exterior finishes.
- J. Concrete Masonry, Concrete Walls and Interior Surfaces of Ceilings and Walls:
  1. Use MPI 140 (Interior High Performance latex, MPI Gloss Level 4)
- K. Concrete Floors: MPI 99 (Water-based Acrylic Curing and Sealing Compound).

### **3.8 EXTERIOR FINISHES:**

- A. Apply following finish coats where specified on finish schedule and color schedule key on drawings.
- B. Steel and Ferrous Metal:
  1. Two (2) coats of MPI 94 (Exterior Alkyd, Semi-Gloss) on exposed surfaces, except on surfaces over 94 degrees C (201 degrees F).
- D. Machinery without factory finish except for primer: One (1) coat MPI 94 (Exterior Alkyd, Semi-Gloss).
- E. Concrete Masonry Units and Concrete:
  1. General:
    - a. Where specified in or indicated on drawings.
    - 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. Apply following finish coats over prime coats in spaces or on surfaces indicated in finish schedule and color schedule key, or as otherwise indicated on drawings.
- B. Metal Work:
  - 1. Apply to exposed surfaces.
  - 2. Omit body and finish coats on surfaces concealed after installation except electrical conduit containing conductors over 600 volts.
  - 3. Ferrous Metal, Galvanized Metal, and Other Metals Scheduled:
    - a. Apply two (2) coats of MPI 47 (Interior Alkyd, Semi-Gloss) unless specified otherwise.
    - b. Machinery: One (1) coat MPI 9 (Exterior Alkyd Enamel).
    - c. Asphalt Coated Metal: One (1) coat MPI 1 (Aluminum Paint ).
- C. Masonry and Concrete Walls:
  - 1. Over MPI 4 (Interior/Exterior Latex Block Filler) on CMU surfaces.
  - 2. Two (2) coats of MPI 140 (Interior High Performance Latex MPI Gloss Level 4).
- D. Concrete Floors: One (1) coat of MPI 68 (Interior/ Exterior Latex Porch & Floor Paint, Gloss).
- E. Miscellaneous:
  - 1. Apply where specified in finish schedule and color schedule key on drawings.
  - 2. MPI 1 (Aluminum Paint): Two (2) coats of aluminum paint.

**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.

- G. Refinish areas as specified for new work to match adjoining work unless specified or scheduled otherwise.
- H. Coat knots and pitch streaks showing through old finish with MPI 36 (Knot Sealer) before refinishing.
- I. Sand or dull glossy surfaces prior to painting.
- J. Sand existing coatings to a feather edge so that transition between new and existing finish will not show in finished work.

**3.11 PAINT COLOR:**

- A. Color and gloss of finish coats is specified in finish schedule and color schedule key on drawings.
- B. For additional requirements regarding color see Articles, "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 MECHANICAL AND ELECTRICAL WORK FIELD PAINTING SCHEDULE:**

- A. Field painting of mechanical and electrical consists of cleaning, touching-up abraded shop prime coats, and applying prime, body and finish coats to materials and equipment if not factory finished in space scheduled to be finished.
- B. In spaces not scheduled to be finish painted per 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

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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 or color schedule key to match surrounding surfaces.

2. Paint colors as specified in color schedule key 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 11 (Exterior Latex, Semi-Gloss) to galvanized and zinc-copper alloy metal.

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## 2. Interior Locations:

a. Apply two (2) coats of MPI 47 (Interior Alkyd, Semi-Gloss) to following items:

1) Metal under 94 degrees C (201 degrees F) of items such as bare piping, fittings, hangers and supports.

2) Equipment and systems such as hinged covers and frames for control cabinets and boxes, cast-iron radiators, electric conduits and panel boards.

3) Heating, ventilating, air conditioning, plumbing equipment, and machinery having shop prime coat and not factory finished.

b. Paint electrical conduits containing cables rated 600 volts or more using two (2) coats of MPI 94 (Exterior Alkyd, Semi-gloss) in the Federal Safety Orange color in exposed and concealed spaces full length of conduit.

## 3. Other exposed locations:

a. Cloth jackets of insulation of ducts and pipes in connection with plumbing, air conditioning, ventilating refrigeration and heating systems: One (1) coat of MPI 50 (Interior Latex Primer Sealer) and one (1) coat of MPI 11 (Exterior Latex Semi-Gloss).

**3.13 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 on drawings.
2. Painting of disturbed, damaged and repaired or patched surfaces when entire space is not scheduled for complete repainting or refinishing.
3. Painting of ferrous metal and galvanized metal.
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.

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- 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. Structural steel encased in concrete, masonry, or other enclosure.
- 11. Ceilings, walls, columns in interstitial spaces.
- 12. Ceilings, walls, and columns in pipe basements.

### **3.14 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.

### **PAINTING**



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<br>EXPOSED PIPING | COLOR OF<br>BACKGROUND | COLOR OF<br>LETTERS | LEGEND<br>ABBREVIATIONS |
|-------------------------------|----------------------------|------------------------|---------------------|-------------------------|
| A/C Condenser Water<br>Supply |                            | Green                  | White               | A/C Cond Wtr Sup        |
| A/C Condenser Water<br>Return |                            | Green                  | White               | A/C Cond Wtr Ret        |
| Air-Instrument Controls       |                            | Green                  | White               | Air-Inst Cont           |
| Drain Line                    |                            | Green                  | White               | Drain                   |
| Gravity Condensate Return     |                            | Green                  | White               | Gravity Cond Ret        |
| Pumped Condensate Return      |                            | Green                  | White               | Pumped Cond Ret         |
| Vacuum Condensate Return      |                            | Green                  | White               | Vac Cond Ret            |
| 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                |
| Reagent Grade Water           |                            | Green                  | White               | RG                      |
| Sanitary Waste                |                            | Green                  | White               | San Waste               |
| Sanitary Vent                 |                            | Green                  | White               | San Vent                |
| Storm Drainage                |                            | Green                  | White               | St Drain                |

## PAINTING

|                       |       |       |            |
|-----------------------|-------|-------|------------|
| Pump Drainage         | Green | White | Pump Disch |
| Atmospheric Vent      | Green | White | ATV        |
| Fire Protection Water |       |       |            |

|           |     |     |       |       |
|-----------|-----|-----|-------|-------|
| Standpipe | Red | Red | White | Stand |
|-----------|-----|-----|-------|-------|

B. Fire and Smoke Partitions:

1. Identify partitions above ceilings on both sides of partitions except within shafts in letters not less than 64 mm (2 1/2 inches) high.
2. Stenciled message: "SMOKE BARRIER" or, "FIRE BARRIER" as applicable.
3. Locate not more than 6096 mm (20 feet) on center on corridor sides of partitions, and with a least one (1) message per room on room side of partition.
4. Use semi-gloss paint of color that contrasts with color of substrate.

C. Identify columns in pipe basements and interstitial space:

1. Apply stenciled number and letters to correspond with grid numbering and lettering indicated on construction documents.
2. Paint numbers and letters 101 mm (4 inches) high, locate 45 mm (18 inches) below overhead structural slab.
3. Apply on four (4) sides of interior columns and on inside face only of exterior wall columns.
4. Color:
  - a. Use black on concrete columns.
  - b. Use white or contrasting color on steel columns.

**3.15 PROTECTION CLEAN UP, AND TOUCH-UP:**

- A. Protect work from paint droppings and spattering by use of masking, drop cloths, removal of items or by other approved methods.
- B. Upon completion, clean paint from hardware, glass and other surfaces and items not required to be painted of paint drops or smears.
- C. Before final inspection, touch-up or refinished in a manner to produce solid even color and finish texture, free from defects in work which was damaged or discolored.

- - - E N D - - -

**SECTION 10 14 00**  
**SIGNAGE****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. This Section includes following types of signs:
1. Reflective vehicular directional and information signs (V-Signs).
  2. Retroreflective regulatory signs (R- Signs).
  3. Non-reflective pedestrian directional and informational signs (PP- Signs).
  4. PVC Pipe Clearance Signs (PVC- Signs).
  5. Dimensional Characters (D- Signs)
  6. Brailled ADA Compliant Identification Signs (A-Signs).
  7. Internally-Illuminated Signs (I- Signs).
- B. Related Sections include following:
1. Division 01 Section "Temporary Facilities & Controls" for temporary project identification signs.
  2. Division 09 Sections "Exterior Painting" or "Interior Painting" for painting by others of surfaces to which signs specified herein may be applied. Painting of signs is included in this Section.
  3. Division 23 Section "Common Work Results for HVAC" for labels, tags, and nameplates for mechanical equipment.
  4. Division 26 Section "Common Work Results for Electrical Transmissions, Lighting, and Control Devices" for labels, tags, and nameplates for electrical equipment. (Room destination signage is included herein.)
  5. Division 26 Section "Interior Lighting" for illuminated exit signs.
  6. See Division 26 Sections for electrical service and connections for electrified and/or illuminated signs and/or letters.

**1.3 SUBMITTALS**

- A. General: Submit following in accordance with Conditions of Contract and Division 01 Specification Sections.

- B. Product Data: Include manufacturer's construction details relative to materials, dimensions of individual components, profiles, and finishes for each type of sign required.
- C. Shop Drawings: Provide shop drawings for fabrication and erection of signs. Include plans, elevations, and large-scale sections of typical members and other components. Show mounting methods, mounting heights, anchors, grounds, reinforcement, accessories, layout, spacing, dimensions and installation details.
  - 1. Provide message list, typestyles, graphic elements, including tactile characters and Braille and artwork as shown on drawings, and layout of lettering. Include large scale details of sign layout.
  - 2. For signs supported by or anchored to permanent construction, provide setting drawings, templates, and directions for installation of anchor bolts and other anchors to be installed as a unit of Work in other Sections.
  - 3. Wiring Diagrams from manufacturer of electrified signs for power, signal and control wiring.
- D. Samples: Provide following samples of each sign component for verification of compliance with requirements indicated.
  - 1. Samples of each sign material type (V-, R-, PP-, VR-, etc), on not less than 6-in. squares of extrusion, sheet or plate, showing full range of colors to be provided.
  - 2. Dimensional characters and castings: Full size sample showing character, material, texture, finish, color, style and attachment method.
  - 3. Brailled Copy: Sample of ADA compliant sign showing raised image text, brailled copy and colors.
- E. Maintenance Data: For signage cleaning and maintenance requirements to be included in maintenance manual.

#### 1.4 QUALITY ASSURANCE

- A. Where warranties are required, manufacturer and/or installers shall be authorized by the entity providing the warranty.
- B. All completed signs shall be free from defects in materials and workmanship and effectively present specified or permitted message under both day and night viewing conditions. Sign faces shall be reasonably smooth, shall exhibit uniform color and brightness over entire background surface and shall not appear mottled, streaked, or stained when viewed either in ordinary daylight or incidental beams of automobile headlamps.
- C. Support structures for signs that are free-standing or extending from any exterior surface of the building, including but not limited to the roof level parking signs on cantilever supports, shall be designed by a licensed professional engineer in the State of Missouri in accordance with ASCE 7-10's requirements for wind loads.

- D. Internally illuminated or electrified sign cases (I): Housing shall be waterproof and shall comply with NEMA Standards Publication 250-Enclosures for Electrical Equipment, for Type 4 enclosures.
- E. Electrical Components, Devices and Accessories: All components shall be listed and labeled by UL and shall comply with NEMA and NFPA standards.
- F. Electrical Service: Sign contractor shall review electrical drawings and coordinate with electrical contractor for any minor changes to design and installation of equipment and/or electrical service for powering signs and/or illumination thereof. If change order(s) are possible, use the Request for Information process.
- G. Electrical Service: Sign contractor shall be responsible for design and installation of all electrical equipment for powering signs, and for design and installation of necessary electrical service from panel boards to signs.
- H. Regulatory Requirements:
  - 1. Comply with Americans with Disabilities Act (ADA) and state and local codes as adopted by authorities having jurisdiction. Signs affected, may include, but not be limited to:
    - a. Illuminated Exit Signs: Refer to Division 26.
    - b. Permanently Designated Rooms and Spaces: A- Signs.
    - c. Standpipe location.
    - d. Fire Extinguisher location
    - e. Elevator Signs.
    - f. Stairway Identification.
  - 2. MUTCD:
    - a. Regulatory R- signs shall be fully compliant with all requirements of the Manual on Uniform Traffic Control Devices (MUTCD) except that sign size may be modified due to space constraints.
- I. Single-Source Responsibility: For each separate required type of sign as defined herein, obtain signs from a single firm specializing in this type of work so that there will be undivided responsibility for such work.
- J. Design Criteria: Drawings indicate sizes, profiles, and dimensional requirements of signs. Other signs with deviations from indicated dimensions and profiles may be considered, provided deviations do not change design concept. Burden of proof of equality is on proposer.
- K. Coordinate sign placement with structural configuration and lighting location. Before sign installation, arrange meeting with Engineer/Architect and lighting installer at site to review sign placement. Additional compensation not allowed for relocating signs after installation if relocation required due to conflicts with lighting or structure.

- L. Trade Names: Do not display manufacturer's name, trade name, trademarks, or similar markings on exterior or visible surfaces.
- M. Sign Quantity Count: Sign Fabricator shall be responsible for determining the final quantity count of all signs, as indicated on the Signage Schedule and Location Plans, prior to fabrication.
- N. Construction Warranty: Installer shall warranty their installation of signage for a period of one (1) year from date of installation and final acceptance by the Government in accordance with the FAR clause 52.246-21, "Warranty of Construction".
- O. Replacement or Repairs: The owner or facilities management shall have the right to continue use of the defective part until such time that the part is replaced or repaired without loss or inconvenience to the owner or facility's management.

#### **1.5 PROJECT CONDITIONS**

- A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication to ensure proper fitting and mounting. Where sizes of signs may be affected by dimensions of surfaces on which they are installed, verify dimensions by field measurement. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay.

#### **1.6 COORDINATION**

- A. For signs to be supported by or anchored to permanent construction, provide installers with specific requirements for anchorage devices. Furnish templates for installation.
- B. Coordinate location of remote transformers with building construction. Ensure that transformers are accessible after completion of Work.

#### **1.7 MAINTENANCE**

- A. Maintenance Instruction: Furnish maintenance manual to instruct the owner or facility's management personnel in procedures to be followed in cleaning and maintaining the signage. Provide manufacturer's brochures describing the actual materials used in the Work, including metal alloys and finishes.
  - 1. Include a list of cleaning materials appropriate for continued cleaning of signs. Include written instructions for proper maintenance, service access, replacement procedures, etc. Include recommended methods for removal of residual adhesives from wall surfaces after removal of adhesive mounted signs.
- B. Extra Materials: Deliver to the owner or facility's management in manufacturer's original packaging and store at the project site where directed.

1. Furnish one quart of each finish paint color for touch-up purposes.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Basis of Design Product: Where named products are specified, subject to compliance with requirements specific to this project, provide either named product or an equivalent product by other manufacturers specified.
- B. Manufacturers: Subject to compliance with requirements specific to this project, accepted manufacturers listed in Part 2 are considered to have been prequalified in conformance with paragraph 1.4.A and B of this section. Acceptable manufacturers include, but are not limited to the following:
  1. Manufacturers of panel signs, including V-, R-, PP-, VR- and, D-signs:
    - a. ABC Architectural Signing System, Division of Nelson-Harkins Industries.
    - b. Alcan Composites, Benton, KY.
    - c. Allenite, A Division of Allen Marking Products, Inc.
    - d. Andco Industries Corp.
    - e. APCO Graphics, Inc.
    - f. Architectural Graphics, Inc.
    - g. ASI Sign Systems, Inc.
    - h. Best Manufacturing Co.
    - i. Britten Studios
    - j. Interstate Highway Sign Corp.
    - k. Henry Graphics.
    - l. Pannier Graphics.
    - m. Signs + Decal Corp., Brooklyn, NY
    - n. Tapco.
    - o. Vomar.
  2. Manufacturers of Brailled Signs (A-):
    - a. Supersine Company.
    - b. Jet Signs.
    - c. Britten Studios
    - d. Signs + Decal Corp., Brooklyn, NY
  3. Manufacturers of I- signs:
    - a. Andco Industries Corp.
    - b. ASI Sign Systems, Inc.
    - c. Interstate Highway Sign Company.
    - d. Vomar.
  4. Manufacturers of "VA" Logo Appliqué in Frosted Vinyl:

- a. Products by 3M; or "Tru-Etch" by Universal Products; or product #8510 or #8810 by Oracal.
- b. Apply to first surface of glazing.
- c. Reference drawings for installation locations.

## 2.2 MATERIALS

### A. Graphics:

1. Graphics shall be highest quality with sharp lines and smooth curves. Images shall be uniform colors and free from streaks or spotting.
2. Content and Style: Provide sign copy that complies with requirements indicated for size, style, spacing, content, position, material, finishes, and colors of letters, numbers, and other graphic devices. Notations contained within the comments section of the sign schedule indicate additional text required on sign such as street name, etc. Notations contained within parenthesis ( ) in the sign schedule and instructions for logos or symbols that are to be included on the sign, as shown on the design drawings. Refer to the sign schedule for copy, description of signs, and reference to sign types.
3. Silk screening: Where specified or permitted, silk screening shall be highest quality, with sharp lines, no sawtooths, or uneven ink coverage.
  - a. Screens shall be photographically reproduced.
  - b. Background ink shall be process inks as recommended by manufacturer of substrate employed.
  - c. Ink application through screens: 1 flood pass and 1 print pass. Images: uniform color and ink thickness; free from squeegee marks and lines.
  - d. Signs: dry in adequate racks with 2 in. spacing for ample air flow and forced air drying and curing.
  - e. Package signs only after they have dried completely per ink manufacturer's time allowances.
  - f. Where reflective messages are specified or permitted to be reverse silk-screened with a non-reflective, opaque background, the sheeting material shall be 3M Scotchlite Engineer Grade Reflective Sheeting Series 3200 or equivalent meeting US Department of Transportation Standard Specification for Construction of Roads and Bridges on Federal Highway Products, 1985 FP-85, Type II, Section 718.01.
  - g. Where reflective messages are specified or permitted to be reverse silk-screened with a reflective, transparent background, the sheeting material shall be 3M Scotchlite High Intensity Grade Sheeting Series 3930 or equivalent meeting US Department of Transportation Standard Specification for Construction of Roads and Bridges on Federal Highway Products, 1985 FP-85, Type IIIA, Section 718.01.



4. Pressure applied graphics:
  - a. Where pressure-applied graphics applied to a painted background are specified or permitted, the paint shall be flat, opaque acrylic polyurethane as recommended by manufacturer of substrate and graphic media.
  - b. Where pressure-applied, reflective graphics on an opaque painted background are specified or permitted, letters shall be digitally produced, and cut by electronic cutting machines from 3M Scotchlite Electrocut Engineer Grade Sheeting Series 3260 material, colors as noted on drawings or equivalent. Edges shall be sealed per manufacturer recommendation.
  - c. Where pressure-applied, reflective graphics on a reflective background are specified or permitted, the sheeting material shall be 3930 Hi Intensity Prismatic or equivalent meeting US Department of Transportation Standard Specification for Construction of Roads and Bridges on Federal Highway Products, 1985 FP-85, Type IIIA, Section 718.01. The letters shall be digitally produced, and cut by electronic cutting machines from 3M Scotchlite Electronic Cuttable Film Series 1170, colors as noted on drawings or equivalent.
  - d. Where pressure-applied, non-reflective graphics are specified, letters shall be digitally produced, and cut by computer-driven processes from 3M Scotchcal Electrocut 7725 film.
  - e. Where electronically cut letters and symbols are specified, the inside corners shall be rounded using the largest radius consistent with acceptable appearance. Minimum radius shall be 1/8 inch on a 3 inch letter. Use prespacing tape as recommended by manufacturer of sheeting as a carrier for letters, numerals and symbols.
5. Digital Imaging: Where digital imaging for original art and multicolored graphics are specified.
  - a. Where first surface, reflective graphics are specified, the image shall be electronically produced and electrostatically printed onto the transfer media and then heat transferred onto 3M Scotchlite Plus Sheeting Series 680 using IJ680-10 technology. Image to be protected with 3M recommended graphic protective clear coating. Not to be used for regulatory signs.
  - b. Where first surface non-reflective graphics are required, the image shall be electronically produced and electrostatically printed onto the transfer media and then heat transferred onto 3M Scotchprint flexible reflective graphic film IJ180-10 technology. Image to be protected with 3M recommended graphic protective clear coating.
  - c. Where second surface, non-reflective graphics are required, the image shall be produced using 3M Scotchprint Electronic Graphics System using Scotchcal 7725 marking film and lamination.
6. Where specified, dry film transfer shall be produced digitally using computer-driven Dry Thermal Transfer system over 3M high intensity reflective vinyl substrates.

7. All products specified to employ 3M sheeting, films, or other components shall be guaranteed and backed by 3M MCS Warranty or equivalent.

B. Inks and Paints:

1. All inks and paints shall be a type made for surface material to which it is applied, and recommended by manufacturer. Exact identification shall be noted on shop drawings, with data describing application method, if other than air-drying. Prohibited: paint or ink that will fade, discolor, or delaminate due to UV or heat exposure.
2. All colors for which color match specified shall be approved by Engineer/Architect prior to production.
3. Acceptable manufacturers and suppliers of inks for silk-screening shall be only those materials recommended by the manufacturer of the sheeting and as required for 3M MCS warranty, or equivalent, where applicable.
4. Paints: all materials best quality. Products of DuPont DeNemours & Company, Pittsburgh Plate Glass Company, Glidden, Matthews or Sherwin-Williams acceptable.
  - a. Opaque background for pressure applied graphics: Two part acrylic polyurethane, low gloss. Care shall be taken to provide proper curing so that outgassing does not occur after application of sheeting and/or graphics.
  - b. Painted finish on Sintra panels: Types of paints known compatible with Sintra material.
    - 1) Vinyls
    - 2) Acrylic Lacquers
    - 3) Two part polyurethanes
    - 4) Surface preparation:
      - a) Surface to be painted must remain dry, clean and grease free.
      - b) Surface to be cleaned with a rag moistened with isopropyl alcohol prior to painting.
  - 5) Apply with a brush, roller or conventional air spray equipment.
  - 6) Vinyl and Vinyl/acrylic solvent based Screen printing inks are very compatible.
- c. Painted graphics on steel doors: Refer to Painting specification section 09910.3.6.C. Ferrous metal paint selection for door base. Graphics paint to be compatible with base paint.
- d. Base for painted graphics on concrete, stucco, masonry and concrete masonry units to be prepared per Paint specifications. Graphics two part acrylic polyurethane, low gloss.
- e. High gloss enamel base: Graphics medium to be determined by installer. Primer may be required.

5. Applied color whether ink or paint shall conform to color and accelerated weathering requirements of FP-79 and shall not be removable when tested by Film Adhesion Test and by Film Hardness Test.
- C. Blank Panels: Comply with requirements indicated for materials, thickness, finish, color, design, shape, size, and details of construction.
1. General:
    - a. Produce smooth, even, level sign panel surfaces, constructed to remain flat under installed conditions within a tolerance of plus or minus 0.0625 in. measured diagonally.
    - b. The back side and edges of all panel signs shall be painted with acrylic polyurethane, color to match the specified background color.
    - c. Edge Condition: Square cut.
    - d. Corner Condition: Square cut for all signs except Regulatory and Warning signs. Regulatory and Warning sign corners shall be rounded per MUTCD.
  2. Fiberglass reinforced plastic (FRP) panels.
    - a. Panels shall be manufactured of clear resin or UV stabilized, acrylic-modified polyester resin reinforced with high solubility, chopped strand fiberglass mat. Glass fibers shall not be readily discernable on sign face. In addition sign shall have a glass content of no less than 28% of total sign weight. FRP panels which outgas and cause bubbling of sheeting will not be accepted. Sign shall meet following:
      - 1) Ambient temperature range of -50° F to +300° F.
      - 2) Minimum Barcol hardness of 50, tensile strength of 12,000 psi, compressive strength of 20000 psi and flexural strength of 18000 psi.
      - 3) Minimum impact strength of 6 ft lbs/in notch with fire resistance of 500 degree F.
  3. Aluminum:
    - a. Provide aluminum sheet of 6061-T6 or 5052-H38 alloys and temper recommended by aluminum producer or finisher for use type and finish indicated, and with not less than strength and durability properties specified in ASTM B209 for 5005-H15.
    - b. Aluminum extrusions shall be of alloy and temper recommended by aluminum producer for type of use and finish and with not less than strength and durability properties specified in ASTM B221 for 6063-T5.
    - c. Panels shall be etched, degreased, flat, and free of ragged edges. Radius corners by stamping. All signs of same size shall be totally uniform in size. Surface shall be completely clear of dust and dirt before finishes applied.

- d. Panels to receive 3M sheeting and/or paint shall be treated with an anodizing conversion coating to provide resistance to corrosion and white rust formation. Conversion coating may be:
    - 1) Chromate, meeting ASTM B449 class 2. Coating weight should be 10 to 35 mg per sq ft with a median of 25 mg per square foot. Coating shall not be dusty and shall be tightly bonded within itself and to the aluminum substrate.
    - 2) Non-chromate coatings must meet the requirements for ASTM B449 class 1 chromate coatings. The non-chrome coating shall be adherent and non-powdery. Adhesion of air dried acrylic coating shall meet ASTM D 3359 or ASTM D 4541 and must be equivalent to that of the coating on chromate coated aluminum of the same alloy.
  - e. Fabricate aluminum signs with adequately sized, full-length stiffener members as indicated on Drawings.
4. DiBond (T.M.); or approved equal.
- a. Provide aluminum composite panel, one or both sides platinum white stove-lacquered or one side metallic-aluminum, reverse mill finish.
    - 1) Outer layers are aluminum, inner core is polyethylene.
  - b. Provide sign panels with overall thickness in accordance with the following:
    - 1) Wall or Column surface mounted signs: 2mm (0.079").
    - 2) Overhead signs less than 5'-0" long: 3 mm (0.12").
    - 3) Overhead signs greater than 5'-0" long: 4mm (0.16").
  - c. Product shall be compatible with temperature ranges varying from -50°C to +80°C.
  - d. Product shall have a minimum modulus of elasticity of 70,000 N/mm<sup>2</sup>.
  - e. Product shall have water absorption in % according to Din 53 495-0, 01.
  - f. Product shall have linear thermal expansion dimensional change of 2.4 mm/m at 100k temperature difference.
  - g. Manufacturer/Supplier - Alcan Composites USA, Inc.  
208 W. 5<sup>th</sup> Street  
P.O. Box 507  
Benton, KY 42025
5. Sintra (T.M.); or approved equal.
- a. Provide a foamed, closed cell polyvinyl chloride (PVC) product.
  - b. Provide sign panels in accordance with the following thicknesses:

- 1) Wall or column surface mounted signs: min. 6mm (0.236").
  - 2) Overhead signs less than 5'-6" long: min. 13mm (0.512").
  - 3) Overhead signs greater than 5'-6" long min 19mm (0.748").
- c. Foamed PVC panels are NOT to be used in areas exposed to direct sunlight.
- d. Primer and paint used shall be as recommended by the manufacturer. Paint finish shall be an "eggshell" finish.
- e. Material Identification and Information:

| <u>Material</u>    | <u>Percent % by Weight</u> |
|--------------------|----------------------------|
| Polyvinyl Chloride | 75-85%                     |
| Antimony Trioxide  | <3.0%                      |
| Cadmium Compounds  | <1.0%                      |
| Lead Compounds     | <2.0%                      |
| Titanium Dioxide   | <5.0%                      |
| Calcium Carbonate  | <5.0%                      |
| Other              | 5-10%                      |
| Melting Point      | >350 degrees F.            |

- f. Manufacturer/Supplier- Alcan Composites USA, Inc.,  
208 W. 5<sup>th</sup> Street  
P.O. Box 507  
Benton, KY 42025,

D. V- Signs: Vehicular signs with reflective graphics and retroreflective message on an opaque background.

1. Base materials:

- a. Aluminum with either reverse silk screened graphics or pressure-applied retroreflective letters.
- b. DiBond with either reverse silk screened graphics or pressure applied retroreflective letters.
- c. Sintra with either reverse silk screened graphics or pressure-applied retroreflective letters.
- d. FRP, but only with painted background and pressure applied retroreflective letters.

2. Background color for all V- Signs, vehicular directional signs, to meet MUTCD standard green, pantone color 342.

3. Graphics and Copy: Any of the following methods of producing graphics and copy may be employed.

- a. Pressure applied retroreflective white letters/symbols. Use 3M High Intensity Prismatic White Sheeting 3930.
- b. Silk screened; background inks shall be opaque, with retroreflective message.

E. R- Regulatory and W- Warning vehicular signs with retroreflective graphics and message on a retroreflective background.

1. All regulatory and warning signs to fully comply with MUTCD standards.
2. Base material: Aluminum.
3. R and W signs shall have retroreflective messages and retroreflective background using either silk screening or pressure applied retroreflective letters and symbols.
4. Retroreflective colors determined by 23 CFR Appendix to Subpart F of Part 655, Alternate Method to Determining the Color of Retroreflective Sign Materials and pavement marking materials.
  - a. Federal Highway Authority (FHWA) Reflective Sheeting Identification Guide using ASTM D 4956-04.
  - b. Sheeting Types I through IX.
  - c. The daytime color of non-fluorescent retroreflective materials may be measured in accordance with ASTM Method E 1349, Standard Test Method for Reflectance Factor and Color by Spectrophotometry using Bi-directional Geometry of ASTM Test Method E 1347. Standard Test Method for Color and Color-Difference Measurement by Tristimulus Colorimetry.
  - d. The geometric conditions to be used in both test methods are 0/45 or 45/0 circumferential illumination or viewing. The CIE standard illuminant used in computing the colorimetric coordinates shall be D 65.
  - e. For fluorescent retroreflective materials ASTM E991 may be used to determine the chromaticity provided that the D65 illumination meets the requirements for E 991.
  - f. The following 3M Diamond Grade DG<sup>3</sup> Reflective Sheeting materials meet the MUTCD retroreflective requirements:
    - 1) White - DG<sup>3</sup>4090
    - 2) Red - DG<sup>3</sup> 4092
    - 3) Blue - DG<sup>3</sup> 4095
    - 4) Yellow - DG<sup>3</sup> 4091
    - 5) Green - DG<sup>3</sup> 4097
    - 6) Brown - DG<sup>3</sup> 4099
    - 7) Fluorescent Yellow - DG<sup>3</sup> 4081
    - 8) Fluorescent Yellow Green - DG<sup>3</sup> 4083
    - 9) Fluorescent Orange - DG<sup>3</sup> 4084

F. PP- Pedestrian Panel Wayfinding and Directional Signs.

1. Base materials:
  - a. Aluminum with either reverse silk screened graphics or pressure-applied letters.
  - b. Di-Bond with either reverse silk screened graphics or pressure applied letters.
  - c. Sintra with either reverse silk screened graphics or pressure-applied letters.
  - d. FRP, but only with painted background and pressure applied letters.

2. Background color for all PP signs, pedestrian directional signs, to meet MUTCD standard blue, pantone color 294.
  3. For level designation sign colors refer to the list of MUTCD pantone colors:
    - a. Pantone Matching Colors and General MUTCD Meanings:
      - 1) Brown (469) - Recreational and cultural interest are guidance.
      - 2) Green (342) - Indicated movements permitted, directional guidance.
      - 3) Blue (294) - Road user services guidance, tourist information, and evacuation route.
  4. Color coding can be used for floor designations except red (187), yellow (116) and orange (52) per MUTCD.
  5. Graphics and Copy: Any of the following methods of producing graphics and copy may be employed:
    - a. Pressure applied non-reflective letters/symbols.
    - b. Silk screened over a flat opaque background.
    - c. Original art and/or multi-color graphics shall be digitally produced on graphic media.
- G. PVC- Signs: PVC pipe clearance signs shall have pressure applied decals on black PVC pipe, rectangular retroreflective yellow base sticker 3M Diamond Grade yellow sheeting DG<sup>3</sup> 4091 with black border, rounded corners, and black text. See drawings.
1. Electronically cut letters: 3M Scotchlite 3840 reflective sheeting.
  2. 10 in. diameter, Schedule 40 PVC pipe, Corrosion Fluid Products Corporation, Addison, IL, or accepted equivalent. Color black.
  3. If black PVC is not available, Paint: "Spraylat" Lacryl B No. 482 High Hiding Black. Meet Lacryl system specifications for painting on PVC.
- H. Dimensional Characters (D-Signs):
1. Aluminum Castings: Provide aluminum castings of alloy and temper recommended by sign manufacturer for casting process used and for type of use and finish indicated. Finish shall be color anodic finish, integrally colored or electrolytically deposited color coating, 0.018 mm or thicker in color specified on schedule, with a satin mechanical finish.
  2. Characters shall have smooth flat faces, sharp corners and precisely formed lines and profiles, free from pits scale, sand holes and other defects. Cast lugs into back of characters and tap to receive threaded mounting studs.
- I. A- Signs: All signs required to be brailled in compliance with ADA requirements for designating permanent rooms and spaces shall comply with ADA Accessibility Guidelines (ADAAG) as published by the

Architectural and Transportation Barriers Compliance Board and ICC/ANSI A117.1. latest editions.

1. Aluminum:

- a. Text to be produced with Supersine process die-cut raised letters and brailled copy.
2. Phenolic-Backed Photopolymer Sheet, "Jet-388 Phenolic Signage" by JetUSA or equivalent. Provide light sensitive, water-wash photopolymer face layer bonded to a phenolic base layer to produce composite sheet with overall thickness of 0.15 inches, and substrate thickness of 0.12 inches and a Type D Shore Durometer hardness of 95.
3. Lettering and Grade II brailled to be raised 1/32". Lettering to be painted white matte finish. Grade II brailled to be painted out with matte finish background in color shown on drawings. Edges painted same as face.
4. Produce precisely formed characters with square cut edges free from burrs and cut marks.
5. Fasteners shall be mechanical, concealed and tamper proof.

J. Internally Illuminated Signs (I Signs):

1. Sign design, construction fabrication and assembly shall be contractor responsibility, subject to Engineer's review. Fiberglass reinforced plastic (FRP), DiBond or aluminum cabinets are acceptable. Colors shall be as specified on drawings.
2. Aluminum panels, when proposed, to be extruded, anodized aluminum with welded corners and aluminum tube framing as required for straight profiles. Case shall be finished with baked enamel or duranodic in color as shown on the drawings. Illuminated messages, where required, shall be precision cut and filled with translucent material. Illuminated graphics shall be integral and flush with sign face for flat appearance. Raised letters or those projecting beyond sign face will not be accepted.
3. DiBond panels, where proposed shall be assembled into final configurations following the manufacturer's recommendations for cutting, drilling, punching, joining, etc. Acceptable joining materials for connecting panels are aluminum, plastic or stainless steel. All other joining materials are prohibited. DiBond panels may be fastened using threaded fasteners, rivets or adhesives as recommended by the manufacturer. All final assemblies shall accommodate thermal expansion movements as recommended by the manufacturer. The final assembly shall be supported as required by aluminum framework. Illuminated messages, where required, shall be precision cut and filled with translucent material. Illuminated graphics shall be integral and flush with sign face for flat appearance. Raised letters or those projecting beyond sign face will not be accepted.
4. Fiberglass panels, where proposed, shall be 3/16 inches with integral molded side returns mounted to an aluminum casing supported by aluminum framework. Posts to match specified cabinet color. Illuminated message shall be subsurface printed, and integral with sign face. Illuminated single color messages



without original art may be translucent. Multi-color messages or signs with original art shall be digitally produced using 3M Electronic Graphics system and Scotchcal marking films. Provide matte UV and vandal resistant overcoat.

5. Non-illuminated messages, where specified, shall employ any of the following methods:
  - a. Pressure applied non-reflective letters/symbols.
  - b. Silk screened.
  - c. Digitally produced graphic media.
6. Full message where shown shall be white **[LED, Fiber Optic]** letters. Full message shall not be readable when turned off. Full message shall be controlled by PARCS system.
7. No buckling, weaving, or oil canning of face panels.
8. Sign mounting shall be as noted as drawings from among following:
  - a. Wall or ceiling mount: Provide mounting channel brackets as required by sign size and location.
  - b. Post mount: Sign to be mounted on aluminum posts at both ends, with base plate bolted to concrete foundation to below local frost depth or a minimum of 1/3 the pole height which ever is greater. Coordinate anchor bolt locations with general contractor.
  - c. Concrete pedestal mount. Sign to be mounted on concrete pedestal as detailed on drawings. Coordinate anchor bolt, post sleeves and concealed electrical connections with pedestal contractor.
  - d. Aluminum pedestal mount: Provide aluminum pedestal cover per drawings. Coordinate anchor bolt, post sleeves and concealed electrical connections with pedestal contractor.
9. All fasteners and brackets shall be non-corrosive.
10. All electrical connections shall be concealed but accessible and serviceable.
11. Interior of cabinet to be primed and painted white with acrylic polyurethane, high gloss finish.
12. Illumination shall be designed by contractor. Incandescent light sources will not be accepted. Each sign shall contain terminal board with adequate wiring. Lamps to be spaced to prevent shadows and hot spots. Uneven illumination will be rejected. Ballast shall be appropriate to temperature ranges at project site. Minimum luminance of sign message shall be 10 cd/m<sup>2</sup> at night and 30 cd/m<sup>2</sup> during the day.

K. Fasteners and Supports:

1. Bolts, nylon insert lock nuts: ASTM A 320, Grade B stainless steel.
2. Rivets for signs: ASTM B 316, Alloy 6063-T61 or equivalent. Aluminum alloy blind rivets of self-plugging variety may be substituted for solid aluminum alloy rivets, subject to acceptance by Engineer/Architect.
3. Use concealed fasteners fabricated from metals not corrosive to sign material and mounting surface.

4. Anchors and Inserts: Use nonferrous metal or hot dipped galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion bolt devices for drilled in place anchors. Furnish inserts, as required, to be set into concrete or masonry work.
5. Sign posts: ASTM A 499 Grade 60 or ASTM A 576, Grade 1080 and meeting mechanical properties specified in ASTM A 499 for Grade 60 steel.
6. Posts shall be zinc coated per ASTM A 123. Posts shall be straight, with smooth, uniform finish, free from defects affecting strength, durability, or appearance. Punch bolt holes such that post face shall be smooth and even. All holes and ends shall be burr free. After all fabrication, flow coat posts with durable, exterior type, rust inhibiting paint. Paint color: black, unless otherwise indicated on Drawings.
7. Adhesives, where used for wall mounted signs, shall be per the sign material manufacturer's recommendations.
8. For DiBond signs, fasteners and mountings shall follow manufacturer's recommendations. Minimum edge distance of 0.75" or 2.5 times the diameter of the fastener being used is recommended as the distance from the center of the hole to the edge of the panel. Large flat washers shall be used to prevent crushing of the sign material.

L. Cantilever Sign Supports:

1. Pipe for poles and arms: steel pipe, ASTM A53, Grade B, Type E or S.
2. Gusset, flange, and base plates: ASTM A 36.
3. Castings: Free of sharp edges and irregularities. Pole top and end cap castings: ASTM A 126, Class A.
4. Bolts: Connect arm connection flanges with galvanized high strength steel bolts, nuts, and washers per ASTM A 325. Hot dip galvanize fasteners per ASTM A 153. Galvanized nuts shall be tapped oversized per ASTM A 563, and Supplementary requirement S1, "Lubricant and Test for Coated Nuts."
5. Welding: Applicable requirements of Sections of Division 05.

**PART 3 - EXECUTION**

**3.1 SURFACE PREPARATION OF SUBSTRATE FOR PAINTED SIGNS**

- A. Prepare and clean in strict accordance with paint manufacturer's instructions and as specified here, for each substrate condition.
- B. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease prior to mechanical cleaning. Program cleaning and painting so contaminants from cleaning process will not fall onto wet, newly painted surfaces.
- C. Cementitious Surfaces:

1. Prepare surfaces to be painted by removing all efflorescence, chalk, dust, dirt, grease, oils, and, by roughening as required, glaze.
  2. Determine alkalinity and moisture content of surfaces to be painted by appropriate testing. If surfaces found to be sufficiently alkaline to cause blistering and burring of finish paint, correct before painting. Do not paint on surfaces with moisture content exceeds manufacturer's limits.
- D. Ferrous Metals: Clean uncoated ferrous surfaces of oil, grease, dirt, loose mill scale, and other foreign substances by solvent or mechanical cleaning. Clean previously coated metals in accordance with manufacturer recommendation.

### **3.2 MATERIALS PREPARATION FOR PAINTED SIGNS**

- A. Mix and prepare painting materials per manufacturer's directions.
- B. Store materials not in use in tightly covered containers. Keep all containers clean, free of foreign materials and residue.
- C. Stir materials before applying to produce uniform mixture, and stir as required during application. Do not stir surface film into material. Remove film and strain material before using if necessary.

### **3.3 INSTALLATION**

- A. General: Locate signs where shown using mounting methods of type described and in compliance with manufacturer's instructions. Install sign units level, plumb, and at height shown, with sign surfaces free from appearance defects.
- B. For drilled anchors in concrete, verify location of embedded reinforcing steel, post-tensioning, or pre-stressing cables prior to installation.
- C. Wall Mounted Panel Signs: Attach to wall surfaces with Hilti "Hit" anchors or ITW Ramset/Red Head Hammer Set anchors into concrete or masonry surfaces as shown on Drawings. DO NOT OVERDRIVE anchors, as overdriven anchors will damage sign faces and spall concrete.
- D. Bracket Mounted Units: Provide manufacturer's standard brackets, fittings, and hardware as appropriate for mounting signs which project at right angles from walls or ceilings. Attach brackets securely to walls or ceilings with concealed fasteners and anchors per manufacturer's directions.
- E. Installation of signs shall conform to requirements of Americans with Disabilities Act (ADA) and/or state or local accessibility standards.

### **3.4 CLEANING AND PROTECTION**

- A. At completion of installation, clean soiled sign surfaces in accordance with manufacturer's instructions. Protect units from damage until acceptance by Owner.
- B. Cleanup: During progress of Work, remove from site all discarded materials and rubbish at end of each day.
- C. Upon completion of painting, clean all paint spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.
- D. Protection: Protect work of other trades, whether to be painted or not, against damage by painting and finishing. Correct any damage by cleaning, repairing, or replacing, and repainting, as acceptable to Engineer/Architect.
- E. Provide "Wet Paint" signs as required.

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**SECTION 10 44 13  
FIRE EXTINGUISHER CABINETS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

A. This section covers surface-mounted fire extinguisher cabinets.

**1.2 RELATED WORK**

A. Clear tempered glass: Section 08 80 00, GLAZING.

**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 instructions.

**PART 2 - PRODUCTS**

**2.1 FIRE EXTINGUISHER CABINET**

A. Surface-mounted type with flat trim of size and design shown.

B. Provide cabinet size to accommodate up to a 10 lb capacity portable fire extinguisher. Extinguisher provided by owner.

**2.2 FABRICATION**

A. Form body of cabinet from 14 gauge thick stainless steel.

B. Fabricate door and trim from 14 gauge thick stainless steel with all face joints fully welded and ground smooth.

1. Door style: Full break glass with break glass handle and lock.

2. Design doors to open 180 degrees.

3. Provide continuous hinge, and adjustable roller catch.

**PART 3 - EXECUTION**

A. Install fire extinguisher cabinets and secure in accordance with manufacturer's instructions.

B. Install cabinet so that bottom of cabinet is 914 mm (36 inches) above finished floor.

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