U.S. Department of Veterans Affairs

U. S. DEPARTMENT OF VETERAN'S AFFAIRS
SIOUX FALLS VA HEALTH CARE SYSTEM CAMPUS

IMPROVE CAMPUS BUILDING EXTERIORS

Sioux Falls, South Dakota

VA Project # 438-22-600

Construction Documents

Project Specifications

SEPTEMBER 15, 2023

STONE GROUP
ARCHITECTS

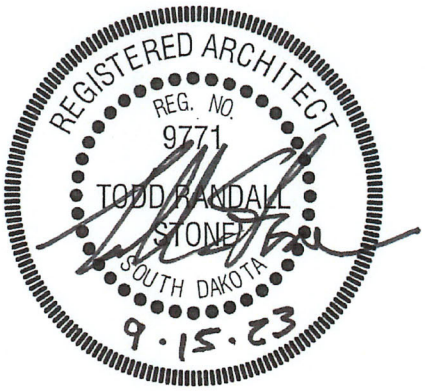
SECTION 00 01 07
SEALS PAGE

1.1 DESIGN PROFESSIONALS OF RECORD

A. Architect:

Stone Group Architects
600 E. 7th Street, Sioux Falls, SD 57103
605-271-1144
Todd Randall Stone
9771

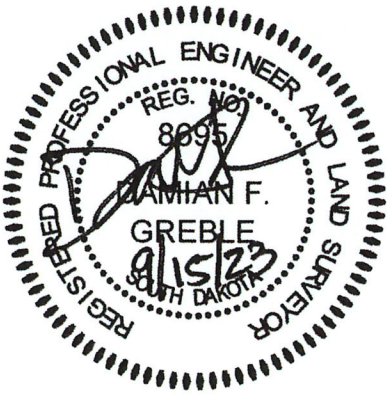
Responsible for: Divisions 01-49 Sections except where indicated below as prepared by other design professionals of record, and excluding section 010000.



B. Civil Engineer:

Ehrhart Griffin & Associates
601 N Minnesota Ave, Sioux Falls, SD 57104
605-339-7215
Damian Greble
8695

Responsible for:
DIVISION 31 - EARTHWORK
DIVISION 33 - UTILITIES



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C. Structural Engineer:
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651-251-7570
Stephen J. Clark
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Responsible for:
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SECTION 05 12 00 - STRUCTURAL STEEL FRAMING
SECTION 05 31 00 - STEEL DECKING

9/15/2023

D. Mechanical Engineer:
Dunham Associates, Inc.
50 South Sixth Street, Suite 1100, Minneapolis, MN 55402
612-465-7550
Jason R. Gottwalt
14944

Responsible for:
DIVISION 22 - PLUMBING (ALL SECTIONS)
DIVISION 23 - HEATING, VENTILATION, AND AIR-CONDITIONING (HVAC) (ALL SECTIONS)

Digitally signed by Jason Gottwalt

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E. Electrical Engineer:
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612-465-7550
Jay Rohkohl
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Responsible for:
DIVISION 26 - ELECTRICAL (ALL SECTIONS)

CN=Jay D Rohkohl, dnQualifier=A01410D0000017C950EE3A30000BD89, O=DUNHAM ASSOCIATES, C=US
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DEPARTMENT OF VETERANS AFFAIRS
VHA MASTER SPECIFICATIONS

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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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	GENERAL
G-000	COVER SHEET
G-001	ARCHITECTURAL PHASING AND SITE PLAN
0.S001	STRUCTURAL COVER SHEET&GENERAL STRUCTURAL NOTES
00.MEP000	MECHANICAL, ELECTRICAL, PLUMBING TITLE SHEET
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01.SE121	STRUCTURAL - ROOF PLAN & DETAILS - A
01.SE122	STRUCTURAL - ROOF PLAN & DETAILS - A.WEST
01.AD120	ARCHITECTURAL - ROOF PLAN -DEMOLITION - OVERALL
01.AD121	ARCHITECTURAL - ROOF PLAN - DEMOLITION - A
01.AD122	ARCHITECTURAL - ROOF PLAN - DEMOLITION - A,C
01.AD123	ARCHITECTURAL - ROOF PLAN - DEMOLITION - D
01.AE120	ARCHITECTURAL - ROOF PLAN - OVERALL
01.AE121	ARCHITECTURAL - ROOF PLAN - A
01.AE122	ARCHITECTURAL - ROOF PLAN - A,C
01.AE123	ARCHITECTURAL - ROOF PLAN - D
01.AE201	ARCHITECTURAL - ELEVATIONS - A
01.AE202	ARCHITECTURAL - ELEVATIONS - A
01.AE203	ARCHITECTURAL - ELEVATIONS - A,C
01.AE204	ARCHITECTURAL - ELEVATIONS - A, B, C
01.AE205	ARCHITECTURAL - ELEVATIONS - D
01.AE501	ARCHITECTURAL - DETAILS
01.AE502	ARCHITECTURAL - DETAILS
01.MEP121	M/E/P - ROOF PLAN - BUILDING 1 - A
01.MEP122	M/E/P - ROOF PLAN - BUILDING 1 - A, B, C
01.MEP123	M/E/P - ROOF PLAN - BUILDING 1 - D
	BUILDING 05
05.CS01	CIVIL - GENERAL NOTES
05.CS02	CIVIL - EXISTING CONDITIONS

05.CS03	CIVIL - GRADING PLAN
05.CS04	CIVIL - ERIOSION CONTROL PLAN
05.CS05	CIVIL - DRAINAGE PLAN
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05.SE122	STRUCTURAL - ROOF PLAN - G,H
05.SE123	STRUCTURAL - ROOF PLAN - M,N
05.SE124	STRUCTURAL - ROOF PLAN - L,O.SOUTH,S
05.SE125	STRUCTURAL - ROOF PLAN - O.NORTH
05.SE126	STRUCTURAL - ROOF PLAN - P.UPPER
05.AD120	ARCHITECTURAL - ROOF PLAN -DEMOLITION - OVERALL
05.AD121	ARCHITECTURAL - ROOF PLAN -DEMOLITION - A, C, E, F
05.AD122	ARCHITECTURAL - ROOF PLAN - DEMOLITION - G, H
05.AD123	ARCHITECTURAL - ROOF PLAN -DEMOLITION - J, K, M, N
05.AD124	ARCHITECTURAL - ROOF PLAN -DEMOLITION - L, O.SOUTH, S
05.AD125	ARCHITECTURAL - ROOF PLAN -DEMOLITION - O.NORTH, T
05.AD126	ARCHITECTURAL - ROOF PLAN -DEMOLITION - P.UPPER
05.AD127	ARCHITECTURAL - ROOF PLAN -DEMOLITION - P.LOWER
05.AD128	ARCHITECTURAL - ROOF PLAN -DEMOLITION - R
05.AE101	ARCHITECTURAL - FLOOR PLAN - A,M,N
05.AE113	ARCHITECTURAL - REFLECTED CEILING PLAN - J
05.AE114	ARCHITECTURAL - REFLECTED CEILING PLAN- O.NORTH
05.AE115	ARCHITECTURAL - REFLECTED CEILING PLAN - L, O.SOUTH
05.AE120	ARCHITECTURAL - ROOF PLAN - OVERALL
05.AE121	ARCHITECTURAL - ROOF PLAN - A, C, E, F
05.AE122	ARCHITECTURAL - ROOF PLAN - G, H
05.AE123	ARCHITECTURAL - ROOF PLAN - J, K, M, N
05.AE124	ARCHITECTURAL - ROOF PLAN - L, O.SOUTH, S
05.AE125	ARCHITECTURAL - ROOF PLAN - O.NORTH, T
05.AE126	ARCHITECTURAL - ROOF PLAN - P.UPPER & DOOR SCHEDULE
05.AE127	ARCHITECTURAL - ROOF PLAN - P.LOWER
05.AE128	ARCHITECTURAL - ROOF PLAN - Q
05.AE129	ARCHITECTURAL - ROOF PLAN - R
05.AE201	ARCHITECTURAL - ELEVATIONS - OVERALL
05.AE202	ARCHITECTURAL - ELEVATIONS - OVERALL
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05.AE204	ARCHITECTURAL - ELEVATIONS - OVERALL
05.AE205	ARCHITECTURAL - ELEVATIONS - OVERALL
05.AE206	ARCHITECTURAL - ELEVATIONS - A
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05.AE502	ARCHITECTURAL - DETAILS
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05.MEPD121	M/E/P - ROOF PLAN - DEMOLITION - A, B, C, D, E, F
05.MEPD122	M/E/P - ROOF PLAN - DEMOLITION - G, H, I
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05.MEPD124	M/E/P - ROOF PLAN - DEMOLITION - L, O.SOUTH
05.MEPD125	M/E/P - ROOF PLAN - DEMOLITION - O.NORTH
05.MEPD126	M/E/P - ROOF PLAN - DEMOLITION - P.UPPER
05.MEPD127	M/E/P - ROOF PLAN - DEMOLITION - P.LOWER
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05.MEP123	M/E/P - ROOF PLAN - J, K, M, N
05.MEP124	M/E/P - ROOF PLAN - L, O.SOUTH
05.MEP125	M/E/P - ROOF PLAN - O.NORTH
05.MEP126	M/E/P - ROOF PLAN - P.UPPER
05.MEP127	M/E/P - ROOF PLAN - P.LOWER
05.MEP128	M/E/P - ROOF PLAN - Q,S
05.MEP129	M/E/P - ROOF PLAN - R

BUILDING 07

07.SE121	STRUCTURAL - ROOF PLAN & DETAILS
07.AE121	ARCHITECTURAL - ROOF PLAN
07.AE201	ARCHITECTURAL - ELEVATIONS
07.AE501	ARCHITECTURAL - DETAILS
07.MEP121	M/E/P - ROOF PLAN

BUILDING 08

08.SE121	STRUCTURAL - ROOF PLAN & DETAILS
08.AE121	ARCHITECTURAL - ROOF PLAN
08.AE201	ARCHITECTURAL - ELEVATIONS
08.AE501	ARCHITECTURAL - DETAILS
08.MEP121	M/E/P - ROOF PLAN

BUILDING 09

09.SE121	STRUCTURAL - ROOF PLAN & DETAILS
09.AE121	ARCHITECTURAL - ROOF PLAN
09.AE201	ARCHITECTURAL - ELEVATIONS
09.AE501	ARCHITECTURAL - DETAILS
09.MEP121	M/E/P - ROOF PLAN

BUILDING 11

11.AE121	ARCHITECTURAL - ROOF PLAN
11.AE201	ARCHITECTURAL - ELEVATIONS
11.AE501	ARCHITECTURAL - DETAILS
11.MEP121	M/E/P - ROOF PLAN

BUILDING 16

16.AE121	ARCHITECTURAL - ROOF PLAN
16.AE201	ARCHITECTURAL - ELEVATIONS
16.AE501	ARCHITECTURAL - DETAILS
16.MEP121	M/E/P - ROOF PLAN

BUILDING 17

17.AE121	ARCHITECTURAL - ROOF PLAN
17.AE201	ARCHITECTURAL - ELEVATIONS
17.AE501	ARCHITECTURAL - DETAILS & DOOR SCHEDULE

17.MEP121	M/E/P - ROOF PLAN

BUILDING 38

38.SE121	STRUCTURAL - ROOF PLAN & DETAILS
38.AD121	ARCHITECTURAL - ROOF PLAN - DEMOLITION
38.AE101	ARCHITECTURAL - FLOOR PLAN
38.AE111	ARCHITECTURAL - REFLECTED CEILING PLAN
38.AE121	ARCHITECTURAL - ROOF PLAN
38.AE201	ARCHITECTURAL - ELEVATIONS
38.AE501	ARCHITECTURAL - DETAILS
38.MEPD121	M/E/P - ROOF PLAN - DEMOLITION
38.MEP121	M/E/P - ROOF PLAN

BUILDING 52

52.AE121	ARCHITECTURAL - ROOF PLAN
52.AE201	ARCHITECTURAL - ELEVATIONS
52.AE501	ARCHITECTURAL - DETAILS
52.MEP121	M/E/P - ROOF PLAN

- - - END - - -

SECTION 01 00 00
GENERAL REQUIREMENTS

GENERAL

1.1 SAFETY REQUIREMENTS

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

1.2 GENERAL INTENTION

A. Contractor shall completely prepare site for building operations, including demolition and removal of existing structures, and furnish labor and materials and perform work for improving the exteriors of various campus buildings as required by drawings and specifications.

B. Offices of Stone Group Architects Inc, as Architect-Engineers, will render certain technical services during construction. Such services shall be considered as advisory to the Government and shall not be construed as expressing or implying a contractual act of the Government without affirmations by Contracting Officer or his duly authorized representative.

C. 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.

1.3 STATEMENT OF BID ITEM(S)

A. ITEM I, BASE BID: Work includes roofing, tuck pointing, alterations, grading, drainage, mechanical and electrical work, utility systems and necessary removal of existing structures and construction and certain other items.

1.4 SPECIFICATIONS AND DRAWINGS FOR CONTRACTOR

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

1.5 CONSTRUCTION SECURITY REQUIREMENTS

A. Security Plan:

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

B. Security Procedures:

1. General Contractor's employees shall not enter the project site without appropriate badge. They may also be subject to inspection of their personal effects when entering or leaving the project site.
2. Before starting work the General Contractor shall give one week's notice to the Contracting Officer so that security arrangements can be provided for the employees. This notice is separate from any notices required for utility shutdown described later in this section.
3. No photography of VA premises is allowed without written permission of the Contracting Officer. Patients and staff are not to be photographed at any time.
4. VA reserves the right to close down or shut down the project site and order General Contractor's employees off the premises in the event of a national emergency. The General Contractor may return to the site only with the written approval of the Contracting Officer.

C. 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.

D. Motor Vehicle Restrictions

1. Vehicle authorization request shall be required for any vehicle entering the site and such request shall be submitted 24 hours before the date and time of access.

Access shall be restricted to picking up and dropping off materials and supplies.

2. A limited number of permits shall be issued for General Contractor and its employees for parking in designated areas only. Contractor to coordinate with VA Medical Center Facility Manager.

1.6 OPERATIONS AND STORAGE AREAS (FAR 52.236-10)

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

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

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

from damage. The Contractor shall repair or pay for the repair of any damaged curbs, sidewalks, or roads.

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

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

F. Execute work so as to interfere as little as possible with normal functioning of Medical Center as a whole, including operations of utility services, fire protection systems and any existing equipment, and with work being done by others. Use of equipment and tools that transmit vibrations and noises through the building structure, are not permitted in buildings that are occupied, during construction, jointly by patients or medical personnel, and Contractor's personnel, except as permitted by COR where required by limited working space.

1. Do not store materials and equipment in other than assigned areas.
2. Schedule delivery of materials and equipment to immediate construction working areas within buildings in use by Department of Veterans Affairs in quantities sufficient for not more than two workdays. Provide unobstructed access to Medical Center areas required to remain in operation.
3. Where access by Medical Center personnel to vacated portions of buildings is not required, storage of Contractor's materials and equipment will be permitted subject to fire and safety requirements.

G. Utilities Services: Where necessary to cut existing pipes, electrical wires, conduits, cables, etc., of utility services, or of fire protection systems or communications systems (except telephone), they shall be cut and capped at

suitable places where shown; or, in absence of such indication, where directed by COR.

H. Phasing:

1. The Medical Center must maintain its operation 24 hours a day 7 days a week. Therefore, any interruption in service must be scheduled and coordinated with the COR to ensure that no lapses in operation occur. It is the CONTRACTOR'S responsibility to develop a work plan and schedule detailing, at a minimum, the procedures to be employed, the equipment and materials to be used, the interim life safety measure to be used during the work, and a schedule defining the duration of the work with milestone subtasks. The work to be outlined shall include, but not be limited to:
2. To ensure such executions, Contractor shall furnish the COR with a schedule of approximate dates on which the Contractor intends to accomplish work in each specific area of site, building or portion thereof. In addition, Contractor shall notify the COR two weeks in advance of the proposed date of starting work in each specific area of site, building or portion thereof. Arrange such dates to ensure accomplishment of this work in successive phases mutually agreeable to COR and Contractor, as follows:

Phase I: Buildings 5, 7, 9, 52

I. Construction Fence: Before construction operations begin, Contractor shall provide a chain link construction fence, 2.1m (seven feet) minimum height, around the construction area. Provide gates as required for access with necessary hardware, including hasps and padlocks. Fasten fence fabric

to terminal posts with tension bands and to line posts and top and bottom rails with tie wires spaced at maximum 375mm (15 inches). Bottom of fences shall extend to 25mm (one inch) above grade. Remove the fence when directed by COR.

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

1. Contractor shall always maintain a minimum temperature of 4 degrees C (40 degrees F), except as otherwise specified.
2. Contractor shall maintain in operating condition existing fire protection and alarm equipment. In connection with fire alarm equipment, Contractor shall make arrangements for pre-inspection of site with Fire Department or Company (Department of Veterans Affairs or municipal) whichever will be required to respond to an alarm from Contractor's employee or watchman.

K. Utilities Services: Maintain existing utility services for 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. 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 for additional requirements.

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

L. Abandoned Lines: All service lines such as wires, cables, conduits, ducts, pipes and the like, and their hangers or supports, shall be removed back to their source. Those

which are indicated to be abandoned but are not required to be entirely removed, shall be sealed, capped or plugged at the main, branch or panel they originate from. The lines shall not be capped in finished areas, but shall be removed and sealed, capped or plugged-in ceilings, within furred spaces, in unfinished areas, or within walls or partitions; so that they are completely behind the finished surfaces.

M. 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.

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

1.7 ALTERATIONS

A. Survey: Before any work is started, the Contractor shall make a thorough survey with the COR of buildings in which alterations occur and areas which are anticipated routes of access, and furnish a report, signed by both to the Contracting Officer. This report shall list by rooms and spaces:
   1. Existing condition and types of resilient flooring, doors, windows, walls and other surfaces not required to be altered throughout the buildings.
   2. Existence and conditions of items such as plumbing fixtures and accessories, electrical fixtures, equipment,

venetian blinds, shades, etc., required by drawings to be either reused or relocated, or both.

3. Shall note any discrepancies between drawings and existing conditions at site.
4. Shall designate areas for working space, materials storage and routes of access to areas within buildings where alterations occur, and which have been agreed upon by Contractor and COR.

B. Any items required by drawings to be either reused or relocated or both, found during this survey to be nonexistent, or in opinion of COR, to be in such condition that their use is impossible or impractical, shall be furnished and/or replaced by Contractor with new items in accordance with specifications which will be furnished by Government. Provided the contract work is changed by reason of this subparagraph B, the contract will be modified accordingly, under provisions of clause entitled "DIFFERING SITE CONDITIONS" (FAR 52.236-2) and "CHANGES" (FAR 52.243-4).

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

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

D. Protection: Provide the following protective measures:

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

1.8 DISPOSAL AND RETENTION

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

1. Reserved items which are to remain property of the Government are noted on drawings or in specifications as items to be stored. Items that remain property of the Government shall be removed or dislodged from present locations in such a manner as to prevent damage which would be detrimental to re-installation and reuse. Store such items where directed by COR.
2. Items not reserved shall become property of the Contractor and be removed by Contractor from Medical Center.
3. Items of portable equipment and furnishings located in rooms and spaces in which work is to be done under this contract shall remain the property of the Government. When rooms and spaces are vacated by the Department of Veterans Affairs during the alteration period, such items

which are NOT required by drawings and specifications to be either relocated or reused will be removed by the Government in advance of work to avoid interfering with Contractor's operation.

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

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

B. The Contractor shall protect from damage all existing improvements and utilities at or near the work site and on adjacent property of a third party, the locations of which are made known to or should be known by the Contractor. The Contractor shall repair any damage to those facilities, including those that are the property of a third party, resulting from failure to comply with the requirements of this contract or failure to exercise reasonable care in performing the work. If the Contractor fails or refuses to repair the damage promptly, the Contracting Officer may have the necessary work performed and charge the cost to the Contractor.

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

1.10 RESTORATION

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

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

C. At Contractor's own expense, Contractor shall immediately restore to service and repair any damage caused by Contractor's workers to existing piping and conduits, wires, cables, etc., of utility services or of fire protection systems and communications systems (including

telephone) which are not scheduled for discontinuance or abandonment.

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

1.11 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.

1.12 LAYOUT OF WORK

A. The Contractor shall lay out the work from Government established base lines and benchmarks, 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 such other lines and grades that are reasonably necessary to properly assure that location, orientation, and elevations 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. 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.

E. 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".

1.13 AS-BUILT DRAWINGS

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

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

C. Contractor shall deliver two approved completed sets of as-built drawings in the electronic version (scanned PDF) to the COR within 15 calendar days after each completed phase and after the acceptance of the project by the COR.

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

1.14 WARRANTY MANAGEMENT

A. Warranty Management Plan: Develop a warranty management plan which contains information relevant to FAR 52.246-21 Warranty of Construction at least 30 days before the planned pre-warranty conference, submit two sets of the warranty management plan. Include within the warranty management plan all required actions and documents to assure that the Government receives all warranties to which it is entitled. The plan must be in narrative form and contain sufficient detail to render it suitable for use by future maintenance and repair personnel, whether tradesman, or of engineering background, not necessarily familiar with this contract. The term “status” as indicated below must include due date and whether item has been submitted or was approved. Warranty information made available during the construction phase must be submitted to the Contracting Officer for approval prior to each monthly invoice for payment. Assemble approved information in a binder and turn

over to the Government upon acceptance of the work. The construction warranty period will begin on the date of the project acceptance and continue for the product warranty period. A joint 4-month and 9-month warranty inspection will be conducted, measured from time of acceptance, by the Contactor and the Contracting Officer. Include in the warranty management plan, but not limited to, the following:

1. Roles and responsibilities of all personnel associated with the warranty process, including points of contact and telephone numbers within the company of the Contractor, subcontractors, manufacturers or suppliers involved.
2. Furnish with each warranty the name, address and telephone number of each of the guarantor’s representatives nearest project location.
3. Listing and status of delivery of all Certificates of Warranty for extended warranty items, to include roofs, HVAC balancing, pumps, motors, transformers and for all commissioned systems such as fire protection and alarm systems, sprinkler systems and lightning protection systems, etc.
4. A list for each warranted equipment item, feature of construction or system indicating:
   a. Name of item.
   b. Model and serial numbers.
   c. Location where installed.
   d. Name and phone numbers of manufacturers and suppliers.
   e. Name and phone numbers of manufacturers or suppliers.
   f. Names, addresses and phone numbers of sources of spare parts.

g. Warranties and terms of warranty. Include one-year overall warranty of construction, including the starting date of warranty of construction. Items which have extended warranties must be indicated with separate warranty expiration dates.
h. Starting point and duration of warranty period.
i. Summary of maintenance procedures required to continue the warranty in force.
j. Cross-reference to specific pertinent Operation and Maintenance manuals.
k. Organizations, names and phone numbers of persons to call for warranty service.
l. Typical response time and repair time expected for various warranted equipment.

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

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

1. In the event the Contractor fails to commence and diligently pursue any construction warranty work required, the Contracting Officer will have the work performed by others, and after completion of the work, will charge the remaining construction warranty funds of expenses incurred by the Government while performing the

work, including, but not limited to administrative expenses.

2. In the event sufficient funds are not available to cover the construction warranty work performed by the Government at the contractor's expenses, the Contracting Officer will have the right to recoup expenses from the bonding company.
3. Following oral or written notification of required construction warranty repair work, the Contractor shall respond in a timely manner. Written verification will follow oral instructions. Failure to respond will be cause for the Contracting Officer to proceed against the Contractor.

C. Pre-Warranty Conference: Prior to contract completion, and at a time designated by the Contracting Officer, the Contractor shall meet with the Contracting Officer to develop a mutual understanding with respect to the requirements of this section. Communication procedures for Contractor notification of construction warranty defects, priorities with respect to the type of defect, reasonable time required for Contractor response, and other details deemed necessary by the Contracting Officer for the execution of the construction warranty will be established/ reviewed at this meeting. In connection with these requirements and at the time of the Contractor's quality control completion inspection, furnish the name, telephone number and address of a licensed and bonded company which is authorized to initiate and pursue construction warranty work action on behalf of the Contractor. This point of contract will be located within the local service area of the warranted construction, be continuously available and be responsive to Government inquiry on warranty work action

and status. This requirement does not relieve the Contractor of any of its responsibilities in conjunction with other portions of this provision.

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

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

    1. First Priority Code 1. Perform onsite inspection to evaluate situation, and determine course of action within 4 hours, initiate work within 6 hours and work continuously to completion or relief.
    2. Second Priority Code 2. Perform onsite inspection to evaluate situation, and determine course of action within 8 hours, initiate work within 24 hours and work continuously to completion or relief.
    3. Third Priority Code 3. All other work to be initiated within 3 workdays and work continuously to completion or relief.
    4. The "Construction Warranty Service Priority List" is as follows:

        a) <u>Code 1-Life Safety Systems</u>

1) Fire suppression systems.
2) Fire alarm system(s).

b) Code 1-Air Conditioning Systems
1) Air conditioning leak in part of the building, if causing damage.
2) Air conditioning system not cooling properly.

c) Code 1-Doors
1) Overhead doors not operational, causing a security, fire or safety problem.
1) Interior, exterior personnel doors or hardware, not functioning properly, causing security, fire or safety problem.

d) Code 3-Doors
1) Overhead doors not operational.
2) Interior/exterior personnel doors or hardware not functioning properly.

e) Code 1-Electrical
1) Power failure (entire area or any building operational after 1600 hours).
2) Security lights.
3) Smoke detectors.

f) Code 2-Electrical
1) Power failure (no power to a room or part of building). Receptacle and lights not operational (in a room or part of building).

g) Code 3-Electrical
1) Exterior lights not operational.

h) Code 1-Gas
1) Leaks and pipeline breaks.

i) Code 1-Heat
1) Power failure affecting heat.

j) Code 1-Plumbing

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

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

l) Code 3- Plumbing
1) Leaky faucets.

m) Code 3-Interior
1) Floors damaged.
2) Paint chipping or peeling.
3) Casework damaged.

n) Code 1-Roof Leaks
1) Damage to property is occurring.

o) Code 2-Water (Exterior)
1) No water to facility.

p) Code 2-Water (Hot)
1) No hot water in portion of building listed.

q) Code 3
1) All work not listed above.

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

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

1.15 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.

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 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 USE OF EXISTING ELEVATORS

A. Outside type hoist shall be used by Contractor for transporting materials and equipment where feasible.

B. Use of existing elevators for handling building materials and Contractor's personnel will be permitted subject to the following provisions:

1. Contractor makes all arrangements with the COR for use of elevators. The COR will ascertain that elevators are in proper condition. Contractor may use all elevators in Building Nos. 1 and 5 for daily use between the hours of 8am and 4:30pm and for special nonrecurring time intervals when permission is granted. Personnel for operating elevators will not be provided by the Department of Veterans Affairs.

2. Contractor covers and provides maximum protection of following elevator components:

   a) Entrance jambs, heads soffits and threshold plates.

   b) Entrance columns, canopy, return panels and inside surfaces of car enclosure walls.

   c) Finish flooring.

3. Government will accept hoisting ropes of elevator and rope of each speed governor if they are worn under normal operation. However, if these ropes are damaged by action of foreign matter such as sand, lime, grit, stones, etc., during temporary use, they shall be removed and replaced by new hoisting ropes at the contractor’s expense.

1.18 TEMPORARY TOILETS

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

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

1.19 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. Heat: Furnish temporary heat necessary to prevent injury to work and materials through dampness and cold. Use of open salamanders or any temporary heating devices which may be fire hazards or may smoke and damage finished work, will not be permitted. Maintain minimum temperatures as specified for various materials:
   1. Obtain heat by connecting to Medical Center heating distribution system.
      a. Steam is available at no cost to Contractor.

D. Electricity (for Construction and Testing): Furnish all temporary electric services.
   1. Obtain electricity by connecting to the Medical Center electrical distribution system.
      a. Electricity for all other uses is available at no cost to the Contractor.

E. Water (for Construction and Testing): Furnish temporary water service.
   1. Obtain water by connecting to the Medical Center water distribution system. Provide reduced pressure backflow preventer at each connection as per code. Water is available at no cost to the Contractor.
   2. Maintain connections, pipe, fittings and fixtures and conserve water-use so none is wasted. Failure to stop

leakage or other wastes will be cause for revocation (at COR discretion) of use of water from Medical Center's system.

1.20 HISTORIC PRESERVATION

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

1.21 LOCAL SIOUX FALLS VA HEALTH CARE SYSTEM CONSTRUCTION CONTRACTOR ORIENTATION AND POLICIES

A. Vehicle Traffic Rules: All construction contractors shall park their vehicles in areas assigned by the Contracting Officer or Engineering Service representatives. All persons coming on the premises of the Sioux Falls VA Health Care System must obey the posted traffic and parking rules. Police Service will issue tickets to contractor vehicles parked in areas other than those assigned.

B. Keys/ID Badges: VA ID badges must be worn while you are on Medical Center premises. Contact Engineering Service to obtain an ID badge and any necessary keys. Contract staff are responsible for the security of keys and ID badges issued to them and may be charged for replacement cost. You must notify Engineering (ext. 6041) personnel immediately to report any loss, theft or suspected reproduction of a Medical Center key or access card.

C. Smoking: Smoking is prohibited except in designated smoking shelters or areas.

D. Use of Government Telephones and Fax Machines

1. Government telephones are for official Government business use. Contract staff may use telephones, for local calls only, to contact your place of employment or

to address unforeseen events such as injury on the job, work schedule changes etc.

2. The Government fax machine located in the M & R Foreman's Office, may be used for local faxes with the approval of Engineering Office staff.

E. Housekeeping

1. All construction sites shall be kept clean, orderly and in sanitary condition.
2. All rags/cloth and rubbish soaked with flammable and/or combustible material shall be placed in a covered metal receptacle until being disposed.
3. A clear and unobstructed path must be maintained to all portable fire extinguishers, hose cabinets, pull stations, fire exits and electrical panels.
4. Fire doors and smoke barrier doors shall not be blocked in a manner to prevent their protective operation in the event of a fire.
5. The use of wedges, stops, ropes, or other unapproved methods of holding doors open is prohibited.
6. All indoor trash containers over 20 gallons will be constructed of non-combustible materials and be covered or have a self-extinguishing cover.

F. Storage

1. Any commodities that may be hazardous in combination with each other must be stored so they cannot come in contact with each other.
2. Store flammable and combustible liquids and gasses in approved storage containers.
3. A clear space of 18 inches will be maintained below sprinkler heads.

4. Items stored in tiers will be stacked, blocked, interlocked and limited in height to prevent sliding or collapse.
5. Materials will not be stored directly on the floor.
6. Storage areas will be kept free from accumulation of materials that constitute hazards.
7. Stairwells, stairways and corridors shall not be utilized for storage.
8. Storage will not be permitted within 3 feet of an electric panel in all directions.

G. Hazardous Materials

1. Discovery of any suspected asbestos containing material shall result in the contractor stopping work in the area and reporting the discovery immediately to the Engineering Office (ext. 6041) or one of the contact persons indicated above. Engineering Service shall then evaluate the suspect material and if it contains asbestos shall arrange for the removal of the asbestos.
2. Contractors shall maintain and provide to the VA Project Engineer MSDS’s for products used during construction which shall explain the labeling system and all other required information. Report any discovery of an existing hazardous material to Engineering Service, (ext. 6041).

H. Infection Control

1. PURPOSE: To prevent the acquisition of nosocomial infection in patients and healthcare workers during Medical Center renovation or construction activities.
2. The Contractor shall contact Engineering Service (ext. 6041) prior to beginning construction in any areas so that a Pre-Construction Risk Assessment (PCRA) may be performed, and all applicable forms completed. Once

completed the Contractor shall obtain a completed and approved copy of a PCRA form for each area of work in which the Contractor is involved. The Contractor shall conform to all the requirements (ILSM's, Infection Control Precautions, etc.) as noted on the completed forms. The Contractor shall post a copy of the completed form outside the construction barrier at each work site in plain view and accessible to VA Staff for verification that requirements noted on PCRA form are being adhered to.

3. General: The goal of Infection Control is to identify and reduce the risks of acquiring and transmitting infections among patients, employees, service workers and visitors to the Medical Center. During construction or renovation projects, hidden infectious disease hazards may be released into the air, carried on dust particles, on workers clothing or be present in damp areas or areas where water has collected. One particular organism of concern is a fungal organism know as Aspergillus. Aspergillus can be found in decaying leaves and compost, plaster and drywall, and settled dust. These organisms like many others encountered in our everyday lives usually do not cause problems in healthy people, however a hospital is full of sick patients. Aspergillus and other organisms can cause severe illness and even death in some patients. Therefore, it is critical that everyone do their best to help prevent conditions that might lead to the dispersion of this or other infectious organisms by:

   a. Maintaining barrier walls that keep dust and dirt inside the worksite.

b. Maintaining a state of negative air pressure within the construction site to prevent dust and dirt from dispersing into the Medical Center from the worksite. The Contractor shall install bulb type pressure differential monitoring devices or an alarm system in temporary construction barriers and shall monitor and maintain negative air pressure in construction areas.
c. Removing demolition debris in a manner that minimizes any contamination of the environment outside the worksite by dust and debris.
d. Utilizing walk off mats and making sure clothing is free of loose soil and debris when leaving the construction site.
e. Assuring that any water or sludge found during demolition of plumbing or in the construction process is collected and disposed of in a controlled manner.
f. Using only designated entry and exit pathways.

4. Please feel free to contact Infection Control if you have questions or concerns.
5. If you find any needles, syringes, sharp medical objects please do not handle or remove yourself. Contact the Medical Center project coordinator or Project Engineer for removal.
6. Infection control activities are critical in all areas of the Medical Center. Construction activities causing disturbance of existing dust or generating new dust must be conducted in ways that will minimize dust generation and dispersion.
7. All construction/maintenance workers and contract workers must follow the infection control procedures as described in this guideline.

8. The following infection control procedures shall be followed at a minimum:
   a. BARRIERS - Complete all critical barriers before construction begins.
      1) Construction or renovation sites not capable of containment within a single room must be separated from patient-care areas and other critical areas by barriers that keep the dirt and dust inside the work site.
      2) The integrity of the barrier walls must assure a complete seal of the construction area from adjacent areas.
      3) Temporary barriers and enclosures must be dust proof with airtight seals maintained at the full perimeter of the walls, floors and upper decking, as well as all penetrations. Seal holes, pipes, conduits and punctures appropriately.
      4) Tightly sealing doors or an overlapping flap of at least 2 feet in width of a durable poly must be used at points of personnel access, where plastic/poly barriers are approved for use by VA Project Engineer.
      5) Elevator shafts or stairways must be isolated outside of the construction field to prevent dispersion of dust from the work site.
   b. ENVIRONMENTAL CONTROLS
      1) Isolate the HVAC system in areas where work is being done to prevent contamination of the duct system.
      2) Maintain negative air pressure within work site. Utilize HEPA-filtration units if air is being re-circulated.

3) Seal holes, pipes, conduits and punctures appropriately.
4) Provide a designated area within the work site where all personnel leaving the work site can vacuum off with a HEPA-filtered vacuum to remove all loose dust and debris from clothing.
5) Vacuum with a HEPA-filtered vacuum and/or wet mop frequently at entrance and exit points.
6) "Sticky" or walk-off mats shall be utilized immediately outside the construction area to remove dust and soil from shoes, cart wheels, etc. as personnel exit the area. The mats must be large enough to cover the entire exit and changed frequently to prevent accumulation of dust. Contractor shall place a form on a wall adjacent to each mat with space to record date, time and exchanger's signature so VA Staff can monitor that mats are changed at required frequency.
7) Contain construction debris during transport in covered containers.
8) Debris must be removed from the construction area daily in covered carts using specified traffic patterns.
9) Control, collection and disposal must be provided for any drain liquid or sludge encountered when demolishing plumbing.

c. CLEANING

1) The construction zone and adjacent areas must be maintained by wet mopping the area daily or more frequently as needed to minimize dust generation.
2) Final cleaning of the area must be completed prior to acceptance of the completed project area by VA.

3) Do not remove barriers from work area until the project is completed and area is thoroughly cleaned. Remove barrier materials carefully to minimize spreading of dirt and debris associated with construction.
4) Clothing shall be free of loose soil and debris before exiting the construction zone.
5) Personnel entering sterile/invasive procedure areas will be provided with a disposable jump suit, head covering, and shoe covers to wear while working in the area. They must be removed when exiting the area and new coverings obtained when reentering the areas.
6) Tools and equipment must be damp wiped prior to entry and exit from sterile and invasive procedure areas.
7) Tools and equipment soiled with blood or body fluids must be cleaned with a hospital-approved disinfectant prior to removing from the area.

d. ENVIRONMENTAL MONITORING AND COMPLETION

1) Infection Control, in cooperation with Engineering and Safety will make periodic visits to the work site to ensure compliance with the infection control guidelines.
2) Whenever safe infection control conditions are not met the appropriate contractor will be notified to correct the conditions immediately.
3) All work will be stopped on a project if a hazardous infection control deficiency exists that would result in patients being put at significant risk.
4) Water supply lines will be flushed before placing newly renovated or constructed areas into service.

Industrial Hygiene will assure that water supply lines are safe for use.

I. Construction Safety

1. The Medical Center policy is to provide an environment for patients, visitors and staff that is free from danger. Within the Medical Center, the NFPA Life Safety Code is followed. Interim life safety measures (ILSM's) are applied to all construction projects as necessary and are defined in construction contracts. Minimum ILSM's are:
2. Exits - provide free and unobstructed egress.
3. Free and unobstructed access to emergency department/service for emergency forces.
4. Temporary construction partitions are in accordance with contract requirements.
5. Smoking is permitted in designated areas only.
6. Storage, housekeeping and debris removal policies and procedures that reduce the flammable and combustible fire load are enforced.
7. Hazard surveillance is increased in construction areas.

J. Fire Safety

1. The contractors shall coordinate all construction activities with the VA Engineering Service to determine if fire alarm initiating devices are located within the construction area. Engineering Service shall disable the appropriate alarm initiating devices. Once work in the area is complete it is the contractor's responsibility to contact Engineering Service to have the fire alarm initiation devices enabled.
2. Fire alarm, detection and suppression systems are not to be impaired unless there is work on the system to be performed. If fire alarm, detection and suppression

systems are impaired for more than four hours the contractor shall implement a fire watch, at no additional cost to the Government, in compliance with NFPA requirements and shall obtain VA Engineering Service approval.

3. Additional firefighting equipment is provided, and employees are trained in its use.
4. Hot works permits and fire extinguishers are required when working with open flames, or hot items and for activities that may generate sparks. Contact Engineering Service to obtain a hot work permit.
5. In the event of a fire alarm, “CODE 5” and the location of a fire will be communicated by an overhead announcement. The "all clear" is authorized by the Fargo Fire Department or by the personnel conducting the fire drill and will be communicated by an overhead announcement. If a fire or fire drill is located in or adjacent to the construction area, construction contractor staff shall be responsible for the following:
   a. Be alert to the Code 5 announcement.
   b. Participate in fire drills.
   c. Follow the RACE Plan (Rescue, Alarm, Contain, Extinguish) if fire is discovered by a construction contractor.
   d. Close all corridor doors within the construction area.
   e. Evacuate the immediate area.

K. Utilities

1. Engineering (ext. 6041) is responsible for all utilities within the Medical Center. If there are problems or failures of the utilities, call extension 6041 during normal business hours (Monday through Friday, 8:00 a.m. to 4:30 p.m.). After hours and on weekends, contact the

VA Police Service to report problems and failures. A utilities failure and its type/location will be communicated by a "Code 2 - Utility Failure" overhead announcement.

2. All utility service connections shall be reviewed with and approved by Engineering Service just prior to the connection being made with the existing utility. This condition shall apply to both temporary and permanent connections. This final utility system connection check is meant to ensure the following:
   a. The Medical Center is prepared for the connection.
   b. The contractor is prepared for the connection work, which shall include but not be limited to, all safety measures have been taken or are in place, backflow preventers are in place, hot work permits have been issued, fire watch is in place, fire alarm initiation devices have been disabled, if necessary, etc.

L. Emergencies

1. Disasters ("Code 6"): The Medical Center has initiated a process that provides an "all-hazard" approach to disaster management. Construction contractor staff shall ensure corridors are free of obstructions and a foreman or representative shall report to the Engineering Service office for further instructions.
2. Hostage Situations - Immediately report to VA Police Service any incident in which the safety of any person is threatened by another.
3. Bomb Threats ("Code 7") - React calmly and evacuate. Notify VA Police Service if the threat poses immediate danger to a person or destruction of property. If you discover a suspicious object, do not touch or move the object

4. Severe Weather – In the event of a "Code 8 – Take Cover" overhead announcement, all personnel are expected to take cover in windowless interior corridors that are not on the top floor of the building.
5. "Code Black" – React calmly and evacuate. Avoid area(s) where it has been indicated an armed assailant is in the building or on the ground.

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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 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.

B. 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.

C. 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.

D. The Complete Project Schedule shall contain approximately _____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 852.232 -Article 71 Including NAS-CPM for (PAYMENTS UNDER FIXED PRICE CONSTRUCTION).

C. In accordance with FAR 52.236 - 1 (PERFORMANCE OF WORK BY THE CONTRACTOR) 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.

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 VA Form 10-6001a or the AIA application and certificate for payment documents G702 & G703 reflecting updated schedule activities and cost data in accordance with the provisions of the following Article, PAYMENT AND PROGRESS REPORTING, as the basis upon which progress payments will be made pursuant to Article, FAR 52.232 - 5 (PAYMENT UNDER FIXED-PRICE CONSTRUCTION CONTRACTS) and VAAR 852.232 - Article 71 Including NAS-CPMfor (PAYMENTS UNDER FIXED PRICE CONSTRUCTION). The Contractor shall be entitled to a monthly progress payment upon approval of estimates as determined from the currently approved updated project schedule. Monthly payment requests shall include: a listing of all agreed upon project schedule changes and associated data; and 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 COR for the contract change(s). When there is a disagreement on logic and/or durations, the Contractor shall use the schedule logic and/or durations provided and approved by the COR. After each rerun update, the resulting electronic project

schedule data file shall be appropriately identified and submitted to the VA in accordance to the requirements listed in articles 1.4 and 1.7. This electronic submission is separate from the regular monthly project schedule update requirements and shall be submitted to the COR within fourteen (14) calendar days of completing the regular schedule update. Before inserting the contract changes durations, care must be taken to ensure that only the original durations will be used for the analysis, not the reported durations after progress. In addition, once the final network diagram is approved, the contractor must recreate all manual progress payment updates on this approved network diagram and associated reruns for contract changes in each of these update periods as outlined above for regular update periods. This will require detailed record keeping for each of the manual progress payment updates.

D. Following approval of the 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 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). 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

PART 1 – GENERAL

1.1 DESCRIPTION

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

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

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

1.2 DEFINITIONS

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

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

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

D. Samples: Physical examples of materials, equipment, or workmanship that illustrate functional and aesthetic characteristics of a material or

product and establish standards by which the work can be judged. Color samples from the manufacturer's standard line (or custom color samples if specified) to be used in selecting or approving colors for the project. Field samples and mock-ups constructed to establish standards by which the ensuing work can be judged.

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

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

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

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

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

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

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

1.3 SUBMITTAL REGISTER

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

submittals required by the contract documents but which have been omitted from the submittal register.

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

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

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

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

1.4 SUBMITTAL SCHEDULING

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

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

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

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

1.5 SUBMITTAL PREPARATION

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

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

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

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

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

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

F. The Contractor is responsible for reviewing and certifying that all submittals are in compliance with contract requirements before submitting for VA review. Proposed deviations from the contract requirements are to be clearly identified. All deviations submitted must include a side by side comparison of item being proposed against item specified. Failure to point out deviations will result in the VA requiring removal and replacement of such work at the Contractor's expense.

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

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

CONTRACTOR

(Firm Name)

_____Approved

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

SIGNATURE: _____

TITLE: _____

DATE: _____

1.6 SUBMITTAL FORMAT AND TRANSMISSION

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

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

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

D. E-mail electronic submittal documents smaller than 5MB in size to e-mail addresses as directed by the Contracting Officer.

E. Provide electronic documents over 5MB through an electronic FTP file sharing system. Confirm that the electronic FTP file sharing system can be accessed from the VA computer network. The Contractor is responsible for setting up, providing, and maintaining the electronic FTP file sharing system for the construction contract period of performance.

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

1.7 SAMPLES

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

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

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

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

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

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

1.8 OPERATION AND MAINTENANCE DATA

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

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

1.9 TEST REPORTS

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

1.10 VA REVIEW OF SUBMITTALS AND RFIS

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

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

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

D. VA review period is 15 working days for submittals.

E. VA review period is 10 working days for RFIs.

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

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

1.11 APPROVED SUBMITTALS

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

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

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

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

1.12 WITHHOLDING OF PAYMENT

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

- - - E N D - - -

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):

10-2018.....Standard for Portable Fire Extinguishers

30-2018.....Flammable and Combustible Liquids Code

51B-2019.....Standard for Fire Prevention During Welding, Cutting and Other Hot Work

70-2020.....National Electrical Code

70B-2019.....Recommended Practice for Electrical Equipment Maintenance

70E-2018 .....Standard for Electrical Safety in the Workplace

99-2018.....Health Care Facilities Code

241-2019.....Standard for Safeguarding Construction, Alteration, and Demolition Operations

F. The Joint Commission (TJC)

TJC Manual .....Comprehensive Accreditation and Certification Manual

G. U.S. Nuclear Regulatory Commission

10 CFR 20 .....Standards for Protection Against Radiation

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

29 CFR 1910 .....Safety and Health Regulations for General Industry

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

1.2 DEFINITIONS:

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

B. 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)).

C. "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.

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

E. Accident/Incident Criticality Categories:

1. No impact - near miss incidents that should be investigated but are not required to be reported to the VA;

2. Minor incident/impact - incidents that require first aid or result in minor equipment damage (less than $5000). These incidents must be investigated but are not required to be reported to the VA;

3. Moderate incident/impact - Any work-related injury or illness that results in:

   a. Days away from work (any time lost after day of injury/illness onset);

   b. Restricted work;

   c. Transfer to another job;

   d. Medical treatment beyond first aid;

   e. Loss of consciousness;

4. A significant injury or illness diagnosed by a physician or other licensed health care professional, even if it did not result in (1) through (5) above or,

5. Any incident that leads to major equipment damage (greater than $5000).

F. These incidents must be investigated and are required to be reported to the VA;

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

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

1.3 REGULATORY REQUIREMENTS:

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

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:

   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);

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

1) Exposure data (man-hours worked);

2) Accident investigation reports;

3) Project site injury and illness 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, patient, and public safety risks in site-specific compliance and accident prevention plans. These Plans shall include but are not be limited to procedures for addressing the risks associates with the following:

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;

18) Crane Critical lift;

19) Respiratory protection;

20) Health hazard control program;

22) Abrasive blasting;

23) Heat/Cold Stress Monitoring;

24) Crystalline Silica Monitoring (Assessment);

25) Demolition plan (to include engineering survey);

26) Formwork and shoring erection and removal;

27) PreCast Concrete;

28) Public (Mandatory compliance with ANSI/ASSE A10.34-2012).

C. Submit the APP to the Contracting Officer Representative for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES 15 [fifteen] calendar days

prior to the date of the preconstruction conference for acceptance. Work cannot proceed without an accepted APP.

D. Once accepted by the Contracting Officer Representative, 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 in accordance with FAR Clause 52.236-13, *Accident Prevention*, 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 Contracting Officer Representative. 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 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 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 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 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.

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 [fourteen] 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). //However, the SSHO has be a separate qualified individual from the Prime Contractor's Superintendent and/or Quality Control Manager with duties only as the SSHO//

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.

E. Submit training records associated with the above training requirements to the Contracting Officer Representative for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES 15 [fifteen] 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 Contracting Officer Representative 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.

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

A. The prime contractor shall establish and maintain an accident reporting, recordkeeping, and analysis system to track and analyze all injuries and illnesses, high visibility incidents, and accidental property damage (both government and contractor) that occur on site. Notify the Contracting Officer Representative as soon as practical, but no more than four hours after any accident meeting the definition of a Moderate or Major incidents, High Visibility Incidents, or any weight handling and hoisting 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 determine whether a government investigation will be conducted.

B. Conduct an accident investigation for all Minor, Moderate and Major incidents as 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 (or equivalent) , and provide the report to the Contracting Officer Representative within 5 [five] calendar days of the accident. The Contracting Officer Representative will provide copies of any required or special forms.

C. A summation of all man-hours worked by the contractor and associated sub-contractors for each month will be reported to the Contracting Officer Representative monthly.

D. A summation of all Minor, Moderate, and Major incidents experienced on site by the contractor and associated sub-contractors for each month will be provided to the Contracting Officer Representative monthly. The contractor and associated sub-contractors' OSHA 300 logs will be made available to the Contracting Officer Representative 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 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 in circumstances of no eye hazards, appropriate safety glasses meeting the ANSI Z.87.1 standard must be worn by each person on site.

3. Appropriate Safety Shoes – based on the hazards present, safety shoes meeting the requirements of ASTM F2413-11 shall be worn by each person on site unless written authorization is given by the Contracting Officer Representative in circumstances of no foot hazards.

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. Special care should be taken to prevent dust and other airborne particles from entering mechanical air intakes and other openings in buildings.

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 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 Contracting Officer Representative. The Infection Control Permits will be posted outside the appropriate construction area. More than one permit may be issued for a construction project if the work is located in separate areas requiring separate classes. The primary project scope area for this project is: **Class [III}**, however, work outside the primary project scope area may vary. The required infection control precautions with each class are as follows:

1. Class III requirements:

   a. During Construction Work:

      1) Obtain permit from the Contracting Officer Representative

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

      3) Complete all critical barriers i.e. sheetrock, plywood, plastic, to seal area from non-work area . Install construction barriers and ceiling protection carefully, outside of normal work hours.

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

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

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

b. Upon Completion:

1) Do not remove barriers from work area until completed project is inspected by the Contracting Officer Representative and thoroughly cleaned by the VA Environmental Services Department.

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

3) Vacuum work area with HEPA filtered vacuums.

4) Wet mop area with cleaner/disinfectant.

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

6) Return permit to the Contracting Officer Representative

C. Barriers shall be erected as required based upon classification (Class III & IV requires barriers) and shall be constructed as follows:

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

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

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

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

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

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

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

D. Products and Materials:

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

2. Barrier Doors: Self Closing solid core wood in steel frame, painted

3. Dust proof drywall

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

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

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

7. Disinfectant: Hospital-approved disinfectant or equivalent product

8. Portable Ceiling Access Module

E. 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.

F. A dust control program will be established and maintained as part of the contractor’s infection preventive measures in accordance with the FGI Guidelines for Design and Construction of Healthcare Facilities. Prior to start of work, prepare a plan detailing project-specific dust protection measures with associated product data, including periodic

status reports, and submit to Contracting Officer Representative for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

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

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

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

4. Vacuum and wet mop all transition areas from construction to the occupied medical center at the end of each workday. Vacuum shall utilize HEPA filtration. Maintain surrounding area frequently. Remove debris as it is created. Transport these outside the construction area in containers with tightly fitting lids.

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

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

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

I. Final Cleanup:

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

2. Perform HEPA vacuum cleaning of all surfaces in the construction area. This includes walls, ceilings, cabinets, furniture (built-in or free standing), partitions, flooring, etc.

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

J. 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, including periodic status reports, and submit to Contracting Officer Representative 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 Construction Partitions:

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

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

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

G. Egress Routes for Construction Workers: Maintain free and unobstructed egress. Inspect daily. Report findings and corrective actions weekly to Contracting Officer Representative.

H. Fire Extinguishers: Provide and maintain extinguishers in construction areas and temporary storage areas in accordance with 29 CFR 1926, NFPA 241 and NFPA 10.

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

J. Sprinklers: Install, test and activate new automatic sprinklers prior to removing existing sprinklers.

K. Existing Fire Protection: Do not impair automatic sprinklers, smoke and heat detection, and fire alarm systems, except for portions immediately under construction, and temporarily for connections. Provide fire watch for impairments more than 4 hours in a 24-hour period. Request interruptions in accordance with Article, OPERATIONS AND STORAGE AREAS, and coordinate with Contracting Officer Representative. All existing or temporary fire protection systems (fire alarms, sprinklers) located in construction areas shall be tested as coordinated with the medical center. Parameters for the testing and results of any tests performed shall be recorded by the medical center and copies provided to the Resident Engineer.

L. Smoke Detectors: Prevent accidental operation. Remove temporary covers at end of work operations each day. Coordinate with Contracting Officer Representative.

M. Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with Contracting Officer Representative. Obtain permits from Contracting Officer Representative at least __48__ hours in advance . Designate contractor's responsible project-site fire prevention program manager to permit hot work.

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

O. Smoking: Smoking is prohibited in and adjacent to construction areas inside existing buildings and additions under construction. In separate and detached buildings under construction, smoking is prohibited except in designated smoking rest areas.

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

Q. If required, submit documentation to the COR that personnel have been trained in the fire safety aspects of working in areas with impaired structural or compartmentalization features.

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

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

2. 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.

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

E. Ground-fault circuit interrupters. GFCI protection shall be provided where an employee is operating or using cord- and plug-connected tools related to construction activity supplied by 125-volt, 15-, 20-, or 30-ampere circuits. Where employees operate or use equipment supplied by greater than 125-volt, 15-, 20-, or 30- ampere circuits, GFCI protection or an assured equipment grounding conductor program shall be implemented in accordance with NFPA 70E - 2015, Chapter 1, Article 110.4(C)(2)..

1.16 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. Excavations less than 5 feet in depth require evaluation by the contractor’s “Competent Person” (CP) for determination of the necessity of an excavation protective system where kneeing, laying in, or stooping within the excavation is required.

B. All excavations and trenches 24 inches in depth or greater shall require a written trenching and excavation permit (NOTE – some States and other local jurisdictions require separate state/jurisdiction-issued excavation permits). The permit shall have two sections, one section will be completed prior to digging or drilling and the other will be completed prior to personnel entering the excavations greater than 5 feet in depth. Each section of the permit shall be provided to the Contracting Officer Representative prior to proceeding with digging or drilling and prior to proceeding with entering the excavation. After completion of the work and prior to opening a new

section of an excavation, the permit shall be closed out and provided to the Contracting Officer Representative. The permit shall be maintained onsite and the first section of the permit shall include the following:

1. Estimated start time & stop time2. Specific location and nature of the work.

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

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

4. Indication of whether soil samples are required to determined soil contamination.

5. Indication of coordination with local authority (i.e. "One Call") or contractor's effort to determine utility location with search and survey equipment.

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

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

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

2. Indication of selected protective system (sloping/benching, shoring, shielding). When soil classification is identified as "Type A" or "Solid Rock", only shoring or shielding or Professional Engineer designed systems can be used for protection. A Sloping/Benching system may only be used when classifying the soil as Type B or Type

C. Refer to Appendix B of 29 CFR 1926, Subpart P for further information on protective systems designs.

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

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

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

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

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

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

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

5. Utility markings will be maintained

E. Excavations will be hand dug or excavated by other similar safe and acceptable means as excavation operations approach within 3 to 5 feet of identified underground utilities. Exploratory bar or other detection equipment will be utilized as necessary to further identify the location of underground utilities.

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

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.

C. A detailed lift plan for all lifts shall be submitted to the Contracting Officer Representative 14 days prior to the scheduled lift complete with route for truck carrying load, crane load analysis, siting of crane and path of swing and all other elements of a critical lift plan where the lift meets the definition of a critical lift. Critical lifts require a more comprehensive lift plan to minimize the potential of crane failure and/or catastrophic loss. The plan must be reviewed and accepted by the General Contractor before being submitted to the VA for review. The lift will not be allowed to proceed without prior acceptance 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 1926, Subpart AA 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 Contracting Officer Representative.

1.22 WELDING AND CUTTING

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

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. 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

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

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

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

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

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

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

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

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

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

AA Aluminum Association Inc.
http://www.aluminum.org

AABC Associated Air Balance Council
https://www.aabc.com

AAMA American Architectural Manufacturer's Association
http://www.aamanet.org

AASHTO American Association of State Highway and Transportation Officials
http://www.aashto.org

AATCC American Association of Textile Chemists and Colorists
http://www.aatcc.org

ACGIH American Conference of Governmental Industrial Hygienists
http://www.acgih.org

ACI American Concrete Institute
http://www.aci-int.net

ACPA American Concrete Pipe Association
http://www.concrete-pipe.org

ACPPA American Concrete Pressure Pipe Association
http://www.acppa.org

ADC Air Diffusion Council
http://flexibleduct.org

AGA American Gas Association
http://www.aga.org

AGC Associated General Contractors of America
http://www.agc.org

AGMA American Gear Manufacturers Association, Inc.
http://www.agma.org

AH American Hort

https://www.americanhort.org

AHAM Association of Home Appliance Manufacturers
http://www.aham.org

AIA American Institute of Architects

http://www.aia.org

AISC American Institute of Steel Construction
http://www.aisc.org

AISI American Iron and Steel Institute
http://www.steel.org

AITC American Institute of Timber Construction
https://aitc-glulam.org

AMCA Air Movement and Control Association, Inc.
http://www.amca.org

ANSI American National Standards Institute, Inc.
http://www.ansi.org

APA The Engineered Wood Association
http://www.apawood.org

ARI Air-Conditioning and Refrigeration Institute
http://www.ari.org

ARPM Association for Rubber Product Manufacturers

https://arpm.com

ASABE American Society of Agricultural and Biological Engineers
https://www.asabe.org

ASCE American Society of Civil Engineers
http://www.asce.org

ASHRAE American Society of Heating, Refrigerating, and Air-Conditioning Engineers
http://www.ashrae.org

ASME American Society of Mechanical Engineers
http://www.asme.org

ASSE American Society of Sanitary Engineering International
http://www.asse-plumbing.org

ASTM American Society for Testing and Materials International
http://www.astm.org

AWI Architectural Woodwork Institute
https://www.awinet.org

AWS American Welding Society
https://www.aws.org

AWWA American Water Works Association
https://www.awwa.org

BHMA Builders Hardware Manufacturers Association
https://www.buildershardware.com

BIA The Brick Industry Association
http://www.gobrick.com

CAGI Compressed Air and Gas Institute
https://www.cagi.org

CGA Compressed Gas Association, Inc.
https://www.cganet.com

CI The Chlorine Institute, Inc.
https://www.chlorineinstitute.org

CISCA Ceilings and Interior Systems Construction Association
https://www.cisca.org

CISPI Cast Iron Soil Pipe Institute
https://www.cispi.org

CLFMI Chain Link Fence Manufacturers Institute
https://www.chainlinkinfo.org

CPA Composite Panel Association

https://www.compositepanel.org

CPMB Concrete Plant Manufacturers Bureau
https://www.cpmb.org

CRA California Redwood Association
http://www.calredwood.org

CRSI Concrete Reinforcing Steel Institute
https://www.crsi.org

CTI Cooling Technology Institute
https://www.cti.org

DHA Decorative Hardwoods Association

https://www.decorativehardwoods.org

DHI Door and Hardware Institute
https://www.dhi.org

EGSA Electrical Generating Systems Association
http://www.egsa.org

EEI Edison Electric Institute
https://www.eei.org

EPA United States Environmental Protection Agency
https://www.epa.gov

ETL ETL Testing Services
http://www.intertek.com

FAA Federal Aviation Administration
https://www.faa.gov

FCC Federal Communications Commission
https://www.fcc.gov

FPS Forest Products Society
http://www.forestprod.org

GANA Glass Association of North America
http://www.glasswebsite.com

FM Factory Mutual Global Insurance
https://www.fmglobal.com

GA Gypsum Association
https://gypsum.org

GSA General Services Administration
https://www.gsa.gov

HI Hydraulic Institute
http://www.pumps.org

ICC International Code Council
https://shop.iccsafe.org

ICEA Insulated Cable Engineers Association
https://www.icea.net

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

IEEE Institute of Electrical and Electronics Engineers
https://www.ieee.org\

IGMA Insulating Glass Manufacturers Alliance

https://www.igmaonline.org

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

MBMA Metal Building Manufacturers Association
https://www.mbma.com

MSS Manufacturers Standardization Society of the Valve and Fittings Industry
http://msshq.org

NAAMM National Association of Architectural Metal Manufacturers
https://www.naamm.org

PHCC Plumbing-Heating-Cooling Contractors Association
https://www.phccweb.org

NBS National Bureau of Standards
See - NIST

NBBI The National Board of Boiler and Pressure Vessel Inspectors
https://www.nationalboard.org

NEC National Electric Code
See - NFPA National Fire Protection Association

NEMA National Electrical Manufacturers Association
https://www.nema.org

NFPA National Fire Protection Association
https://www.nfpa.org

NHLA National Hardwood Lumber Association
https://www.nhla.com

NIH National Institute of Health
https://www.nih.gov

NIST National Institute of Standards and Technology
https://www.nist.gov

NELMA Northeastern Lumber Manufacturers Association, Inc.
http://www.nelma.org

NPA National Particleboard Association
(See CPA, Composite Panel Association)

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

OSHA Occupational Safety and Health Administration
Department of Labor
https://www.osha.gov

PCA Portland Cement Association
https://www.cement.org

PCI Precast Prestressed Concrete Institute
https://www.pci.org

PPI Plastics Pipe Institute
https://www.plasticpipe.org

PEI Porcelain Enamel Institute
http://www.porcelainenamel.com

PTI Post-Tensioning Institute
http://www.post-tensioning.org

RFCI Resilient Floor Covering Institute
https://www.rfci.com

RIS Redwood Inspection Service
(See Western Wood Products Association)

https://www.wwpa.org

SCMA Southern Cypress Manufacturers Association
http://www.cypressinfo.org

SDI Steel Door Institute
http://www.steeldoor.org

SJI Steel Joist Institute
https://www.steeljoist.org

SMACNA Sheet Metal & Air-Conditioning Contractors' National Association
https://www.smacna.org

SSPC The Society for Protective Coatings
https://www.sspc.org

STI Steel Tank Institute
https://www.steeltank.com

SWI Steel Window Institute
https://www.steelwindows.com

TCNA Tile Council of North America

https://www.tcnatile.com

TEMA Tubular Exchanger Manufacturers Association
http://www.tema.org

TPI Truss Plate Institute
https://www.tpinst.org

UBC The Uniform Building Code
(See ICC)

UL Underwriters' Laboratories Incorporated
https://www.ul.com

ULC Underwriters' Laboratories of Canada
https://www.ulc.ca

WCLB West Coast Lumber Inspection Bureau
http://www.wclib.org

WDMA Window and Door Manufacturers Association

https://www.wdma.com

WRCLA Western Red Cedar Lumber Association
https://www.realcedar.com

WWPA Western Wood Products Association
http://www.wwpa.org

- - - E N D - - -

SECTION 01 45 00
QUALITY CONTROL

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies requirements for Contractor Quality Control (CQC) for Design-Bid-Build (DBB) construction projects.

1.2 APPLICABLE PUBLICATIONS

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

B. ASTM International (ASTM)

1. D3740 - (2012a) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
2. E329 - (2014a) Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction

1.3 SUBMITTALS

Government approval is required for all submittals. CQC inspection reports shall be submitted under this Specification section and follow the [Applicable CQC Control Phase (Preparatory, Initial, or Follow-Up)]: [Applicable Specification section] naming convention.

1. Preconstruction Submittals
   a. Interim CQC Plan
   b. CQC Plan
   c. Additional Requirements for Design Quality Control (DQC) Plan
2. Design Data
   a. Discipline-Specific Checklists
   b. Design Quality Control
3. Test Reports
   a. Verification Statement

PART 2 PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Establish and maintain an effective quality control (QC) system. that complies with the FAR Clause 52.246.12 titled “Inspection of Construction”. QC consists of plans, procedures, and organization necessary to produce an end product which complies with the Contract requirements. The QC system covers all design and construction operations, both onsite and offsite, and be keyed to the proposed

design and construction sequence. The project superintendent will be held responsible for the quality of work and is subject to removal by the Contracting Office or Authorized designee for non-compliance with the quality requirements specified in the Contract. In this context the highest level manager responsible for the overall construction activities at the site, including quality and production is the project superintendent. The project superintendent maintains a physical presence at the site at all times and is responsible for all construction and related activities at the site, except as otherwise acceptable to the Contracting Officer.

3.2 CQC PLAN:

A. Submit the CQC Plan no later than 15 days after receipt of Notice to Proceed (NTP) proposed to implement the requirements of the FAR Clause 52.246.12 titled "Inspection of Construction". The Government will consider an Interim CQC Plan for the first 15 days of operation, which must be accepted within 20 business days of NTP. Design and/or construction will be permitted to begin only after acceptance of the CQC Plan or acceptance of an Interim plan applicable to the particular feature of work to be started. Work outside of the accepted Interim CQC Plan will not be permitted to begin until acceptance of a CQC Plan or another Interim CQC Plan containing the additional work scope is accepted.

B. Content of the CQC Plan: Include, as a minimum, the following to cover all design and construction operations, both onsite and offsite, including work by subcontractors, fabricators, suppliers, and purchasing agents:

1. A description of the QC organization, including a chart showing lines of authority and acknowledgement that the CQC staff will implement the three-phase control system for all aspects of the work specified. Include a CQC System Manager that reports to the project superintendent.
2. The name, qualifications (in resume format) duties, responsibilities, and authorities of each person assigned a CQC function.
3. A copy of the letter to the CQC System Manager signed by an authorized official of the firm which describes the responsibilities and delegates sufficient authorities to adequately perform the functions of the CQC System Manager, including authority to stop

work which is not in compliance with the Contract. Letters of direction to all other various quality control representatives outlining duties, authorities, and responsibilities will to the Contracting Officer or Authorized designee. be issued by the CQC System Manager. Furnish copies of these letters

4. Procedures for scheduling, reviewing, certifying, and managing submittals including those of subcontractors, designers of record, consultants, suppliers and purchasing agents. These procedures must be in accordance with Section 01 33 23 Shop Drawings, Product Data, and Samples.
5. Control, verification, and acceptance of testing procedures for each specific test to include the test name, specification paragraph requiring test, feature of work to be tested, test frequency, and person responsible for each test. (Laboratory facilities approved by the Contracting Officer or Authorized designee are required to be used)
6. Procedures for tracking Preparatory, Initial, and Follow-Up control phases and control, verification, and acceptance tests including documentation.
7. Procedures for tracking design and construction deficiencies from identification through acceptable corrective action. Establish verification procedures that identified deficiencies have been corrected.
8. Reporting procedures, including proposed reporting formats.
9. A list of the definable features of work. A definable feature of work is a task which is separate and distinct from other tasks has separate control requirements, and is identified by different trades or disciplines, or it is work by the same trade in a different environment. Although each section of specifications can generally be considered as a definable feature of work, there are frequently more than one definable feature under a particular section. This list will be agreed upon during the Coordination meeting.
10. Coordinate schedule work with Special Inspections required by Section 01 45 35 Special Inspections, the Statement of Special Inspections and Schedule of Special Inspections. Where the applicable Code issue by the International Code Council (ICC) calls for inspections by the Building Official, the Contractor must include the inspections in the CQC Plan and must perform the

inspections required by the applicable ICC. The Contractor must perform these inspections using independent qualified inspectors. Include the Special Inspection Plan requirements in the CQC Plan.

C. Acceptance of Plan: Acceptance of the Contractor's plan is required prior to the start of construction. Acceptance is conditional and will be predicated on satisfactory performance during the design and construction. The Government reserves the right to require the Contractor to make changes in the CQC Plan and operations including removal of personnel as necessary, to obtain the quality specified.

D. Notification of Changes: After acceptance of the CQC Plan, notify the Contracting Officer or Authorized designee in writing of any proposed change. Proposed changes are subject to acceptance by the Government prior to implementation by the Contractor.

3.3 COORDINATION MEETING:

A. After the Preconstruction Conference Post-award Conference before start of design or construction, and prior to acceptance by the Government of the CQC Plan, meet with the Contracting Officer or Authorized designee to discuss the Contractor's quality control system. Submit the CQC Plan a minimum of 2 business days prior to the Coordination Meeting. During the meeting, a mutual understanding of the system details must be developed, including the forms for recording the CC operations, design activities (if applicable), control activities, testing, administration of the system for both onsite and offsite work, and the interrelationship of Contractor's Management and control with the Government's Quality Assurance. Minutes of the meeting will be prepared by the Government, signed by both the Contractor and Contracting Officer or Authorized designee and will become a part of the contract file. There can be occasions when subsequent conferences will be called by either party to reconfirm mutual understandings or address deficiencies in the CQC system or procedures which can require corrective action by the Contractor.

3.4 QUALITY CONTROL ORGANIZATION:

A. Personnel Requirements: The requirements for the CQC organization are a Safety and Health Manager, CQC System Manager, and sufficient number of additional qualified personnel to ensure safety and Contract compliance. The Safety and Health Manager shall satisfy the requirements of Specification 01 35 26 Safety Requirements and reports directly to a senior project (or corporate) official independent from

the CQC System Manager. The Safety and Health Manager will also serve as a member of the CQC Staff. Personnel identified in the technical provisions as requiring specialized skills to assure the required work is being performed properly will also be included as part of the CQC organization. The Contractor's CQC staff maintains a presence at the site at all times during progress of the work and have complete authority and responsibility to take any action necessary to ensure Contract compliance. The CQC staff will be subject to acceptance by the Contracting Officer or Authorized designee. Provide adequate office space, filing systems, and other resources as necessary to maintain an effective and fully functional CQC organization. Promptly complete and furnish all letters, material submittals, shop drawings submittals, schedules and all other project documentation to the CQC organization. The CQC organization is responsible to maintain these documents and records at the site at all times, except as otherwise acceptable to the Government.

B. CQC System Manager: Identify as CQC System Manager an individual within the onsite work organization that is responsible for overall management of CQC and has the authority to act in all CQC matters for the Contractor. The CQC system Manager is required to be a PM or SRE to determine qualifications based on project complexity at construction review. This CQC System manager is on the site at all times during construction and is employed by the General Contractor. The CQC System Manger is assigned as CQC System Manager but has duties as project superintendent in addition to quality control. Identify in the plan an alternate to serve in the event of the CDQC System Manager's absence. The requirements for the alternate are the same as the CQC System Manager.

C. CQC Personnel: In addition to CQC personnel specified elsewhere in the contract, provide as part of the CQC organization specialized personnel to assist in the CQC System Manager for the following areas, as applicable: electrical, mechanical, structural, environmental, materials technician submittals clerk, and low voltage systems. These individuals or specified technical companies are directly employed by the General Contractor and cannot be employed by a supplier or subcontractor on this project; be responsible to the CQC System Manager; be physically present at the construction site during work on the specialized personnel's areas of responsibility; have the necessary

education or experience in accordance with the Experience Matrix listed herein. These individuals can perform other duties but need to be allowed sufficient time to perform the specialized personnel's assigned quality controls duties as described in the CQC Plan. A single person can cover more than one area provided that the single person is qualified to perform QC activities in each designated and that workload allows.

D. Organizational Changes: Maintain the CQC staff at full strength at all times. When it is necessary to make changes to the CQC staff, revise the CQC Plan to reflect the changes and submit the changes to the Contracting Officer or Authorized designee for acceptance.

3.5 SUBMITTALS AND DELIVERABLES:

A. Submittals have to comply with the requirements in Section 01 33 23 Shop Drawings, Product Data, and Samples. The CQC organization is responsible for certifying that all submittals and deliverables are in compliance with the contract requirements

3.6 CONTROL:

A. CQC is the means by which the Contractor ensures that the construction, to include that of subcontractors and suppliers, complies with the requirements of the contract. At least three phases of control are required to be conducted by the CQC System Manager for each definable feature of the construction work as follows:

1. Preparatory Phase: This phase is performed prior to beginning work on each definable feature of work after all required plans/documents/materials are approved/accepted, and after copies are at the work site. This phase includes:
   a. A review of each paragraph of applicable specifications, references codes, and standards. Make available during the preparatory inspection a copy of those sections of referenced codes and standards applicable to that portion of the work to be accomplished in the field. Maintain and make available in the field for use by Government personnel until final acceptance of the work.
   b. Review of the Contract drawings.
   c. Check to assure that all materials and equipment have been tested, submitted, and approved.

d. Review of provisions that have been made to provide required control inspection and testing.
e. Review Special Inspections required by Section 01 45 35 Special Inspections, that Statement of Special Inspections and the Schedule of Specials Inspections.
f. Examination of the work area to assure that all required preliminary work has been completed and is in compliance with the Contract.
g. Examination of required materials, equipment, and sample work to assure that they are on hand conform to approved shop drawings or submitted data and are properly stored.
h. Review of the appropriate Activity Hazard Analysis (AHA) to assure safety requirements are met.
i. Discussion of procedures for controlling quality of the work including repetitive deficiencies. Document construction tolerances and workmanship standards - contract defined or industry standard if not contract defined - for that feature of work.
j. Check to ensure that the portion of the plan for the work to be performed has been accepted by the Contracting Officer.
k. Discussion of the initial control phase.
l. The Government needs to be notified at least 48 hours or 2 business days in advance of beginning the Preparatory control phase. Include a meeting conducted by the CQC System Manager and attended by the superintendent, other CQC personnel (as applicable), and the foreman responsible for the definable feature. Document the results of the Preparatory phase actions by separate minutes prepared by the CQC System Manager and attach to the daily CQC report. Instruct applicable workers as to the acceptable level of workmanship required in order to meet contract specifications.

B. Initial Phase: This phase is accomplished at the beginning of a definable feature of work. Accomplish the following:
1. Check work to ensure that it is in full compliance with contract requirements. Review minutes of the Preparatory meeting.
2. Verify adequacy of controls to ensure full contract compliance. Verify the required control inspection and testing is in compliance with the contract.

3. Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Compare with required sample panels as appropriate.
4. Resolve all differences.
5. Check safety to include compliance with an upgrading of the safety plan and activity hazard analysis. Review the activity analysis with each worker.
6. The Government needs to be notified at least 48 hours or 2 business days in advance of beginning the initial phase for definable features of work. Prepare separate minutes of this phase by the CQC System Manager and attach to the daily CQC report. Indicate the exact location of initial phase for definable feature of work for future reference and comparison with Follow-Up phases.
7. The initial phase for each definable feature of work is repeated for each new crew to work onsite, or any time acceptable specified quality standards are not being met.
8. Coordinate scheduled work with Special Inspections required by Section 01 45 35 Special Inspections, the Statement of Special Inspections, and the Schedule of Special Inspections.

C. Follow-Up Phase: Perform daily checks to assure control activities, including control testing, are providing continued compliance with contract requirements until the completion of the particular feature of work. Record the checks in the CQC documentation. Conduct final Follow-Up checks and correct all deficiencies prior to the start of additional features of work which may be affected by the deficient work. Do not build upon nor conceal non-conforming work. Coordinate scheduled work with Special Inspections required by Section 01 45 35 Special Inspections, the Statement of Special Inspections, and the Schedule of Special Inspections

D. Additional Preparatory and Initial Phases on the same definable features of work if: the quality ongoing work is unacceptable; if there are changes in the applicable CQC staff, onsite production supervision or work crew; if work on a definable feature is resumed after a substantial period of inactivity, or if other problems develop.

3.7 TESTS

A. Testing Procedure: Perform specified or required tests to verify that control measures are adequate to provide a product which conforms to contract requirements. Upon request, furnish to the Government

duplicate samples of test specimens for possible testing by the Government. Testing includes operation and acceptance test when specified. Procure the services of a Department of Veteran Affairs approved testing laboratory or establish an approved testing laboratory at the project site. Perform the following activities and record and provide the following data:

1. Verify that testing procedures comply with contract requirements.
2. Verify that facilities and testing equipment are available and comply with testing standards.
3. Check test instrument calibration data against certified standards.
4. Verify that recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.
5. Record results of all tests taken, both passing and failing on the CQC report for the date taken. Specification paragraph reference, location where tests were taken, and the unique sequential control number identifying the test. If approved by the Contracting Officer or Authorized designee, actual test reports are submitted later with a reference to the test number and date taken. Provide an information copy of tests performed by an offsite or commercial test facility directly to the Contracting Officer or Authorized designee. Failure to submit timely test reports as stated results in nonpayment for related work performed and disapproval of the test facility for this Contract.

B. Testing Laboratories: All testing laboratories must be validated through the procedures contained in Specification section 01 45 29 Testing Laboratory Services.

1. Capability Check: The Government reserves the right to check laboratory equipment in the proposed laboratory for compliance with the standards set forth in the contract specifications and to check the laboratory technician’s testing procedures and techniques. Laboratories utilized for testing soils, concrete, asphalt and steel is required to meet criteria detailed in ASTM D3740 and ASTM E329.
2. Capability Recheck: If the selected laboratory fails the capability check, the Contractor will be assessed a charge equal to value of recheck to reimburse the Government for each succeeding recheck of the laboratory or the checking of a subsequently selected

laboratory. Such costs will be deducted from the Contract amount due the Contractor.

C. Onsite Laboratory: The Government reserves the right to utilize the Contractor's control testing laboratory and equipment to make assurance tests, and to check the Contractor's testing procedures, techniques, and test results at no additional cost to the Government.

3.8 COMPLETION INSPECTION

A. Punch-Out Inspection: Conduct an inspection of the work by the CQC system Manager near the end of the work, or any increment of the work established by the specifications. Prepare and include in the CQC documentation a punch list of items which do not conform to the approved drawings and specifications. Include within the list of deficiencies the estimated date by which the deficiencies will be corrected. Make a second inspection the CQC System Manager or staff to ascertain that all deficiencies have been corrected. Once this is accomplished, notify the Government that the facility is ready for the Government Pre-Final Inspection.

B. Pre-Final Inspection: The Government will perform the Pre-Final Inspection to verify that the facility is complete and ready to be occupied. A Government Pre-Final Punch List may be developed as a result of this inspection. Ensure that all items on this list have been corrected before notifying the Government, so that a Final Acceptance Inspection with the customer can be scheduled. Correct any items noted on the Pre-Final Inspection in a timely manner. These inspections and any deficiency corrections required by this paragraph need to be accomplished within the time slated for completion of the entire work or any particular increment of the work if the project is divided into increments by separate construction completion dates.

C. Final Acceptance Inspection: The Contractor's QC Inspection personnel, plus the superintendent or other primary management person, and the Contracting Officer's Authorized designee is required to be in attendance at the Final Acceptance Inspection. Additional Government personnel can also be in attendance. The Final Acceptance Inspection will be formally scheduled by the Contracting Officer's or Authorized designee based upon results of the Pre-Final Inspection. Notify the Contracting Officer through the Resident Engineer office at least 14 days prior to the Final Acceptance Inspection and include the Contractor's assurance that all specific items previously identified to

the Contractor as being unacceptable, along with all remaining work performed under the contract, will be complete and acceptable by the date schedule for the Final Acceptance Inspection. Failure of the Contractor to have all contract work acceptably complete for this inspection will be cause for the Contracting Officer to bill the Contractor for the Government's additional inspection cost in accordance with FAR Clause 52.246-12 titled "Inspection of Construction".

3.9 DOCUMENTATION

A. Quality Control Activities: Maintain current records providing factual evidence that required QC activities and tests have been performed. Include in these records the work of subcontractors and suppliers on an acceptable form that includes, as a minimum, the following information:

1. The name and area of responsibility of the Contractor/Subcontractor
2. Operating plant/equipment with hours worked, idle, or down for repair.
3. Work performed each day, giving location, description, and by whom. When Network Analysis (NAS) is used, identify each phase of work performed each day by NAS activity number.
4. Test and control activities performed with results and references to specification/drawing requirements. Identify the Control Phase (Preparatory, Initial, and/or Follow-Up). List deficiencies noted, along with corrective action.
5. Quantity of materials received at the site with statement as to acceptability, storage, and reference to specification/drawing requirements.
6. Submittals and deliverables reviewed, with Contract reference, by whom, and action taken.
7. Offsite surveillance activities, including actions taken.
8. Job safety evaluations stating what was checked, results, and instructions or corrective actions.
9. Instructions given/received and conflicts in plans and specifications.
10. Provide documentation of design quality control activities. For independent design reviews, provide, as a minimum, identification of the Independent Technical Reviewer (ITR) team, the ITR review comments, responses, and the record of resolution of the comments.

B. Verification Statement: Indicate a description of trades working on the project; the number of personnel working; weather conditions encountered; and any delays encountered. Cover both conforming and deficient features and include a statement that equipment and materials incorporated in the work and workmanship comply with the Contract. Furnish the original and one copy of these records in report form to the Government daily with 1 week after the date covered by the report, except that reports need not be submitted for days on which no work is performed. As a minimum, prepare and submit on report for every 7 days of no work and on the last day of a no work period. All calendar days need to be accounted for throughout the life of the contract. The first report following a day of no work will be for that day only. Reports need to be signed and dated by the CQC System Manager. Include copies of test reports and copies of reports prepared by all subordinate QC personnel within the CQC System Manager Report.

3.10 SAMPLE FORMS

A. Templates of various quality control reports can be found on the Whole Building Design Guide website at https://www.wbdg.org/FFC/NAVGRAPH/01%2045%2000.00%2020_quality_control_reports.pdf

3.11 NOTIFICATION OF NONCOMPLIANCE

A. The Contracting Officer or Authorized designee will notify the Contractor of any detected noncompliance with the foregoing requirements. The Contractor should take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the work site will be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Contracting Officer can issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders will be made the subject of claim for extension of time or for excess costs or damages by the Contractor.

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SECTION 01 45 29
TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.1 DESCRIPTION:

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

1.2 APPLICABLE PUBLICATIONS:

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

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

T27-11.....Standard Method of Test for Sieve Analysis of Fine and Coarse Aggregates

T96-02 (R2006).....Standard Method of Test for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

T99-10.....Standard Method of Test for Moisture-Density Relations of Soils Using a 2.5 Kg (5.5 lb.) Rammer and a 305 mm (12 in.) Drop

T104-99 (R2007).....Standard Method of Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate

T180-10.....Standard Method of Test for Moisture-Density Relations of Soils using a 4.54 kg (10 lb.) Rammer and a 457 mm (18 in.) Drop

T191-02(R2006).....Standard Method of Test for Density of Soil In-Place by the Sand-Cone Method

T310-13.....Standard Method of Test for In-place Density and Moisture Content of Soil and Soil-aggregate by Nuclear Methods (Shallow Depth)

C. American Concrete Institute (ACI):

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

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

A370-12.....Standard Test Methods and Definitions for Mechanical Testing of Steel Products

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

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

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

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

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

C136-06.....Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates

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

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

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

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

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

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

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

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

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

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

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

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

D422-63(2007).....Standard Test Method for Particle-Size Analysis of Soils

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

D1140-00(2006).....Standard Test Methods for Amount of Material in Soils Finer than No. 200 Sieve

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

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

D1556-07.....Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method

D1557-09.....Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft lbf/ft3 (2,700 KNm/m3))

D2166-06.....Standard Test Method for Unconfined Compressive Strength of Cohesive Soil

D2167-08).....Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method

D2216-10.....Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

D2974-07a.....Standard Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils

D3666-11.....Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials

D3740-11.....Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as used in Engineering Design and Construction

D6938-10.....Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

E94-04(2010).....Standard Guide for Radiographic Examination

E164-08.....Standard Practice for Contact Ultrasonic Testing of Weldments

E329-11c.....Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection

E543-09.....Standard Specification for Agencies Performing Non-Destructive Testing

E605-93(R2011).....Standard Test Methods for Thickness and Density of Sprayed Fire Resistive Material (SFRM) Applied to Structural Members

E709-08.....Standard Guide for Magnetic Particle Examination

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

F3125/F3125M-15.....Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions

E. American Welding Society (AWS):

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

1.3 REQUIREMENTS:

A. Accreditation Requirements: Construction materials testing laboratories must be accredited by a laboratory accreditation authority and will be required to submit a copy of the Certificate of Accreditation and Scope of Accreditation. The laboratory's scope of accreditation must include the appropriate ASTM standards (i.e.; E329, C1077, D3666, D3740, A880, E543) listed in the technical sections of the specifications. Laboratories engaged in Hazardous Materials Testing shall meet the requirements of OSHA and EPA. The policy applies to the specific laboratory performing the actual testing, not just the "Corporate Office."

B. Inspection and Testing: Testing laboratory shall inspect materials and workmanship and perform tests described herein and additional tests requested by COR. 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 COR, Contractor, unless other arrangements are agreed to in writing by the COR. Submit reports of tests that fail to meet construction contract requirements on colored paper.

D. Verbal Reports: Give verbal notification to the COR immediately of any irregularity.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 LANDSCAPING:

A. Test topsoil for organic materials, pH, phosphate, potash content, and gradation of particles.

1. Test for organic material by using ASTM D2974.
2. Determine percent of silt, sand, clay, and foreign materials such as rock, roots, and vegetation.

B. Submit laboratory test report of topsoil to COR.

3.2 CONCRETE:

A. Batch Plant Inspection and Materials Testing:

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

B. Field Inspection and Materials Testing:

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

10. Environmental Conditions: Determine the temperature per ASTM C1064 for each truckload of concrete during hot weather and cold weather concreting operations:
    a. When ambient air temperature falls below 4.4 degrees C (40 degrees F), record maximum and minimum air temperatures in each 24 hour period; record air temperature inside protective enclosure; record minimum temperature of surface of hardened concrete.
    b. When ambient air temperature rises above 29.4 degrees C (85 degrees F), record maximum and minimum air temperature in each 24 hour period; record minimum relative humidity; record maximum wind velocity; record maximum temperature of surface of hardened concrete.
11. Inspect the reinforcing steel placement, including bar size, bar spacing, top and bottom concrete cover, proper tie into the chairs, and grade of steel prior to concrete placement. Submit detailed report of observations.
12. Observe conveying, placement, and consolidation of concrete for conformance to specifications.
13. Observe condition of formed surfaces upon removal of formwork prior to repair of surface defects and observe repair of surface defects.
14. Observe curing procedures for conformance with specifications, record dates of concrete placement, start of preliminary curing, start of final curing, end of curing period.
15. Observe preparations for placement of concrete:
    a. Inspect handling, conveying, and placing equipment, inspect vibrating and compaction equipment.
    b. Inspect preparation of construction, expansion, and isolation joints.
16. Observe preparations for protection from hot weather, cold weather, sun, and rain, and preparations for curing.
17. Observe concrete mixing:
    a. Monitor and record amount of water added at project site.
    b. Observe minimum and maximum mixing times.
18. Measure concrete flatwork for levelness and flatness as follows:
    a. Perform Floor Tolerance Measurements F_F and F_L in accordance with ASTM E1155. Calculate the actual overall F- numbers using the inferior/superior area method.

b. Perform all floor tolerance measurements within 48 hours after slab installation and prior to removal of shoring and formwork.

c. Provide the Contractor and the COR with the results of all profile tests, including a running tabulation of the overall F_F and F_L values for all slabs installed to date, within 72 hours after each slab installation.

19. Other inspections:

a. Grouting under base plates.

b. Grouting anchor bolts and reinforcing steel in hardened concrete.

C. Laboratory Tests of Field Samples:

1. Test compression test cylinders for strength in accordance with ASTM C39. For each test series, test one cylinder at 7 days and one cylinder at 28 days. Use remaining cylinder as a spare tested as directed by the COR. Compile laboratory test reports as follows: Compressive strength test shall be result of one cylinder, except when one cylinder shows evidence of improper sampling, molding or testing, in which case it shall be discarded and strength of spare cylinder shall be used.

2. Make weight tests of hardened lightweight structural concrete in accordance with ASTM C567.

3. Furnish certified compression test reports (duplicate) to the COR. In test report, indicate the following information:

a. Cylinder identification number and date cast.

b. Specific location at which test samples were taken.

c. Type of concrete, slump, and percent air.

d. Compressive strength of concrete in MPa (psi).

e. Weight of lightweight structural concrete in kg/m^3 (pounds per cubic feet).

f. Weather conditions during placing.

g. Temperature of concrete in each test cylinder when test cylinder was molded.

h. Maximum and minimum ambient temperature during placing.

i. Ambient temperature when concrete sample in test cylinder was taken.

j. Date delivered to laboratory and date tested.

3.3 MASONRY:

A. Mortar Tests:

1. Laboratory compressive strength test:

a. Comply with ASTM C780.

b. Obtain samples during or immediately after discharge from batch mixer.

c. Furnish molds with 50 mm (2 inch), 3 compartment gang cube.

d. Test one sample at 7 days and 2 samples at 28 days.

2. Two tests during first week of operation; one test per week after initial test until masonry completion.

B. Grout Tests:

1. Laboratory compressive strength test:

a. Comply with ASTM C1019.

b. Test one sample at 7 days and 2 samples at 28 days.

c. Perform test for each 230 m2 (2500 square feet) of masonry.

C. Masonry Unit Tests:

1. Laboratory Compressive Strength Test:

a. Comply with ASTM C140.

b. Test 3 samples for each 460 m2 (5000 square feet) of wall area.

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

3.4 STEEL DECKING:

A. Provide field inspection of welds of metal deck to the supporting steel, and testing services to insure steel decking has been installed in accordance with contract documents and manufacturer’s requirements.

B. Qualification of Field Welding: Qualify welding processes and welding operators in accordance with “Welder Qualification” procedures of AWS D1.1. Refer to the “Plug Weld Qualification Procedure” in Part 3 “Field Quality Control.”

C. Submit inspection reports, certification, and instances of noncompliance to the COR.

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SECTION 01 45 35
SPECIAL INSPECTIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This guide specification will be applicable to both new buildings and existing building rehabilitations/renovations. In addition to the Special Inspection and testing specified requirements, a registered design professional must perform structural observations during construction. All observed deficiencies will be immediately reported to the Contracting Officer. The registered design professional performing these observations will be a representative of the Designer of Record (DOR) for the building being constructed.

1.2 APPLICABLE PUBLICATIONS

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

B. American Society of Civil Engineers (ASCE)

1. ASCE 7 - (2010; Errata 2011; Supp 2 2013) Minimum Design Loads for Buildings and Other Structures

C. International Code Council (ICC)

2. ICC IBC - (2021) International Building Code

1.3 GENERAL REQUIREMENTS

A. Perform Special Inspections in accordance with Chapter 17 of ICC IBC. Special Inspections are to be performed by an independent third party and are intended to ensure that the work of the prime contractor is in accordance with the Contract Documents and applicable building codes. Special inspections do not take the place of the three phases of control inspections performed by the Contractor's QC Manager or any testing and inspections required by other sections of the specifications.

B. Structural observations will be performed by the Government. The contractor must provide notification to the Contracting Officer 14 days prior to the following points of construction that structural observations need to occur:

1.4 **DEFINITIONS**

A. Continuous Special Inspections - The constant monitoring of specific tasks by a special inspector. These inspections must be carried out continuously over the duration of the particular tasks.

B. Periodic Special Inspections - Special Inspections by the special inspector who is intermittently present where the work to be inspected has been or is being performed. Specific time interval on a specific Special Inspection should be indicated on the Schedule of Special Inspections.

C. Perform - Perform these Special Inspections tasks for each welded joint or member.

D. Observe - Observe these Special Inspections items on a random daily basis. Operations need not be delayed pending these inspections.

E. Special Inspector (SI) - A qualified person retained by the contractor and approved by the Contracting Officer as having the competence necessary to inspect a particular type of construction requiring Special Inspections. The SI must be an independent third party hired directly by the Prime Contractor.

F. Associate Special Inspector (ASI) - A qualified person who assists the SI in performing Special Inspections but must perform inspection under the direct supervision of the SI and cannot perform inspections without the SI on site.

G. Third Party - A third party inspector must not be company employee of the Contractor or any Sub-Contractor performing the work to be inspected.

H. Contracting Officer - The Government official having overall authority for administrative contracting actions. Certain contracting actions may be delegated to the Contracting Officer's Representative (COR).

I. Contractor’s Quality Control (QC) Manager - An individual retained by the prime contractor and qualified in accordance with the Section 01 45 00.00 10 QUALITY CONTROL having the overall responsibility for the contractor's QC organization.

J. Designer of Record (DOR) - A registered design professional is contracted by the Government as an A/E responsible for the overall design and review of submittal documents prepared by others. The DOR is registered or licensed to practice their respective design profession as defined by the statutory requirements of the professional registration laws in state in which the design professional works. The

DOR is also referred to as the Engineer of Record (EOR) in design code documents.

K. Submittals: Government approval is required for all submittals. CQC Special Inspection reports shall be submitted under this Specification section and follow the [Special Inspection]: [Applicable Specification section or description] naming convention. Submit the following:

1. SD-01 Preconstruction Submittals;
2. Special Inspections Project Manual;
3. Special Inspections Agency's Written Practices
4. NDT Procedures and Equipment’ Calibration Records;
5. SD-06 Test Reports;
6. Special Inspections
7. Daily Reports;
8. Special Inspections; Biweekly Reports;
9. SD-07 Certificates;
10. Fabrication Plant
11. Steel Truss Plant;
12. AC472 Accreditation;
13. Steel Joist Institute Membership;
14. Certificate of Compliance;
15. Special Inspector Qualifications;
16. Qualification Records for NDT technicians;
17. SD-11 Closeout Submittals;
18. Interim Final Report of Special Inspections;
19. Comprehensive Final Report of Special Inspections;

L. Special Inspector Qualifications: Submit qualifications for each SI, and ASI from the following certifying associations: American Concrete Institute (ACI); Association of the Wall and Ceiling Industry (AWCI); American Welding Society (AWS); Factory Mutual (FM); International Code Council (ICC); Nondestructive Testing (NDT); National Institute for Certification in Engineering Technologies (NICET); Underwriters Laboratories (UL). Qualifications should be in accordance with the following minimums; PM or SRE can restrict qualifications to the higher standards shown if multiple options are shown for a role based on complexity of project.

QUALIFICATIONS

Area	Special Inspector	Associated Special Inspector	SIOR
Steel Construction and High Strength Bolting	ICC Structural Steel and Bolting Special Inspector certificate with on year of related experience, or Registered Professional Engineer with related experience	Engineer-In-Training with one year of related experience	
Welding Structural Steel (For highly complex steel use only AWS Certified Welding Inspectors)	ICC Welding Special Inspector certificate with one year of related experience or AWS Certified Welding Inspector	AWS Certified Associate Welding Inspector	
Nondestructive Testing of Welds	NDT Level II Certificate	NDT Level II Certificate plus one year of related experience	
Concrete Construction	ICC Reinforced Concrete Special Inspector Certificate with one year of related experience, or ACI Concrete Construction Special Inspector, or NICET Concrete Technician Level III Certificate in Construction Materials Testing, or, Registered Professional Engineer with related experience	ACI Concrete Construction Special Inspector in Training, or Engineer-In-Training with one year of related experience	
Masonry Construction	ICC Structural Masonry Special Inspector Certificate with one year of related experience, or Registered Professional Engineer with related experience	Engineer-In-Training with one year of related experience	

PART 2 - PRODUCTS

2.1 FABRICATORS SPECIAL INSPECTION

A. Special Inspections of fabricator's work performed in the fabricator's shop is required to be inspected in accordance with the Statement of Special Inspections and the Schedule of Special Inspections unless the fabricator is certified by the approved agency to perform such work without Special Inspections. Submit the applicable certification(s) from the following list to the Contracting Officer for information to allow work performed in the fabricator's shop to not be subjected to Special Inspections.

PART 3 - EXECUTION

3.1 RESPONSIBILIES MATRIX

Inspector	Responsibility	Condition
QC Manager	a. If there is no SIOR, QC Manager must Supervise all Special Inspectors required by the contract documents and the IBC; Verify the qualifications of all of the Special Inspectors; Verify the qualifications of fabricators; Maintain a 3-ring binder for the Special Inspector's daily and biweekly reports. This file must be located in a conspicuous place in the project trailer/office to allow review by the Contracting Officer and the DOR.	Applicable when SIOR is not required
	b. Maintain a rework items list that includes discrepancies noted on the Special Inspectors daily report.	n/a
Special Inspectors	a. Inspect all elements of the project for which the special inspector is qualified to inspect and are identified in the Schedule of Special Inspections. b. Attend preparatory phase meetings related to the Definable Feature of Work (DFOW) for which the special inspector is qualified to inspect.	
	c. Submit a copy of the daily reports to the QC Manager. d. Discrepancies that are observed during Special Inspections must be reported to the QC Manager for correction. If discrepancies are not corrected before the special inspector leaves the site the observed discrepancies must be documented in the daily report.	Applicable when SIOR is not required

Inspector	Responsibility	Condition
	e. Submit a biweekly Special Inspection Report until all inspections are complete. A report is required for each biweekly period in which Special Inspections activity occurs, and must include the following: 1. A brief summary of the work performed during the reporting time frame 2. Changes and/or discrepancies with the drawings, specifications, and mechanical or electrical component certification if they require seismic systems that were observed during the reporting period. 3. Discrepancies which were resolved or corrected. 4. A list of nonconforming items requiring resolution. 5. All applicable test result including nondestructive testing reports. j. At the completion of the project submit a comprehensive final report of Special Inspections that documents the Special Inspections completed for the project and corrections of all discrepancies noted in the daily reports. The comprehensive final report of Special Inspections must be signed, dated and indicate the certification of the special inspector qualifying them to conduct the inspection.	
	k. Submit daily reports to the SIOR	Applicable when SIOR is required

3.2 DEFECTIVE WORK

Check work as it progresses, but failure to detect any defective work or materials must in no way prevent later rejection if defective work or materials are discovered, nor obligate the Government to accept such work.

-- End of Section -

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 affect human health or welfare,
2. Unfavorably alter ecological balances of importance to human life,
3. Effect other species of importance to humankind, or;
4. Degrade the utility of the environment for aesthetic, cultural, and historical purposes.

C. Definitions of Pollutants:

1. Chemical Waste: Petroleum products, bituminous materials, salts, acids, alkalis, herbicides, pesticides, organic chemicals, and inorganic wastes.
2. Debris: Combustible and noncombustible wastes, such as leaves, tree trimmings, ashes, and waste materials resulting from construction or maintenance and repair work.
3. Sediment: Soil and other debris that has been eroded and transported by runoff water.
4. Solid Waste: Rubbish, debris, garbage, and other discarded solid materials resulting from industrial, commercial, and agricultural operations and from community activities.
5. Surface Discharge: The term "Surface Discharge" implies that the water is discharged with possible sheeting action and subsequent soil erosion may occur. Waters that are surface discharged may terminate in drainage ditches, storm sewers, creeks, and/or "water of the United States" and would require a permit to discharge water from the governing agency.
6. Rubbish: Combustible and noncombustible wastes such as paper, boxes, glass and crockery, metal and lumber scrap, tin cans, and bones.

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

1.2 QUALITY CONTROL

A. Establish and maintain quality control for the environmental protection of all items set forth herein.

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

1.3 REFERENCES

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

B. U.S. National Archives and Records Administration (NARA): 33 CFR 328 Definitions

1.4 SUBMITTALS

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

1. Environmental Protection Plan: After the contract is awarded and prior to the commencement of the work, the Contractor shall meet with the Contracting Officer’s Representative (COR) to discuss the proposed Environmental Protection Plan and to develop mutual understanding relative to details of environmental protection. Not more than 20 days after the meeting, the Contractor shall prepare and submit to the COR for approval, a written and/or graphic Environmental Protection Plan including, but not limited to, the following:
   a. Name(s) of person(s) within the Contractor's organization who is (are) responsible for ensuring adherence to the Environmental Protection Plan.
   b. Name(s) and qualifications of person(s) responsible for manifesting hazardous waste to be removed from the site.
   c. Name(s) and qualifications of person(s) responsible for training the Contractor's environmental protection personnel.
   d. Description of the Contractor's environmental protection personnel training program.
   e. A list of Federal, State, and local laws, regulations, and permits concerning environmental protection, pollution control,

noise control and abatement that are applicable to the Contractor's proposed operations and the requirements imposed by those laws, regulations, and permits.

f. Methods for protection of features to be preserved within authorized work areas including trees, shrubs, vines, grasses, ground cover, landscape features, air and water quality, fish and wildlife, soil, historical, and archeological and cultural resources.

g. Procedures to provide the environmental protection that comply with the applicable laws and regulations. Describe the procedures to correct pollution of the environment due to accident, natural causes, or failure to follow the procedures as described in the Environmental Protection Plan.

h. Permits, licenses, and the location of the solid waste disposal area.

i. Drawings showing locations of any proposed temporary excavations, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials. Include as part of an Erosion Control Plan approved by the District Office of the U.S. Soil Conservation Service and the Department of Veterans Affairs.

j. Environmental Monitoring Plans for the job site including land, water, air, and noise.

k. Work Area Plan showing the proposed activity in each portion of the area and identifying the areas of limited use or nonuse. Plan should include measures for marking the limits of use areas. This plan may be incorporated within the Erosion Control Plan.

l. Inclusion of “best management practices” and methodologies.

B. Approval of the Contractor's Environmental Protection Plan will not relieve the Contractor of responsibility for adequate and continued control of pollutants and other environmental protection measures.

1.5 PROTECTION OF ENVIRONMENTAL RESOURCES

A. Protect environmental resources within the project boundaries and those affected outside the limits of permanent work during the entire period of this contract. Confine activities to areas defined by the specifications and drawings.

B. Protection of Land Resources: Prior to construction, identify all land resources to be preserved within the work area. Do not remove, cut, deface, injure, or destroy land resources including trees, shrubs,

vines, grasses, topsoil, and landforms without permission from the COR. Do not fasten or attach ropes, cables, or guys to trees for anchorage unless specifically authorized, or where special emergency use is permitted. Provide erosion control plans, in phases where required.

1. Work Area Limits: Prior to any construction, mark the areas that require work to be performed under this contract. Mark or fence isolated areas within the general work area that are to be saved and protected. Protect monuments, works of art, and markers before construction operations begin. Convey to all personnel the purpose of marking and protecting all necessary objects.
2. Protection of Landscape: Protect trees, shrubs, vines, grasses, landforms, and other landscape features shown on the drawings to be preserved by marking, fencing, or using any other approved techniques.
   a. Box and protect from damage existing trees and shrubs to remain on the construction site.
   b. Immediately repair all damage to existing trees and shrubs by trimming, cleaning, and painting with antiseptic tree paint.
   c. Do not store building materials or perform construction activities closer to existing trees or shrubs than the farthest extension of their limbs.
3. Reduction of Exposure of Unprotected Erodible Soils: Plan and conduct earthwork to minimize the duration of exposure of unprotected soils. Clear areas in reasonably sized increments only as needed to use. Form earthwork to final grade as shown. Immediately protect side slopes and back slopes upon completion of rough grading.
4. Temporary Protection of Disturbed Areas: Construct diversion ditches, benches, and berms to retard and divert runoff from the construction site to protected drainage areas approved under paragraph 208 of the Clean Water Act.
   a. Sediment Basins: Trap sediment from construction areas in temporary or permanent sediment basins that accommodate the runoff of a local 50 (design year) storm. After each storm, pump the basins dry and remove the accumulated sediment. Control overflow/drainage with paved weirs or by vertical overflow pipes, draining from the surface.

b. Reuse or conserve the collected topsoil sediment as directed by the COR. Topsoil use and requirements are specified in Section 31 20 11, EARTHWORK (SHORT FORM).

c. Institute effluent quality monitoring programs as required by Federal, State, and local environmental agencies.

5. Erosion and Sedimentation Control Devices: The erosion and sediment controls selected and maintained by the Contractor shall be such that water quality standards are not violated as a result of the Contractor's activities. Construct or install all temporary and permanent erosion and sedimentation control features 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 and off Government property to minimize erosion and to prevent sediment from entering nearby water courses or lakes.

7. Manage and control spoil areas on and off Government property to limit spoil to areas on the Environmental Protection Plan and prevent erosion of soil or sediment from entering nearby water courses or lakes.

8. Protect adjacent areas from despoilment by temporary excavations and embankments.

9. Handle and dispose of solid wastes in such a manner that will prevent contamination of the environment. Place solid wastes (excluding clearing debris) in containers that are emptied on a regular schedule. Transport all solid waste off Government property and dispose of waste in compliance with Federal, State, and local requirements.

10. Store chemical waste away from the work areas in corrosion resistant containers and dispose of waste in accordance with Federal, State, and local regulations.

11. Handle discarded materials other than those included in the solid waste category as directed by the COR.

C. Protection of Water Resources: Keep construction activities under surveillance, management, and control to avoid pollution of surface and ground waters and sewer systems. Implement management techniques to

control water pollution by the listed construction activities that are included in this contract.

1. Washing and Curing Water: Do not allow wastewater directly derived from construction activities to enter water areas. Collect and place wastewater in retention ponds allowing the suspended material to settle, the pollutants to separate, or the water to evaporate.
2. Control movement of materials and equipment at stream crossings during construction to prevent violation of water pollution control standards of the Federal, State, or local government.

3. Monitor water areas affected by construction.

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

E. Protection of Air Resources: Keep construction activities under surveillance, management, and control to minimize pollution of air resources. Burning is not permitted on the job site. Keep activities, equipment, processes, and work operated or performed, in strict accordance with the State of South Dakota and Federal emission and performance laws and standards. Maintain ambient air quality standards set by the Environmental Protection Agency, for those construction operations and activities specified.

1. Particulates: Control dust particles, aerosols, and gaseous by-products from all construction activities, processing, and preparation of materials (such as from asphaltic batch plants) at all times, including weekends, holidays, and hours when work is not in progress.
2. Particulates Control: Maintain all excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and all other work areas within or outside the project boundaries free from particulates which would cause a hazard or a nuisance. Sprinklering, chemical treatment of an approved type, light bituminous treatment, baghouse, scrubbers, electrostatic precipitators, or other methods are permitted to control particulates in the work area.

3. Hydrocarbons and Carbon Monoxide: Control monoxide emissions from equipment to Federal and State allowable limits.
4. Odors: Control odors of construction activities and prevent obnoxious odors from occurring.

F. Reduction of Noise: Minimize noise using every action possible. Perform noise-producing work in less sensitive hours of the day or week as directed by the COR. Maintain noise-produced work at or below the decibel levels and within the time periods specified.

1. Perform construction activities involving repetitive, high-level impact noise only between 8:00 a.m. and 6:00 p.m. unless otherwise permitted by local ordinance or the COR. Repetitive impact noise on the property shall not exceed the following dB limitations:

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

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

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

EARTHMOVING		MATERIALS HANDLING	
FRONT LOADERS	75	CONCRETE MIXERS	75
BACKHOES	75	CONCRETE PUMPS	75
		CRANES	75
		JACK HAMMERS	75
TRUCKS	75		
		PNEUMATIC TOOLS	80
PUMPS	75		
GENERATORS	75	SAWS	75
COMPRESSORS	75		

b. Use shields or other physical barriers to restrict noise transmission.

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

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

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

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

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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:

D. Waste Management Plan development and implementation.

E. Techniques to minimize waste generation.

F. Sorting and separating of waste materials.

G. Salvage of existing materials and items for reuse or resale.

H. Recycling of materials that cannot be reused or sold.

I. At a minimum the following waste categories shall be diverted from landfills:

1. Soil.
2. Inerts (eg, concrete, masonry and asphalt).
3. Clean dimensional wood and palette wood.
4. Green waste (biodegradable landscaping materials).
5. Engineered wood products (plywood, particle board and I-joists, etc).
6. Metal products (eg, steel, wire, beverage containers, copper, etc).
7. Sheathings
8. Cardboard, paper and packaging.
9. Plastics (eg, ABS, PVC).
10. Gypsum board.
11. Insulation.
12. Paint.
13. Fluorescent lamps.

1.2 RELATED WORK

A. Section 02 41 00, DEMOLITION.

B. Section 01 00 00, GENERAL REQUIREMENTS.

1.3 QUALITY ASSURANCE

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

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

C. Contractor shall develop and implement procedures to recycle construction and demolition waste to a minimum of 50 percent.

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

E. Contractor shall provide all demolition, removal and legal disposal of materials. Contractor shall ensure that facilities used for recycling, reuse and disposal shall be permitted for the intended use to the extent required by local, state, federal regulations.

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

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

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

1.4 TERMINOLOGY

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

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

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

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

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

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

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

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

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

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

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

L. Recycling: The process of sorting, cleansing, treating, and reconstituting materials for the purpose of using the altered form in the manufacture of a new product. Recycling does not include burning, incinerating or thermally destroying solid waste.

1. On-site Recycling - Materials that are sorted and processed on site for use in an altered state in the work, i.e. concrete crushed for use as a sub-base in paving.
2. Off-site Recycling - Materials hauled to a location and used in an altered form in the manufacture of new products.

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

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

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

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

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

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

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

1.5 SUBMITTALS

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

B. Prepare and submit to the COR a written demolition debris management plan. The plan shall include, but not be limited to, the following information:

1. Procedures to be used for debris management.
2. Techniques to be used to minimize waste generation.
3. Analysis of the estimated job site waste to be generated:
   a. List of each material and quantity to be salvaged, reused, recycled.
   b. List of each material and quantity proposed to be taken to a landfill.

4. Detailed description of the Means/Methods to be used for material handling.
   a. On site: Material separation, storage, protection where applicable.
   b. Off site: Transportation means and destination. Include list of materials.
      1) Description of materials to be site-separated and self-hauled to designated facilities.
      2) Description of mixed materials to be collected by designated waste haulers and removed from the site.
         a) The names and locations of mixed debris reuse and recycling facilities or sites.
         b) The names and locations of trash disposal landfill facilities or sites.
         c) Documentation that the facilities or sites are approved to receive the materials.

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

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

E. Target waste diversion rate by material and an overall diversion rate.

F. Final report documenting the results of implementation of the preconstruction waste management plan.

1.6 APPLICABLE PUBLICATIONS

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

1. Green Building Initiative (GBI): Green Globes for New Construction 2019

1.7 RECORDS

A. Maintain records to document the quantity of waste generated; the quantity of waste diverted through sale, reuse, or recycling; and the quantity of waste disposed by landfill or incineration. Records shall be kept in accordance with the Green Globes for New Construction 2019 Technical Reference Manual.

PART 2 - PRODUCTS

2.1 MATERIALS

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

B. List of each material and quantity proposed to be taken to a landfill.

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

PART 3 - EXECUTION

3.1 COLLECTION

A. Provide all necessary containers, bins and storage areas to facilitate effective waste management.

B. Clearly identify containers, bins and storage areas so that recyclable materials are separated from trash and can be transported to respective recycling facility for processing.

C. Hazardous wastes shall be separated, stored, disposed of according to local, state, federal regulations.

3.2 DISPOSAL

A. Contractor shall be responsible for transporting and disposing of materials that cannot be delivered to a source-separated or mixed materials recycling facility to a transfer station or disposal facility that can accept the materials in accordance with state and federal regulations.

B. Construction or demolition materials with no practical reuse or that cannot be salvaged or recycled shall be disposed of at a landfill or incinerator.

3.3 REPORT

A. With each application for progress payment, submit a summary of construction and demolition debris diversion and disposal including beginning and ending dates of period covered.

B. Quantify all materials diverted from landfill disposal through salvage or recycling during the period with the receiving parties, dates removed, transportation costs, weight tickets, manifests, invoices. Include the net total costs or savings for each salvaged or recycled material.

C. Quantify all materials disposed of during the period with the receiving parties, dates removed, transportation costs, weight tickets, tipping fees, manifests, invoices. Include the net total costs for each disposal.

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SECTION 01 81 13
SUSTAINABLE CONSTRUCTION REQUIREMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section describes general requirements and procedures to comply with federal mandates and U.S. Department of Veterans Affairs (VA) policies for sustainable construction.

B. The Design Professional has selected materials and utilized integrated design processes that achieve the Government's objectives. Contractor is responsible to maintain and support these objectives in developing means and methods for performing work and in proposing product substitutions or changes to specified processes. Obtain approval from Contracting Officer for all changes and substitutions to materials or processes. Proposed changes must meet, or exceed, materials or processes specified.

1.2 RELATED WORK

A. Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS.

B. Section 01 74 19 CONSTRUCTION WASTE MANANGEMENT.

1.3 DEFINITIONS

A. Recycled Content: Recycled content of materials is defined according to Federal Trade Commission Guides for the Use of Environmental Marketing Claims (16 CFR Part 260). Recycled content value of a material assembly is determined by weight. Recycled fraction of assembly is multiplied by cost of assembly to determine recycled content value.

1. "Post-Consumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
2. "Pre-Consumer" material is defined as material diverted from waste stream during the manufacturing process. Excluded is reutilization of materials such as rework, regrind, or scrap generated in a process and capable of being reclaimed within the same process that generated it.

B. Biobased Products: Biobased products are derived from plants and other renewable agricultural, marine, and forestry materials and provide an alternative to conventional petroleum derived products. Biobased

products include diverse categories such as lubricants, cleaning products, inks, fertilizers, and bioplastics.

C. Low Pollutant-Emitting Materials: Materials and products which are minimally odorous, irritating, or harmful to comfort and well-being of installers and occupants.

D. Volatile Organic Compounds (VOC): Chemicals that are emitted as gases from certain solids or liquids. VOCs include a variety of chemicals, some of which may have short- and long-term adverse health effects.

1.4 REFERENCE STANDARDS

A. Carpet and Rug Institute Green Label Plus program.

B. U.S. Department of Agriculture BioPreferred program (USDA BioPreferred).

C. U.S. Environmental Protection Agency Comprehensive Procurement Guidelines (CPG).

D. U.S. Environmental Protection Agency WaterSense Program (WaterSense).

E. U.S. Environmental Protection Agency ENERGY STAR Program (ENERGY STAR).

F. U. S. Department of Energy Federal Energy Management Program (FEMP).

G. Green Electronic Council EPEAT Program (EPEAT).

1.5 SUBMITTALS

A. All submittals to be provided by contractor to COR.

B. Sustainability Action Plan:

1. Submit documentation as required by this section; provide additional copies of typical submittals required under technical sections when sustainable construction requires copies of record submittals.
2. Within 30 days after Preconstruction Meeting provide a narrative plan for complying with requirements stipulated within this section.
3. Sustainability Action Plan must:
   a. Make reference to sustainable construction submittals defined by this section.
   b. Address all items listed under PERFORMANCE CRITERIA.
   c. Indicate individual(s) responsible for implementing the plan.

C. Low Pollutant-Emitting Materials Tracking Spreadsheet: Within 30 days after Preconstruction Meeting provide a preliminary Low Pollutant-Emitting Materials Tracking Spreadsheet. The Low Pollutant-Emitting Materials Tracking Spreadsheet must be an electronic file and include all materials on Project in categories described under Low Pollutant-Emitting Materials in 01 81 13.

D. Construction Indoor Air Quality (IAQ) Management Plan:

1. Not more than 30 days after Preconstruction Meeting provide a Construction IAQ Management Plan as an electronic file including descriptions of the following:
   a. Instruction procedures for meeting or exceeding minimum requirements of ANSI/SMACNA 008-2008, Chapter 3, including procedures for HVAC Protection, Source Control, Pathway Interruption, Housekeeping, and Scheduling.
   b. Instruction procedures for protecting absorptive materials stored on-site or installed from moisture damage.
   c. Schedule of submission of photographs of on-site construction IAQ management measures such as protection of ducts and on-site stored oil installed absorptive materials.
   d. Instruction procedures if air handlers must be used during construction, including a description of filtration media to be used at each return air grille.
   e. Instruction procedure for replacing all air-filtration media immediately prior to occupancy after completion of construction, including a description of filtration media to be used at each air handling or air supply unit.
   f. Instruction procedures and schedule for implementing building flush-out.

E. Product Submittals:

1. Recycled Content: Submit product data from manufacturer indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content (excluding MEP systems equipment and components).
2. Biobased Content: Submit product data for products to be installed or used which are included in any of the USDA BioPreferred program's product categories. Data to include percentage of biobased content and source of biobased material.
3. Low Pollutant-Emitting Materials: Submit product data confirming compliance with relevant requirements for all materials on Project in categories described under Low Pollutant-Emitting Materials in 01 81 13.
4. For applicable products and equipment, submit product documentation confirming ENERGY STAR label, FEMP certification, WaterSense, and/or EPEAT certification.

F. Sustainable Construction Progress Reports: Concurrent with each Application for Payment, submit a Sustainable Construction Progress Report to confirm adherence with Sustainability Action Plan.
   1. Include narratives of revised strategies for bringing work progress into compliance with plan and product submittal data.
   2. Include updated and current Low Pollutant-Emitting Materials Tracking Spreadsheet.
   3. Include construction waste tracking, in tons or cubic yards, including waste description, whether diverted or landfilled, hauler, and percent diverted for comingled quantities; and excluding land-clearing debris and soil. Provide haul receipts and documentation of diverted percentages for comingled wastes.

G. Closeout Submittals: Within 14 days after Substantial Completion provide the following:
   1. Final version of Low Pollutant-Emitting Materials Tracking Spreadsheet.
   2. Manufacturer’s cut sheets and product data highlighting the Minimum Efficiency Reporting Value (MERV) for filtration media installed at return air grilles during construction if permanently installed air handling units are used during construction.
   3. Manufacturer’s cut sheets and product data highlighting the Minimum Efficiency Reporting Value (MERV) for final filtration media in air handling units.
   4. Minimum 18 construction photographs including six photographs taken on three different occasions during construction of ANSI/SMACNA 008-2008, Chapter 3 approaches employed, along with a brief description of each approach, documenting implementation of IAQ management measures, such as protection of ducts and on-site stored or installed absorptive materials.
   5. Flush-out Documentation:
      a. Product data for filtration media used during flush-out.
      b. Product data for filtration media installed immediately prior to occupancy.
      c. Signed statement describing building air flush-out procedures including dates when flush-out was begun and completed and statement that filtration media was replaced after flush-out.

1.6 QUALITY ASSURANCE

A. Preconstruction Meeting: After award of Contract and prior to commencement of Work, schedule and conduct meeting with COR/Resident Engineer and Architect to discuss the Project Sustainable Action Plan content as it applies to submittals, project delivery, required Construction Indoor Air Quality (IAQ) Management Plan, and other Sustainable Construction Requirements. The purpose of this meeting is to develop a mutual understanding of the Sustainable Construction Requirements and coordination of contractor's management of these requirements with the Contracting Officer and the Construction Quality Manager.

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

1.7 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.

B. Green Seal Standard GS-11, Paints, 1st Edition, May 20, 1993.

C. Green Seal Standard GC-03, Anti-Corrosive Paints, 2nd Edition, January 7, 1997.

D. Green Seal Standard GC-36, Commercial Adhesives, October 19, 2000.

E. South Coast Air Quality Management District (SCAQMD) Rule 1113, Architectural Coatings, rules in effect on January 1, 2004.

F. South Coast Air Quality Management District (SCAQMD) Rule 1168, July 1, 2005 and rule amendment date of January 7, 2005.

G. Sheet Metal and Air Conditioning National Contractors' Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction, 2nd Edition (ANSI/SMACNA 008-2008), Chapter 3.

H. California Department of Public Health Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, Version 1.1, Emission Testing method for California Specification 01350 (CDPH Standard Method V1.1-2010).

I. Federal Trade Commission Guides for the Use of Environmental Marketing Claims (16 CFR Part 260).

J. ASHRAE Standard 52.2-2007.

PART 2 - PRODUCTS

2.1 PERFORMANCE CRITERIA

A. Construction waste diversion from landfill disposal must comprise at least 50 percent of total construction waste, excluding land clearing debris and soil. Alternative daily cover (ADC) does not qualify as material diverted from disposal.

B. Low Pollutant-Emitting Materials:

1. Adhesives, sealants and sealant primers applied on site within the weatherproofing membrane must comply with VOC limits of SCAQMD Rule 1168:
   a. Non-Flooring Adhesives and Sealants:
      1) Drywall and Panel Adhesives: 50 g/L.
      2) Multipurpose Construction Adhesives: 70 g/L.
      3) Architectural Non-Porous Sealant Primer: 250 g/L.
      4) Architectural Porous Sealant Primer: 775 g/L.
      5) Other Sealant Primer: 750 g/L.
      6) PVC Welding Adhesives: 510 g/L.
      7) CPVC Welding Adhesives: 490 g/L.
      8) ABS Welding Adhesives: 325 g/L.
      9) Plastic Cement Welding Adhesives: 250 g/L.
      10) Architectural Sealants: 250 g/L.
2. 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. Comply with the following VOC content limits:
      1) Anti-Corrosive/Antirust Paints: 250 g/L.
      2) Interior Flat Paint, Coating or Primer: 50 g/L.
      3) Interior Non-Flat Paint, Coating or Primer: 150 g/L.

C. Recycled Content:

1. Any products being installed or used that are listed on EPA Comprehensive Procurement Guidelines designated product list must meet or exceed the EPA's recycled content recommendations. The EPA Comprehensive Procurement Guidelines categories include:

a. Building insulation.
b. Cement and concrete.
c. Consolidated and reprocessed latex paint.
d. Nonpressure pipe.
e. Roofing materials.
f. Hydraulic mulch.

D. Biobased Content:
1. Materials and equipment being installed or used that are listed on the USDA BioPreferred program product category list must meet or exceed USDA's minimum biobased content threshold. Refer to individual specification sections for detailed requirements applicable to that section.
a. USDA BioPreferred program categories include:
1) Adhesive and Mastic Removers.
2) Cleaners.
3)
4) Corrosion Preventatives.
5) Erosion Control Materials.
6) Dust Suppressants.
7) Fertilizers.
8) Interior Paints and Coatings.
9) Mulch and Compost Materials.
10) Multipurpose Cleaners.
11) Packaging Films.
12) Plastic Insulating Foam.
b. Other:
1) Roof Products.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Construction Indoor Air Quality Management:
1. During construction, meet or exceed recommended control measures of ANSI/SMACNA 008-2008, Chapter 3.
2. Protect stored on-site and installed absorptive materials from moisture damage.
3. If permanently installed air handlers are used during construction, filtration media with a minimum efficiency reporting value (MERV) of 8 must be used at each return air grille, as determined by ASHRAE

Standard 52.2-1999 (with errata but without addenda). Replace all filtration media immediately prior to occupancy.

4. Perform building flush-out as follows:
   a. After construction ends, prior to occupancy and with interior finishes installed, perform a building flush-out by supplying a total volume of 14000 cu. ft. of outdoor air per sq. ft. of floor area while maintaining an internal temperature of at least 60 degrees Fahrenheit and a relative humidity no higher than 60 percent. OR
   b. If occupancy is desired prior to flush-out completion, the space may be occupied following delivery of a minimum of 3500 cu. ft. of outdoor air per sq. ft. of floor area to the space. Once a space is occupied, it must be ventilated at a minimum rate of 0.30 cfm per sq. ft. of outside air or design minimum outside air rate determined until a total of 14000 cu. ft./sq. ft. of outside air has been delivered to the space. During each day of flush-out period, ventilation must begin a minimum of three hours prior to occupancy and continue during occupancy.

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SECTION 02 41 00
DEMOLITION

PART 1 - GENERAL

1.1 DESCRIPTION:

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

1.2 RELATED WORK:

A. Demolition and removal of roads, walks, curbs, and on-grade slabs outside buildings to be demolished: Section 31 20 11, EARTH MOVING (SHORT FORM).

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.

G. Environmental Protection: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.

H. Construction Waste Management: Section 01 74 19 CONSTRUCTION WASTE MANAGEMENT.

I. Infectious Control: Section 01 35 26, SAFETY REQUIREMENTS.

1.3 PROTECTION:

A. Perform demolition in such manner as to eliminate hazards to persons and property; to minimize interference with use of adjacent areas, utilities and structures or interruption of use of such utilities; and to provide free passage to and from such adjacent areas of structures. Comply with requirements of GENERAL CONDITIONS Article, ACCIDENT PREVENTION.

B. Provide safeguards, including warning signs, barricades, temporary fences, warning lights, and other similar items that are required for protection of all personnel during demolition and removal operations. Comply with requirements of Section 01 00 00, GENERAL REQUIREMENTS, Article PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES AND IMPROVEMENTS.

C. Maintain fences, barricades, lights, and other similar items around exposed excavations until such excavations have been completely filled.

D. Provide enclosed dust chutes with control gates from each floor to carry debris to truck beds and govern flow of material into truck.

Provide overhead bridges of tight board or prefabricated metal construction at dust chutes to protect persons and property from falling debris.

E. Prevent spread of flying particles and dust. Sprinkle rubbish and debris with water to keep dust to a minimum. Do not use water if it results in hazardous or objectionable condition such as, but not limited to; ice, flooding, or pollution. Vacuum and dust the work area daily.

F. In addition to previously listed fire and safety rules to be observed in performance of work, include following:
   1. No wall or part of wall shall be permitted to fall outwardly from structures.
   3. Wherever a cutting torch or other equipment that might cause a fire is used, provide and maintain fire extinguishers nearby ready for immediate use. Instruct all possible users in use of fire extinguishers.
   4. Keep hydrants clear and accessible at all times. Prohibit debris from accumulating within a radius of 4500 mm (15 feet) of fire hydrants.

G. Before beginning any demolition work, the Contractor shall survey the site and examine the drawings and specifications to determine the extent of the work. The contractor shall take necessary precautions to avoid damages to existing items to remain in place, to be reused, or to remain the property of the Medical Center; any damaged items shall be repaired or replaced as approved by the Resident Engineer. The Contractor shall coordinate the work of this section with all other work and shall construct and maintain shoring, bracing, and supports as required. The Contractor shall ensure that structural elements are not overloaded and shall be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under this contract. Do not overload structural elements. Provide new supports and reinforcement for existing construction weakened by demolition or removal works. Repairs, reinforcement, or structural replacement must have Resident Engineer’s approval.

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

I. The work shall comply with the requirements of Section 01 00 00, GENERAL REQUIREMENTS and 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:

B. Debris, including masonry, 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. Contractor shall dispose debris in compliance with applicable federal, state or local permits, rules and/or regulations.

D. Remove and legally dispose of all materials 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.

E. Remove existing utilities as indicated or uncovered by work and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the COR. When Utility lines are encountered that are not indicated on the drawings, the COR shall be notified prior to further work in that area.

3.2 CLEAN-UP:

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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SECTION 03 30 53
(SHORT FORM) CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cast-in-place structural concrete.
2. Slab on grade infill.
3. Preparation of existing surfaces to receive concrete.

1.2 RELATED WORK

A. Section 01 45 29, TESTING LABORATORY SERVICES: Materials Testing and Inspection During Construction.

B. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS

1.3 APPLICABLE PUBLICATIONS

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

B. American Concrete Institute (ACI):

117-10(R2015).....Specification for Tolerances for Concrete Construction and Materials and Commentary

211.1-91(R2009).....Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.

301/301M-16.....Specifications for Structural Concrete.

305.1-14 - .....Hot Weather Concreting.

306.1-90(R2002).....Cold Weather Concreting.

318/318M-19.....Building Code Requirements for Structural Concrete and Commentary

347R-14 - .....Guide to Formwork for Concrete.

SP-66-04-.....ACI Detailing Manual.

C. ASTM International(ASTM):

A615/A615M-20.....Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement

A996/A996M-16.....Standard Specification for Rail Steel and Axle Steel Deformed Bars for Concrete Reinforcement

A1064/A1064M-18a.....Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete

C33/C33M-18.....Standard Specification for Concrete Aggregates.

C39/C39M-20.....Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

C94/C94M-20.....Standard Specification for Ready-Mixed Concrete.

C143/C143M-20.....Standard Test Method for Slump of Hydraulic Cement Concrete.

C150/C150M-20.....Standard Specification for Portland Cement.

C171-16.....Standard Specification for Sheet Materials for Curing Concrete.

C192/C192M-19.....Standard practice for Making and Curing Concrete Test Specimens in the Laboratory.

C219-20a.....Standard Terminology Relating to Hydraulic and Other Inorganic Cements.

C260/C260M-10a(2016)....Standard Specification for Air-Entraining Admixtures for Concrete.

C330/C330M-17a.....Standard Specification for Lightweight Aggregates for Structural Concrete.

C494/C494M-19.....Standard Specification for Chemical Admixtures for Concrete.

C618-19 .....Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.

C881/C881M-20 .....Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

C989/C989M-18a .....Standard Specification for Slag Cement for Use in Concrete and Mortars.

C1240-20 .....Standard Specification for Silica Fume Used in Cementitious Mixtures.

D1751-18 .....Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).

E1155-20.....Determining FF Floor Flatness and FL Floor Levelness Numbers.

E1745-17 .....Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

D. International Concrete Repair Institute:

310.2R-2013 -.....Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair.

1.4 SUBMITTALS

A. Submittal Procedures: Refer to Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. All items indicated below are required submittals requiring Contracting Officer’s Representative (COR) review and approval.

B. Submittal Drawings:

1. Submit large scale drawings of reinforcing steel, including all reinforcing bend diagrams and reinforcing details, to the COR for review and approval.

C. Manufacturer's Literature and Data:

1. Concrete Mix Design.
2. Air-entraining admixture, chemical admixtures, and curing compounds.
3. Indicate manufacturer's recommendation for each application.

D. Sustainable Construction Submittals:

1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.

E. Certificates: Certify products comply with specifications.

1. Each ready mix concrete batch delivered to site.

1.5 DELIVERY

A. Deliver each ready-mixed concrete batch with mix certification in duplicate according to ASTM International(ASTM) C94/C94M.

1.6 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or II.

B. Pozzolans:

1. Fly Ash: ASTM International(ASTM) C618, Class C or F including supplementary optional physical requirements. Pozzolans shall not exceed 25 percent of total cementitious materials by weight.
2. Silica Fume: ASTM International(ASTM) C1240.

C. Coarse Aggregate: ASTM International(ASTM) C33/C33M.

1. Size 467 for footings and walls over 300 mm (12 inches) thick.

2. Size 7 for coarse aggregate for applied topping and metal pan stair fill.
3. Size 67 for other applications.

D. Fine Aggregate: ASTM International(ASTM) C33/C33M.

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

F. Air-Entraining Admixture: ASTM International(ASTM) C260/C260M.

G. Chemical Admixtures: ASTM International(ASTM) C494/C494M.

H. Vapor Barrier: ASTM International(ASTM) E1745, Class A with a minimum puncture resistance of 2200 g (3000 pounds); minimum 0.38 mm (15 mil) thick.

I. Reinforcing Steel: ASTM International(ASTM) A615/A615M or ASTM International(ASTM) A996/A996M, deformed. See Structural Drawings for grade.

J. Forms: Wood, plywood, metal, or other materials, approved by Contracting Officer, of grade or type suitable to obtain type of finish specified.
1. Plywood: Exterior grade, free of defects and patches on contact surface.
2. Lumber: Sound, grade-marked, S4S stress graded softwood.
3. Form coating: As recommended by Contractor.

K. Welded Wire Fabric: ASTM International(ASTM) A185/A185M, plain; Grade 70 sized as indicated.

L. Expansion Joint Filler: ASTM International(ASTM) D1751.

M. Sheet Materials for Curing Concrete: ASTM International(ASTM) C171.

N. Abrasive Aggregates: Aluminum oxide grains or emery grits.

O. Liquid Densifier/Sealer: 100 percent active colorless aqueous siliconate solution.

P. Grout, Non-Shrinking: Premixed ferrous or non-ferrous. Grout to show no settlement or vertical drying shrinkage at 3 days. Compressive strength for grout, at least 18 MPa (2500 psi) at 3 days and 35 MPa (5000 psi) at 28 days.

2.2 ACCESSORIES

A. Bonding Agent: ASTM International (ASTM) C 1059/C 1059M, Type II.

B. Structural Adhesive: ASTM International (ASTM) C881, 2-component material suitable for use on dry or damp surfaces. Provide material Type, Grade, and Class to suit Project requirements.

C. Water Stops: Rubber base with self-healing properties. Expanding clay based products not acceptable.

D. Weeps: Geotextile type as recommended by Contractor and approved by the COR.

2.3 CONCRETE MIXES

A. Design concrete mixes according to ASTM International (ASTM) C94/C94M, Option C.

B. Compressive strength at 28 days: minimum 30 MPa (4,000 psi).

C. Submit mix design and results of compression tests to the Contracting Officer for his evaluation. Identify all materials, including admixtures, making-up the concrete.

D. Maximum Slump for Vibrated Concrete: 100 mm (4 inches) tested according to ASTM International (ASTM) C143.

E. Cement and Water Factor (See Table I):

TABLE I - CEMENT AND WATER FACTORS FOR CONCRETE				
Concrete: Strength	Non-Air-Entrained		Air-Entrained	
Min. 28 Day Comp. Str. MPa (psi)	Min. Cement kg/cu. m (lbs./cu. yd.)	Max. Water Cement Ratio	Min. Cement kg/cu. m (lbs./cu. yd.)	Max. Water Cement Ratio
30 (4000)1,3,5	325 (550)	0.45	340 (570)	0.50

Notes:

1. If trial mixes are used, achieve a compressive strength 8.3 MPa (1 200 psi) in excess of f'c. For concrete strengths greater than 35 MPa (5,000 psi), achieve a compressive strength 9.7 MPa (1,400 psi) in excess of f’c.

3. For Concrete Exposed to High Sulfate Content Soils: Maximum water cement ratio is 0.44.

4. Laboratory Determined according to ACI 211.1 for normal weight concrete or ACI 211.2 for lightweight structural concrete.

5. Provide 6% +/- 1% Air entrainment.

F. Air-entrainment as specified, and conform with the following for air content table:

TABLE II - TOTAL AIR CONTENT FOR VARIOUS SIZES OF COARSE AGGREGATES	
Nominal Maximum Size of Coarse Aggregate	Total Air Content, percent
10 mm (3/8 inches)	6 Moderate exposure; 7.5 severe exposure
13 mm (1/2 inches)	5.5 Moderate exposure; 7 severe exposure

TABLE II - TOTAL AIR CONTENT FOR VARIOUS SIZES OF COARSE AGGREGATES	
Nominal Maximum Size of Coarse Aggregate	Total Air Content, percent
19 mm (3/4 inches)	5 Moderate exposure; 6 severe exposure
25 mm (1 inches)	4.5 Moderate exposure; 6 severe exposure
40 mm (1 1/2 inches)	4.5 Moderate exposure; 5.5 severe exposure

2.4 BATCHING AND MIXING

A. Store, batch, and mix materials according to ASTM C94/C94M.

1. Job-Mixed: Batch mix concrete in stationary mixers as specified in ASTM International(ASTM) C94/C94M.
2. Ready-Mixed Concrete: Comply with ASTM International(ASTM) C94/C94M, except use of non-agitating equipment for transporting concrete to Site is not acceptable.
3. When aggregate producer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

PART 3 - EXECUTION

3.1 FORMWORK

A. Installation: Conform to ACI 347. Construct forms to obtain concrete of the shapes, dimensions and profiles indicated, with tight joints.

B. Design and construct forms to prevent bowing-out of forms between supports and to be removable without prying against or otherwise damaging fresh concrete.

C. When patching formed concrete, seal form edges against existing surface to prevent leakage; set forms so that patch is flush with adjacent surfaces.

D. Treating and Wetting: Treat or wet concrete contact surfaces:

1. Coat plywood and lumber forms with non-staining form sealer.
2. Wet wood forms thoroughly when they are not treated with form release agent.
3. Prevent water from accumulating and remaining within forms.
4. Clean and coat removable metal forms with light form oil before reinforcement is placed.
5. In hot weather, cool metal forms by thoroughly wetting with water just before placing concrete.

6. Prevent water from accumulating and remaining within forms.

E. Inserts, Sleeves, and Similar Items: Install flashing reglets, masonry ties, anchors, inserts, wires, hangers, sleeves, boxes for floor hinges, and other cast-in items specified in other Sections. Place where indicated, square, flush and secured to formwork.

F. Construction Tolerances - General: Install and maintain concrete formwork to assure completion of work within specified tolerances.

G. Adjust or replace completed work exceeding specified tolerances before placing concrete.

3.2 REINFORCEMENT

A. Install concrete reinforcement according to ACI 318 and ACI SP-66.

B. Support and securely tie reinforcing steel to prevent displacement during placing of concrete.

C. Drilling for Dowels in Existing Concrete: Use sharp bits, drill hole slightly oversize, fill with epoxy grout, inset the dowel, and remove excess epoxy.

3.3 VAPOR BARRIER

A. Except where membrane waterproofing is required, place interior concrete slabs on a continuous vapor barrier.

B. Lap joints 150 mm (6 inches) and seal with a compatible pressure-sensitive tape.

C. Patch punctures and tears.

3.4 PLACING CONCRETE

A. Remove water from excavations before concrete is placed. Remove hardened concrete, debris and other foreign materials from interior of forms, and from inside of mixing and conveying equipment. Obtain approval from Contracting Officer's Representative before placing concrete.

B. Install screeds at required elevations for concrete slabs.

C. Roughen and clean free from laitance, foreign matter, and loose particles before placing new concrete on existing concrete.

1. Blow-out areas with compressed air and immediately coat contact areas with adhesive in compliance with manufacturer's instructions.

D. Place structural concrete according to ACI 301 and ACI 318.

E. Convey concrete from mixer to final place of deposit by method that will prevent segregation or loss of ingredients. Do not deposit, in Work, concrete that has attained its initial set or has contained its water or cement more than 1 1/2 hours. Do not allow concrete to drop

freely more than 1500 mm (5 feet) in unexposed work nor more than 900 mm (3 feet) in exposed work.

F. Place and consolidate concrete in horizontal layers not exceeding 300 mm (12 inches) in thickness. Consolidate concrete by spading, rodding, and mechanical vibrator. Do not secure vibrator to forms or reinforcement. Continuously vibrate during placement of concrete.

G. Concrete Fill in Stair Tread and Landing Pans: Coat steel with bonding agent and fill pans with concrete. Reinforce with 2 inch by 2 inch by 1.6 mm (0.06 inch) welded wire mesh at midpoint.

H. Hot Weather Concrete Placement: As recommended by ACI 305.1 to prevent adversely affecting properties and serviceability of hardened concrete.

I. Cold Weather Concrete Placement: As recommended by ACI 306.1, to prevent freezing of thin sections less than 300 mm (12 inches) and to permit concrete to gain strength properly.

1. Do not use calcium chloride without written approval from Contracting Officer's Representative.

3.5 TOLERANCES

A. Slab on Grade Finish Tolerance: Comply with ACI 117, FF-number and FL-number method.

1. Paragraph 4.8.3, Class A 3 mm (1/8 inches) for offset in form-work.
2. Table R4.8.4, "Flat" 6 mm (1/4 inch) in 3 m (10 feet) for slabs.

3.6 PROTECTION AND CURING

A. Protect exposed surfaces of concrete from premature drying, wash by rain or running water, wind, mechanical damage, and excessive hot or cold temperatures.

B. Curing Methods: Cure concrete with curing compound using wet method with sheets.

C. Formed Concrete Curing: Wet the tops and exposed portions of formed concrete and keep moist until forms are removed.

1. If forms are removed before 14 days after concrete is cast, install sheet curing materials as specified above.

D. Concrete Flatwork Curing:

1. Install sheet materials according to the manufacturer's instructions.
   a. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

3.7 FINISHES

A. Vertical and Overhead Surface Finishes:

1. Surfaces Concealed in Completed Construction: As-cast; no additional finishing required.
2. Surfaces Exposed to View Scheduled for Paint Finish: Remove fins, burrs and similar projections by mechanical means approved by Contracting Officer's Representative flush with adjacent surface. Lightly rub with fine abrasive stone or hone. Use ample amount of water during rubbing without working up a lather of mortar or changing texture of concrete.
3. Surfaces Exposed to View in Finished Areas: Grout finish, unless otherwise shown, for uniform color and smooth finish treated.
   a. Remove laitance, fins and burrs.
   b. Scrub concrete with wire brushes. Clean stained concrete surfaces with hone or stone.
   c. Apply grout composed of 1 part Portland cement and 1 part clean, fine sand (smaller than 600 micro-m (No. 30) sieve). Work grout into surface of concrete with cork floats or fiber brushes until pits and honeycomb are filled.
   d. After grout has hardened, but is still plastic, remove surplus grout with sponge rubber float and by rubbing with clean burlap.
   e. In hot, dry weather fog spray surfaces with water to keep grout wet during setting period. Complete finished areas in same day. Confine limits of finished areas to natural breaks in wall surface. Do not leave grout on concrete surface overnight.

B. Slab Finishes:

1. Allow bleed water to evaporate before surface is finished. Do not sprinkle dry cement on surface to absorb water.
2. Scratch Finish: Rake or wire broom after partial setting slab surfaces to received bonded applied cementitious application, within 2 hours after placing, to roughen surface and provide permanent bond between base slab and applied cementitious materials.

   SPEC WRITER NOTE: Include float finish for exterior locations in warm climates.

3. Float Finish: Interior except as specified.
   a. Screen and float to smooth dense finish.
   b. After first floating, while surface is still soft, check surfaces for alignment using straightedge or template. Correct high spots

by cutting down with trowel or similar tool. Correct low spots by filling in with material same composition as floor finish. Remove any surface projections on floated finish by rubbing or dry grinding. Refloat slab to uniform sandy texture.

4. Steel Trowel Finish: Applied toppings, concrete surfaces to receive resilient floor covering or carpet, future floor roof and other monolithic concrete floor slabs exposed to view without other finish indicated or specified.
   a. Delay final steel troweling to secure smooth, dense surface, usually when surface can no longer be dented by fingers. During final troweling, tilt steel trowel at slight angle and exert heavy pressure on trowel to compact cement paste and form dense, smooth surface.
   b. Finished surface: Free from trowel marks. Uniform in texture and appearance.
5. Broom Finish: Finish exterior slabs, ramps, and stair treads with bristle brush moistened with clear water after surfaces have been floated.
6. Finished Slab Flatness (FF) and Levelness (FL):
   a. Slab on Grade: Specified overall value FF 25/FL 20. Minimum local value FF 17/FL 15.
   b. Test flatness and levelness according to ASTM E1155.

3.8 SURFACE TREATMENTS

A. Mix and apply the following surface treatments according to manufacturer's instructions.
   1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

B. Liquid Densifier/Sealer: Use for exposed concrete floors and concrete floors to receive carpeting except those specified to receive non-slip finish .

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SECTION 04 01 00
MAINTENANCE OF MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Repointing existing damaged masonry joints.
2. Replacing existing damaged masonry units.

1.2 RELATED WORK

A. Section 04 05 13, MASONRY MORTARING: Mortars for new masonry.

1.3 APPLICABLE PUBLICATIONS

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

B. ASTM International (ASTM):

C67/C67M-20.....Sampling and Testing Brick and Structural Clay Tile.

C144-18.....Aggregate for Masonry Mortar.

C150/C150M-20.....Specification for Portland Cement.

C207-18 - .....Hydrated Lime for Masonry Purposes

C216-19 - .....Facing Brick (Solid Masonry Units Made from Clay or Shale)

C270-19ae1.....Mortar for Unit Masonry

C295/C295M-19.....Petrographic Examination of Aggregates for Concrete

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. Replacement units indicating manufacturer recommendation for each application.

C. Samples:

1. Pointing Mortar: Molded, 150 mm (6 inches) long for each type, texture, and color.

D. Test reports:

1. Preconstruction test results of existing masonry mortar and units.
2. Recommended mortar mix and mortar materials sources.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. Documented experience in completion of work, similar in design, material, and extent specified.

B. Preconstruction Testing:

1. Existing Brick: according to ASTM C67.
2. Existing Mortar: according to ASTM C295/C295M.
   a. Recommend mortar mix compatible with existing mortar and mortar material sources required to match existing color and texture.

C. Mockups: Prepare 48 inch by 48 inch mockup for each individual building area requiring tuck pointing demonstrating quality and aesthetics of tuck pointing, masonry unit replacement, and cleaning.

1.6 DELIVERY

A. Deliver products in manufacturer's original sealed packaging.

B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, production run number, and manufacture date.

C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.7 STORAGE AND HANDLING

A. Store materials covered, protected from weather, and elevated above grade.

1. Prevent contamination of aggregates.

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

1.8 FIELD CONDITIONS

A. Environment:

1. Cold Weather Requirements: Maintain mortar ingredients and substrate within temperature range between 4 degrees C (40 degrees F) and 49 degrees C (120 degrees F) when outside temperature is less than 4 degrees C (40 degrees F).
2. Hot Weather Requirements: Protect mortar-joint from evaporation of moisture from mortar material. When required, provide adequately shaded work area.

1.9 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Mortar Components:

1. Hydrated Lime: ASTM C207, Type S.

2. Aggregate: ASTM C144.
3. Portland Cement: ASTM C150/C150M, Type I.
4. Water: Potable, free of substances that are detrimental to grout, masonry, and metal.

2.2 PRODUCTS - GENERAL

A. Provide each product from one manufacturer and from one production run.

2.3 REPLACEMENT MASONRY UNITS

A. Face Brick:
1. ASTM C216, Grade SW, Type FBS matching existing sizes, textures, and colors for each individual building area.
2. Efflorescence: Rated slight efflorescent when tested according to ASTM C67.

B. Other Masonry Units: Match existing.

2.4 MIXES

A. Tuck Pointing Mortar: ASTM C270;
1. Type N.

2.5 ACCESSORIES

A. Cleaning Agent: Soapless, non-acidic, detergent, specially prepared for cleaning brick and limestone masonry.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.
B. Protect existing construction and completed work from damage.
1. Protect site and building elements from mortar droppings and cleaning operations.

C. Remove existing fixtures and fittings concealing masonry joints to permit repointing and repair.

3.2 EXISTING MORTAR JOINTS

A. Cut out existing bed and head mortar joints, to uniform depth of 19 mm (3/4 inches), or to sound mortar without damaging edges and faces of existing masonry units to remain.
B. Remove dust and debris from joints.
1. Do not rinse when temperature is below freezing.

3.3 TUCK POINTING

A. Dampen joints immediately before tuck pointing. Allow masonry units to absorb surface water.
B. Tightly pack tuck pointing mortar into joints in thin layers, 6 mm (1/4 inch) thick, maximum.

C. Allow layer to become slightly hardened before applying next layer.

D. Pack final layer flush with surfaces of masonry units.

3.4 MASONRY UNIT REPLACEMENT

A. Cut out mortar joints surrounding masonry units requiring replacement.

1. Remove existing masonry units creating opening for replacement masonry unit installation.
2. Where large portions of brick are removed, provide temporary support of brick above opening. Do not remove temporary support until mortar has set and reached bearing capacity.
3. Remove mortar, dust, and debris from opening perimeter surfaces.
4. Prevent debris from falling into cavity.

B. Dampen surfaces of surrounding existing masonry before installing replacement masonry units.

1. Allow existing masonry to absorb surface moisture before installing replacement units.
2. Butter contact surfaces of existing masonry and replacement masonry units with mortar.
3. Center replacement masonry units in opening and press into position.
4. Remove excess mortar.
5. Tuck point replacement masonry units to ensure full head and bed joints.

3.5 JOINT TOOLING

A. Tool repointed and replaced masonry joints when mortar becomes slightly hardened.

B. Produce smooth, compacted, joint matching existing unless otherwise noted.

3.6 CLEANING

A. Remove mortar splatter from exposed surfaces immediately.

B. Clean exposed masonry surfaces on completion.

C. Remove mortar droppings and other foreign substances from wall surfaces.

D. Wet surfaces with clean water.

E. Wash with cleaning agent.

F. Brush masonry surfaces with stiff fiber brushes while washing.

G. Immediately after washing, rinse with clean water.

1. Remove traces of detergent, foreign streaks or stains.

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SECTION 04 05 13
MASONRY MORTARING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Masonry mortar installed by other masonry sections.

1.2 RELATED REQUIREMENTS

A. Mortar used in Section:

1. Section 04 01 00, MAINTENANCE OF MASONRY.
2. Section 04 05 16, MASONRY GROUTING.
3. Section 04 20 00, UNIT MASONRY.
4. Section 04 72 00, CAST STONE MASONRY.

1.3 APPLICABLE PUBLICATIONS

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

B. ASTM International (ASTM):

1. C40/C40M-11 - Organic Impurities in Fine Aggregates for Concrete.
2. C91/C91M-12 - Masonry Cement.
3. C144-11 -Aggregate for Masonry Mortar.
4. C150/C150M-15 - Portland Cement.
5. C207-06(2011) - Hydrated Lime for Masonry Purposes.
6. C270-14a - Mortar of Unit Masonry.
7. C595/C595M-15e1 - Blended Hydraulic Cements.
8. C780-15 - Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
9. C979/C979M-10 - Pigments for Integrally Colored Concrete.
10. C1329/C1329M-15 - Mortar Cement.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:

1. Description of each product.

C. Certificates: Certify each product complies with specifications.

1. Portland cement.
2. Masonry cement.
3. Mortar cement.
4. Hydrated lime.
5. Fine aggregate.

6. Color admixture.

D. Qualifications: Substantiate qualifications comply with specifications.

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 masonry materials under waterproof covers on planking clear of ground.

1. Protect loose, bulk materials from contamination.

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

1.7 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Hydrated Lime: ASTM C207, Type S.

B. Aggregate for Masonry Mortar: ASTM C144 and as follows:

1. Light colored sand for mortar for laying face brick.

2. White plastering sand meeting sieve analysis for mortar joints for pointing except that 100 percent passes No. 8 sieve, and maximum 5 percent retained on No. 16 sieve.

3. Test sand for color value according to ASTM C40/C40M. Sand producing color darker than specified standard is unacceptable.

C. Blended Hydraulic Cement: ASTM C595/C595M, Type IS, IP.

D. Masonry Cement: ASTM C91/C91M. Type N, S, Or M.

1. Use white masonry cement whenever white mortar is specified.

E. Mortar Cement: ASTM C1329/C1329M, Type N, S or M.

F. Portland Cement: ASTM C150/C150M, Type I.

1. Use white Portland cement wherever white mortar is specified.

G. Pigments: ASTM C979/C979M; inorganic, inert, mineral pigments only, unaffected by atmospheric conditions, nonfading, alkali resistant, and water insoluble.

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

2.2 PRODUCTS - GENERAL

A. Provide each product from one manufacturer and from one production run.

2.3 MIXES

A. Pointing Mortar for New Work:
   1. For Cast Stone: Proportion by volume; one part white Portland cement, two parts white sand, and 1/5 part hydrated lime.

B. Tuck Pointing Mortar for Repair Work: Tuck pointing mortar specified in Section 04 01 00, MAINTENANCE OF MASONRY.

C. Masonry Mortar: ASTM C270.
   1. Admixtures:
      a. Do not use mortar admixtures, and color admixtures unless approved by Contracting Officer's Representative.
      b. Do not use antifreeze compounds.

D. Colored Mortar:
   1. Maintain uniform mortar color for exposed work, throughout.
   2. Alteration Work Mortar Color: Match existing mortar.

E. Color Admixtures:
   1. Proportion as specified by manufacturer.
   2. For color, match existing adjacent surfaces.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.

B. Protect existing construction and completed work from damage.

3.2 MIXING

A. Measure ingredients by volume using known capacity container.

B. Mix for 3 to 5 minutes in a mechanically operated mortar mixer.

C. Mix water with dry ingredients in sufficient amount to provide a workable mixture which will adhere to vertical surfaces of masonry units.

D. Mortar Stiffened Because of Water Loss Through Evaporation:
   1. Re-temper by adding water to restore to proper consistency and workability.
   2. Discard mortar reaching initial set or unused within two hours of mixing.

E. Pointing Mortar:
   1. Mix dry ingredients with enough water to produce damp mixture of workable consistency retaining shape when formed into ball.
   2. Allow mortar to stand in dampened condition for 60 to 90 minutes.
   3. Add water to bring mortar to a workable consistency before use.

3.3 MORTARING

A. Type S Mortar: Use for masonry below grade and setting cast stone units.

B. Type N Mortar: Use for other masonry work.

C. Type N Mortar: Use for pointing items and tuck pointing specified.

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SECTION 04 05 16
MASONRY GROUTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Grout for filling hollow concrete masonry cores.

1.2 RELATED WORK

A. Section 04 20 00, UNIT MASONRY: Grout

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section

American National Standards Institute (ANSI):

A118.6-19 - .....Standard Cement Grouts for Tile Installation.

B. ASTM International (ASTM):

C40/C40M-20 - .....Organic Impurities in Fine Aggregates for Concrete.

C150/C150M-20 - .....Portland Cement.

C207-18 - .....Hydrated Lime for Masonry Purposes.

C404-18 - .....Aggregates for Masonry Grout.

C476-20 - .....Grout for Masonry.

C595/C595M-20 - .....Blended Hydraulic Cement.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. All items indicated below are required submittals requiring Contracting Officer’s Representative (COR) review and approval.

B. Manufacturer's Literature and Data:

1. Description of each product.

C. Test Reports: Certify each product complies with specifications.

1. Grout, each type.
2. Cement.
3. Aggregate.

D. Certificates: Certify each product complies with specifications.

1. Blended hydraulic cement.
2. Portland cement.
3. Grout.
4. Hydrated lime.
5. Aggregate.

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.

1.6 STORAGE AND HANDLING

A. Store masonry materials under waterproof covers on planking clear of ground, and protect damage from handling, dirt, stain, water and wind.

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

1.7 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Grout Components:

1. Hydrated Lime: ASTM C207, Type S.
2. Aggregate For Masonry Grout: ASTM C404, Size 8.
3. Blended Hydraulic Cement: ASTM C595, Type IS, IP.
4. Portland Cement: ASTM C150, Type I.
5. Water: Potable, free of substances that are detrimental to grout, masonry, and metal.

2.2 PRODUCTS - GENERAL

A. Provide each product from one manufacturer.

2.3 MIXES

A. Grout: ASTM C476; fine grout and coarse grout.

B. Ready-Mixed Grout: ANSI A118.8.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.

B. Protect existing construction and completed work from damage.

C. Clean mortar from masonry cells protruding more than 13 mm (1/2 inch) to permit grout flow.

D. Remove debris from grout spaces.

E. Verify reinforcement is correctly placed before placing grout.

3.2 MIXING

A. Mix grout in mechanically operated mixer.

1. Mix grout for five minutes, minimum.

B. Measure ingredients by volume using container of known capacity.

C. Mix water with grout dry ingredients.

1. Slump Range: 200 to 275 mm (8 to 11 inches).

3.3 GROUTING

A. Install grout according to Section 04 20 00, UNIT MASONRY.

B. Use fine grout for filling wall cavities and hollow concrete masonry units where smallest cell dimension is 50 mm (2 inches) or less.

C. Use either fine grout or coarse grout for filling wall cavities and hollow concrete masonry units where smallest cell dimension is greater than 50 mm (2 inches).

D. Use grout for filling bond beam or lintel units.

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SECTION 04 20 00
UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Concrete masonry unit (CMU) assemblies for:
   1. Exterior walls.

1.2 RELATED REQUIREMENTS

A. Sealants and Sealant Installation: Section 07 92 00, JOINT SEALANTS.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.
B. American Concrete Institute (ACI):
   1. 315-99 - Details and Detailing of Concrete Reinforcement.
   2. 530.1/ASCE 6/TMS 602-13 - Specification for Masonry Structures.
C. ASTM International (ASTM):
   1. A615/A615M-15ae1 - Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
   2. A951/A951M-14 - Steel Wire for Masonry Joint Reinforcement.
   3. A1064/A1064M-15 - Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
   4. C90-14 - Load-Bearing Concrete Masonry Units.
   5. C126-15 - Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units.
   6. C216-15 - Facing Brick (Solid Masonry Units Made From Clay or Shale).
   7. F1667-15 - Driven Fasteners: Nails, Spikes, and Staples.
D. American Welding Society (AWS):
   1. D1.4/D1.4M-11 - Structural Welding Code - Reinforcing Steel.
E. Federal Specifications (Fed. Spec.):
   1. FF-S-107C(2) - Screws, Tapping and Drive.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
B. Submittal Drawings:
   1. Fabrication, bending, and placement of reinforcing bars. Comply with ACI 315. Show bar schedules, diagrams of bent bars, stirrup spacing, lateral ties and other arrangements and assemblies.
   2. Special masonry shapes, profiles, and placement.

3. Masonry units for typical window and door openings, and, for special conditions as affected by structural conditions.

C. Manufacturer's Literature and Data:
1. Description of each product.
2. Installation instructions.

D. Samples:
1. Face brick: Sample panel, 200 mm by 400 mm (8 inches by 16 inches,) showing full color range and texture of bricks, bond, and proposed mortar joints.
2. Anchors and Ties: Each type.
3. Joint Reinforcing: 1200 mm (48 inches) long each type.

E. Test reports: Certify products comply with specifications.

F. Certificates: Certify products comply with specifications.
1. Face brick.
2. Solid and load-bearing concrete masonry units.

1.5 QUALITY ASSURANCE

A. Welders and Welding Procedures Qualifications: AWS D1.4/D1.4M.

B. Mockups:
1. Before starting masonry, build a mockup panel minimum 1200 mm by 1200 mm (4 feet by 4 feet) with 600 mm (24 inch) 90 degree return for outside corner.
   a. Use masonry units from random cubes of units delivered on site.
   b. Include structural backup, reinforcing, ties, and anchors.
2. Mockup panel approved by Contracting Officer's Representative set workmanship and aesthetic quality for masonry work.
3. Clean sample panel to test cleaning methods.
4. Remove mockup panel when directed by Contracting Officer's Representative.

1.6 DELIVERY

A. Deliver products in manufacturer's original sealed packaging.

B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, production run number, and manufacture date.

C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.7 STORAGE AND HANDLING

A. Store products above grade, protected from contamination.

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

1.8 FIELD CONDITIONS

A. Hot and Cold Weather Requirements: Comply with ACI 530.1/ASCE 6/TMS 602.

1.9 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 PRODUCTS - GENERAL

A. Provide each product from one manufacturer.

2.2 UNIT MASONRY PRODUCTS

A. Brick:
   1. Face Brick:
      a. ASTM C216, Grade SW, Type FBS.
      b. Brick when tested according to ASTM C67: Classified slightly efflorescent or better.
      c. Size:
         1) To match existing.
   2. One Face Exposed: Grade S, Type I.
   3. Two Faces Exposed: Grade S, Type II.

B. Concrete Masonry Units (CMU):
   1. Hollow Load-Bearing Concrete Masonry Units: ASTM C90.
      a. Unit Weight: Normal weight .
   2. Sizes: Modular, 200 mm by 400 mm (8 inches by 16 inches) nominal face dimension; thickness as indicated on drawings.

2.3 ANCHORS, TIES, AND REINFORCEMENT

A. Steel Reinforcing Bars: ASTM A615/A615M; Grade 60, deformed bars.

B. Joint Reinforcement:
   1. Form from wire complying with ASTM A951/A951M.
   2. Hot dipped galvanized after fabrication.
   3. Width of joint reinforcement 40 mm (1.6 inches) less than nominal thickness of masonry wall or partition.
   4. Cross wires welded to longitudinal wires.
   5. Joint reinforcement minimum 3000 mm (10 feet) long, factory cut.

6. Joint reinforcement with crimp formed drip is not acceptable.
7. Maximum spacing of cross wires 400 mm (16 inch) to longitudinal wires.
8. Multiple Wythes and Cavity Wall Ties:
   a. Longitudinal wires 4 mm (0.16 inch), two in each wythe with ladder truss wires 4 mm (0.16 inch) overlay, welded to each longitudinal wire.

2.4 ACCESSORIES

A. Weeps:
   1. Weep Hole Wicks: Glass fiber ropes, 10 mm (3/8 inch) minimum diameter, 300 mm (12 inches) long.
   2. Weep Tubing: Round, polyethylene, 9 mm (3/8 inch) diameter, 100 mm (4 inches) long.
   3. Weep Hole: Flexible PVC louvered configuration with rectangular closure strip at top.

B. Preformed Compressible Joint Filler:
   1. Thickness and depth to fill joint.
   2. Closed Cell Neoprene: ASTM D1056, Type 2, Class A, Grade 1, B2F1.
   3. Non-Combustible Type: ASTM C612, Type 5, Max. Temp.1800 degrees F.

C. Masonry Cleaner:
   1. Detergent type cleaner selected for each type masonry.
   2. Acid cleaners are not acceptable.
   3. Use soapless type specially prepared for cleaning brick or concrete masonry as appropriate.

D. Fasteners:
   1. Concrete Nails: ASTM F1667, Type I, Style 11, 19 mm (3/4 inch) minimum length.
   2. Masonry Nails: ASTM F1667, Type I, Style 17, 19 mm (3/4 inch) minimum length.
   3. Screws: FS-FF-S-107, Type A, AB, SF thread forming or cutting.

E. Welding Materials: AWS D1.4/D1.4M, type to suit application.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

A. Install products according to manufacturer's instructions and approved submittal drawings.

1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

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

C. Wall Openings:

1. When items are not available when walls are built, prepare openings for subsequent installation.

D. Tooling Joints:

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

E. Wall, Furring, and Partition Units:

1. Lay out field units to provide running bond to match existing.
2. Align head joints of alternate vertical courses.
3. At sides of openings, balance head joints in each course on vertical center lines of openings.
4. Minimum Masonry Unit Length: 100 mm (4 inches).

F. Before connecting new masonry with previously laid masonry, remove loosened masonry or mortar, and clean and wet work in place as specified under wetting.

G. Wetting and Wetting Test:

1. Test and wet brick and clay tile according to BIA TN 11B.
2. Do not wet concrete masonry units before laying.

H. Temporary Formwork: Provide formwork and shores as required for temporary support of masonry elements.

I. Masonry Facing to Backup and Cavity Wall Ties:

1. Install joint reinforcing for multiple wythes and cavity wall ties spaced maximum 400 mm (16 inches) vertically.

3.2 INSTALLATION - REINFORCEMENT

A. Joint Reinforcement:

1. Install joint reinforcement in CMU wythe of combination brick and CMU, cavity walls, and single wythe concrete masonry unit walls or partitions.

2. Locate joint reinforcement in mortar joints at 400 mm (16 inch) maximum vertical intervals.
3. Additional joint reinforcement is required in mortar joints at both 200 mm (8 inches) and 400 (16 inches) above and below windows, doors, louvers and similar openings in masonry.

B. Steel Reinforcing Bars:
1. Install reinforcing bars in cells of hollow masonry units where required for vertical reinforcement and in bond beam units for horizontal reinforcement. Install in wall cavities of reinforced masonry walls where indicated on drawings.
2. Bond Beams:
a. Form Bond beams of load-bearing concrete masonry units filled with grout and reinforced with two No. 15m (No. 5) reinforcing bars unless shown otherwise. Do not cut reinforcement.
b. Brake bond beams only at expansion joints and at control joints, if shown.

3.3 INSTALLATION - BRICK EXPANSION AND CMU CONTROL JOINTS

A. Provide brick expansion joint (EJ) and CMU control joints (CJ) where indicated on drawings.
B. Keep joint free of mortar and other debris.
C. Joints Occur In Masonry Walls:
1. Install preformed compressible joint filler in brick wythe.
2. Install cross shaped shear keys in concrete masonry unit wythe with preformed compressible joint filler on both sides of shear key.
D. Use standard notched concrete masonry units (sash blocks) made in full and half-length units where shear keys are used to create a continuous vertical joint.
E. Interrupt joint reinforcement at expansion and control joints.
F. Fill opening in exposed face of expansion and control joints with sealant as specified in Section 07 92 00, JOINT SEALANTS.

3.4 INSTALLATION - BRICKWORK

A. Lay clay brick according to BIA TN 11B.
B. Laying:
1. Lay brick in bond pattern to match existing, unless indicated otherwise. Match bond of existing building on alterations and additions.
2. Maintain bond pattern throughout.

3. Do not use brick smaller than half-brick at any angle, corner, break, and jamb.
4. Where length of cut brick is greater than one half length, maintain vertical joint location.
5. Lay exposed brickwork joints symmetrical about center lines of openings.
6. Do not structurally bond multi-wythe brick walls, unless indicated on drawings.
7. Before starting work, lay facing brick on foundation wall and adjust bond to openings, angles, and corners.

C. Joints:
1. Exterior And Interior Joint Widths: Provide joint widths to match existing.
2. Rake joints for pointing to match existing.

D. Weep Holes:
1. Install weep holes at 600 mm (24 inches) on center in bottom of vertical joints of exterior masonry veneer or cavity wall facing over foundations, bond beams, and other water stops in wall.
2. Form weep holes using wicks made of mineral fiber insulation strips turned up 200 mm (8 inches) in cavity. Anchor top of strip to backup to securely hold in place.
3. Install sand or pea gravel in cavity approximately 75 mm (3 inches) high between weep holes.

E. Cavity Walls:
1. Keep air space clean of mortar accumulations and debris.
2. Lay the interior wythe of the masonry wall full height before laying outer wythe.
3. Insulated Cavity Type Exterior Walls:
   a. Install insulation against cavity face of inner masonry wythe.
   b. Place insulation between rows of ties or joint reinforcing. Adhere insulation to masonry surface with a bonding agent as recommended by insulation manufacturer.
   c. Lay outer masonry wythe up with air space between insulation and

3.5 INSTALLATION - CONCRETE MASONRY UNITS

A. Types and Uses:
1. Provide special concrete masonry shapes as required, including lintel and bond beam units and corner units. Provide solid concrete

masonry units, where full units cannot be installed, or where needed for anchorage of accessories.

2. Provide solid load-bearing concrete masonry units or grout cell of hollow units at jambs of openings in walls, where structural members impose loads directly on concrete masonry, and where shown.
3. Install concrete building brick only as filler in backup material where not exposed.

B. Laying:

1. Lay concrete masonry units with 9 mm (3/8 inch) joints, with a bond overlap of minimum 1/4 of unit length, except where stack bond is indicated on drawings.
2. Do not wet concrete masonry units before laying.
3. Bond external corners of partitions by overlapping alternate courses.
4. Lay first course in a full mortar bed.
5. Set anchorage items as work progress.
6. Where ends of anchors, bolts, and other embedded items, project into voids of units, completely fill voids with mortar or grout.
7. Lay concrete masonry units with full face shell mortar beds and fill head joint beds for depth equivalent to face shell thickness.
8. Lay concrete masonry units so cores of units, that are to be filled with grout, are vertically continuous with joints of cross webs of such cores completely filled with mortar. Unobstructed core openings minimum 50 mm (2 inches) by 75 mm (3 inches).
9. Do not wedge masonry against steel reinforcing. Minimum 13 mm (1/2 inch) clear distance between reinforcing and masonry units.
10. Install deformed reinforcing bars of sizes indicated on drawings.
11. At time of placement, ensure steel reinforcement is free of loose rust, mud, oil, and other contamination capable of affecting bond.
12. Place steel reinforcement at spacing indicated on drawings before grouting.
13. Minimum clear distance between parallel bars: One bar diameter.
14. Hold vertical steel reinforcement in place vertically by centering clips, caging devices, tie wire, or other approved methods.
15. Support vertical bars near each end and at maximum 192 bar diameter on center.
16. Splice reinforcement or attach reinforcement to dowels by placing in contact and securing with wire ties.

17. Stagger splices in adjacent horizontal reinforcing bars. Lap reinforcing bars at splices a minimum of 40 bar diameters.
18. Grout cells of concrete masonry units, containing reinforcing bars, solid as specified.
19. Install cavity and joint reinforcement as masonry work progresses.
20. Rake joints 6 to 10 mm (1/4 to 3/8 inch) deep for pointing with colored mortar when colored mortar is not full depth.

3.6 POINTING

A. Fill joints with pointing mortar using rubber float trowel to apply mortar solidly into raked joints.

B. Wipe off excess mortar from joints of glazed masonry units with dry cloth.

C. Tool exposed joints to match existing surfaces or as noted.

D. At joints with existing work, match existing joint.

3.7 GROUTING

A. Preparation:

1. Clean grout space of mortar droppings before placing grout.
2. Close cleanouts.
3. Install vertical solid masonry dams across grout space for full height of wall at intervals of maximum 9000 mm (30 feet). Do not bond dam units into wythes as masonry headers.
4. Verify reinforcing bars are installed as indicated on drawings.

B. Placing:

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

C. Puddling Method:

1. Consolidate by puddling with grout stick during and immediately after placing.

2. Grout cores of concrete masonry units containing reinforcing bars solid as masonry work progresses.

D. Low Lift Method:

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

3.8 PLACING REINFORCEMENT

A. General: Clean reinforcement of loose rust, mill scale, earth, ice or other materials which will reduce bond to mortar or grout. Do not use reinforcement bars with kinks or bends not shown on drawings or approved submittal drawings, or bars with reduced cross-section due to excessive rusting or other causes.

B. Position reinforcement accurately at spacing indicated on drawings. Support and secure vertical bars against displacement. Install horizontal reinforcement as masonry work progresses. Where vertical bars are shown in close proximity, provide clear distance between bars of minimum one bar diameter or 25 mm (1 inch), whichever is greater.

C. Splice reinforcement bars only where indicated on drawings, unless approved by Contracting Officer's Representative. Provide lapped splices. In splicing vertical bars or attaching to dowels, lap ends, place in contact and wire tie.

D. Provide minimum lap as indicated on approved submittal drawings, or if not indicated, minimum 48 bar diameters.

E. Embed metal ties in mortar joints as work progresses, with minimum mortar cover of 15 mm (5/8 inch) on exterior face of walls and 13 mm (1/2 inch) at other locations.

F. Embed prefabricated horizontal joint reinforcement as work progresses, with minimum cover of 15 mm (5/8 inch) on exterior face of walls and 13 mm (1/2 inch) at other locations. Lap joint reinforcement minimum 150 mm (6 inches) at ends. Use prefabricated “L” and “T” sections to provide continuity at corners and intersections. Cut and bend joint reinforcement for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.

G. Anchoring: Anchor reinforced masonry work to supporting structure as indicated on drawings.

H. Anchor reinforced masonry walls at intersections with non-reinforced masonry.

3.9 CONSTRUCTION TOLERANCES

A. Lay masonry units plumb, level and true to line within tolerances according to ACI 530.1/ASCE 6/TMS 602 and as follows:

B. Maximum variation from plumb:

1. In 3000 mm (10 feet) - 6 mm (1/4 inch).
2. In 6000 mm (20 feet) - 9 mm (3/8 inch).
3. In 12,000 mm (40 feet) or more - 13 mm (1/2 inch).

C. Maximum variation from level:

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

D. Maximum variation from linear building lines:

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

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

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

F. Maximum variation in prepared opening dimensions:

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

3.10 CLEANING AND REPAIR

A. General:

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

B. Brickwork:

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

C. Concrete Masonry Units:

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

- - E N D - -

SECTION 04 72 00
CAST STONE MASONRY

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies manufactured concrete units to simulate a natural stone.

B. Installation of cast stone units.

1.2 RELATED WORK

A. Section 04 05 13, MASONRY MORTARING, Setting and pointing mortar.

B. Section 04 05 16, MASONRY GROUTING, Setting and pointing mortar.

C. Section 07 92 00, JOINT SEALANTS, Joint sealant and application.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. All items indicated below are required submittals requiring Contracting Officer’s Representative (COR) review and approval.

B. Samples:

1. Cast stone, sample panel, size 100 by 300 by 300 mm (4 by 12 by 12 inches) each color and finish.
2. Show finish on two 100 mm (4-inch) edges and 300 by 300 mm (12 by 12 inch) surface.

C. Shop Drawings:

1. Cast stone showing exposed faces, profiles, cross sections, anchorage, reinforcing, jointing and sizes.
2. Setting drawings with setting mark.

D. Certificates: Test results indicating that the cast stone meets specification requirements and proof of plant certification.

E. Submit manufacturers test results of cast stone previously made by manufacturer.

F. Laboratory Data: Description of testing laboratories facilities and qualifications of its principals and key personnel.

G. List of jobs furnished by the manufacturer, which were similar in scope and at least three (3) years of age.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Store cast stone under waterproof covers on planking clear of ground.

B. Protect from handling, dirt, stain, and water damage.

C. Mark production units with the identification marks as shown on the shop drawings.

D. Package units and protect them from staining or damage during shipping and storage.

E. Provide an itemized list of product to support the bill of lading.

1.5 WARRANTY

A. Warranty exterior masonry walls against moisture leaks, any defects and subject to terms of "Warranty of Construction", FAR clause 52.246-21, except that warranty period shall be two years.

1.6 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by the basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.

B. Cast Stone Institute Technical Manual and Cast Stone Institute standard specifications.

C. ASTM International(ASTM):

A167-99(R2009).....Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

A615/A615M-20.....Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement

A1064/A1064M-18a.....Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete

C33/C33M-18.....Standard Specification for Concrete Aggregates

C150/C150M-20.....Standard Specification for Portland Cement

C568/C568M-15.....Standard Specification for Limestone Dimension Stone

C979/C979M-16.....Standard Specification for Pigments for Integrally Colored Concrete

C1194-19.....Standard Test Method for Compressive Strength of Architectural Cast Stone

C1195-19a.....Standard Test Method for Absorption of Architectural Cast Stone

C1364-19.....Standard Specification for Architectural Cast Stone.

D2244-16.....Standard Practice for Calculation of Color Differences from Instrumentally Measured Color Coordinates.

1.7 QUALITY ASSURANCE

A. The Manufacturer:

1. Must have 5 years minimum continuous operating experience and have facilities for manufacturing cast stone as described herein. Manufacturer shall have sufficient plant facilities to produce the shapes, quantities and size of cast stone required in accordance with the project schedule.

B. Stone setter: Must have 5 years' experience setting cast or natural building stone.

C. Testing: One (1) sample from production units may be selected at random from the field for each 500 cubic feet (14 meters squared) delivered to the job:

1. Three (3) field cut cube specimens from each of these sample shall have an average minimum compressive strength of not less than 85 percent with no single specimen testing less than 75 percent of design strength as specified.
2. Three (3) field cut cube specimens from each of these samples shall have an average maximum cold-water absorption of 6 percent.
3. Field specimens shall be tested in accordance with ASTMC 1194 and C 1195.
4. Manufacturer shall submit a written list of projects similar and at least three (3) years of age, along with owner, architect and contractor references.

1.8 MANUFACTURING TOLERANCES

A. Cross section dimensions shall not deviate by more than + 1/8 inch (3 mm) from approved dimension.

B. Length of units shall not deviate by more than length /360 or + 1/8 inch (3mm), whichever is greater, not to exceed + 1/4 inch (6 mm). Maximum length of any unit shall not exceed 15 times the average thickness of such unit unless otherwise agreed by the manufacturer.

C. Warp bow or twist of units shall not exceed length/360 or + 1/8 inch (3 mm), whichever is greater.

D. Location of dowel holes, anchor slots, flashing grooves, false joints and similar features – On formed sides of unit, 1/8 inch (3 mm), on unformed sides of unit, 3/8 inch (9 mm) maximum deviation.

PART 2 - PRODUCTS

2.1 ARCHITECTURAL CAST STONE

A. Comply with ASTM C 1364

B. Physical properties: Provide the following:
   1. Compressive Strength – ASTM C 1194: 6,500 psi (45 Mpa) minimum for products at 28 days.
   2. Absorption – ASTM C 1195: 6 percent maximum by the cold water method, or 10 percent maximum by the boiling method for products as 28 days.
   3. Air Content – ASTM C173 or C231, for wet cast product shall be 4-8 percent for units exposed to freeze-thaw environments. Air entrainment is not required for vibrant dry tamp (VDT) products.
   4. Freeze thaw - ASTM C 1364L The cumulative percent weight loss (CPWL) shall be less than 5 percent after 300 cycles of freezing and thawing.
   5. Linear Shrinkage - ASTM C 426L Shrinkage shall not exceed 0.065 percent.

2.2 RAW MATERIALS

A. Portland cement – Type I or Type III, white and/or grey, ASTM C 150.
B. Coarse aggregates – Granite, quartz or limestone, ASTM C 33, except for gradation, and are optional for the vibrant dry tamp (VDT) casting method.
C. Fine aggregates – Manufactured or natural sands, ASTM C 33, except for gradation.
D. Colors – Inorganic iron oxide pigments, ASTM C 979 except that carbon black pigments shall not be used.
E. Admixtures- Comply with the following:
   1. ASTM C 260 for air-entraining admixtures.
   2. ASTM C 494/C 495 M Types A-G for water reducing, retarding, accelerating and high range admixtures.
   3. Other admixtures: integral water repellents and other chemicals, for which no ASTM Standard exists, shall be previously established as suitable for use in concrete by proven field performance or through laboratory testing.
   4. ASTM C 618 mineral admixtures of dark and variable colors shall not be used in surfaces intended to be exposed to view.
   5. ASTM C 989 granulated blast furnace slag may be used to improve physical properties. Tests are required to verify these features.
F. Water – Potable
G. Reinforcing bars:

1. ASTM A 615/A 615M. Grade 40 or 60 steel galvanized or epoxy coated when cover is less than 1.5 inch (37 mm).
2. Welded Wire Fabric: ASTM A 1064 where applicable for wet cast units.

H. All anchors, dowels and other anchoring devices and shims shall be standard building stone anchors commercially available in a non-corrosive material such as zinc plated, galvanized steel, brass, or stainless steel Type 302 or 304.

2.3 COLOR AND FINISH

A. Match color and finish of existing cast stone units.

B. All surfaces intended to be exposed to view shall have a fine-grained texture similar to natural stone, with no air voids in excess of 1/32 inch (0.8 mm) and the density of such voids shall be less than 3 occurrences per any 1 inch (25 mm) and not obvious under direct daylight illumination at a 5 feet (1.5 meters) distance.

C. Units shall exhibit a texture approximately equal to the approved sample when viewed under direct daylight illumination at a 10 feet (3 meters) distance.

D. ASTM D 2244 permissible variation in color between units of comparable age subjected to similar weathering exposure.

1. Total color difference - not greater than 6 units.
2. Total hue difference-not greater than 2 units.

2.4 REINFORCING

A. Reinforce the units as required for safe handling and structural stress.

1. Minimum reinforcing shall be 0.25 percent of the cross section area.

B. Reinforcement shall be non-corrosive where faces exposed to weather are covered with less than 1.5inch (38 mm) of concrete material. All reinforcement shall have minimum coverage of twice the diameter of the bars.

C. Minor chipping resulting from shipment and delivery shall not be grounds for rejection. Minor chips shall not be obvious under direct daylight illumination from a 20 foot (6 meter) distance.

D. The occurrence of crazing or efflorescence shall not constitute a cause for rejection.

E. Remove cement film, if required, from exposed surface prior to packaging for shipment.

2.5 CURING

A. Cure units in a warm curing chamber 100 degrees F (37.8 degrees C) at 95 percent relative humidity for approximately 12 hours, or cure in a 95 percent moist environment at a minimum 70 degrees F (21.1 degrees C) for 16 hours after casting. Additional yard curing at 95 percent relative humidity shall be 350-degree-days (i.e. 7 days @ 50 degrees F (10.0 degrees C) or 5 days @ 70 degrees F (21.0 degrees C) prior to shipping. Form cured units shall be protected from moisture evaporation with curing blankets or curing compounds after casting.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Installing contractor shall check cast stone materials for fit and finish prior to installation. Do not set unacceptable units.

3.2 SETTING TOLERANCES

A. Comply with Cast Stone Institute Technical Manual.

B. Set stones 1/8 inch (3 mm) or less, within the plane of adjacent units.

C. Joints, plus - 1/6 inch (1.5 mm), minus - 1/8 inch (3 mm).

3.3 JOINTING

A. Joint size: To match existing joints.

B. Joint Materials:

1. Mortar, Type N, ASTM C 270.
2. Use a full bed of mortar at all bed joints.
3. Flush vertical joints in units other than coping units full with mortar.
4. Leave all joints with exposed tops or under relieving angles open for sealant.
5. Leave head joints in coping and projecting components open for sealant.

C. Location of joints:

1. As shown on shop drawings.
2. At control and expansion joints unless otherwise shown.

3.4 SETTING

A. Drench units with clean water prior to setting.

B. Fill dowel holes and anchor slots completely with non-shrink grout.

C. Set units in full bed of mortar, unless otherwise detailed.

D. Rake mortar joints 3/4 inch (18 mm) for pointing or sealant as noted in drawings.

E. Remove excess mortar from unit faces immediately after setting.

F. Tuck point unit joints to a slight concave profile.

3.5 JOINT PROTECTION

A. Comply with requirements of Section 07 92 00, JOINT SEALANTS.

B. Prime ends of units, insert properly sized backing rod and install required sealant.

3.6 REPAIR AND CLEANING

A. Repair chips with touchup materials furnished by manufacturer.

B. Saturate units to be cleaned prior to applying an approved masonry cleaner.

C. Consult with manufacturer for appropriate cleaners.

3.7 INSPECTION AND ACCEPTANCE

A. Inspect finished installation according to Bulletin #36 published by the Cast Stone Institute.

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SECTION 05 12 00
STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Structural steel shapes, plates, and bars.
   2. Structural pipe.
   3. Bolts, nuts, and washers.

1.2 RELATED REQUIREMENTS

A. Materials Testing and Inspection During Construction: Section 01 45 29, TESTING and LABORATORY SERVICES.

B. Steel Decking: Section 05 31 00, STEEL DECKING.

1.3 APPLICABLE PUBLICATIONS

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

B. American Institute of Steel Construction (AISC):
   1. AISC Manual - Steel Construction Manual, 14th Ed.
   2. 303-10 - Code of Structural Steel Buildings and Bridges.
   3. 360-10: Specification for Structural Steel Buildings.

C. The American Society of Mechanical Engineers (ASME):
   1. B18.22.1-09 - Washers: Helical Spring-Lock, Tooth Lock, and Plain Washers.

D. American Welding Society (AWS):
   1. D1.1/D1.1M-15 - Structural Welding Code - Steel.

E. ASTM International (ASTM):
   1. A6/A6M-14 - General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling.
   2. A36/A36M-14 - Carbon Structural Steel.
   3. A53/A53M-12 - Pipe, Steel, Black and Hot-Dip, Zinc-Coated, Welded and Seamless.
   4. A123/A123M-15 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   5. A242/A242M-13 - High-Strength Low-Alloy Structural Steel.
   6. A283/A283M-13 - Low and Intermediate Tensile Strength Carbon Steel Plates.
   7. A307-14 - Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength.

8. A500/A500M-13 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing and Rounds and Shapes.
9. A501/A501M-14 - Hot-Formed Welded and Seamless Carbon Steel Structural Tubing and Rounds and Shapes.
10. A572/A572M-15 - High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
11. A992/A992M-15 - Structural Shapes.
12. F2329/F2329M-15 - Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy steel Bolts, Screws, washers, Nuts, and Special Threaded Fasteners.
13. F3125/F3125M-15 - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions

F. Master Painters Institute (MPI):
1. No. 18 - Primer, Zinc Rich, Organic.

G. Military Specifications (Mil. Spec.):
1. MIL-P-21035 - Paint, High Zinc Dust Content, Galvanizing, Repair.

H. Occupational Safety and Health Administration (OSHA):
1. 29 CFR 1926.752(e) - Guidelines For Establishing The Components Of A Site-Specific Erection Plan.
2. 29 CFR 1926-2001 - Safety Standards for Steel Erection.

I. Research Council on Structural Connections (RCSC) of The Engineering Foundation:
1. Specification for Structural Joints Using ASTM F3125 Bolts.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submittal Drawings:
1. Show size, configuration, and fabrication and installation details.

C. Sustainable Construction Submittals:
1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.

D. Test Reports: Certify products comply with specifications.
1. Welders' qualifying tests.

E. Certificates: Certify each product complies with specifications.
1. Structural steel.
2. Steel connections.

3. Welding materials.
4. Shop coat primer paint.

F. Qualifications: Substantiate qualifications comply with specifications.
1. Fabricator with project experience list.
2. Installer with project experience list.
3. Welders and welding procedures.

G. Delegated Design Drawings and Calculations: Signed and sealed by responsible Architect/Engineer.
1. Connection calculations.

H. Record Surveys: Signed and sealed by responsible surveyor or engineer.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: AISC Quality Certification participant designated as AISC Certified Plant, Category STD.
1. Regularly fabricates specified products.
2. Fabricated specified products with satisfactory service on five similar installations for minimum five years.
a. Project Experience List: Provide contact names and addresses for completed projects.

B. Installer Qualifications: AISC Quality Certification Program participant designated as AISC-Certified Erector, Category ACSE.
1. Regularly installs specified products.
2. Installed specified products with satisfactory service on five similar installations for minimum five years.
a. Project Experience List: Provide contact names and addresses for completed projects.

C. Before commencement of Work, ensure steel erector provides written notification required by OSHA 29 CFR 1926.752(e). Submit a copy of the notification to Contracting Officer's Representative.

D. Welders and Welding Procedures Qualifications: AWS D1.1/D1.1M.

1.6 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

A. Delegated Design: Prepare submittal documents including design calculations and drawings signed and sealed by registered design professional, licensed in state where project is located.

B. Design structural steel framing connections complying with specified performance:

1. Load Capacity: Resist loads indicated on drawings. Account for connection and member loads and eccentricities.
   a. Request additional design criteria when necessary to complete connection design.
2. Configuration: Design and detail all connections for each member size, steel grade and connection type to resist the loads and reactions indicated on the drawings or specified herein. Use details consistent with details shown on drawings, supplementing where necessary. The details shown on drawings are conceptual and do not indicate the required weld sizes or number of bolts unless specifically noted. Use rational engineering design and standard practice in detailing, accounting for all loads and eccentricities in both the connection and the members. Promptly notify the Contracting Officer Representative of any location where the connection design criteria is not clearly indicated. The design of all connections is subject to the review and acceptance of the Contracting Officer's Representative. Submit structural calculations prepared and sealed by a qualified engineer registered in the state where the project is located. Submit calculations for review before preparation of detail drawings.

2.2 MATERIALS

A. W-Shapes:

1. ASTM A992/A992M.

B. Channel and Angles:

1. ASTM A36/A36M.

C. Plates and Bars:

1. ASTM A36/A36M.
2. ASTM A572/A572M; Grade // 50.

D. Hollow Structural Sections:

1. ASTM A500/A500M.

E. Bolts, Nuts and Washers: Galvanized for galvanized framing and plain finish for other framing.
   1. High-strength bolts, including nuts and washers: ASTM F3125.
   2. Bolts and nuts, other than high-strength: ASTM A307, Grade A.
   3. Plain washers, other than those in contact with high-strength bolt heads and nuts: ASME B18.22.1.

F. Welding Materials: AWS D1.1, type to suit application.

2.3 PRODUCTS - GENERAL

A. Sustainable Construction Requirements:
   1. Steel Recycled Content: 30 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. Paints and coatings.

2.4 FABRICATION

A. Fabricate structural steel according to Chapter M, AISC 360.

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

2.5 FINISHES

A. Shop Priming:
   1. Prime paint structural steel according to AISC 303, Section 6.
      a. Interstitial Space Structural Steel: Prime paint, unless indicated to receive sprayed on fireproofing.

B. Shop Finish Painting: Apply primer and finish paint as specified in Section 09 91 00, PAINTING.

C. Do not paint:
   1. Surfaces within 50 mm (2 inches) of field welded joints.

2. Surfaces indicated to be encased in concrete.
3. Surfaces receiving sprayed on fireproofing.
4. Beam top flanges receiving shear connector studs applied.

D. Structural Steel Galvanizing: ASTM A123/A123M, hot dipped, after fabrication. Touch-up after erection: Clean and wire brush any abraded and other spots worn through zinc coating, including threaded portions of bolts and welds and touch-up with galvanizing repair paint.
1. Galvanize structural steel framing installed at exterior locations.

E. Bolts, Nuts, and Washers Galvanizing: ASTM F2329, hot-dipped.

2.6 ACCESSORIES

A. General: Shop paint steel according to AISC 303, Section 6.
B. Finish Paint System: Primer and finish as specified in Section 09 91 00, PAINTING.
C. Galvanizing Repair Paint: MPI No. 18.

PART 3 - EXECUTION

3.1 ERECTION

A. Erect structural steel according to AISC 303 and AISC 360.
B. Set structural steel accurately at locations and elevations indicated on drawings.
C. Maintain erection tolerances of structural steel within AISC 303 requirements.
1. Pour Stop Elevation Tolerance: 6 mm (1/4 inch), maximum, before concrete placement.

D. Weld and bolt connections as specified for shop connections.

3.2 FIELD PAINTING

A. After welding, clean and prime weld areas to match adjacent finish.
B. Touch-up primer damaged by construction operations.
C. Apply galvanizing repair paint to galvanized coatings damaged by construction operations.
D. Finish Painting: As specified in Section 09 91 00, PAINTING.

3.3 FIELD QUALITY CONTROL

A. Record Survey:
1. Engage registered land surveyor or registered civil engineer as specified in Section 01 00 00, GENERAL REQUIREMENTS to perform survey.

2. Measure and record structural steel framing plumbness, level, and alignment after completing bolting and welding and before installation of work supported by structural steel.
3. Identify deviations from allowable tolerances specified in AISC Manual.

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SECTION 05 31 00
STEEL DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Single pan fluted metal roof deck as roof substrate.

1.2 RELATED WORK

A. Section 01 81 13. SUSTAINABLE CONSTRUCTION REQUIREMENTS.

B. Section 05 12 00, STRUCTURAL STEEL FRAMING: Structural Steel Shapes.

C. Section 09 91 00, PAINTING: Finish Painting.

1.3 APPLICABLE PUBLICATIONS

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

B. AISI - American Iron and Steel Institute.

S100-16.....Specification for the Design of Cold-formed Steel Structural Members.

C. American Welding Society (AWS):

D1.1/D1.1M-20.....Structural Welding Code - Steel.

1.3/D1.3M-18..... Structural Welding Code - Sheet Steel.

D. ASTM International (ASTM):

A36/A36M-19.....Standard Specification for Carbon Structural Steel.

A653/A653M-20.....Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

A1008/A1008M-20.....Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Baked Hardenable.

C423-17.....Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

E119-20.....Standard Test Methods for Fire Tests of Building Construction and Materials.

E. FM Global (FM):

1-28-15.....Wind Design.

Factory Mutual Research Approval Guide.

F. Master Painters Institute (MPI):
No. 18.....Primer, Zinc Rich, Organic.

G. Military Specifications (Mil. Spec.):
MIL-P-21035B..... Paint, High Zinc Dust Content, Galvanizing Repair.

H. Steel Deck Institute (SDI):
No. 31-07.....Design Manual for Composite Deck, Form Decks, and Roof Decks.

I. UL LLC (UL):
Listed Online Certifications Directory.
580.....Tests for Uplift Resistance of Roof Assemblies.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. All items indicated below are required submittals requiring Contracting Officer’s Representative (COR) review and approval.

B. Submittal Drawings:
1. Show layout, connections to supporting members, anchorage, sump pans, accessories, deck openings and reinforcements.
2. Show similar information necessary for completing installation as shown and specified, including supplementary framing, ridge and valley plates, cant strips, cut openings, special jointing or other accessories.
3. Show welding, side lap, closure, deck reinforcing and closure reinforcing details.
4. Show openings required for work of other trades, including openings not shown on structural drawings. Indicate where temporary shoring is required to satisfy design criteria.

C. Manufacturer's Literature and Data:
1. Description of each product.
2. Show steel decking section properties and structural characteristics.

D. Sustainable Construction Submittals:

1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.

E. Certificates: Certify each product complies with specifications.

1. Fire Resistance Product Listing: For each metal deck type and thickness supporting concrete slab or fill.

2. Show steel decking is UL Listed for specified application.

3. Show noise reduction coefficient test results.

F. Qualifications: Substantiate qualifications comply with specifications.
   1. Welders and welding procedures.

G. Insurance Certification: Assist the Government in preparation and submittal of roof installation acceptance certification as may be necessary in connection with fire and extended coverage insurance.

1.5 QUALITY ASSURANCE

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

B. Welders and Welding Procedures Qualifications: AWS D1.3/D1.3M.

1.6 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

A. Design steel decking and accessories according to AISI S100.
   1. Wind Uplift Resistance and Corner Conditions:
      a. See Structural Documents for uplift loads.
   2. Fire Resistance: ASTM E119; Verify with Architect.
   3. Noise Reduction Coefficient (NRC): Minimum 0.90 when tested according to ASTM C423.
   4. Design side and end closures and attachment to supporting steel to safely support wet weight of concrete and construction loads.
   5. Cantilever Closure Deflection: 3 mm (1/8 inch), maximum.

2.2 MATERIALS

A. Galvanized Steel Sheet: ASTM A653/A653M; G60 coating.

B. Primer for Shop Painted Sheets: Manufacturer's standard primer (2 coats). When finish painting of steel decking is specified in Section 09 91 00, PAINTING primer coating shall be compatible with specified finish painting.

C. Steel Shapes: ASTM A36/A36M.

D. Acoustic Deck: Cellular deck profile, SDI Publication No. 31.

E. Acoustic Insulation: Manufacturer’s standard mineral fiber type, profile matching deck flute profile.

2.3 PRODUCTS - GENERAL

A. Sustainable Construction Requirements:

1. Steel Recycled Content: 30 percent total recycled content, minimum.

2.4 METAL ROOF DECK

A. Metal Roof Deck: UL Listed as metal roof deck panels.

1. Steel decking of the type, depth, thickness, and section properties as shown.
2. Deck Style:
   a. As indicated on drawings.
3. Depth and Thickness: As indicated on drawings.
4. Material: // Galvanized sheet steel.

B. Do not use steel deck for hanging supports of building components including suspended ceilings, electrical light fixtures, plumbing, heating, or air conditioning pipes or ducts or electrical conduits.

2.5 FABRICATION

A. Fabricate steel decking in sufficient lengths to extend over 3 or more supports, except for interstitial levels.

1. Cut metal deck units to proper length in shop.

B. Fabricate accessories required to complete installation of steel decking.

1. Exposed to View: Fabricate from sheet steel matching metal decking.
2. Concealed from View: Fabricate from galvanized sheet steel.

C. Sheet Metal Accessories:

1. Metal Cover Plates: For end-abutting decking, to close gaps at changes in deck direction, columns, walls and openings.
   a. Sheet Steel: Minimum 1.0 mm (0.04 inch) thick.
2. Continuous Sheet Metal Edging: At openings, concrete slab edges and roof deck edges.
   a. Sheet Steel: Minimum 1.0 mm (0.04 inch) thick.
3. Metal Closure Strips: For openings between decking and other construction. Form to configurations required to provide tight-fitting closures at open ends of flutes and sides of decking.
   a. Sheet Steel: Minimum 1.0 mm (0.04 inch) thick.

4. Ridge and Valley Plates: Minimum 100 mm (4 inch) wide ridge and valley plates where roof slope exceeds 1/24 (1/2 inch per foot).
   a. Sheet Steel: Minimum 1.0 mm (0.04 inch) thick.
5. Cant Strips: Provide bent metal 45 degree leg cant strips where indicated on the drawings. Fabricate cant strips with minimum 125 mm (5 inch) face width.
   a. Sheet Steel: Minimum 0.8 mm (0.03 inch) thick.
6. Seat Angles for Deck: Provide where beam does not frame into column.
7. Sump Pans for Roof Drains: Fabricated from single piece galvanized sheet steel with level bottoms and sloping sides to direct water flow to drain. Provide sump pans of adequate size to receive roof drains and with bearing flanges minimum 75 mm (3 inches) wide. Recess pans minimum 38 mm (1-1/2 inches) below roof deck surface, unless otherwise shown or required by deck configuration. Drain holes will be field cut.
   a. Sheet Steel: Minimum 1.7 mm (0.06 inch) thick.

2.6 FINISHES

A. Shop prime painted sheet steel with two coats of primer.

2.7 ACCESSORIES

A. Primer: Manufacturer's standard primer compatible with finish painting specified in Section 09 91 00, PAINTING.
B. Welding Materials: AWS D1.1, type to suit application.
C. Galvanizing Repair Paint: MPI No. 18.
D. Touch-Up Paint: Match shop finish.

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. Remove contaminates from structural steel surfaces where steel decking will be welded.
D. Verify structural steel framing installation is completed, plumbed, and aligned with temporary bracing installed where required.
E. Coordinate with structural steel erector to prevent overloading of structural members when placing steel decking for installation.

3.2 ERECTION

A. Do not use floor deck units for storage or working platforms until permanently secured. Do not overload deck units once placed. Replace

deck units that become damaged after erection and before casting concrete at no cost additional to the Government.

B. Place steel decking at right angles to supporting members with ends located over supports.

C. Lap end joints 50 mm (2 inches), minimum.

End Closure Fastening: Tack weld or self-tapping No. 8 or larger machine screws at 900 mm (3 feet) on center.

a. Longitudinal End Closure Fastening: Tack weld only.

2. Weld side laps of adjacent decking units.

a. Fastener Locations: Mid-span and maximum 900 mm (3 feet) on center.

D. Roof Deck Fastening:

1. Fasten decking to steel supporting members by welding.

a. Welds: 16 mm (5/8 inch) diameter puddle welds or elongated welds of equal strength.

b. Weld Spacing: as shown on Drawings.

2. Fasten split or partial decking panels to structure in every valley.

3. Fasten decking to each supporting member at ribs where side laps occur.

a. Power driven fasteners are acceptable in lieu of welding if strength equivalent to welding specified above is provided. Submit test data and design calculations verifying equivalent design strength.

4. Mechanically fasten decking side laps with self-tapping No. 8 or larger machine screws.

a. Fastener Locations: As shown on Drawings.

E. Cutting and Fitting:

1. Field cut steel decking to accommodate columns and other penetrating items.

2. Cut openings located and dimensioned on Structural Drawings.

3. Coordinate openings for other penetrations shown on approved submittal drawings but not shown on Structural Drawings.

a. Cut and reinforce required opening.

4. Make cuts neat and trim using metal saw, drill or punch-out device. Cutting with torches is prohibited.

5. Do not make cuts in the metal deck that are not shown on the approved metal decking submittal drawings.

a. When additional openings are required, submit scaled drawing, locating required opening and other openings and supports in immediate area.
b. Do not cut the opening until the drawing is approved by Contracting Officer's Representative.
c. Provide additional reinforcing and framing required for opening.
d. Failure to comply with these requirements is cause for rejection of the work and removal and replacement of the affected steel decking.

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

F. Touch up damaged factory finishes.
1. Apply galvanizing repair paint to damaged galvanized surfaces.
2. Apply touch up paint to damaged shop painted surfaces.

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SECTION 05 50 00
METAL FABRICATIONS

SPEC WRITER NOTE:

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies items and assemblies fabricated from structural steel shapes and other materials as shown and specified.

B. Items specified.

2. Frames
5. Gratings
11. Ladders
12. Railings
13. Screens.

1.2 RELATED WORK

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

1.3 SUBMITTALS

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

B. Manufacturer's Literature and Data:

Grating, each type	
	Screens

C. Shop Drawings:

1. Each item specified, showing complete detail, location in the project, material and size of components, method of joining various components and assemblies, finish, and location, size and type of anchors.
2. Mark items requiring field assembly for erection identification and furnish erection drawings and instructions.
3. Provide templates and rough-in measurements as required.

D. Manufacturer's Certificates:

2. Live load designs as specified.

E. Design Calculations for specified live loads including dead loads.

F. Furnish setting drawings and instructions for installation of anchors to be preset into concrete and masonry work, and for the positioning of items having anchors to be built into concrete or masonry construction.

1.4 QUALITY ASSURANCE

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

B. Each product type shall be the same and be made by the same manufacturer.

C. Assembled product to the greatest extent possible before delivery to the site.

D. Include additional features, which are not specifically prohibited by this specification, but which are a part of the manufacturer's standard commercial product.

1.5 APPLICABLE PUBLICATIONS

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

B. American Society of Mechanical Engineers (ASME):

B18.6.1-97.....Wood Screws

B18.2.2-87(R2010).....Square and Hex Nuts

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

A36/A36M-14.....Structural Steel

A47-99(R2014).....Malleable Iron Castings

A48-03(R2012).....Gray Iron Castings

A53-12.....Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless

A123-15.....Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

A240/A240M-15.....Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels and for General Applications.

A307-14.....Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength

C1107-13.....Packaged Dry, Hydraulic-Cement Grout (Nonshrink)

F436-16.....Hardened Steel Washers

F468-06(R2015).....Nonferrous Bolts, Hex Cap Screws, Socket Head Cap Screws and Studs for General Use

F593-13.....Stainless Steel Bolts, Hex Cap Screws, and Studs

F1667-15.....Driven Fasteners: Nails, Spikes and Staples

D. American Welding Society (AWS):

D1.1-15.....Structural Welding Code Steel

D1.2-14.....Structural Welding Code Aluminum

D1.3-18.....Structural Welding Code Sheet Steel

E. National Association of Architectural Metal Manufacturers (NAAMM)

AMP 521-01(R2012).....Pipe Railing Manual

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

MBG 531-09(R2017).....Metal Bar Grating Manual

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

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

SP 1-15.....No. 1, Solvent Cleaning

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

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

G. Federal Specifications (Fed. Spec):

RR-T-650E.....Treads, Metallic and Nonmetallic, Nonskid

PART 2 - PRODUCTS

2.1 DESIGN CRITERIA

A. In addition to the dead loads, design fabrications to support the following live loads unless otherwise specified.

B. Ladders and Rungs: 120 kg (250 pounds) at any point.

C. Railings and Handrails: 900 N (200 pounds) in any direction at any point.

D. Gratings: 500 kg/m^2 (100 pounds per square foot).

2.2 MATERIALS

A. Structural Steel: ASTM A36.

B. Stainless Steel: ASTM A240, Type 302 or 304.

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

G. Malleable Iron Castings: A47.

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

K. Grout: ASTM C1107, pourable type.

L. Insect Screening: ASTM D3656.

2.3 HARDWARE

A. Rough Hardware:

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

B. Fasteners:

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

2.4 FABRICATION GENERAL

A. Material

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

B. Size:

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

C. Connections

1. Except as otherwise specified, connections may be made by welding, riveting or bolting.
2. Field riveting will not be approved.
3. Design size, number and placement of fasteners, to develop a joint strength of not less than the design value.
4. Holes, for rivets and bolts: Accurately punched or drilled and burrs removed.

5. Size and shape welds to develop the full design strength of the parts connected by welds and to transmit imposed stresses without permanent deformation or failure when subject to service loadings.
6. Use Rivets and bolts of material selected to prevent corrosion (electrolysis) at bimetallic contacts. Plated or coated material will not be approved.
7. Use stainless steel connectors for removable members machine screws or bolts.

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

E. Workmanship
1. General:
   a. Fabricate items to design shown.
   b. Furnish members in longest lengths commercially available within the limits shown and specified.
   c. Fabricate straight, true, free from warp and twist, and where applicable square and in same plane.
   d. Provide holes, sinkages and reinforcement shown and required for fasteners and anchorage items.
   e. Provide openings, cut-outs, and tapped holes for attachment and clearances required for work of other trades.
   f. Prepare members for the installation and fitting of hardware.

g. Cut openings in gratings and floor plates for the passage of ducts, sumps, pipes, conduits and similar items. Provide reinforcement to support cut edges.
h. Fabricate surfaces and edges free from sharp edges, burrs and projections which may cause injury.

2. Welding:
   a. Weld in accordance with AWS.
   b. Welds shall show good fusion, be free from cracks and porosity and accomplish secure and rigid joints in proper alignment.
   c. Where exposed in the finished work, continuous weld for the full length of the members joined and have depressed areas filled and protruding welds finished smooth and flush with adjacent surfaces. All exposed welds are to be ground smooth to blend with adjacent surfaces before application of prime coat or galvanizing.
   d. Finish welded joints to match finish of adjacent surface.
3. Joining:
   a. Miter or butt members at corners.
   b. Where frames members are butted at corners, cut leg of frame member perpendicular to surface, as required for clearance.
4. Anchors:
   a. Where metal fabrications are shown to be preset in concrete, weld 32 x 3 mm (1-1/4 by 1/8 inch) steel strap anchors, 150 mm (6 inches) long with 25 mm (one inch) hooked end, to back of member at 600 mm (2 feet) on center, unless otherwise shown.
   b. Where metal fabrications are shown to be built into masonry use 32 x 3 mm (1-1/4 by 1/8 inch) steel strap anchors, 250 mm (10 inches) long with 50 mm (2 inch) hooked end, welded to back of member at 600 mm (2 feet) on center, unless otherwise shown.
5. Cutting and Fitting:
   a. Accurately cut, machine and fit joints, corners, copes, and miters.
   b. Fit removable members to be easily removed.
   c. Design and construct field connections in the most practical place for appearance and ease of installation.
   d. Fit pieces together as required.
   e. Fabricate connections for ease of assembly and disassembly without use of special tools.

f. Joints firm when assembled.
g. Conceal joining, fitting and welding on exposed work as far as practical.
h. Do not show rivets and screws prominently on the exposed face.
i. The fit of components and the alignment of holes shall eliminate the need to modify component or to use exceptional force in the assembly of item and eliminate the need to use other than common tools.

F. Finish:
1. Finish exposed surfaces in accordance with NAAMM AMP 500 Metal Finishes Manual.
3. Steel and Iron: NAAMM AMP 504.
a. Zinc coated (Galvanized): ASTM A123, G90 unless noted otherwise.
b. Surfaces exposed in the finished work:
1) Finish smooth rough surfaces and remove projections and welding slag.
2) Fill holes, dents and similar voids and depressions with epoxy type patching compound.
c. Shop Prime Painting:
1) Surfaces of Ferrous metal:
a) Items not specified to have other coatings.
b) Galvanized surfaces specified to have prime paint.
c) Remove all loose mill scale, rust, and paint, by hand or power tool cleaning as defined in SSPC-SP2 and SP3.
d) Clean of oil, grease, soil and other detrimental matter by use of solvents or cleaning compounds as defined in SSPC-SP1.
e) After cleaning and finishing apply one coat of primer as specified in Section 09 91 00, PAINTING.
2) Non ferrous metals: Comply with MAAMM-500 series.

G. Protection:
2. Spot prime all abraded and damaged areas of zinc coating which expose the bare metal, using zinc rich paint on hot-dip zinc coat items and zinc dust primer on all other zinc coated items.

2.9 GRATINGS

A. Fabricate gratings to support live loads specified and a concentrated load as specified.
E. Fabricate sections of grating with end-banding bars.

5. Butt or miter, and weld angle frame at corners.

G. Steel Bar Gratings:

1. Fabricate grating using steel bars, frames, supports and other members shown in accordance with Metal Bar Grating Manual.
2. Galvanize steel members after fabrication in accordance with ASTM A123, G-90 for exterior gratings, gratings in concrete floors, and interior grating where specified.

4. Use serrated bars for exterior gratings used at exterior roof access ladder landings. I. Plank Gratings:

1. Conform to Fed. Spec. RR-G-1602.
2. Manufacturers standard widths, lengths and side channels to meet live load requirements.
3. Galvanize exterior steel gratings ASTM A123, G-90 after fabrication.

2.14 LADDERS

A. Steel Ladders:

1. Fixed-rail type with steel rungs shouldered and headed into and welded to rails.
2. Fabricate angle brackets of 50 mm (2 inch) wide by 13 mm (1/2 inch) thick steel; brackets spaced maximum of 1200 mm (4 feet) apart and of length to hold ladder 175 mm (7 inches) from wall to center of rungs. Provide turned ends or clips for anchoring.
3. Provide holes for anchoring with expansion bolts through turned ends and brackets.
4. Where shown, fabricate side rails curved, twisted and formed into a gooseneck.
5. Galvanize exterior ladders after fabrication, ASTM A123, G-90.

2.15 RAILINGS

A. In addition to the dead load design railing assembly to support live load specified.

B. Fabrication General:

1. Provide continuous welded joints, dressed smooth and flush.
2. Standard flush fittings, designed to be welded, may be used.
3. Exposed threads will not be approved.
4. Form handrail brackets to size and design shown.

C. Handrails:

1. Close free ends of rail with flush metal caps welded in place except where flanges for securing to walls with bolts are shown.

2. Make provisions for attaching handrail brackets to wall, posts, and handrail as shown.

D. Steel Pipe Railings:

1. Fabricate of steel pipe with welded joints.
2. Number and space of rails as shown.
3. Space posts for railings not over 1200 mm (4 feet) on centers between end posts or as noted on drawings.
4. Form handrail brackets from malleable iron.

2.19 SCREENED FRAMES

A. Galvanized ASTM A123, G-90 after fabrication.

B. Wall frame:

1. Fabricate frame from steel members as shown.
3. Miter and weld frame at corners.

C. Insect screen:

1. Fabricate from carbon steel wire.
2. Mesh type: Square (4 x 4).
3. Wire size: 0.063 inch.
4. Opening size: 0.187 inch.
5. Construction type: Woven.
6. Finish: Galvanized.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set work accurately, in alignment and where shown, plumb, level, free of rack and twist, and set parallel or perpendicular as required to line and plane of surface.

B. Items set into concrete or masonry.

1. Provide temporary bracing for such items until concrete or masonry is set.
2. Place in accordance with setting drawings and instructions.
3. Build strap anchors, into masonry as work progresses.

D. Field weld in accordance with AWS.

1. Design and finish as specified for shop welding.
2. Use continuous weld unless specified otherwise.

E. Install anchoring devices and fasteners as shown and as necessary for securing metal fabrications to building construction as specified. Power actuated drive pins may be used except for removable items and where members would be deformed or substrate damaged by their use.

F. Spot prime all abraded and damaged areas of zinc coating as specified and all abraded and damaged areas of shop prime coat with same kind of paint used for shop priming.

3.6 OTHER FRAMES

A. Set frame flush with surface unless shown otherwise.

B. Anchor frames at ends and not over 450 mm (18 inches) on centers unless shown otherwise.

3.13 LADDERS

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

3.14 RAILINGS

A. Steel Posts:

1. Secure fixed posts into concrete with sleeves or core drilled holes as shown in drawings.
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.
7. Secure posts to steel with welds.

G. 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.

3.20 CLEAN AND ADJUSTING

A. Adjust movable parts including hardware to operate as designed without binding or deformation of the members centered in the opening or frame and, where applicable, contact surfaces fit tight and even without forcing or warping the components.

B. Clean after installation exposed prefinished and plated items and items fabricated from stainless steel, aluminum and copper alloys, as recommended by the metal manufacture and protected from damage until completion of the project.

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SECTION 06 10 00
ROUGH CARPENTRY

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies wood blocking, framing, sheathing, nailers, rough hardware, and light wood construction.

1.2 RELATED WORK:

A Gypsum sheathing: Section 09 29 00, GYPSUM BOARD.

B. Cement board sheathing: Section 06 16 63, CEMENTITIOUS SHEATHING.

1.3 SUBMITTALS:

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

B. Manufacturer’s Literature and Data:

1. Submit data for lumber.
2. Submit data for wood-preservative treatment from chemical treatment manufacturer and certification from treating plants that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
3. Submit data for fire retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
4. For products receiving a waterborne treatment, submit statement that moisture content of treated materials was reduced to levels specified before shipment to project site.

C. Manufacturer’s certificate for unmarked lumber.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Protect lumber and other products from dampness both during and after delivery at site.

B. Pile lumber in stacks in such manner as to provide air circulation around surfaces of each piece.

C. Stack plywood and other board products so as to prevent warping.

D. Locate stacks on well drained areas, supported at least 152 mm (6 inches) above grade and cover with well-ventilated sheds having firmly constructed over hanging roof with sufficient end wall to protect lumber from driving rain.

1.5 QUALITY ASSURANCE:

A. Installer: A firm with a minimum of three (3) years' experience in the type of work required by this section.

1.6 GRADING AND MARKINGS:

A. Any unmarked lumber or plywood panel for its grade and species will not be allowed on VA Construction sites for lumber and material not normally grade marked, provide manufacturer's certificates (approved by an American Lumber Standards approved agency) attesting that lumber and material meet the specified the specified requirements.

1.7 APPLICABLE PUBLICATIONS:

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

B. American Forest and Paper Association (AFPA):

NDS-15.....National Design Specification for Wood Construction

WCD1-01.....Details for Conventional Wood Frame Construction

C. American 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

C954-11.....Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Studs from 0.033 inch (2.24 mm) to 0.112-inch (2.84 mm) in thickness

C1002-14.....Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Metal Studs

D198-14.....Test Methods of Static Tests of Lumber in Structural Sizes

D2344/D2344M-13.....Test Method for Short-Beam Strength of Polymer Matrix Composite Materials and Their Laminates

F844-07a(R2013).....Washers, Steel, Plan (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

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 LUMBER:

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

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

B. Lumber Other Than Structural:

1. Unless otherwise specified, species graded under the grading rules of an inspection agency approved by Board of Review, American Lumber Standards Committee.

2. Furring, blocking, nailers and similar items 101 mm (4 inches) and narrower Standard Grade; and, members 152 mm (6 inches) and wider, Number 2 Grade.

C. Sizes:

1. Conforming to PS 20.
2. Size references are nominal sizes, unless otherwise specified, actual sizes within manufacturing tolerances allowed by standard under which produced.

D. Moisture Content:

1. Maximum moisture content of wood products is to be as follows at the time of delivery to site.
   a. Boards and lumber 50 mm (2 inches) and less in thickness: 19 percent or less.

E. Fire Retardant Treatment:

1. Comply with Mil Spec. MIL-L-19140.
2. Treatment and performance inspection, by an independent and qualified testing agency that establishes performance ratings.

F. Preservative Treatment:

1. Do not treat Heart Redwood and Western Red Cedar.
2. Treat wood members and plywood exposed to weather or in contact with plaster, masonry or concrete, including framing of open roofed structures; sills, sole plates, furring, and sleepers that are less than 610 mm (24 inches) from ground; nailers, edge strips, blocking, crickets, curbs, cant, vent strips and other members provided in connection with roofing and flashing materials.
3. Treat other members specified as preservative treated (PT).
4. Preservative treat by the pressure method complying with AWPA Book use category system standards U1 and T1, except any process involving the use of Chromated Copper Arsenate (CCA) or other agents classified as carcinogenic for pressure treating wood is not permitted.

2.2 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.

2.3 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:
   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.

PART 3 - EXECUTION

3.1 INSTALLATION OF FRAMING AND MISCELLANEOUS WOOD MEMBERS:

A. Conform to applicable requirements of the following:
   1. AFPA NDS for timber connectors.
   3. AFPA WCD1 for nailing and framing unless specified otherwise.
   4. 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. For sheathing and subflooring, select length of nails sufficient to extend 25 mm (1 inch) into supports.
      c. Use 8d or larger nails for nailing through 25 mm (1 inch) thick lumber and for toe nailing 50 mm (2 inch) thick lumber.
      d. Use 16d or larger nails for nailing through 50 mm (2 inch) thick lumber.
   2. Bolts:
      a. Fit bolt heads and nuts bearing on wood with washers.
      b. Countersink bolt heads flush with the surface of nailers.
      c. Embed in concrete and solid masonry or provide expansion bolts. Special bolts or screws designed for anchor to solid masonry or concrete in drilled holes may be used.
      d. Provide toggle bolts to hollow masonry or sheet metal.
      e. Provide bolts to steel over 2.84 mm (0.112 inch, 11 gage) in thickness. Secure wood nailers to vertical structural steel members with bolts, placed one at ends of nailer and 610 mm (24 inch) intervals between end bolts. Provide clips to beam flanges.
   3. Drill Screws to steel less than 2.84 mm (0.112 inch) thick.
      a. ASTM C1002 for steel less than 0.84 mm (0.033 inch) thick.
      b. ASTM C954 for steel over 0.84 mm (0.033 inch) thick.
   4. Power actuated drive pins may be provided where practical to anchor to solid masonry, concrete, or steel.
   5. Do not anchor to wood plugs or nailing blocks in masonry or concrete. Provide metal plugs, inserts or similar fastening.

6. Screws to Join Wood:
   a. Where shown or option to nails.
   b. ASTM C1002, sized to provide not less than 25 mm (1 inch) penetration into anchorage member.
   c. Spaced same as nails.

C. Blocking Nailers, and Furring:
1. Install furring, blocking, nailers, and grounds where shown.
2. Provide longest lengths practicable.
3. Provide fire retardant treated wood blocking where shown at openings and where shown or specified.
4. Layers of Blocking or Plates:
   a. Stagger end joints between upper and lower pieces.
   b. Nail at ends and not over 610 mm (24 inches) between ends.
   c. Stagger nails from side to side of wood member over 127 mm (5 inches) in width.

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

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SECTION 06 16 63
CEMENTITIOUS SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cement board sheathing at exterior framed wall construction.

1.2 APPLICABLE PUBLICATIONS

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

B. American National Standards Institute (ANSI):

1. A118.9-10 - Cementitious Backer Units.

C. ASTM International (ASTM):

1. C954-18 - Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness
2. C1002-18 - Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
3. C1325-14 - Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units.

1.3 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. Installation instructions.
3. Warranty.

1.4 DELIVERY AND STORAGE

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.

1.5 STORAGE AND HANDLING

A. Store products indoors in dry, weathertight facility.

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

1.6 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

B. Manufacturer's Warranty: Warrant sheathing against material and manufacturing defects.

1. Warranty Period: 10 years.

PART 2 - PRODUCTS

2.1 PRODUCTS - GENERAL

A. Provide each product from one manufacturer.

2.2 SHEATHING

A. Cement Boards: Meeting ANSI A118.9 and ASTM C1325.

1. Thickness: As noted in drawngs.

2. Width: 1219 mm (48 inches), minimum.

2.3 ACCESSORIES

A. Steel Drill Screws: Corrosion-resistant, self-drilling.

1. ASTM C1002, Type S for fastening to framing less than 0.8 mm (33 mils) thick.

2. ASTM C954 for fastening to framing 0.8 mm (33 mils) thick and greater.

B. Joint Reinforcement: Alkali resistant tape as recommended by sheathing manufacturer.

C. Bonding Material: As recommended by sheathing manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.

B. Protect existing construction and completed work from damage.

C. Verify framing is plumb and level and in plane.

D. Correct substrate deficiencies.

3.2 SHEATHING INSTALLATION

A. Install products according to manufacturer's instructions.

1. Secure units to framing members with screws spaced maximum 200 mm (8 inches) o.c. and not closer than 13 mm (1/2 inch) from edge of unit.

2. Install screw heads without penetrating cement board surface.

3. Install sheathing with 6 mm (1/4 inch) gap where sheathing abuts masonry or similar materials to prevent wicking of moisture.
4. Install sheathing with 10 mm (3/8 inch) gap where non-load-bearing construction abuts structural elements or building expansion joints.
5. Horizontal Installation: Abut ends of boards over centers of studs. Stagger end joints minimum one stud spacing for adjacent boards. Fasten boards at perimeter and within field of board to each stud.
6. Vertical Installation: Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Fasten boards at perimeter and with fin field of board to each stud.
7. Apply bonding material to imbed tape and completely fill board joints, and gaps between each panel.

3.3 PROTECTION

A. Remove loose or spalling joint finish. Patch areas missing joint finish.
B. Replace broken or damaged boards.
C. Protect boards from moisture using temporary coverings until finishes are applied.

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SECTION 06 20 13
EXTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior wood trim.
2. Lumber soffits and fascia.
3. Exterior ornamental trim.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for furring, blocking, and other carpentry work not exposed to view.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of factory-fabricated product. Indicate component materials, dimensions, profiles and include construction and application details.

1. Include data for wood-preservative treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained. Include chemical-treatment manufacturer's written instructions for finishing treated material.
2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced before shipment to Project site to levels specified.

B. Samples for Initial Selection: For each type of product involving selection of profiles.

1.3 INFORMATIONAL SUBMITTALS

A. Compliance Certificates:

1. For lumber that is not marked with grade stamp.
2. For preservative-treated wood that is not marked with treatment-quality mark.

B. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated wood.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber and other panels flat with spacers between each bundle to provide air circulation. Protect materials from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

1.5 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecast weather conditions permit work to be performed and at least one

coat of specified finish can be applied without exposure to rain, snow, or dampness.

B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.

1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated.

B. Factory mark each piece of lumber with grade stamp of inspection agency, indicating grade, species, moisture content at time of surfacing, and mill.

1. For exposed lumber, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by inspection agency.

C. Softwood Plywood: DOC PS 1.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Water-Repellent Preservative Treatment by Nonpressure Process: AWPA N1; dip, spray, flood, or vacuum-pressure treatment.

1. Preservative Chemicals: 3-iodo-2-propynyl butyl carbamate (IPBC).

2. Use chemical formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants in solution to distinguish treated material from untreated material.

3. Application: Exterior trim.

B. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC3a.

1. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 18 percent, respectively.

2. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

3. Do not use material that is warped or does not comply with requirements for untreated material.

4. Mark lumber with treatment-quality mark of an inspection agency approved by the American Lumber Standard Committee's Board of Review.

2.3 EXTERIOR TRIM

A. Lumber Trim for Painted Finish:

1. Species and Grade: Hem-fir, Prime or D finish; NLGA, WCLIB, or WWPA.

2. Maximum Moisture Content: 15 percent with at least 85 percent of shipment at 12 percent or less.

3. Finger Jointing: Not allowed.

4. Face Surface: Surfaced (smooth).

5. Factory Priming: Factory coated on faces and edges, with exterior primer compatible with topcoats specified.

B. Moldings for Painted Finish: MMPA WM 4, P-grade wood moldings. Made from kiln-dried stock to patterns included in MMPA's "WM/Series Wood Moulding Patterns."

1. Species: Eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine.

2. Finger Jointing: Not allowed.

3. Factory Priming: Factory coated on faces and edges, with exterior primer compatible with topcoats specified.

2.4 LUMBER SOFFITS AND FASCIA

A. Provide kiln-dried lumber siding complying with DOC PS 20, factory coated with exterior primer compatible with topcoats specified.

B. Species and Grade: Prime or D finish hem-fir; NLGA, WCLIB, or WWPA.

2.5 MISCELLANEOUS MATERIALS

A. Fasteners for Exterior Finish Carpentry: Provide nails or screws, in sufficient length to penetrate not less than 1-1/2 inches (38 mm) into wood substrate.

1. For pressure-preservative-treated wood, provide hot-dip galvanized-steel fasteners.

2. For applications not otherwise indicated, provide hot-dip galvanized-steel fasteners.

B. Continuous Soffit Vents: Copper channel shape with 3/32 inch perforations on 5/32 inch staggered centers, 2 inches (51 mm) wide and in lengths not less than 96 inches (2438 mm).

1. Net-Free Area: 40 percent.

2.6 FABRICATION

A. Back out or kerf backs of standing and running trim wider than 5 inches (125 mm), except members with ends exposed in finished work.

B. Ease edges of lumber less than 1 inch (25 mm) in nominal thickness to 1/16-inch (1.5-mm) radius and edges of lumber 1 inch (25 mm) or more in nominal thickness to 1/8-inch (3-mm) radius.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

B. Prime lumber and moldings to be painted, including both faces and edges, unless factory primed. Cut to required lengths and prime ends. Comply with requirements in Section 099100 "Painting."

3.3 INSTALLATION, GENERAL

A. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, or too small to fabricate with proper jointing arrangements.

B. Install exterior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.

1. Scribe and cut exterior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.

2. Install to tolerance of 1/8 inch in 96 inches (3 mm in 2438 mm) for level and plumb. Install adjoining exterior finish carpentry with 1/32-inch (0.8-mm) maximum offset for flush installation and 1/16-inch (1.5-mm) maximum offset for reveal installation.

3. Coordinate exterior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate exterior finish carpentry.

3.4 STANDING AND RUNNING TRIM INSTALLATION

A. Install flat-grain lumber with bark side exposed to weather.

B. Install trim with minimum number of joints as is practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches (610 mm) long, except where necessary.

1. Use scarf joints for end-to-end joints.

2. Stagger end joints in adjacent and related members.

C. Fit exterior joints to exclude water. Cope at returns and miter at corners to produce tight-fitting joints, with full-surface contact throughout length of joint. Plane backs of casings to provide uniform thickness across joints, where necessary for alignment.

D. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.

3.5 ADJUSTING

A. Replace exterior finish carpentry that is damaged or does not comply with requirements. Exterior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing. Adjust joinery for uniform appearance.

3.6 CLEANING

A. Clean exterior finish carpentry on exposed and semiexposed surfaces.

3.7 PROTECTION

A. Protect installed products from damage from weather and other causes during construction.

B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.

1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 062013

SECTION 07 01 50.19
PREPARATION FOR RE-ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Complete roof removal for new roof system installation.

B. Existing Roofing Systems: EPDM (ballasted and adhered) and TPO (adhered). System components include:

1. Pavers.
2. Aggregate ballast.
3. Roof insulation.
4. Roofing membrane.
5. Cover board.
6. Roof insulation.
7. Vapor retarder.
8. Substrate board.
9. Specific components for each roof area are noted in the roof demolition plans.

1.2 RELATED WORK

A. Section 05 31 00, STEEL DECKING: Replacement Roof Deck.

B. Section 06 10 00, ROUGH CARPENTRY: Replacement Parapet Sheathing and Blocking.

C. Section 07 54 23, THERMOPLASTIC POLYOLEFIN (TPO) ROOFING: New Roofing System.

D. Section 07 60 00, FLASHING AND SHEET METAL: Sheet Metal Counterflashing.

1.3 APPLICABLE PUBLICATIONS

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

B. American National Standards Institute/Single-Ply Roofing Institute (ANSI/SPRI):

FX-1 (R2016).....Standard Field Test Procedure for Determining the Withdrawal Resistance of Roofing Fasteners.

C. ASTM International (ASTM):

C578-19.....Rigid, Cellular Polystyrene Thermal Insulation.

D4263-83(2018).....Indicating Moisture in Concrete by the Plastic Sheet Method.

D. U.S. Department of Commerce National Institute of Standards and Technology (NIST):
DOC PS 1-19.....Structural Plywood.
DOC PS 2-18.....Performance Standard for Wood-Based Structural-Use Panels.

1.4 PREINSTALLATION MEETINGS

A. Conduct preinstallation meeting minimum 30 days before beginning Work of this section.
1. Required Participants:
a. Contracting Officer's Representative.
b. Architect.
c. Contractor.
d. Installer.
e. Manufacturer's field representative.
f. Other installers responsible for adjacent and intersecting work, including mechanical and electrical equipment installers.
2. Meeting Agenda: Distribute agenda to participants minimum 3 days before meeting.
a. Removal and installation schedule.
b. Removal and installation sequence.
c. Preparatory work.
d. Protection before, during, and after installation.
e. Removal and installation.
f. Temporary roofing including daily terminations.
g. Transitions and connections to other work.
h. Inspecting and testing.
i. Other items affecting successful completion.
3. Document and distribute meeting minutes to participants to record decisions affecting installation.

1.5 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
B. Photographs: Document existing conditions potentially affected by roofing operations before work begins.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:
1. Same installer as Section 07 54 23, THERMOPLASTIC POLYOLEFIN (TPO) ROOFING.

1.7 FIELD CONDITIONS

A. Building Occupancy: Perform work to minimize disruption to normal building operations.
   1. Verify occupants are evacuated from affected building areas when working on structurally impaired roof decking above occupied areas.
   2. Provide notice minimum 72 hours before beginning activities affecting normal building operations.

B. Weather Limitations: Proceed with reroofing preparation only during dry weather conditions as specified for new roofing installation in Section 07 54 23, THERMOPLASTIC POLYOLEFIN (TPO) ROOFING.
   1. Remove only as much roofing in one day as can be made watertight in same day.

C. Hazardous materials are not expected in existing roofing system.
   1. Do not disturb suspected hazardous materials. If materials are discovered that are suspected to be of hazardous content, notify Contracting Officer's Representative immediately.
   2. Hazardous materials discovered during execution of the work will be removed by Government as work of a separate contract.

1.8 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Patching Materials: Match existing roofing system materials.

B. Plywood Sheathing: See Section 06 10 00, ROUGH CARPENTRY.

C. Metal Flashing: See Section 07 60 00, FLASHING AND SHEET METAL.

D. Temporary Protection Materials:
   1. Expanded Polystyrene (EPS) Insulation: ASTM C578-19.
   2. Plywood: NIST DOC PS 1-19, Grade CD Exposure 1-18.
   3. Oriented Strand Board (OSB): NIST DOC PS 2-18, Exposure 1.

E. Temporary Roofing System Materials: Contractor's option.
   1. Insulation: See Section 07 22 00, ROOF AND DECK INSULATION.

F. Fasteners: Type and size required by roof membrane manufacturer to resist wind uplift.

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. Protect landscaping from damage.

D. Maintain access to existing walkways and adjacent occupied facilities.

E. Coordinate use of rooftop fresh air intakes with Contracting Officer's Representative to minimize effect on indoor air quality.

F. Ensure temporary protection materials are available for immediate use in case of unexpected rain.

G. Ensure roof drainage remains functional.

1. Keep drainage systems clear of debris.

2. Prevent water from entering building and existing roofing system.

H. Coordinate rooftop utilities remaining active during roofing work with Contacting Officer's Representative.

3.2 RE-ROOFING PREPARATION - GENERAL

A. Notify Contacting Officer's Representative of planned operations, daily.

1. Identify location and extent of roofing removal.

2. Request authorization to proceed.

3.3 OVERBURDEN REMOVAL

A. Remove aggregate ballast.

B. Remove pavers..

1. Dispose of pavers.

3.4 COMPLETE ROOFING SYSTEM REMOVAL

A. Remove existing roofing system completely, exposing structural roof deck.

1. Remove cover boards, roof insulation, vapor retarders, and substrate boards.

2. Remove or cut-off roofing system fasteners. Cut-off fasteners should not be allowed to fall onto finished spaces or onto APC ceilings below.

3.5 DECK PREPARATION

A. Inspect structural roof deck after roofing system removal.

B. Concrete Roof Decks:

1. Visually confirm concrete roof deck is dry.

2. Remove any mastics or adhesives that may impact the installation of new roofing products.

3. Perform moisture test according to ASTM D4263-83(2018) each day for each separate roof area.

a. Proceed with roofing work only when moisture is not observed.

C. Steel Roof Decks:

1. Visually inspect structural roof deck installation and fasteners.
   a. Notify Contracting Officer's Representative of unsuitable conditions and inadequate fastenings potentially affecting roof system performance.
2. Secure roof deck with additional fastenings as determined by Contracting Officer's Representative.
3. Replace roof deck as indicated on drawings.
   a. Replacement Roof Deck: See Section 05 31 00, STEEL DECKING.

3.6 TEMPORARY ROOFING

A. Install temporary roofing to maintain building watertight.

B. Remove temporary roofing before installing new roofing.

3.7 BASE FLASHING REMOVAL

A. Expose base flashings to permit removal.
   1. Two-Piece Counterflashings: Remove cap flashing and store for reuse.
   2. Single Piece Counterflashings: Carefully bend counterflashing or remove as indicated in drawings.
   3. Metal Copings: Remove and dispose of.

B. Remove existing base flashings.
   1. Clean substrates to receive new flashings.

C. Replace counterflashings damaged during removal.
   1. Counterflashings: See Section 07 60 00 FLASHING AND SHEET METAL.

3.8 DISPOSAL

A. Collect waste materials in containers.

B. Remove waste materials from project site, regularly, to prevent accumulation.

C. Legally dispose of waste materials.

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SECTION 07 13 52
MODIFIED BITUMINOUS SHEET WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Modified bituminous sheet material used for exterior below grade waterproofing.

1.2 APPLICABLE PUBLICATIONS

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

B. ASTM International (ASTM):

C578-19.....Rigid, Cellular Polystyrene Thermal Insulation.

D41/D41M-11(2016).....Asphalt Primer Used in Roofing, Dampproofing and Waterproofing.

D4586/D4586M-07(2018)...Asphalt Roof Cement, Asbestos-Free.

D6380/D6380M-03(2018)...Asphalt Roll Roofing (Organic Felt).

1.3 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. Installation instructions.
3. Warranty.

C. Samples:

1. Waterproofing and Flashing Sheet: 200 mm (8 inch) square, each type and color.
2. Insulation: 200 mm (8 inch) square.

D. Test reports: Certify products comply with specifications.

E. Certificates: Certify products comply with specifications.

1.4 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.

1.5 STORAGE AND HANDLING

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

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

1.6 FIELD CONDITIONS

A. Environment:

1. Product Temperature: Minimum 4 degrees C (40 degrees F) for minimum 48 hours before installation.
2. Weather Limitations: Install waterproofing only during dry current and forecasted weather conditions.

1.7 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Waterproofing System: Modified bituminous sheet material for exterior below grade.

2.2 PRODUCTS - GENERAL

A. Provide each product from one manufacturer.

2.3 BITUMINOUS SHEET

A. Cold applied waterproofing membrane composed primarily of modified bituminous material prefabricated in sheet form designed for below grade exterior. Sheet reinforced with fibers at manufacturer's option.

B. Thickness: Not less than 1.5 mm (60 mils), plus or minus 0.13 mm (5 mils), and bonded to 0.1 mm (4 mil) thick plastic sheet.

C. Provide release sheet to prevent bonding of bituminous sheet to itself.

2.4 PROTECTION MATERIAL

A. Polystyrene Insulation: ASTM C578, Type I or VIII, 13 mm (1/2 inch) minimum thickness.

2.5 ACCESSORIES

A. Patching Compound: Factory-prepared, non-shrinking, fast-setting, cementitious adhesive compound containing no ferrous metal or oxide.

B. Primer: ASTM D41/D41M.

C. Roof Cement: ASTM D4586/D4586M.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.

1. Concrete surfaces cured minimum time recommended by waterproofing manufacturer.
2. Substrate to be dry as recommended by waterproofing manufacturer.

B. Protect existing construction and completed work from damage.

C. Correct substrate deficiencies.

1. Fill voids, joints, and cracks with patching compound.

D. Clean substrates. Remove contaminants capable of preventing full adhesion.

E. Priming:

1. Prime concrete and masonry surfaces.
2. Application method, amount of primer and condition or primer before installation of bituminous sheet as recommended by primer manufacturer.
3. Reprime when required according to manufacturer's instructions.

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.

3.3 WATERPROOFING INSTALLATION

A. Bituminous Sheet Installation:

1. Remove release sheet before application.
2. Lay bituminous sheet from low point to high point so laps shed water.
3. Treat expansion, construction and control joints and evident working cracks as expansion joints. Apply bituminous sheet in double thickness over joint by first applying a strip of bituminous sheet minimum 200 mm (8 inches) wide, centered over joint.
4. Lap seams minimum 50 mm (2 inches).
5. Lay succeeding sheet with laps, and roll or press into place.
6. Repair misaligned or inadequately lapped seams according to manufacturer’s instructions.
7. Seal seams and terminations according to sheet manufacturer’s instructions.

B. Corner Treatment:

1. At inside and outside corners, apply double cover using an initial strip minimum 280 mm (11 inches) wide, centered along axis of corner.
2. Cover each strip completely by the regular application of bituminous sheet.
3. Provide a fillet or cant on inside corners.
4. Form cants using patching compound.

5. Do not use wood, fiber, and insulating materials for cants.

C. Projection Treatment:

1. Apply a double layer of bituminous sheet around pipes and similar projections at least 150 mm (6 inches) wide.
2. At drains, apply a bead of roof cement over a double layer of bituminous sheet under clamping rings.

D. Patching:

1. Repair tears, punctures, air blisters, and inadequately lapped seams, according to manufacturer’s instructions before protection course is applied.

E. Permanent Protection:

1. Vertical Surfaces:
   a. Install polystyrene insulation protection material.
   b. Extend protection full height from footing to top of backfill.

F. Temporary Protection:

1. When waterproofing materials are subjected to damage by sunlight and cannot be immediately protected as specified, protect waterproofing materials by waterproof building paper or suitable coating approved by manufacturer of waterproofing system used.

3.4 CLEANING

A. Remove excess adhesive before adhesive sets.

B. Clean exposed waterproofing surfaces. Remove contaminants and stains.

3.5 PROTECTION

A. Protect waterproofing from construction operations.

B. Remove protective materials immediately before acceptance.

C. Repair damage.

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SECTION 07 21 13
THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Thermal insulation.

a. Board insulation at masonry cavity walls.

1.2 RELATED WORK

A. Section 04 20 00, UNIT MASONRY: Insulation for Cavity Face of Masonry.

B. Section 07 22 00, ROOF AND DECK INSULATION; Insulation for roofing.

1.3 APPLICABLE PUBLICATIONS

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

B. ASTM International (ASTM):

C578-19.....Rigid, Cellular Polystyrene Thermal Insulation.

C591-20.....Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.

E84-20.....Surface Burning Characteristics of Building Materials.

F1667-18a.....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.

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: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 INSULATION - GENERAL

A. Insulation Thickness:

1. Provide thickness indicated on drawings.

B. Insulation Types:

1. Provide one insulation type for each application.

2.2 THERMAL INSULATION

A. Perimeter Insulation In Contact With Soil:

1. Polystyrene Board: ASTM C578, Type IV, V, VI, VII, or IX.

B. Masonry Cavity Wall Insulation:

1. Polyurethane or Polyisocyanurate Board: ASTM C591, Type I, with vapor retarder facing; maximum permeance 29 ng/Pa/s/sq. m (0.5 perms).

2.3 ACCESSORIES

A. Insulation Adhesive: Nonflammable type recommended by insulation manufacturer to suit application.

B. Tape: 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.

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. Masonry Cavity Wall Insulation:

1. Install insulation on exterior faces of concrete and masonry inner wythes of cavity walls.
2. Bond polyurethane or polyisocyanurate board to surfaces with adhesive.
3. Fill insulation joints with same material used for bonding.

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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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 existing concrete and metal deck substrates ready to receive roofing membrane.

1.2 RELATED WORK

A. Section 06 10 00, ROUGH CARPENTRY: Wood Blocking, and Edge Strips.

1.3 APPLICABLE PUBLICATIONS

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

B. American Society of Civil Engineers

ASCE 7-16.....Minimum Design Loads and Associated Criteria for Buildings and Other Structures

C. American Society of Heating, Refrigeration and Air Conditioning (ASHRAE):

Standard 90.1-13.....Energy Standard for Buildings Except Low-Rise Residential Buildings.

D. ASTM International (ASTM):

C1177/C1177M-17.....Glass Mat Gypsum Substrate for Use as Sheathing.

C1289-19.....Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.

D41/D41M-11 (2016).....Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.

D312/D312M-16a.....Asphalt Used in Roofing.

D1970/D1970M-20.....Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.

D2178/D2178M-15a.....Asphalt Glass Felt Used in Roofing and Waterproofing.

D4586/D4586M-07(2018)...Asphalt Roof Cement, Asbestos-Free.

E84-20.....Surface Burning Characteristics of Building Materials.

F1667-18a.....Driven Fasteners: Nails, Spikes, and Staples.

E. National Roofing Contractors Association (NRCA):

Manual-15.....The NRCA Roofing Manual: Membrane Roof Systems-2019.

F. UL LLC (UL):
Listed Online Certifications Directory.

G. U.S. Department of Agriculture (USDA):
USDA BioPreferred Program Catalog.

H. U.S. Department of Commerce National Institute of Standards and Technology (NIST):
DOC PS 1-19.....Structural Plywood.
DOC PS 2-18.....Performance Standard for Wood-Based Structural-Use Panels.

1.4 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 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. 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.

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: Install products when existing and forecasted weather permit installation according to manufacturer's instructions.

1.9 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

B. Manufacturer's Warranty: Warrant substrate board, vapor retarder, insulation, and cover board against material and manufacturing defects as part of Division 07 roofing system warranty.

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

A. Insulation Thermal Performance:

1. Overall Average R-Value: R-30, minimum.
2. Any Location R-Value: R-8, minimum.

B. Fire and Wind Uplift Resistance: Provide roof insulation complying with requirements specified in Division 07 roofing section.

C. Insulation on Metal Decking: UL labeled indicating compliance with one of the following:

1. UL Listed.
2. Insulation Surface Burning Characteristics: When tested according to ASTM E84.
   a. Flame Spread Rating: 75 maximum.
   b. Smoke Developed Rating: 150 maximum.

2.2 PRODUCTS - GENERAL

A. Provide each product from one manufacturer.

2.3 ADHESIVES

A. Primer: ASTM D41/D41M.

B. Asphalt: ASTM D312, Type III or IV for vapor retarders and insulation.

C. 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.

D. 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.

E. Roof Cement: Asbestos free, ASTM D2822/D2822M, Type I or Type II; or, ASTM D4586/D4586M, Type I or Type II.

2.4 ROOF AND DECK INSULATION

A. Roof and Deck Insulation, General: Preformed roof insulation boards approved by roofing manufacturer.

B. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 1, Grade 2, faced with glass fiber reinforced cellulosic felt facers on both major surfaces of the core foam.

C. 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).

D. Composite Nail Base Insulated Roof Sheathing:

1. Oriented-Strand-Board-Surfaced, Polyisocyanurate-Foam Sheathing: Polyisocyanurate thermal insulation ASTM C1289, Type V, insulation thickness as shown, with oriented strand board laminated to top surface.
2. Oriented Strand Board: NIST DOC PS 1, Exposure 1, 16 mm (5/8 inch) thick.
3. Bottom surface faced with felt facers.

2.5 INSULATION ACCESSORIES

A. Glass (Felt): ASTM D2178/D2178M, Type VI, heavy duty ply sheet.

B. Vapor Retarder:

1. Self-Adhering Sheet Vapor Retarder: ASTM D1970/D1970M, minimum 1.0 mm (40 mils) thick membrane of HDPE film fully coated with asphalt adhesive, or 0.76 to 1.0 mm (30 to 40 mils) thick membrane of butyl rubber based adhesive backed by a layer of high density cross-laminated polyethylene; maximum permeance rating of 6 ng/Pa/s/sq. m (0.1 perms).
2. Polyethylene Film: ASTM D4397, 10 mil (0.25 mm) thick, minimum, with maximum permeance rating of 0.076 perm (0.050 metric perm)].
   a. Tape: Pressure-sensitive tape of type recommended by vapor retarder manufacturer for sealing joints and penetrations in vapor retarder.

C. Cover Board:

1. Glass-Mat, Water-Resistant Gypsum Roof Board: ASTM C1177/C1177M, 16 mm (5/8 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.

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:

1. Prime substrate if required by manufacturer. Install self-adhering-sheet vapor retarder over area to receive vapor retarder, side and end lapping each sheet a minimum of 3-1/2 and 6 inches (90 and 150 mm), respectively. Seal laps by rolling.

C. Metal Decks:

1. Loosely lay polyethylene-film vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of 2 and 6 inches (50 and 150 mm), respectively. Continuously seal side and end laps with tape.

3.5 INSULATION INSTALLATION

A. Insulation Thickness:
   1. Thickness of roof insulation shown on drawings is nominal. Provide thickness required to comply with specified thermal performance.
   2. Insulation on Metal Decks: Provide insulation in minimum thickness recommended by insulation manufacturer to span deck flutes. Support edges of insulation on metal deck ribs.
   3. When actual insulation thickness differs from drawings, coordinate alignment and location of roof drains, flashing, gravel stops, fascias and similar items.
   4. Where tapered insulation is used, maintain insulation thickness at high points and roof edges shown on drawings.
      a. Low Point Thickness: Minimum 38 mm (1-1/2 inches).
   5. Use minimum two layers of insulation with joints offset a minimum of 6 inches..

B. Lay insulating units with close joints, in regular courses and with end joints staggered.
   1. Stagger joints between layers minimum 150 mm (6 inches).

C. Seal cut edges at penetrations and at edges against blocking with bitumen or roof cement.

D. Cut to fit tightly against blocking or penetrations.

E. Cover all insulation installed on the same day; comply with temporary protection requirements of Division 07 roofing section.

F. Installation Method:
   1. Adhered Insulation at Concrete Roof Decks:
      a. Prime substrate as required.
      b. Set each layer of insulation firmly in ribbons of bead-applied insulation adhesive or in uniform application of full-spread insulation adhesive.
   2. Mechanically Fastened Insulation at Metal Roof Decks:
      a. Fasten insulation according to requirements in Division 07 roofing section.
      b. Fasten insulation to resist uplift pressures specified in Division 07 roofing section and ASCE-7.

3.6 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" and "Mechanically Fastened Insulation" requirements.

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SECTION 07 24 00
DIRECT EXTERIOR FINISH SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Drainable direct exterior finish systems (DEFS).

1.2 RELATED WORK

A. Section 06 16 63, CEMENTITIOS SHEATHING; Cement Board Sheathing.

B. Section 09 29 00, GYPSUM BOARD: Gypsum Board Sheathing.

1.3 APPLICABLE PUBLICATIONS

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

B. ASTM International (ASTM):

B117-19.....Operating Salt Spray (Fog) Apparatus.

C67/C67M-20.....Sampling and Testing Brick and Structural Clay Tile.

C177-19.....Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.

C297/C297M-16.....Flatwise Tensile Strength of Sandwich Constructions.

C578-19.....Rigid, Cellular Polystyrene Thermal Insulation.

C666/C666M-15.....Resistance of Concrete to Rapid Freezing and Thawing.

C920-18.....Elastomeric Joint Sealants.

D968-17.....Abrasion Resistance of Organic Coatings by Falling Abrasive.

D2794-93(2019).....Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).

E84-20.....Surface Burning Characteristics of Building Materials.

E96/E96M-16.....Water Vapor Transmission of Materials.

E119-20.....Fire Tests of Building Construction and Materials.

E330/E330M-14.....Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

E331-00(2016).....Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Wall by Uniform Static Air Pressure Differences.

E2486/E2486M-13(2018)...Impact Resistance of Class PB and PI Exterior Insulation and Finish Systems (EIFS).

G90-17.....Performing Accelerated Outdoor Weathering of Nonmetallic Materials Using Concentrated Natural Sunlight.

1.4 PREINSTALLATION MEETINGS

A. Conduct preinstallation meeting at project site minimum 30 days before beginning Work of this section.

1. Required Participants:
   a. Contracting Officer's Representative.
   b. Architect/Engineer.
   c. Contractor.
   d. Installer.
   e. Other installers responsible for adjacent and intersecting work, including air barriers and sealants.
2. Meeting Agenda: Distribute agenda to participants minimum 3 days before meeting.
   a. Installation schedule.
   b. Installation sequence.
   c. Preparatory work.
   d. Protection before, during, and after installation.
   e. Installation.
   f. Terminations.
   g. Transitions and connections to other work.
   h. Other items affecting successful completion.
3. Document and distribute meeting minutes to participants to record decisions affecting installation.

1.5 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submittal Drawings:

1. Show size, configuration, and fabrication and installation details.
2. Show details for corner treatment, soffits, penetrations, flashing, and other special applications.

C. Manufacturer's Literature and Data:

1. Description of each product.
2. Installation instructions.
3. Warranty.

D. Samples: Two 300 mm (1 foot) square samples of finishes over cement board identical to proposed installation in thickness, color, texture and workmanship.

E. Test reports: Certify each product and complete system complies with specifications.

F. Qualifications: Substantiate qualifications comply with specifications.
1. Installer with project experience list.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:
1. Regularly installs specified products.
2. Installed specified products with satisfactory service on five similar installations for minimum five years.

1.7 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.

1.8 STORAGE AND HANDLING

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

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

1.9 FIELD CONDITIONS

A. Environment: Unless greater temperature is required by system manufacturer, install products only when ambient air temperature is minimum 7 degrees C (45 degrees F) and rising and predicted to persist for 24 hours after installation.

1.10 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

B. Manufacturer's Warranty: Warrant EIFS system materials against material and manufacturing defects.
1. Warranty Period: 10 years.

PART 2 - PRODUCTS

2.1 PRODUCTS - GENERAL

A. Provide system components from one manufacturer.

2.2 DIRECT EXTERIOR FINISH SYSTEMS (DEFS)

A. Description: Direct exterior finish system consisting of synthetic base coat with reinforcing mesh, and simulated stucco finish coat applied over an exterior cement board that is installed over a drainage spacer and water-resistive barrier.

B. Water resistive barrier: Flexible roller or trowel applied polymer based, non-cementitious, protective air/water-resistive barrier applied over acceptable exterior substrates.

1. Joint tape: An open weave fiberglass mesh tape with pressure sensitive adhesive in rolls 4 in (102 mm) wide by 100 yds (91 m) long.

C. Spacer: A polyethylene spacer, installed over the water resistive barrier which separates the exterior cement board from the sheathing substrate 1/8 in (3.2 mm) thick by 3 in (76 mm) wide.

D. Stucco Finish:

1. Base coat: Ready-to-mix, Portland cement mortar containing dry latex polymers.
2. Finish coat: Pre-colored, ready-mixed, polymeric coating.

E. Performance Requirements:

1. Surface Burning Characteristics: When tested according to ASTM E84.
   a. Flame Spread Rating: 25 maximum.
   b. Smoke Developed Rating: 450 maximum.
2. Abrasion Resistance: ASTM D968; 500 liters of light smoothing sand with no loss of film integrity.
3. Bond Strength (with gypsum board sheathing): ASTM C297/C297M, 345 kPa (50 psi).
4. Salt Spray Resistance: ASTM B117; 300 hours exposure with no deleterious effects.
5. Freeze/Thaw Resistance (with gypsum board sheathing): ASTM C666/C666M; 100 Cycles with no deterioration, no delamination.
6. Accelerated Weathering: ASTM G90; 2000 hours with no deterioration.
7. Rapid Deformation: ASTM D2794; No cracking or impact failure.

F. Accessories:

1. Trim, control joints, casing beads, casing beads with weeps, and corner beads as recommended by DEFS manufacturer.

2. Joint Reinforcement:
   a. Reinforcing tape: Minimum 100 mm (4 inch) wide, polymer coated, open mesh glass fiber tape.
   b. Tape embedding material: Ready-to-mix Portland cement mortar base coat containing dry latex polymers.
3. Sealant: ASTM C920, Class 50 with 100 percent recovery. Type, grade and use as recommended by the sealant manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.
B. Protect existing construction and completed work from damage.
C. Notify Contracting Officer's Representative in writing of conditions detrimental to proper completion of work.
D. Do not proceed with work until unsatisfactory conditions are corrected.

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.

3.3 CONTROL JOINT INSTALLATION

A. See drawings for location of building control joints and surface control joints.
B. Install surface control joints as follows:
   1. Direct Exterior Finish: Install at 6 meters (20 feet) maximum on center, both directions, erecting continuous vertical joints first at building expansion joints, intersection of dissimilar substrates or finishing materials where concentrated stresses or movement is anticipated. Leave 13 mm (1/2inch) minimum continuous gap between board panels to receive control joint.

3.4 SEALANT INSTALLATION

A. Direct Exterior Finish System: Apply sealant at intersections of cement board with windows, doors, control joints, other openings and locations as shown on drawings.
B. Do not apply sealant in locations intended for water drainage.

3.5 DIRECT EXTERIOR FINISH SYSTEM INSTALLATION

A. Water Resistive Barrier: Apply joint tape over all sheathing joints, including inside and outside corners and trowel apply a layer of water

resistive barrier over the tape. Apply water resistive barrier over the entire wall surface, including previously treated joints. Refer to the manufacturer’s instructions for proper tools and respective coverage. Allow water resistive barrier to dry per manufacturer’s instructions.

B. Spacer: Secure the spacer to the gypsum sheathing in continuous vertical strips spaced a maximum of 16 in (406 mm) on center installed over each framing member using corrosion resistant staples through the water-resistive barrier and into the substrate or framing. Additionally, install the spacers flush with the vertical edge of all system terminations and changes in wall direction. Do not install spacers horizontally.

C. Cement Board: Install in accordance with manufacturer’s instructions and Section 06 16 63 - Cementitious Sheathing.
   1. Align sheathing joints with the spacer and install fasteners through the spacer as needed.
   2. Do not align joints with corners of wall penetrations.
   3. Exterior cement board joints shall be offset from gypsum sheathing board substrate joints.

D. Trim: Install trim pieces and flash per project details and per manufacturer’s instructions.

E. Joint Reinforcement: Pre-fill sheathing board joints and trim with synthetic base coat mixed according to manufacturer's directions.
   1. Immediately embed reinforcing tape into wet base coat and tightly trowel to board surface to avoid crowning joints.
   2. Cure for four hours minimum before applying base coat.

F. Base Coat: Uniformly apply base coat minimum 1.6 mm (1/16 inch) thick, smooth and flat over entire surface including joints and trim. Dampen board surface as necessary under rapid drying conditions.
   1. Embed reinforcing fabric in basecoat while wet and cover with basecoat material so fabric pattern is not visible.

G. Finish: Trowel apply exterior finish to base coat texturing surface as specified to uniform thickness of 1.5 mm to 5 mm (1/16 inch to 3/16 inch).
   1. Dampen base coat as necessary under rapid drying conditions.
   2. Extend finish so breaks between batches occur at surface breaks such as corners, control joints, windows, and other interruptions.

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SECTION 07 31 26
SLATE SHINGLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Synthetic slate shingles over underlayment nailed to roof sheathing.

1.2 RELATED WORK

A. Section 07 60 00, FLASHING AND SHEET METAL; Counterflashing and Flashing of Roof Projections.

1.3 APPLICABLE PUBLICATIONS

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

B. ASTM International (ASTM):

C406/C406M-15.....Roofing Slate.

D1970/D1970M-19.....Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.

D4586/D4586M-07(2018)...Asphalt Roof Cement, Asbestos-Free.

F1667-18a.....Driven Fasteners: Nails, Spikes, and Staples.

1.4 PREINSTALLATION MEETINGS

A. Conduct pre-installation meeting at project site minimum 30 days before beginning Work of this section.

1. Required Participants:

1.5 CONTRACTING OFFICER'S REPRESENTATIVE.

1. Architect/Engineer.
2. Contractor.
   a. Installer.
   b. Other installers responsible for adjacent and intersecting work, including flashing and sheet metal.
3. Meeting Agenda: Distribute agenda to participants minimum 3 days before meeting.
   a. Installation schedule.
   b. Installation sequence.
   c. Preparatory work.
   d. Protection before, during, and after installation.
   e. Installation.
   f. Terminations.
   g. Transitions and connections to other work.
   h. Other items affecting successful completion.

4. Document and distribute meeting minutes to participants to record decisions affecting installation.

1.6 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. Installation instructions.

C. Samples:

1. Shingles: Full sized, each type and color. Submit quantity required to show full color and texture range.

D. Qualifications: Substantiate qualifications comply with specifications.

1. Installer with project experience list.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacture of synthetic shingles.

B. Installer Qualifications:

1. Regularly installs specified products.
2. Installed specified products with satisfactory service on five similar installations.
   a. Project Experience List: Provide contact names and addresses for completed projects.

1.8 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.

1.9 STORAGE AND HANDLING

A. Protect products from damage during handling and construction operations.

1.10 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

B. Manufacturer’s Warranty: 50 year warranty against breakage and deterioration resulting in leaks under normal weather and use conditions.

PART 2 - PRODUCTS

2.1 PRODUCTS - GENERAL

A. Basis of Design: Multi-Width Synthetic Slate in Vinyard color by DaVinci Roofscapes or equal.

B. Provide each product from one manufacturer.

2.2 SLATE SHINGLES

A. Synthetic Slate Shingles:

1. Description: Lightweight, synthetic slate shingles with appearance, color, texture, and thickness of quarried shakes.
2. Material: Engineered polymer formulated from 100 percent virgin plastic resins; recycled materials not acceptable.
3. Performance characteristics:
   a. Fire resistance: Class A, tested to ASTM E 108.
   b. Class A rated by Cal-Fire.
   c. Water absorption: 0.18 percent by weight, tested to ASTM D471.
   d. Impact resistance: Class 4, tested to UL 2218.
   e. Nail pull through resistance: 138 foot-pounds at 72 degree F (187 joules at 22 degrees C) and 166 foot-pounds at 32 degrees F (225 joules at 0 degrees C), tested to ASTM D3462/D3462M.
   f. Freeze-thaw resistance: No crazing, cracking, delamination of coating, or other deleterious surface changes after one month exposure with temperature cycled from minus 40 to plus 180 degrees F (0 degrees to 82 degrees C) in 22 hours, tested to ICC ES Acceptance Criteria AC07 Section 4.9.
   g. Accelerated weathering: Little change after 2,500 hours exposure to ultraviolet radiation, elevated temperature, moisture, and thermal shock.
   h. Fungus resistance: No algae growth when inoculated with blue green algae in warm, damp environment for 4 to 6 weeks, tested to ASTM G21.
   i. Approved by NRCC CCMC.
4. Installation exposure:
   a. 8 inch (203 mm) exposure.
5. Profile:
   a. Rectangular shape with exposed-to-view upper surface and edges textured to resemble natural slate.
   b. Underside formed with reinforcing ribs.
6. Size:

a. Thickness: Varies from 1/8 inch (3 mm) at top to 1/2 inch (13 mm) at bottom.
b. Length: 18 inches (457 mm).
c. Widths: Variable widths from 6, 7, 9, 10, and 12 inches (152, 178, 229, 254, and 305 mm) to create appearance of random sized natural slate.

7. Starter shingle: 12 inches (305 mm) long x 12 inches (305 mm) wide.
8. Markings: Form shingles with markings on upper surface to indicate nailing locations and provide alignment guide lines for different exposure lengths.
9. Color and pattern:
   a. Provide shingles in multiple colors comparable to natural slate.
   b. Provide ultraviolet protection consisting of internal stabilizer.
   c. Provide shingles factory blended in multiple colors and widths.
   d. Shingles to be Multi-Width Synthetic Slate in Vinyard color by DaVinci Roofscapes or equal.

2.3 ROOFING NAILS

A. Roofing Nails:
1. 3/8 inch (9.5 mm) flat head nails, 1-1/2 inches (38 mm) long.
2. Material: Stainless steel.

2.4 ROOFING UNDERLAYMENT

A. Self-Adhering Modified Bituminous Underlayment: ASTM D1970/D1970M.

2.5 METAL FLASHING

A. Provide metal roof flashings, including apron flashings, step flashings, valley flashings, drip edges, and vent pipe flashings specified in Section 07 60 00, FLASHING AND SHEET METAL.
1. Metal: Copper.
   a. Valleys: 1 mm (20 oz., 0.039 inches).
   b. Other Locations: 0.55 mm (16 oz., 0.022 inches).

2.6 SNOW GUARDS

A. Snow Guards: Individual copper snow guards, designed not to penetrate slate shingles.

2.7 ACCESSORIES

A. Asphalt Roof Cement: ASTM D4586/D4586M.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for roofing installation.

1. Verify roof substrates are sound, within manufacturer's tolerances, and free from defects which would interfere with roofing installation.
2. Verify roof accessories, vent pipes and other projections through roof are in place and roof flashing is installed, or ready for installation, before installing shingles.

B. Protect existing construction and completed work from damage.

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 METAL DRIP EDGE INSTALLATION

A. At eaves and rakes, install copper drip edges specified in Section 07 60 00, FLASHING AND SHEET METAL.
1. Eaves: Install metal drip edge before underlayment.
2. Rakes: Install metal drip edge after underlayment.

B. Secure metal drip edges with compatible nails spaced minimum 250 mm (10 inches) on center along inner edges.

3.4 FLASHING INSTALLATION

A. Install copper flashings at intersections of roofs, adjoining walls, roof slope changes, under ridges, hips, and valleys, and at projections through deck such as chimneys and vent stacks. Install metal flashings to comply with requirements in Section 07 60 00, FLASHING AND SHEET METAL.

B. Install step flashing at intersections with vertical surfaces.
1. Length: Length of shingle plus 50 mm (2 inches).
2. Vertical Leg Height: 200 mm (8 inches) minimum.
3. Horizontal Leg Width: 150 mm (6 inches) minimum.

C. Valley Flashing: Shingle type, as shown and as specified in Section 07 60 00, FLASHING AND SHEET METAL.
1. Secure valley flashing according to shingle manufacturer's instructions.
2. Width: 300 mm (12 inches) minimum, both sides of valley.

D. Hip and Ridge Flashing: Step flashing.
1. Length: Length of shingle plus 50 mm (2 inches).
2. Width: 13 mm (1/2 inch) less than shingle on both sides of hip or ridge.

3. Install step flashing as each course of slate shingles is installed. Extend upper edge of flashing 50 mm (2 inches) minimum above each course of shingles. Extend lower edge 13 mm (1/2 inch) above butt of shingle forming next course.

3.5 UNDERLAYMENT INSTALLATION

A. Install self-adhering sheet underlayment, working from low point to high point. Lap sides 90 mm (3-1/2 inches) minimum, and lap ends 150 mm (6 inches) minimum. Install at the following locations:
   1. Eaves and Rakes: From edge of eave and rake to 600 mm (24 inches) minimum beyond inside face of exterior wall.
      a. Lap underlayment over eave metal drip edge.
   2. Valleys, Hips and Roof Slope Transitions: Centered over change in slope, and extended 450 mm (18 inches) minimum on both sides.
   3. Ridges: Centered on ridge, and extended 900 mm (36 inches) minimum on both sides.
   4. Sidewalls and Projections through Roof: Extended 450 mm (18 inches) from projection, and extended up projection 100 mm (4 inches) minimum.
   5. Roll underlayment to ensure adhesion to roof deck and metal flashings.

B. Underlayment/Slip Sheet: Install one ply asphalt felt over full roof area, with ends weather lapped minimum 4 inches (102 mm). Nail in place with roofing nails spaced in accordance with manufacturer's recommendations.

3.6 SLATE SHINGLE INSTALLATION

A. Install starter course of roof shingles with 50 mm (2 inch) overhang at eaves. Install first course over starter course.

B. At rake, overhang roof edge 25 mm (1 inch).

C. Install shingles with specified head lap.

D. Fasten shingles using two nails per shingle, concealed by head lap.

E. Valleys: Open, to match existing.

3.7 HIP AND RIDGE SHINGLE INSTALLATION

A. Fasten nailing strips to both sides of hip and ridge.

B. Install step flashing at hips and ridges.
   1. Begin ridge shingle installation at leeward end of ridge.
   2. Begin hip shingle installation at eave.

C. Install hip and ridge shingles in pairs, over step flashing. Butt shingles together, nail in place, then install the next course of flashing.

D. Seal ridge joint with asphalt roof cement.

3.8 SNOW GUARD INSTALLATION

A. Install snow guards as recommended by manufacturer.

B. Snow guard layout:

1. Lower portion of roof:
   a. Install three rows of snow guards 16” from eave and 16” between rows.
   b. Snow guards spaced 24” o.c. in each row.
   c. Offset snow guards 12” from previous row.
2. Middle portion of roof:
   a. Snow guards 48” o.c. in each row.
   b. Each row 24” o.c. between rows
   c. Offset snow guards 24" from previous row.
   d. Install to within 10’ of ridge.
3. Fasten snow guards with fasteners concealed by shingles. Do not penetrate shingles.

3.9 PROTECTION

A. Protect slate shingles from construction operations.

B. Repair damage.

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SECTION 07 41 13.16
STANDING SEAM METAL ROOF PANELS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies pre-finished, pre-fabricated standing seam metal roof system and related flashing, trim, and underlayment as shown on contract documents.

1.2 RELATED WORK

A. Section 05 31 00, STEEL DECKING

B. Section 06 16 00, SHEATHING

C. Section 07 22 00, ROOF AND DECK INSULATION

D. Section 07 92 00, JOINT SEALANTS: Sealant.

1.3 DEFINITIONS

A. Metal Roof Panel Assembly: Metal roof panels, attachment system components, miscellaneous metal framing, thermal, and accessories necessary for a complete weathertight roofing system.

1.4 SUBMITTALS

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

B. Samples: Finish samples of manufacturer’s colors for color selection.

C. Shop Drawings:

1. Detailed drawings showing profile and gauge of exterior sheets, location and type of fasteners, location, gauges, shape and method of attachment of all trim locations and types of sealants, and any other details as may be required for a weather-tight installation.
2. Show fabrication and installation layouts of metal roof panels, metal wall corners, anchorages, trim, flashings, closures and accessories and special details. Distinguish between factory and field-assembled work.
3. Roof Plans, drawn to scale, on which roof panels and attachments; metal trusses, bracings and supports; and any roof mounted items are coordinated with each other based on input from installer of items involved.

D. Manufacturer's Literature and Data: Standing Seam Roof Panels

E. Manufacturer’s Certificates: Indicating manufacturer’s qualifications specified.

F. Installer qualifications.

G. Manufacturer warranty.

1.5 QUALITY ASSURANCE

A. Approval by Contracting Officer Representative (COR) is required of products of proposed manufacturer.

B. Certify manufacturer has five (5) years continuous documented experience in fabrication of metal roofing and siding panels.

C. Source: For each material type required for work of this section, provide primary materials, which are products of one manufacturer. Provide secondary or accessory materials, which are acceptable to manufacturers of primary materials.

D. Installer: A firm with a minimum of five (5) years' experience in type of work required by this section and which is acceptable to manufacturers of primary materials.

E. Panels shall be factory-produced only. No portable, installer-owned or installer-rented machines will be permitted.

1.6 DELIVERY, STORAGE AND HANDLING

A. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

B. Deliver components, sheets, metal roof panels and other manufactured items in manufacturer's original sealed packaging in a manner so as not to be damaged or deformed. Package metal roof panels for protection during transportation and handling.

C. Unload, store and erect metal roof panels in a manner to prevent bending, warping, twisting and surface damage.

D. Stack metal roof panels on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal roof panels to ensure dryness. Do not store metal roof panels in contact with other materials that might cause staining, denting or other surface damage.

E. Protect strippable protective coating on any metal coated product from exposure to sunlight and high humidity, except to the extent necessary for material installation.

1.7 FIELD CONDITIONS

A. Environment: Install products when existing and forecasted weather permit installation according to manufacturer's instructions.

B. Field Measurements: Verify actual dimensions of construction contiguous with metal roof panels by field measurements before fabrication.

1.8 WARRANTY

A. Construction Warranty: Comply with FAR clause 52.246-21 "Warranty of Construction".

B. Manufacturer Weathertight Warranty: Manufacturer shall agree to repair or replace standing seam metal roof panel assemblies that fail to remain weathertight, including leaks, for a minimum of twenty (20) years from date of installation and final acceptance by the Government. Submit manufacturer warranty.

C. Warranty on Panel Finishes: Manufacturer shall agree to repair finish or replace standing seam metal roof panels that show evidence of deterioration of factory-applied finish within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
   a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
   b. Chalking in excess of a No. 8 rating when testing according to ASTM D4214.
   c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Finish Warranty Period: 20 years from date of installation and final acceptance by the COR.

1.9 APPLICABLE PUBLICATIONS

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

B. Aluminum Association. Aluminum Design Manual.

C. American Architecture Manufacturers Association (AAMA):

611-14 ..... Anodized Architectural Aluminum

621-02 ..... Voluntary Specifications for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) and Zinc-Aluminum Coated Steel Substrates

2605-13 ..... Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels

D. American Iron and Steel Institute (AISI):

SG03-02 ..... Cold-Formed Steel Design Manual

E. ASTM International (ASTM):

A463/A463M-15 ..... Steel Sheet, Cold-Rolled, Aluminum-Coated, by the Hot-Dip Process

A653/A653M-20 ..... Steel Sheet, Zinc-Coated (Galvanized), or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

ASTM A792 ..... Steel Sheet, Aluminum-Zinc Alloy Coated by the Hot Dip Process

A924/A924M-19 ..... Steel Sheet, Metallic Coated by the Hot-Dip Process

A1008/A1008M-18 ..... Steel, Sheet, Cold-Rolled, Carbon, Structural, High Strength Low Alloy

B209-14 ..... Aluminum and Aluminum Alloy Sheet and Plate

B209M-14 ..... Aluminum and Aluminum Alloy Sheet and Plate (Metric)

B370 ..... Standard Specification for Copper Sheet and Strip for Building Construction

C553-19 ..... Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications

C591-20 ..... Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation

C612-14(2019) ..... Mineral Fiber Block and Board Thermal Insulation

C1396/C1396M-17 ..... Gypsum Board

D2244-16 ..... Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates

D4214-07(2015) ..... Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films

E119-20 ..... Fire Test of Building Construction and Materials

E283-19 ..... Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

E331-00(2016) ..... Test Method for Water Penetration of Exterior Windows, Skylight, Doors, and Curtain Walls by Uniform Static Air Pressure Difference

E1592-05(2017) ..... Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Method

E1646-95(2018) ..... Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference

E1680-16 ..... Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems

E1980-11(2019) ..... Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces

E2140-01(2017) ..... Test Method for Water Penetration of Metal Roof Panel Systems by Static Water Pressure Head

F. Cool Roof Rating Council (CRRC):
Standard-14

G. FM Global:
4471-10..... Class 1 Panel Roofs

H. Metal Construction Association. Preformed Metal Wall Guidelines.

I. Sheet Metal and Air Conditioning Contractors National Association (SMACNA). SMACNA Architectural Sheet Metal Manual, current edition.

J. Underwriters Laboratories (UL):
580-05(R2018) ..... Tests for Uplift Resistance of Roof Assemblies
Fire Resistance Directory

K. Code References:
a. ASCE, Minimum Loads for Buildings and Other Structures
b. BOCA National Building Codes
c. UBC Uniform Building Code
d. SBC Standard Building Code

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS ROOF PANELS

A. General Performance: Metal roof panels shall comply with performance requirements without failure due to defective manufacture, fabrication, installation or other defects in construction.

B. Energy Performance: Provide roof panels according to one of the following when tested according to CRRC-1:

1. Three-year, aged solar reflectance of not less than 0.55 and emissivity of not less than 0.75.
2. Three-year, aged Solar Reflectance Index (SRI) of not less than 64 when calculated according to ASTM E1980.

C. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592.
1. Wind Loads: Roof System shall be designed to meet Standard Building Code Wind Load requirements.
2. Other Design Loads: As indicated.
3. Deflection Limits: For wind loads, as indicated.
4. Minimum Panel rib depth: 1-3/4”H Seam.
5. Panel width: 12 inches.

D. Air Infiltration: Air leakage of not more than 0.3 liter/second per square meter (0.06 cfm/square foot) when tested according to ASTM E1680 or ASTM E283 at the following test-pressure difference:
1. Test-Pressure Difference: 75 Pa (1.57 pound force/square foot);300 Pa (6.24 pound force/square foot).

E. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E1646 or ASTM E331 at the following test-pressure difference:
1. Test-Pressure Difference: 137 Pa (2.86 pound force/square foot);300 Pa (6.24 pound force/square foot).

F. Hydrostatic-Head Resistance: No water penetration when tested according to ASTM E2140.

G. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
1. Uplift Rating: UL 90.

H. FM Global Listing: Provide metal roof panels and composite component materials that comply with requirements FM Global 4771 as part of a panel roofing system and that are listed in FM Global’s “Approval Guide” for Class 1 or noncombustible construction, as applicable. Identify materials with FM Global markings.
1. Fire/Windstorm Classification: UL Class 90.
2. Hail Resistance: SH; UL2218 Impact Resistant rated..

I. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joints sealants, failure of

connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

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

2.2 SHEET STEEL

A. Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips inside laps. Include clips, cleats, pressure plates and accessories required for weathertight installation.

1. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTME 1514.

B. Vertical Rib, Snap-Joint, Standing Seam Metal Roof Panels: Formed with vertical ribs at panel edges and a flat pan between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels, engaging opposite edge of adjacent panels, and snapping panels together.

1. Steel, Sheet, Galvanized: ASTM A653/A653M and AISI SG03-3, Structural.
2. Grade 40, galvanized coating conforming to ASTM A924/A924M, Class Z 275 G-90.
3. Steel, Sheet, Commercial: ASTM A1008, Type C.
4. Steel, Sheet, Aluminized: ASTM A463/A463M and AISI SG03-3. Steel to be coated on both sides with 0.15 Kg/square meter (0.5 ounce of aluminum per square foot).
5. Nominal Thickness: Minimum 0.8mm (0.31 inch) thick for roof panels.
6. Exterior Finish: Two-coat fluoropolymer.
7. Color: As selected by Architect from manufacturer’s full range.
8. Panel Coverage: 16 inches.
9. Panel Seam Height: 1.75 inches.

C. Recycled Content of Steel Products: Postconsumer recycled content not less than 30 percent.

2.3 ALUMINUM PLATE AND SHEET

A. ASTM B209M (B209).

2.4 FASTENERS

A. Fasteners for Steel Panels: Galvanized or cadmium plated steel.

1. Fasteners of size, type and holding strength as recommended by panel manufacturer.

2.5 FABRICATION

A. General:

1. Fabricate and finish metal panels and accessories at the factory, by manufacturer’s standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
2. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full-length of panel.
3. Fabricate metal panel joints with factory installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
4. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
   a. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
   b. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
   c. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
   d. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
   e. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
      1) Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal panel manufacturer for application, but not less than thickness of metal being secured.
5. Provide collateral steel framing, metal and bituminous closures, fastenings, flashing, clip, caulking, panel reinforcements for

support of mechanical and electrical work as shown on the contract documents, and related components and accessories.

a. Accessories, fastenings, and flashings to be the same material and finish as the panels. Thickness and installation of accessories and flashing to be as recommended by the panel manufacturer.

2.6 FINISH

A. Provide manufacturer's two-coat fluoropolymer finishes for steel face sheets as follows at exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat.
2. Concealed Finish: Provide manufacturer's standard pretreatment and white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 3 mm (0.5 mil).

2.7 ROOFING UNDERLAYMENT

A. Self Adhering Modified Bituminous Underlayment: ASTM D1970/D1970M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the work.

1. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.
2. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.
   a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
3. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

3.3 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated on Drawings, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Extend underlayment into gutter trough. Roll laps with roller. Cover underlayment within 14 days.
   1. Apply over the entire roof surface.

B. Slip Sheet: Apply slip sheet over underlayment before installing metal roof panels.

C. Flashings: Install flashings to cover underlayment to comply with requirements specified in Section 076200 "Sheet Metal Flashing and Trim."

3.4 METAL PANEL INSTALLATION

A. General: Install panels in accordance with the manufacturer's approved erection instructions and diagrams, except as specified otherwise.

B. Install panels in full and firm contact with supports and with each other at side and end laps.

C. Where panels are cut in the field, or where factory applied coverings or coatings are abraded or damaged in handling or installation, make finish repairs with material of the same type and color as the weather coating, before being installed.

D. Seal cut ends and edges, including those at openings through the sheets.

E. Correct defects or errors in the materials in a manner approved by the COR.

F. Replace defective materials which cannot be corrected with nondefective material.

G. Provide molded closure strips where indicated and whenever sheets terminate with open ends after installation.

H. Flashing:
   1. Provide flashing and related closures and accessories in connection with the preformed metal panels as indicated and as necessary to provide a watertight installation.

2. Install details of installation, which are not indicated, in accordance with the panel manufacturer's printed instruction and details, or the approved shop drawings.
3. Allow for expansion and contraction of flashing.

I. Fasteners:

1. Space fasteners in accordance with the manufacturer's recommendations, and as necessary to withstand the design loads indicated.
2. Install fasteners in valleys or crowns as recommended by the manufacturer of the panel being used.
3. Install fasteners in straight lines within a tolerance of 13 mm (1/2-inch) in the length of a bay.
4. Drive exposed penetrating type fasteners normal to the surface, and to a uniform depth to seat gasketed washers properly, and drive so as not to damage factory applied coating.
5. Exercise care in drilling pilot holes for fastenings to keep drills perpendicular and centered in valleys, or crowns, as applicable. After drilling, remove metal filings and burrs from holes prior to installing fasteners and washers. Do not torque fasteners to exceed values recommended by the manufacturer.
6. Remove panels deformed or otherwise damaged by over-torqued fastenings, and provide new panels.
7. Remove metal shavings and filings from roofs on completion to prevent rusting and discoloration of the panels.

3.5 PROTECTION AND CLEANING

A. Protect panels and other components from damage during and after erection, and until project is accepted by the COR.

B. After completion of work, all exposed finished surfaces of panels are to be cleaned of soil, discoloration and disfiguration. Touch-up abraded surfaces of panels.

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SECTION 07 54 23
THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Thermoplastic Polyolefin (TPO) sheet roofing adhered to roof deck.

1.2 RELATED WORK

A. Section 07 01 50.19, PREPARATION FOR REROOFING: Preparation of Existing Membrane Roofs and Repair Areas.

B. Section 07 22 00, ROOF AND DECK INSULATION: Roof Insulation.

1.3 APPLICABLE PUBLICATIONS

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

B. American National Standards Institute/Single-Ply Roofing Institute (ANSI/SPRI):

FX-1-16.....Standard Field Test Procedure for Determining the Withdrawal Resistance of Roofing Fasteners.

C. American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI):

7-16.....Minimum Design Loads for Buildings and Other Structures.

D. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE):

90.1-13.....Energy Standard for Buildings Except Low-Rise Residential Buildings.

E. ASTM International (ASTM):

C67-20.....Sampling and Testing Brick and Structural Clay Tile.

C140/C140M-20a.....Sampling and Testing Concrete Masonry Units and Related Units.

C1371-15.....Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers.

C1549-16.....Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer.

D1876-08(2015)e1.....Peel Resistance of Adhesives (T-Peel Test).

D4263-83(2018).....Indicating Moisture in Concrete by the Plastic Sheet Method.

D4434/D4434M-15.....Poly(Vinyl Chloride) Sheet Roofing.
D6878/D6878M-13.....Thermoplastic Polyolefin Based Sheet Roofing.
E408-13.....Total Normal Emittance of Surfaces Using Inspection-Meter Techniques.
E1918-16.....Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field.
E1980-11(2019).....Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.

F. Cool Roof Rating Council (CRRC):
1-20.....Product Rating Program.

G. National Roofing Contractors Association (NRCA):
Manual-19.....The NRCA Roofing Manual: Membrane Roofing Systems.

H. U.S. Department of Agriculture (USDA):
BioPreferred® Program Catalog.

I. UL LLC (UL):
580-06.....Tests for Uplift Resistance of Roof Assemblies.
1897-20.....Uplift Tests for Roof Covering Systems.

J. U.S. Department of Commerce National Institute of Standards and Technology (NIST):
DOC PS 1-19.....Structural Plywood.
DOC PS 2-18.....Performance Standard for Wood-Based Structural-Use Panels.

K. U.S. Environmental Protection Agency (EPA):
Energy Star.....ENERGY STAR Program Requirements for Roof Products Version 3.0.

1.4 PREINSTALLATION MEETINGS

A. Conduct pre-installation meeting at project site minimum 30 days before beginning Work of this section.
   1. Required Participants:
      a. Contracting Officer's Representative.
      b. Architect/Engineer.
      c. Contractor.
      d. Installer.
      e. Manufacturer's field representative.
      f. Other installers responsible for adjacent and intersecting work, including roof deck, flashings, roof penetrations, roof

accessories, utility penetrations, rooftop curbs and equipment and lightning protecton.

2. Meeting Agenda: Distribute agenda to participants minimum 3 days before meeting.
   a. Installation schedule.
   b. Installation sequence.
   c. Preparatory work.
   d. Protection before, during, and after installation.
   e. Installation.
   f. Terminations.
   g. Transitions and connections to other work.
   h. Inspecting and testing.
   i. Other items affecting successful completion.
   j. Pullout test of fasteners.
   k. Material storage, including roof deck load limitations.
3. Document and distribute meeting minutes to participants to record decisions affecting installation.

1.5 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submittal Drawings:
   1. Roof membrane layout.
   2. Roofing membrane seaming and joint details.
   3. Roof membrane penetration details.
   4. Base flashing and termination details.

C. Manufacturer's Literature and Data:
   1. Description of each product.
   2. Minimum fastener pullout resistance.
   3. Installation instructions.
   4. Warranty.

D. Samples:
   1. Roofing Membrane: 150 mm (6 inch) square.
   2. Base Flashing: 150 mm (6 inch) square.
   3. Fasteners: Each type.
   4. Roofing Membrane Seam: 300 mm (12 inches) square.

E. Certificates: Certify products comply with specifications.
   1. Fire and windstorm classification.
   2. Energy performance requirements.

F. Qualifications: Substantiate qualifications comply with specifications.
   1. Installer, including supervisors with project experience list.
   2. Manufacturer's field representative with project experience list.
G. Field quality control reports.
H. Temporary protection plan. Include list of proposed temporary materials.
I. Operation and Maintenance Data:
   1. Maintenance instructions.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Approved by roofing system manufacturer as installer for roofing system with specified warranty.
   2. Regularly installs specified products.
   3. Installed specified products with satisfactory service on five similar installations for minimum five years.
      a. Project Experience List: Provide contact names and addresses for completed projects.
   4. Employs full-time supervisors experienced installing specified system and able to communicate with Contracting Officer's Representative and installer's personnel.
B. Manufacturer's Field Representative:
   1. Manufacturer's full-time technical employee or independent roofing inspector.
   2. Individual certified by Roof Consultants Institute as Registered Roof Observer.

1.7 DELIVERY

A. Deliver products in manufacturer's original sealed packaging.
B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, and manufacture date.
C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.8 STORAGE AND HANDLING

A. Comply with NRCA Manual storage and handling requirements.
B. Store products indoors in dry, weathertight facility.
C. Store adhesives according to manufacturer's instructions.
D. Protect products from damage during handling and construction operations.

E. Products stored on the roof deck must not cause permanent deck deflection.

1.9 FIELD CONDITIONS

A. Environment:

1. Product Temperature: Minimum 4 degrees C (40 degrees F) for minimum 48 hours before installation.
2. Weather Limitations: Install roofing only during dry current and forecasted weather conditions.

1.10 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

B. Manufacturer's Warranty: Warrant roofing system against material and manufacturing defects and agree to repair any leak caused by a defect in the roofing system materials or workmanship of the installer.

1. Warranty Period: 20 years.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Roofing System: Thermoplastic Polyolefin (TPO) sheet roofing adhered to roof deck.

2.2 SYSTEM PERFORMANCE

A. Design roofing system complying with specified performance:

1. Load Resistance: ASCE/SEI 7; Design criteria: as indicated on Drawings.
   a. Uplift Pressures:
      1) Corner Uplift Pressure: 3.5 kPa/square meter (73 per square foot).
      2) Perimeter Uplift Pressure: 2.6 kPa/square meter (54 per square foot).
      3) Field-of-Roof Uplift Pressure: 1.6 kPa/square meter (34 per square foot).

2.3 PRODUCTS - GENERAL

A. Provide roof system components from one manufacturer.

2.4 TPO ROOFING MEMBRANE

A. TPO Sheet: ASTM D6878/D6878M, internally fabric or scrim reinforced, 1.5 mm (60 mils) thick, with no backing.
   a. Color: White.

2.5 MEMBRANE ACCESSORY MATERIALS

A. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as TPO sheet membrane.

B. Factory Formed Flashings: Inside and outside corners, pipe boots, and other special flashing shapes to minimize field fabrication.

C. Bonding Adhesive: Manufacturer's standard, water based.

D. Metal Termination Bars: Manufacturer's standard, stainless-steel or aluminum, 25 mm wide by 3 mm thick (1-inch wide by 1/8 inch thick) factory drilled for fasteners.

E. Battens: Manufacturer's standard, galvannealed or galvanized steel sheet, 25 mm wide by 1.3 mm thick (1-inch wide by 0.05 inch thick), factory punched for fasteners.

F. Fasteners: Manufacturer's standard coated steel with metal or plastic plates, to suit application.

G. Primers, Sealers, T-Joint Covers, Lap Sealants, and Termination Reglets: As specified by roof membrane manufacturer.

H. 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.

2.6 WALKWAY PADS

A. Manufacturer's standard, slip-resistant rolls, minimum 900 mm (3 feet) wide by 5 mm (3/16 inch) thick.

2.7 ACCESSORIES

A. Temporary Protection Materials:

1. Expanded Polystyrene (EPS) Insulation: ASTM C578.
2. Plywood: NIST DOC PS 1, Grade CD Exposure 1.
3. Oriented Strand Board (OSB): NIST DOC PS 2, Exposure 1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine and verify substrate suitability with roofing Installer and roofing inspector present.

1. Verify roof penetrations are complete, secured against movement.
2. Verify roof deck is adequately secured to resist wind uplift.
3. Verify roof deck is clean, dry, and in-plane ready to receive roofing system.

B. Correct unsatisfactory conditions before beginning roofing work.

3.2 PREPARATION

A. Complete roof deck construction before beginning roofing work:
   1. Curbs, blocking, edge strips, and other components to which insulation, roofing, and base flashing is attached in place ready to receive insulation and roofing.
   2. Coordinate roofing membrane installation with flashing work and roof insulation work so insulation and flashing are installed concurrently to permit continuous roofing operations.
   3. Complete installation of flashing, insulation, and roofing in same day except for the area where temporary protection is required when work is stopped for inclement weather or end of work day.

B. Dry out surfaces including roof deck flutes, that become wet from any cause during progress of the work before roofing work is resumed. Apply materials to dry substrates, only.

C. Broom clean roof decks. Remove dust, dirt and debris.

D. Remove projections capable of damaging roofing materials.

E. Concrete Decks, except Insulating Concrete:
   1. Test concrete decks for moisture according to ASTM D4263 before installing roofing materials.
   2. Prime concrete decks. Keep primer back 100 mm (4 inches) from precast concrete deck joints.
   3. Allow primer to dry before application of bitumen.

F. Existing Membrane Roofs and Repair Areas:
   1. Comply with requirements in Section 07 01 50.19 PREPARATION FOR REROOFING.

3.3 TEMPORARY PROTECTION

A. Install temporary protection consisting of a temporary seal and water cut-offs at the end of each day's work and when work is halted for an indefinite period or work is stopped when precipitation is imminent.

B. Install temporary cap flashing over top of base flashings where permanent flashings are not in place to protect against water intrusion into roofing system. Securely anchor in place to prevent blow off and damage by construction activities.

C. Temporarily seal exposed insulation surfaces within roofing membrane.
   1. Apply temporary seal and water cut off by extending roofing membrane beyond insulation and securely embedding edge of the roofing membrane in 6 mm (1/4 inch) thick by 50 mm (2 inches) wide strip of temporary closure sealant. Weight roofing membrane edge with

sandbags, to prevent displacement; space sandbags maximum 2400 mm (8 feet) on center.

2. Direct water away from work. Provide drainage, preventing water accumulation.
3. Check daily to ensure temporary seal remains watertight. Reseal open areas and weight down.

D. Before the work resumes, cut off and discard portions of roof membrane in contact with temporary seal.

1. Cut minimum 150 mm (6 inches) back from sealed edges and surfaces.

E. Remove sandbags and store for reuse.

3.4 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. Comply with NRCA Manual installation requirements.

C. Comply with UL 580 or UL 1897 for uplift resistance.

D. Do not allow membrane and flashing to contact surfaces contaminated with asphalt, coal tar, oil, grease, or other substances incompatible with TPO.

3.5 ROOFING INSTALLATION

A. Install the membrane so the sheets run perpendicular to the long dimension of the insulation boards.

B. Begin installation at the low point of the roof and work towards the high point. Lap membrane shingled in water flow direction.

C. Position the membrane free of buckles and wrinkles.

D. Roll membrane out; inspect for defects as membrane is unrolled. Remove defective areas:

1. Lap edges and ends of sheets 50 mm (2 inches) or more as recommended by the manufacturer.
2. Heat weld laps. Apply pressure as required. Seam strength of laps as required by ASTM D4434/D4434M.
3. Check seams to ensure continuous adhesion and correct defects.
4. Finish seam edges with beveled bead of lap sealant.
5. Finish seams same day as membrane is installed.
6. Anchor membrane perimeter to roof deck or parapet wall as indicated on drawings.

7. Repair areas of welded seams where samples have been taken or marginal welds, bond voids, or skips occurs.
8. Repair fishmouths and wrinkles by cutting to lay flat and installing patch over cut area extending 100 mm (4 inches) beyond cut.

E. Membrane Perimeter Anchorage:
1. Install batten at perimeter of each roof area, curb flashing, expansion joints and similar penetrations on top of roof membrane as indicated on drawings.

F. Adhered System:
1. Apply bonding adhesive in quantities required by roof membrane manufacturer.
2. Fold sheet back on itself, clean and coat the bottom side of the membrane and the top of substrate with adhesive. Do not coat the lap joint area.
3. After adhesive has set according to adhesive manufacturer's instruction, roll roofing membrane into adhesive minimizing voids and wrinkles.
4. Repeat for other half of sheet.

3.6 FLASHING INSTALLATION

A. Install flashings same day as roofing membrane is installed. When flashing cannot be completely installed in one day, complete installation until flashing is watertight and provide temporary covers or seals.

B. Flashing Roof Drains:
1. Install roof drain flashing as recommended by roofing membrane manufacturer.
   a. Coordinate to set the metal drain flashing in asphalt roof cement, holding cement back from the edge of the metal flange.
   b. Do not allow the roof cement to come in contact with TPO roofing membrane.
   c. Adhere roofing membrane to metal flashing with bonding adhesive.
2. Turn down the metal drain flashing and roofing membrane into drain body. Install clamping ring and strainer.

C. Installing Base Flashing and Pipe Flashing:
1. Install flashing sheet to pipes, wall or curbs to minimum200 mm (8 inches) above roof surfaces and extending roofing manufacturer's standard lap dimension onto roofing membranes.
   a. Adhere flashing with bonding adhesive.

b. Form inside and outside corners of flashing sheet according to NRCA manual. Form pipe flashing according to NRCA manual.
c. Lap ends roofing manufacturer's standard dimension.
d. Heat weld flashing membranes together and flashing membranes to roofing membranes. Finish exposed edges with lap sealant.
e. Install flashing membranes according to NRCA manual.

2. Anchor top of flashing to walls and curbs with fasteners spaced maximum150 mm (6 inches) on center. Use surface mounted fastening strip with sealant on ducts. Use pipe clamps on pipes or other round penetrations.
3. Apply sealant to top edge of flashing.

D. Installing Building Expansion Joints:
1. Install base flashing on curbs as specified.
2. Coordinate installation with roof expansion joint system.
3. Install flexible tubing 1-1/2 times the width of joint centered over joint. Cover tubing with flashing sheet adhered to base flashing and lapping base flashing roofing manufacturer's standard dimension. Finish edges of laps with sealant.

E. Repairs to Membrane and Flashings:
1. Remove sections of roofing membrane or flashing that are creased, wrinkled, or fishmouthed.
2. Cover removed areas, cuts and damaged areas with a patch extending 100 mm (4 inches) beyond damaged, cut, or removed area. Heat weld to roofing membrane or flashing sheet. Finish edge of lap with lap sealant.

3.7 WALKWAY PAD INSTALLATION

A. Heat weld walkway sheet to roofing membrane at edges. Weld area 50 mm (2 inches) wide by the entire length of the walkway sheet.
B. Finish edges of laps with lap sealant.

3.8 FIELD QUALITY CONTROL

A. Field Tests: Performed by testing laboratory specified in Section 01 45 29, TESTING LABORATORY SERVICES.
1. Fastener Pull Out Tests: ANSI/SPRI FX-1; one test for every 230 square meter (2,500 square feet) of deck. Perform tests for each combination of fastener type and roof deck type before installing roof insulation.
a. Test at locations selected by Contracting Officer's Representative.

b. Do not proceed with roofing work when pull out resistance is less than manufacturer's required resistance.

c. Test Results:

1) Repeat tests using different fastener type or use additional fasteners achieve pull out resistance required to meet specified wind uplift performance.

2) Patch cementitious deck to repair areas of fastener tests holes.

2. Examine and probe roofing membrane and flashing seams in presence of Contracting Officer's Representative and Manufacturer's field representative.

3. Probe seams to detect marginal bonds, voids, skips, and fishmouths.

4. Cut 100 mm (4 inch) wide by 300 mm (12 inch) long samples through seams where directed by Contracting Officer's Representative.

5. Cut one sample for every 450 m (1500 feet) of seams.

6. Cut samples perpendicular to seams.

7. Failure of samples to pass ASTM D1876 test will be cause for rejection of work.

8. Repair areas where samples are taken and where marginal bond, voids, and skips occur.

9. Repair fishmouths and wrinkles by cutting to lay flat. Install patch over cut area extending 100 mm (4 inches) beyond cut.

B. Manufacturer Services:

1. Inspect initial installation, installation in progress, and completed work.

2. Issue supplemental installation instructions necessitated by field conditions.

3. Prepare and submit inspection reports.

4. Certify completed installation complies with manufacturer's instructions and warranty requirements.

3.9 CLEANING

A. Remove excess adhesive before adhesive sets.

B. Clean exposed roofing surfaces. Remove contaminants and stains.

3.10 PROTECTION

A. Protect roofing system from traffic and construction operations.

1. Protect roofing system when used for subsequent work platform, materials storage, or staging.

2. Distribute scaffolding loads to exert maximum 50 percent roofing system materials compressive strength.

B. Loose lay temporary insulation board overlaid with plywood or OSB.

1. Weight boards to secure against wind uplift.

C. Remove protective materials immediately before acceptance.

D. Repair damage.

- - - E N D - - -

SECTION 07 60 00
FLASHING AND SHEET METAL

PART 1 - GENERAL

1.1 DESCRIPTION

A. Formed sheet metal work for wall and roof flashing, copings, roof edge metal, drainage specialties, and formed expansion joint covers are specified in this section.

1.2 RELATED WORK

A. Section 07 54 23 THERMOPLASTIC POLYOLEFIN (TPO) ROOFING: Membrane base flashings and stripping.

B. Section 07 72 00, ROOF ACCESSORIES: Integral flashing components of manufactured roof specialties and accessories or equipment.

C. Section 07 92 00, JOINT SEALANTS: Joint Sealants.

1.3 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only. Editions of applicable publications current on date of issue of bidding documents apply unless otherwise indicated.

B. Aluminum Association (AA):

AA-C22A41.....Aluminum Chemically etched medium matte, with clear anodic coating, Class I Architectural, 0.7-mil thick

AA-C22A42.....Chemically etched medium matte, with integrally colored anodic coating, Class I Architectural, 0.7 mils thick

AA-C22A44.....Chemically etched medium matte with electrolytically deposited metallic compound, integrally colored coating Class I Architectural, 0.7-mil thick finish

C. American National Standards Institute/Single-Ply Roofing Institute/Factory Mutual (ANSI/SPRI/FM):

4435/ES-1-11.....Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems

D. American Architectural Manufacturers Association (AAMA):

AAMA 620-02.....Voluntary Specification for High Performance Organic Coatings on Coil Coated Architectural Aluminum

AAMA 621-02.....Voluntary Specification for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) and Zinc-Aluminum Coated Steel Substrates

E. ASTM International (ASTM):

A240/A240M-20.....Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels and for General Applications.

A653/A653M-20.....Steel Sheet Zinc-Coated (Galvanized) or Zinc Alloy Coated (Galvanized) by the Hot- Dip Process

B32-08(2014).....Solder Metal

B209-14.....Aluminum and Aluminum-Alloy Sheet and Plate

B370-12(2019).....Copper Sheet and Strip for Building Construction

D173/D173M-03(2018).....Bitumen-Saturated Cotton Fabrics Used in Roofing and Waterproofing

D412-16.....Vulcanized Rubber and Thermoplastic Elastomers-Tension

D1187/D1187M-97(2018)...Asphalt Base Emulsions for Use as Protective Coatings for Metal

D1784-20.....Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds

D3656/D3656M-13.....Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns

D4586/D4586M-07(2018)...Asphalt Roof Cement, Asbestos Free

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

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

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

H. Federal Specification (Fed. Spec):

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

UU-B-790A.....Building Paper, Vegetable Fiber

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

1.4 PERFORMANCE REQUIREMENTS

A. Wind Uplift Forces: Resist the following forces per FM Approvals 1-49:
   1. Wind Zone 1: 1.00 to 1.44 kPa (21 to 30 pound force/square foot): 2.87-kPa (60 pound force/square foot) perimeter uplift force, 4.31-kPa (90 pound force/square foot) corner uplift force, and 1.44-kPa (30 pound force/square foot) outward force.

B. Wind Design Standard: Fabricate and install copings and roof-edge flashings tested per ANSI/SPRI/FM 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. Gutter and Conductors
   4. Expansion joints

C. Manufacturer's Literature and Data: For all specified items, including:
   1. Two-piece counterflashing
   2. Thru wall flashing
   3. Expansion joint cover, each type

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. Copper ASTM B370, cold-rolled temper.

C. Aluminum Sheet: ASTM B209, alloy 3003-H14 .

D. 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^2(6 pounds/100 square feet).

C. Bituminous Paint: ASTM D1187, Type I.

D. Fasteners:
   1. Use copper, copper alloy, bronze, brass, or stainless steel for copper and copper clad stainless steel, and stainless steel for stainless steel and aluminum alloy. Use galvanized steel or stainless steel for galvanized steel.
   2. Nails:
      a. Minimum diameter for copper nails: 3 mm (0.109 inch).
      b. Minimum diameter for aluminum nails 3 mm (0.105 inch).
      c. Minimum diameter for stainless steel nails: 2 mm (0.095 inch) and annular threaded.
      d. Length to provide not less than 22 mm (7/8 inch) penetration into anchorage.
   3. Rivets: Not less than 3 mm (1/8 inch) diameter.
   4. Expansion Shields: Fed Spec A-A-1925A.
E. Sealant: As specified in Section 07 92 00, JOINT SEALANTS for exterior locations.
F. Roof Cement: ASTM D4586.

2.3 SHEET METAL THICKNESS

A. Except as otherwise shown or specified use thickness or weight of sheet metal as follows:
   1. Galvanized steel: 0.5 mm (0.021 inch) thick minimum.
   2. Copper: 0.5 Kg (20 oz) minimum.
   3. Stainless steel: 0.45 mm (0.018 inch) minimum.
B. Thickness of aluminum or galvanized steel is specified with each item.

2.4 FABRICATION, GENERAL

A. Jointing:
   1. In general, copper and stainless steel, except expansion and contraction joints, shall be locked and soldered.
   2. Jointing of copper over 0.5 Kg (20 oz) weight or stainless steel over 0.45 mm (0.018 inch) thick shall be done by lapping, riveting and soldering.
   3. Joints shall conform to following requirements:
      a. Flat-lock joints shall finish not less than 19 mm (3/4 inch) wide.
      b. Lap joints subject to stress shall finish not less than 25 mm (one inch) wide and shall be soldered and riveted.
      c. Unsoldered lap joints shall finish not less than 100 mm (4 inches) wide.

4. Flat and lap joints shall be made in direction of flow.
5. Soldering:
   a. Pre tin both mating surfaces with solder for a width not less than 38 mm (1 1/2 inches) of uncoated copper, stainless steel, and copper clad stainless steel.
   b. Wire brush to produce a bright surface before soldering lead coated copper.
   c. Treat in accordance with metal producers recommendations other sheet metal required to be soldered.
   d. Completely remove acid and flux after soldering is completed.

B. Expansion and Contraction Joints:
1. Fabricate in accordance with the Architectural Sheet Metal Manual recommendations for expansion and contraction of sheet metal work in continuous runs.
2. Space joints as shown or as specified.
3. Space expansion and contraction joints for copper, stainless steel, and copper clad stainless steel at intervals not exceeding 7200 mm (24 feet).
4. Space expansion and contraction joints for aluminum at intervals not exceeding 5400 mm (18 feet), except do not exceed 3000 mm (10 feet) for gravel stops and fascia-cant systems.
5. Fabricate slip-type or loose locked joints and fill with sealant unless otherwise specified.
6. Fabricate joint covers of same thickness material as sheet metal served.

C. Cleats:
1. Fabricate cleats to secure flashings and sheet metal work over 300 mm (12 inches) wide and where specified.
2. Provide cleats for maximum spacing of 300 mm (12 inch) centers unless specified otherwise.
3. Form cleats of same metal and weights or thickness as the sheet metal being installed unless specified otherwise.
4. Fabricate cleats from 50 mm (2 inch) wide strip. Form end with not less than 19 mm (3/4 inch) wide loose lock to item for anchorage. Form other end of length to receive fasteners free of item to be anchored and end edge to be folded over and cover fastener heads.

D. Edge Strips or Continuous Cleats:

1. Fabricate continuous edge strips where shown and specified to secure loose edges of the sheet metal work.
2. Except as otherwise specified, fabricate edge strips or minimum 0.6 mm (0.024 inch) thick stainless steel.
3. Use material compatible with sheet metal to be secured by the edge strip.
4. Fabricate in 3000 mm (10 feet) maximum lengths with not less than 19 mm (3/4 inch) loose lock into metal secured by edge strip.
5. Fabricate Strips for fascia anchorage to extend below the supporting wood construction to form a drip and to allow the flashing to be hooked over the lower edge at least 19 mm (3/4-inch).
6. Fabricate anchor edge maximum width of 75 mm (3 inches) or of sufficient width to provide adequate bearing area to insure a rigid installation using 0.8 mm (0.031 inch) thick stainless steel.

E. Drips:
1. Form drips at lower edge of sheet metal counter-flashings (cap flashings), fascias, gravel stops, wall copings, by folding edge back 13 mm (1/2 inch) and bending out 45 degrees from vertical to carry water away from the wall.
2. Form drip to provide hook to engage cleat or edge strip for fastening for not less than 19 mm (3/4 inch) loose lock where shown.

F. Edges:
1. Edges of flashings concealed in masonry joints opposite drain side shall be turned up 6 mm (1/4 inch) to form dam, unless otherwise specified or shown otherwise.
2. Finish exposed edges of flashing with a 6 mm (1/4 inch) hem formed by folding edge of flashing back on itself when not hooked to edge strip or cleat. Use 6 mm (1/4 inch) minimum penetration beyond wall face with drip for through-wall flashing exposed edge.
3. All metal roof edges shall meet requirements of IBC, current edition.

2.5 FINISHES

A. Use same finish on adjacent metal or components and exposed metal surfaces unless specified or shown otherwise.

B. In accordance with NAAMM Metal Finishes Manual AMP 500, unless otherwise specified.

C. Finish exposed metal surfaces as follows, unless specified otherwise:
1. Copper: Mill finish.

2. Stainless Steel: Finish No. 2B or 2D.
3. Aluminum:
   a. Fluorocarbon Finish: AAMA 620, high performance organic coating.
4. Steel and Galvanized Steel:
   a. Manufacturer's finish:
      1) Fluorocarbon Finish: AAMA 621, high performance organic coating.

2.6 THROUGH-WALL AND STONE CAP FLASHINGS

A. Form through-wall and stone cap flashing to provide a mechanical bond or key against lateral movement in all directions. Install a sheet having 2 mm (1/16 inch) deep transverse channels spaced four to every 25 mm (one inch), or ribbed diagonal pattern, or having other deformation unless specified otherwise.
   1. Fabricate in not less than 2400 mm (8 feet) lengths; 3000 mm (10 feet) maximum lengths.
   2. Fabricate so keying nests at overlaps.
B. For Masonry Work When Concealed Except for Drip:
   1. Either copper or stainless steel as noted.
   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 copper or, stainless steel.
   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.

2.7 BASE FLASHING

A. Fabricate metal base flashing up vertical surfaces not less than 200 mm (8 inch) nor more than 400 mm (16 inch).
B. Fabricate roof flange not less than 100 mm (4 inches) wide unless shown otherwise. When base flashing length exceeds 2400 mm (8 feet) form flange edge with 13 mm (1/2 inch) hem to receive cleats.
C. Form base flashing bent from strip except pipe flashing. Fabricate ends for riveted soldered lap seam joints. Fabricate expansion joint ends as specified.
D. Pipe Flashing: (Other than engine exhaust or flue stack)

1. Fabricate roof flange not less than 100 mm (4 inches) beyond sleeve on all sides.
2. Extend sleeve up and around pipe and flange out at bottom not less than 13 mm (1/2 inch) and solder to flange and sleeve seam to make watertight.
3. At low pipes 200 mm (8 inch) to 450 mm (18 inch) above roof:
   a. Form top of sleeve to turn down into the pipe at least 25 mm (one inch).
   b. Allow for loose fit around and into the pipe.
4. At high pipes and pipes with goosenecks or other obstructions which would prevent turning the flashing down into the pipe:
   a. Extend sleeve up not less than 300 mm (12 inch) above roofing.
   b. Allow for loose fit around pipe.

2.8 COUNTERFLASHING (CAP FLASHING OR HOODS)

A. Either copper or stainless steel, unless specified otherwise.

B. Fabricate to lap base flashing a minimum of 100 mm (4 inches) with drip:
   1. Form lock seams for outside corners. Allow for lap joints at ends and inside corners.
   2. In general, form flashing in lengths not less than 2400 mm (8 feet) and not more than 3000 mm (10 feet).
   3. Two-piece, lock in type flashing may be used in-lieu-of one piece counter-flashing.
   4. Manufactured assemblies may be used.
   5. Where counterflashing is installed at new work use an integral flange at the top designed to be extended into the masonry joint or reglet in concrete.
   6. Where counterflashing is installed at existing work use surface applied type, formed to provide a space for the application of sealant at the top edge.

C. One-piece Counterflashing:
   1. Back edge turned up and fabricate to lock into reglet in concrete.
   2. Upper edge formed to extend full depth of masonry unit in mortar joint with back edge turned up 6 mm (1/4 inch).

D. Two-Piece Counterflashing:
   1. Receiver to extend into masonry wall depth of masonry unit with back edge turned up 6 mm (1/4 inch) and exposed edge designed to receive and lock counterflashing upper edge when inserted.

2. Counterflashing upper edge designed to snap lock into receiver.

E. Surface Mounted Counterflashing; one or two piece:

1. Use at existing or new surfaces where flashing cannot be inserted in vertical surface.
2. One piece fabricate upper edge folded double for 65 mm (2 1/2 inches) with top 19 mm (3/4 inch) bent out to form "V" joint sealant pocket with vertical surface. Perforate flat double area against vertical surface with horizontally slotted fastener holes at 400 mm (16 inch) centers between end holes. Option: One piece surface mounted counter-flashing (cap flashing) may be used. Fabricate as detailed on Plate 51 of SMACNA Architectural Sheet Metal Manual.
3. Two pieces: Fabricate upper edge to lock into surface mounted receiver. Fabricate receiver joint sealant pocket on upper edge and lower edge to receive counterflashing, with slotted fastener holes at 400 mm (16 inch) centers between upper and lower edge.

F. Pipe Counterflashing:

1. Form flashing for water-tight umbrella with upper portion against pipe to receive a draw band and upper edge to form a "V" joint sealant receiver approximately 19 mm (3/4 inch) deep.
2. Fabricate 100 mm (4 inch) over lap at end.
3. Fabricate draw band of same metal as counter flashing. Use 0.6 Kg (24 oz) copper or 0.33 mm (0.013 inch) thick stainless steel or copper coated stainless steel.
4. Use stainless steel bolt on draw band tightening assembly.
5. Vent pipe counter flashing may be fabricated to omit draw band and turn down 25 mm (one inch) inside vent pipe.

G. Where vented edge decks intersect vertical surfaces, form in one piece, shape to slope down to a point level with and in front of edge-set notched plank; then, down vertically, overlapping base flashing.

2.9 HANGING GUTTERS

A. Fabricate gutters of not less than the following:

1. 0.5 Kg (20 oz) copper.
2. 1.3 mm (0.051 inch) thick aluminum.

B. Fabricate hanging gutters in sections not less than 2400 mm (8 feet) long, except at ends of runs where shorter lengths are required.

C. Building side of gutter shall be not less than 38 mm (1 1/2 inches) higher than exterior side.

D. Gutter Bead: Stiffen outer edge of gutter by folding edge over approximately 19 mm (3/4 inch) toward roof and return down at angle to receive gutter straps 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 hem front edge to engage 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. Solder tube to gutter. Seal aluminum tube to gutter and rivet to gutter.
4. Fabricate basket strainers of same material as gutters.
5. Fabricate perforated screens of same material as gutters.

2.10 CONDUCTORS (DOWNSPOUTS)

A. Fabricate conductors of same metal and thickness as gutters in sections approximately 3000 mm (10 feet) long.

1. At aluminum downspouts, fabricate open face channel shape to dimensions indicated with hemmed longitudinal edges.
2. At copper downspouts, provide prefabricated rectangular gutters with ribbed surface in dimensions indicated.
   a. Provide prefabricated offsets and elbows as required.

B. Fabricate elbows in open-face downspouts by mitering, riveting, seal. Lap upper section to the inside of the lower piece.

C. Fabricate aluminum conductor brackets or hangers of same material as conductor, 2 mm (1/16 inch) thick by 25 mm (one inch) minimum width. Form to support conductors 25 mm (one inch) from wall surface in accordance with Architectural Sheet Metal Manual for rectangular and round shapes.

D. Fabricate copper conductor brackets from 1 1/2 inch wide by 1/8 inch copper bar stock as indicated.

E. Aluminum 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.

F. Copper Conductor Heads:
1. Provide prefabricated conductor heads of same material as conductors.
2. Conductor profile to be “Churchill” style in sizes indicated.
3. Conductor head outlet size and shape to match size of conductor (downspout).

2.11 SCUPPERS

A. Fabricate scuppers with minimum of 100 mm (4 inch) wide flange.
B. Provide flange at top on through wall scupper to extend to top of base flashing.
C. Fabricate exterior wall side to project not less than 13 mm (1/2 inch) beyond face of wall with drip at bottom outlet edge.
D. Fabricate not less than 100 mm (4 inch) wide flange to lap behind gravel stop fascia.
E. Fabricate exterior wall flange for through wall scupper not less than 25 mm (one inch) wide on top and sides with edges hemmed.
F. Fabricate gravel stop bar of 25 mm x 25 mm (one by one inch) angle strip soldered to bottom of scupper.
G. Fabricate scupper not less than 200 mm (8 inch) wide and not less than 125 mm (5 inch) high for through wall scupper.
H. Solder joints watertight.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
1. Install flashing and sheet metal items as shown in Sheet Metal and Air Conditioning Contractors National Association, Inc.,

publication, ARCHITECTURAL SHEET METAL MANUAL, except as otherwise shown or specified.

2. Apply Sealant as specified in Section 07 92 00, JOINT SEALANTS.
3. Apply sheet metal and other flashing material to surfaces which are smooth, sound, clean, dry and free from defects that might affect the application.
4. Remove projections which would puncture the materials and fill holes and depressions with material compatible with the substrate. Cover holes or cracks in wood wider than 6 mm (1/4 inch) with sheet metal compatible with the roofing and flashing material used.
5. Coordinate with masonry work for the application of a skim coat of mortar to surfaces of unit masonry to receive flashing material before the application of flashing.
6. Apply a layer of 7 Kg (15 pound) saturated felt followed by a layer of rosin paper to wood surfaces to be covered with copper. Lap each ply 50 mm (2 inch) with the slope and nail with large headed copper nails.
7. Confine direct nailing of sheet metal to strips 300 mm (12 inch) or less wide. Nail flashing along one edge only. Space nail not over 100 mm (4 inches) on center unless specified otherwise.
8. Install bolts, rivets, and screws where indicated, specified, or required in accordance with the SMACNA Sheet Metal Manual. Space rivets at 75 mm (3 inch) on centers in two rows in a staggered position. Use neoprene washers under fastener heads when fastener head is exposed.
9. Coordinate with roofing work for the installation of metal base flashings and other metal items having roof flanges for anchorage and watertight installation.
10. Nail continuous cleats on 75 mm (3 inch) on centers in two rows in a staggered position.
11. Nail individual cleats with two nails and bend end tab over nail heads. Lock other end of cleat into hemmed edge.
12. Install flashings in conjunction with other trades so that flashings are inserted in other materials and joined together to provide a water tight installation.
13. Where required to prevent galvanic action between dissimilar metal isolate the contact areas of dissimilar metal with sheet lead, waterproof building paper, or a coat of bituminous paint.

14. Isolate aluminum in contact with dissimilar metals others than stainless steel, white bronze or other metal compatible with aluminum by:
    a. Paint dissimilar metal with a prime coat of zinc-chromate or other suitable primer, followed by two coats of aluminum paint.
    b. Paint dissimilar metal with a coat of bituminous paint.
    c. Apply an approved caulking material between aluminum and dissimilar metal.
15. Paint aluminum in contact with or built into mortar, concrete, plaster, or other masonry materials with a coat of bituminous paint.
16. Paint aluminum in contact with absorptive materials that may become repeatedly wet with two coats of bituminous paint or two coats of aluminum paint.
17. Bitumen Stops:
    a. Install bitumen stops for built-up roof opening penetrations through deck and at formed sheet metal gravel stops.
    b. Nail leg of bitumen stop at 300 mm (12 inch) intervals to nailing strip at roof edge before roofing material is installed.

3.2 THROUGH-WALL FLASHING

A. General:
1. Install continuous through-wall flashing between top of concrete foundation walls and bottom of masonry building walls; at top of concrete floors; under masonry, concrete, or stone copings and elsewhere as shown.
2. Where exposed portions are used as a counter flashings, lap base flashings at least 100 mm (4 inches) and use thickness of metal as specified for exposed locations.
3. Exposed edge of flashing may be formed as a receiver for two piece counter flashing as specified.
4. Terminate exterior edge beyond face of wall approximately 6 mm (1/4 inch) with drip edge where not part of counter flashing.
5. Turn back edge up 6 mm (1/4 inch) unless noted otherwise where flashing terminates in mortar joint or hollow masonry unit joint.
6. Terminate interior raised edge in masonry backup unit approximately 38 mm (1 1/2 inch) into unit unless shown otherwise.
7. Under copings terminate both edges beyond face of wall approximately 6 mm (1/4 inch) with drip edge.

8. Lap end joints at least two corrugations, but not less than 100 mm (4 inches). Seal laps with sealant.
9. Where dowels, reinforcing bars and fastening devices penetrate flashing, seal penetration with sealing compound. Sealing compound is specified in Section 07 92 00, JOINT SEALANTS.
10. Coordinate with other work to set in a bed of mortar above and below flashing so that total thickness of the two layers of mortar and flashing are same as regular mortar joint.
11. Where ends of flashing terminate turn ends up 25 mm (1 inch) and fold corners to form dam extending to wall face in vertical mortar or veneer joint.
12. Turn flashing up not less than 200 mm (8 inch) between masonry or behind exterior veneer.
13. When flashing terminates in reglet extend flashing full depth into reglet and secure with lead or plastic wedges spaced 150 mm (6 inch) on center.
14. Continue flashing around columns:
    a. Where flashing cannot be inserted in column reglet hold flashing vertical leg against column.
    b. Counter flash 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 Cavity Wall Construction: Where flashing occurs in cavity walls turn vertical portion up against backup under waterproofing, if any, into mortar joint. Turn up over insulation, if any, and horizontally through insulation into mortar joint.

C. Flashing at Veneer Walls:
1. Install near line of finish floors over shelf angles or where shown.
2. Turn up against sheathing.
3. At concrete backing, extend flashing into reglet as specified.
4. Coordinate with installation of waterproofing or asphalt felt for lap over top of flashing.

D. Flashing at Masonry, Stone, or Precast Concrete Copings:
1. Install flashing with drips on both wall faces unless shown otherwise.
2. Form penetration openings to fit tight against dowel or other item with edge turned up. Seal penetrations with sealant.

3.3 BASE FLASHING

A. Install where roof membrane type base flashing is not used and where shown.

1. Install flashing at intersections of roofs with vertical surfaces or at penetrations through roofs, to provide watertight construction.
2. Install metal flashings and accessories having flanges extending out on top of the built-up roofing before final bituminous coat and roof aggregate is applied.
3. Set flanges in heavy trowel coat of roof cement and nail through flanges into wood nailers over bituminous roofing.
4. Secure flange by nailing through roofing into wood blocking with nails spaced 75 mm (3 inch) on centers or, when flange over 100 mm (4 inch) wide terminate in a 13 mm (1/2 inch) folded edge anchored with cleats spaced 200 mm (8 inch) on center. Secure one end of cleat over nail heads. Lock other end into the seam.

B. For long runs of base flashings install in lengths of not less than 2400 mm (8 feet) nor more than 3000 mm (ten feet). Install a 75 mm (3 inch) wide slip type, loose lock expansion joint filled with sealant in joints of base flashing sections over 2400 mm (8 feet) in length. Lock and solder corner joints at corners.

C. Extend base flashing up under counter flashing of roof specialties and accessories or equipment not less than 75 mm (3 inch).

3.4 COUNTERFLASHING (CAP FLASHING OR HOODS)

A. General:

1. Install counterflashing over and in conjunction with installation of base flashings, except as otherwise specified or shown.
2. Install counterflashing to lap base flashings not less than 100 mm (4 inch).
3. Install upper edge or top of counterflashing not less than 225 mm (9 inch) above top of the roofing.
4. Lap joints not less than 100 mm (4 inch). Stagger joints with relation to metal base flashing joints.
5. Use surface applied counterflashing on existing surfaces and new work where not possible to integrate into item.
6. When fastening to concrete or masonry, use screws driven in expansion shields set in concrete or masonry. Use screws to wood and sheet metal. Set fasteners in mortar joints of masonry work.

B. One Piece Counterflashing:

1. Where flashing is installed at new masonry, coordinate to insure proper height, embed in mortar, and end lap.
2. Where flashing is installed in reglet in concrete insert upper edge into reglet. Hold flashing in place with lead wedges spaced not more than 200 mm (8 inch) apart. Fill joint with sealant.
3. Where flashing is surface mounted on flat surfaces.
   a. When top edge is double folded anchor flat portion below sealant "V" joint with fasteners spaced not over 400 mm (16 inch) on center:
      1) Locate fasteners in masonry mortar joints.
      2) Use screws to sheet metal or wood.
   b. Fill joint at top with sealant.
4. Where flashing or hood is mounted on pipe.
   a. Secure with draw band tight against pipe.
   b. Set hood and secure to pipe with a one by 25 mm x 3 mm (1 x 1/8 inch) bolt on stainless steel draw band type clamp, or a stainless worm gear type clamp.
   c. Completely fill joint at top with sealant.

C. Two-Piece Counterflashing:
1. Where receiver is installed at new masonry coordinate to insure proper height, embed in mortar, and lap.
2. Surface applied type receiver:
   a. Secure to face construction in accordance, with manufacturers' instructions.
   b. Completely fill space at the top edge of receiver with sealant.
3. Insert counter flashing in receiver in accordance with fabricator or manufacturer's instructions and to fit tight against base flashing.

D. Where vented edge occur install so lower edge of counterflashing is against base flashing.

E. When counter flashing is a component of other flashing install as shown.

3.5 COPINGS

A. General:
1. On walls topped with a wood plank, install a continuous edge strip on the front 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.

3.6 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. 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. Gutter Expansion Joint:
1. Locate expansion joints midway between outlet tubes.
2. Provide at least a 25 mm (one inch) expansion joint space between end baffles of gutters.
3. Install a cover plate over the space at expansion joint.
4. Fasten cover plates to gutter section on one side of expansion joint only.
5. Secure loose end of cover plate to gutter section on other side of expansion joint by a loose-locked slip joint.

F. Outlet Tubes: Set bracket strainers loosely into gutter outlet tubes.

3.7 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 72 00
ROOF ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies roof hatches.

1.2 RELATED WORK

A. Section 07 21 13, THERMAL INSULATION: General insulation.

B. Section 07 22 00, ROOF AND DECK INSULATION: Rigid insulations for roofing.

C. Section 07 92 00, JOINT SEALANTS: Sealant material and installation.

1.3 QUALITY ASSURANCE

A. Provide roof accessories that are the products of manufacturers regularly engaged in producing the kinds of products specified.

B. For each accessory type provide the same product made by the same manufacturer.

C. Assemble each accessory to the greatest extent possible before delivery to the site.

1.4 SUBMITTALS

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

B. Shop Drawings: Each item specified showing design, details of construction, installation and fastenings.

C. Manufacturer's Literature and Data: Each item specified.

1.5 APPLICABLE PUBLICATIONS

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

B. ASTM International (ASTM):

A653/A653M-20.....Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) By the Hot-Dip Process

B209-14.....Aluminum and Aluminum-Alloy Sheet and Plate

B209M-14.....Aluminum and Aluminum-Alloy Sheet and Plate (Metric)

B221-14.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

B221M-13.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes (Metric)

C726-17.....Mineral Wool Roof Insulation Board
C1289-19.....Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
D1187/D1187M-97(2018)...Asphalt-Base Emulsions for Use as Protective Coatings for Metal

C. National Association of Architectural Metal Manufacturers (NAAMM):
AMP 500-06 Series.....Metal Finishes Manual

D. American Architectural Manufacturers Association (AAMA):
611-14.....Anodized Architectural Aluminum

E. American Society of Civil Engineers (ASCE):
ASCE/SEI 7-16.....Minimum Design Loads and Associated Criteria for Buildings and Other Structures

F. U.S. Occupational Safety and Health Standards (OSHA):
29 CFR 1910 Subpart D... Walking-Working Surfaces (1910.21-1910.30)

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum, Extruded: ASTM B221M (B221).
B. Aluminum Sheet: ASTM B209M (B209).
C. Galvanized Sheet Steel: ASTM A653/A653M; G-90 coating.
D. Asphalt Coating: ASTM D1187/D1187M, Type I, quick setting.

2.2 ROOF HATCH (SCUTTLE)

A. Performance Characteristics:
1. Cover to be reinforced to support a minimum live load of 195 kilogram per square meter (40 pounds per square foot) with a maximum deflection of 1/150th of the span or 97 kilogram per square meter (20 pounds per square foot) wind uplift.
2. Operation of the Cover: Smooth and easy with controlled operation throughout the entire arc of opening and closing.
3. Operation of the Cover: Not affected by temperature.
4. Entire Hatch: Weathertight with fully welded corner joints on cover and curb.

B. Shop fabricate from aluminum with mill finish.

C. Curb and Cover:
1. Exterior facing: Minimum 2.3 mm (0.09 inch) thick sheet aluminum with mill finish.
2. Interior facing: Minimum 1 mm (0.04 inch) thick sheet aluminum.

3. Minimum of 50 mm (2 inch) thick polyisocyanurate insulation (ASTM C1289) with a U-value = 0.47 W/mK (R-value = 12) between facings of cover and over exterior face of curb.
4. Form exterior curb facing with an integral 76 mm (3 inch) wide roof flange and cap flashing minimum 2.3 mm (0.09 inch) thick sheet aluminum.
5. Make curb 305 mm (12 inches)above finish roof surface.
6. Form cover to lap curb and cap flashing.
7. Size opening as shown on construction documents.

D. Hardware:

1. Provide spring snap latch with inside and outside operating handles and padlock hasp on inside. Provide two snap latches when hinge side is over 2100 mm (7 feet) long. Bolt hardware into heavy gauge channel reinforcement welded to the underside of the cover and concealed within the insulation space.
2. Provide heavy duty pintle hinges.
3. Provide automatic hold open and operating arm with enclosed torsion or compression spring lifting mechanism.
4. Latch Strike: Stamped component bolted or welded to the curb assembly.
5. Automatically lock in the open position at not less than 70 degrees.
6. Provide weather stripping at cover closure.
7. Galvanize all hardware items.

E. Assembly:

1. Shop assemble roof scuttle.
2. Weld joints exposed to the weather and built into the roofing.
3. Finish weld smooth where exposed.

F. Safety Accessories:

1. Ladder Assist Post: Provide a telescoping tubular section that locks automatically when fully extended. Control upward and downward movement by a stainless steel spring balancing mechanism. Provide unit completely assembled with fasteners for securing to the ladder rungs in accordance with the manufacturer’s instructions.

2.3 FINISH:

A. In accordance with NAAMM AMP 500 Series.

B. Aluminum, Mill Finish: AA-MIX, as fabricated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install roof specialties where indicated on construction documents.

B. Secure with fasteners in accordance with manufacture's printed installation instructions and approved shop drawings unless shown otherwise.

C. Coordinate to install insulation where shown; see Section 07 21 13, THERMAL INSULATION and Section 07 22 00, ROOF AND DECK INSULATION.

D. Comply with section 07 92 00, JOINT SEALANTS to install sealants where required by manufactures installation instructions require sealant.

E. Coordinate with roofing work for installation of items in sequence to prevent water infiltration.

3.2 PROTECTION OF ALUMINUM

A. Provide protection for aluminum against galvanic action wherever dissimilar materials are in contact, by painting the contact surfaces of the dissimilar material with two (2) coats of asphalt coating (complete coverage), or by separating the contact surfaces with a preformed neoprene tape having pressure sensitive adhesive coating on side.

B. Paint aluminum in contact with wood, concrete and masonry, or other absorptive materials, that may become repeatedly wet, with two coats of asphalt coating.

3.3 ADJUSTING

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

3.4 PROTECTION

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

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SECTION 07 92 00
JOINT SEALANTS

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section covers 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):

C. Masonry Control and Expansion Joint: Section 04 20 00, UNIT MASONRY./

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.
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.

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.

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: Comply with 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.

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

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:

1. Vertical surfaces, provide non-staining ASTM C920, Type S or M, Grade NS, Class 25, Use NT.
2. Horizontal surfaces, provide ASTM C920, Type S or M, Grade P, Class 25, Use T.
3. Provide location(s) of exterior sealant as follows:
   a. Joints formed where frames and subsills of windows, doors, louvers, and vents adjoin masonry, concrete, or metal frames. Provide sealant at exterior surfaces of exterior wall penetrations.
   b. Metal to metal.
   c. Masonry to masonry or stone.
   d. Stone to stone.
   e. Cast stone to cast stone.
   f. Masonry expansion and control joints.
   g. Wood to masonry.

i. Voids where items penetrate exterior walls.

j. Metal reglets, where flashing is inserted into masonry joints, and where flashing is penetrated by coping dowels.

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), 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).

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.
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.

C. Do not cut or damage joint edges.

D. Apply non-staining masking tape to face of surfaces adjacent to joints before applying primers, caulking, or sealing compounds.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

E. Apply primer to sides of joints wherever required by compound manufacturer's printed instructions or as indicated by pre-construction joint sealant substrate test.

1. Apply primer prior to installation of back-up rod or bond breaker tape.
2. Use brush or other approved means that will reach all parts of joints. Avoid application to or spillage onto adjacent substrate surfaces.

3.3 BACKING INSTALLATION:

A. Install backing material, to form joints enclosed on three sides as required for specified depth of sealant.

B. Where deep joints occur, install filler to fill space behind the backing rod and position the rod at proper depth.

C. Cut fillers installed by others to proper depth for installation of backing rod and sealants.

D. Install backing rod, without puncturing the material, to a uniform depth, within plus or minus 3 mm (1/8 inch) for sealant depths specified.

E. Where space for backing rod does not exist, install bond breaker tape strip at bottom (or back) of joint so sealant bonds only to two opposing surfaces.

3.4 SEALANT DEPTHS AND GEOMETRY:

A. At widths up to 6 mm (1/4 inch), sealant depth equal to width.

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

3.5 INSTALLATION:

A. General:

1. Apply sealants and caulking only when ambient temperature is between 5 degrees C and 38 degrees C (40 degrees and 100 degrees F).

2. Do not install polysulfide base sealants where sealant may be exposed to fumes from bituminous materials, or where water vapor in continuous contact with cementitious materials may be present.
3. Do not install sealant type listed by manufacture as not suitable for use in locations specified.
4. Apply caulking and sealing compound in accordance with manufacturer's printed instructions.
5. Avoid dropping or smearing compound on adjacent surfaces.
6. Fill joints solidly with compound and finish compound smooth.
7. Tool exposed joints to form smooth and uniform beds, with slightly concave surface conforming to joint configuration per Figure 5A in ASTM C1193 unless shown or specified otherwise in construction documents. Remove masking tape immediately after tooling of sealant and before sealant face starts to “skin” over. Remove any excess sealant from adjacent surfaces of joint, leaving the working in a clean finished condition.
8. Finish paving or floor joints flush unless joint is otherwise detailed.
9. Apply compounds with nozzle size to fit joint width.
10. Test sealants for compatibility with each other and substrate. Use only compatible sealant. Submit test reports.
11. Replace sealant which is damaged during construction process.

B. 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.

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SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Hollow metal doors hung in hollow metal frames at exterior locations.

1.2 RELATED WORK

A. Section 08 71 00, DOOR HARDWARE: Door Hardware:

1.3 APPLICABLE PUBLICATIONS

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

B. American National Standard Institute (ANSI):

A250.8-2014.....Standard Steel Doors and Frames

C. ASTM International (ASTM):

A240/A240M-15b.....Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

A653/A653M-15.....Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip

A1008/A1008M-15.....Steel, Sheet, Cold-Rolled, Carbon, Structural, High Strength Low Alloy and High Strength Low Alloy with Improved Formability, Solution Hardened, and Bake Hardenable

D. Master Painters Institute (MPI):

No. 18.....Primer, Zinc Rich, Organic

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

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

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submittal Drawings:

1. Show size, configuration, and fabrication and installation details.

C. Manufacturer's Literature and Data:

1. Description of each product.
2. Include schedule showing each door and frame requirements for openings.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Regularly manufactures specified products.

1.6 DELIVERY

A. Fasten temporary steel spreaders across the bottom of each door frame before shipment.

B. Deliver products in manufacturer's original sealed packaging.

C. Mark packaging, legibly. Indicate manufacturer's name or brand, type, production run number, and manufacture date.

D. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.7 STORAGE AND HANDLING

A. Store products indoors in dry, weathertight facility.

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

1.8 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Sheet Steel: ASTM A1008/A1008M, cold-rolled.

B. Galvanized Sheet Steel: ASTM A653.

2.2 PRODUCTS - GENERAL

A. Provide hollow metal doors and frames from one manufacturer.

2.3 HOLLOW METAL DOORS

A. Hollow Metal Doors: ANSI A250.8; 44 mm (1-3/4 inches) thick. See drawings for sizes and designs.

1. Exterior Doors: Level 3 and Physical Performance Level A, extra-heavy duty; Model 2, seamless.

B. Door Faces:

1. Exterior Doors: Galvanized sheet steel minimum Z180 or ZF180 (G60 or A60) coating.

C. Door Cores:

1. Exterior Doors: Polystyrene or polyurethane.

2.4 HOLLOW METAL FRAMES

A. Hollow Metal Frames: ANSI A250.8; fully welded. See drawings for sizes and designs.

a. Exterior Frames:

1) Level 3 Hollow Metal Doors: 1.3 mm (0.053 inch) thick.

B. Frame Materials:

1. Exterior Frames: Galvanized sheet steel minimum Z180 or ZF180 (G60 or A60) coating.

2.5 FABRICATION

A. Hardware Preparation: ANSI A250.8; for hardware specified in Section 08 71 00, DOOR HARDWARE.

B. Hollow Metal Door Fabrication:

1. Close top edge of exterior doors flush and seal to prevent water intrusion.
2. Fill spaces between vertical steel stiffeners with insulation.

C. Hollow Metal Frame Fabrication:

1. Fasten mortar guards to back of hardware reinforcements.
2. Frame Anchors:

a. Jamb anchors:

1) Place anchors on jambs:

a) Near top and bottom of each frame.

b) At intermediate points at maximum 600 mm (24 inches) spacing.

2) Form jamb anchors from steel minimum 1 mm (0.042 inch) thick.

3) Anchors for frames set in prepared openings:

a) Steel pipe spacers 6 mm (1/4 inch) inside diameter, welded to plate reinforcing at jamb stops, or hat shaped formed strap spacers 50 mm (2 inches) wide, welded to jamb near stop.

b) Drill jamb stop and strap spacers for 6 mm (1/4 inch) flat head bolts to pass through frame and spacers.

4) Modify frame anchors to fit special frame and wall construction.

5) Provide special anchors where shown on drawings and where required to suit application.

2.6 FINISHES

A. Galvanized Steel: ANSI A250.8; shop primed.

B. Finish exposed surfaces after fabrication.

2.7 ACCESSORIES

A. Primers: ANSI A250.8.

B. Barrier Coating: ASTM D1187/D1187M.

C. Welding Materials: AWS D1.1/D1.1M, type to suit application.

D. Clips Connecting Members and Sleeves: Match door faces.

E. Fasteners: Stainless steel.

1. Metal Framing: Steel drill screws.

2. Masonry and Concrete: Expansion bolts.

F. Anchors: Stainless steel.

G. Galvanizing Repair Paint: MPI No. 18.

H. Insulation: Unfaced mineral wool.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.

B. Protect existing construction and completed work from damage.

C. Apply barrier coating to metal surfaces in contact with cementitious materials to minimum 0.7 mm (30 mils) dry film thickness.

3.2 INSTALLATION - GENERAL

A. Install products according to manufacturer's instructions and approved submittal drawings.

1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

3.3 FRAME INSTALLATION

A. Apply barrier coating to concealed surfaces of frames built into masonry.

B. Plumb, align, and brace frames until permanent anchors are set.

1. Use triangular bracing near each corner on both sides of frames with temporary wood spreaders at midpoint.

2. Use wood spreaders at bottom of frame when shipping spreader is removed.

3. Where construction permits concealment, leave shipping spreaders in place after installation, otherwise remove spreaders when frames are set and anchored.

4. Remove wood spreaders and braces when walls are built and jamb anchors are secured.

C. Jamb Anchors:

1. Prepared Masonry and Concrete Openings:

a. Direct Securement: 6 mm (1/4 inch) diameter expansion bolts through spacers.

b. Subframe or Rough Buck Securement:

1) 6 mm (1/4 inch) diameter expansion bolts on 600 mm (24 inch) centers.

D. Touch up damaged factory finishes.

1. Repair galvanized surfaces with galvanized repair paint.

3.4 DOOR INSTALLATION

A. Install doors plumb and level.

B. Adjust doors for smooth operation.

C. Touch up damaged factory finishes.

1. Repair galvanized surfaces with galvanized repair paint.

3.5 CLEANING

A. Clean exposed door and frame surfaces. Remove contaminants and stains.

3.6 PROTECTION

A. Protect doors and frames from construction operations.

B. Remove protective materials immediately before acceptance.

C. Repair damage.

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SECTION 08 31 13
ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Access doors and panels installed in walls and ceilings.

1.2 RELATED WORK

A. Section 09 91 00, PAINTING: Field Painting.

1.3 APPLICABLE PUBLICATIONS

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

B. American Welding Society (AWS):

D1.3/D1.3M-2018.....Structural Welding Code - Sheet Steel (6th Edition.

C. ASTM International (ASTM):

A653/A653M-20.....Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Sip Process.

A1008/A1008M-18.....Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.

A666-15.....Annealed or Cold-Worked Austenitic Stainless Steel sheet, Strip, Plate, and Flat Bar.

E119-20.....Fire Test of Building Construction and Materials.

D. National Fire Protection Association (NFPA):

80-2019 Edition.....Fire Doors and Other Opening Protectives.

252-2017 Edition.....Fire Tests of Door Assemblies.

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

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

F. UL LLC (UL):

Listed.....Online Certifications Directory.

10B-08 (Edition 10).....Standard for Fire Tests of Door Assemblies.

263-11 (Edition 14).....Fire Tests of Building Construction and Materials.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submittal Drawings:
   1. Show size, configuration, and fabrication and installation details.
C. Manufacturer's Literature and Data:
   1. Description of each product.
   2. Installation instructions.

1.5 DELIVERY

A. Deliver products in manufacturer's original sealed packaging.
B. Mark packaging, legibly. Indicate manufacturer's name or brand, and type.
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.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify field conditions affecting access door fabrication and installation. Show field measurements on Submittal Drawings.
   1. Coordinate field measurement and fabrication schedule to avoid delay.

1.8 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel Sheet: ASTM A1008/A1008M.
B. Galvanized Steel: ASTM A653/A653M.

2.2 PRODUCTS - GENERAL

2.3 ACCESS DOORS, FLUSH PANEL, NON-RATED

A. Door Panel:
   1. 1.9 mm (0.07 inch) thick steel sheet.
   2. Reinforce to maintain flat surface.
B. Frame:
   1. 1.5 mm (0.06 inch) thick steel sheet, depth and configuration to suit material and construction type where installed.
   2. Frame Flange: Provide at units installed in gypsum board.

3. Exposed Joints in Flange: Weld and grind smooth.

C. Hinge:

1. Concealed spring hinge, 175 degrees of opening.
2. Removable hinge pin to allow removal of door panel from frame.

D. Lock:

1. Flush, screwdriver-operated cam lock.

2.4 FABRICATION - GENERAL

A. Size: As indicated in drawings.

B. Component Fabrication: Straight, square, flat and in same plane where required.

1. Exposed Edges: Slightly rounded, without burrs, snags and sharp edges.
2. Exposed Welds: Continuous, ground smooth.
3. Welding: AWS D1.3/D1.3M.

C. Anchoring: Make provisions in frame for anchoring to adjacent construction. Provide anchors in size, number and location on four sides to secure access door to substrate.

2.5 FINISHES

A. Steel Paint Finish:

1. Powder-Coat Finish: Manufacturer's standard finish system consisting of the following:
   a. One coat primer.

2.6 ACCESSORIES

A. Fasteners: Type and size recommended by access door manufacturer, to suit application.

1. Other Access Doors: Galvanized steel fasteners.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.

1. Verify access door locations and sizes provide required maintenance access to installed building services components.

B. Protect existing construction and completed work from damage.

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 access doors and panels permitting access to cleanouts concealed in walls and partitions.

3.3 ACCESS DOOR AND FRAME INSTALLATION

A. Wall Installations: Install access doors in openings with sides vertical.

B. Frames with Flanges: Overlap opening, with face uniformly spaced from finish surface.

C. Secure frames to adjacent construction with fasteners.

D. Install type, size and quantity of anchoring device suitable for material surrounding opening to maintain alignment, and resist displacement, during normal use of access door.

E. Field Painting Primed Access Doors: Comply with the requirements of Section 09 91 00, PAINTING.

3.4 ADJUSTMENT

A. Adjust hardware so door panel opens freely.

B. Adjust door when closed so door panel is centered in frame.

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SECTION 08 71 00
DOOR HARDWARE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Door hardware and related items necessary for complete installation and operation of doors.

1.2 RELATED WORK

A. Caulking: Section 07 92 00 JOINT SEALANTS.

B. Application of Hardware: Section 08 11 13, HOLLOW METAL DOORS AND FRAMES.

C. Painting: Section 09 91 00, PAINTING.

1.3 GENERAL

A. All hardware shall comply with ABAAS, (Architectural Barriers Act Accessibility Standard) unless specified otherwise.

B. Hardware for application on metal doors and frames shall be made to standard templates. Furnish templates to the fabricator of these items in sufficient time so as not to delay the construction.

C. The following items shall be of the same manufacturer, except as otherwise specified:

1. Mortise locksets.
2. Hinges for hollow metal and wood doors.
3. Surface applied overhead door closers.

1.4 WARRANTY

A. Hardware shall be subject to the terms of FAR Clause 52.246-21, except that the Warranty period shall be two years in lieu of one year for all items except as noted below:

1. Locks and latchsets: 5 years.
2. Door closers: 10 years.

1.5 MAINTENANCE MANUALS

A. In accordance with Section 01 00 00, GENERAL REQUIREMENTS Article titled "INSTRUCTIONS", furnish maintenance manuals and instructions on all door hardware. Provide installation instructions with the submittal documentation.

1.6 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Submit 6 copies of the schedule per Section 01 33 23. Submit 2 final copies of the final approved schedules to VAMC

Locksmith as record copies (VISN Locksmith if the VAMC does not have a locksmith).

B. Hardware Schedule: AHC certified hardware consultant to prepare and submit hardware schedule in the following form:

Hardware Item	Quantity	Size	Reference Publication Type No.	Finish	Mfr. Name and Catalog No.	Key Control Symbols	UL Mark (if fire rated and listed)	ANSI/BHMA Finish Designation

C. Samples and Manufacturers' Literature:

1. Samples: All hardware items (proposed for the project) that have not been previously approved by Builders Hardware Manufacturers Association shall be submitted for approval. Tag and mark all items with manufacturer's name, catalog number and project number.
2. Samples are not required for hardware listed in the specifications by manufacturer's catalog number, if the contractor proposes to use the manufacturer's product specified.

D. Certificate of Compliance and Test Reports: Submit certificates that hardware conforms to the requirements specified herein. Certificates shall be accompanied by copies of reports as referenced. The testing shall have been conducted either in the manufacturer's plant and certified by an independent testing laboratory or conducted in an independent laboratory, within four years of submittal of reports for approval.

1.7 DELIVERY AND MARKING

A. Deliver items of hardware to job site in their original containers, complete with necessary appurtenances including screws, keys, and instructions. Tag one of each different item of hardware and deliver to COR for reference purposes. Tag shall identify items by Project Specification number and manufacturer's catalog number. These items shall remain on file in COR's office until all other similar items have been installed in project, at which time the COR will deliver items on file to Contractor for installation in predetermined locations on the project.

1.8 INSTRUCTIONS

A. Hardware Set Symbols on Drawings: Except for protective plates, door stops, mutes, thresholds and the like specified herein, hardware requirements for each door are indicated on drawings by symbols. Symbols for hardware sets consist of letters (e.g., "HW") followed by a number. Each number designates a set of hardware items applicable to a door type.

B. Keying: All cylinders shall be keyed into existing Falcon Great Grand Master Key System. Provide removable core cylinders that are removable only with a special key or tool without disassembly of knob or lockset. Cylinders shall be 6 pin D keyway type. Keying information shall be furnished at a later date by the COR.

1.9 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. In text, hardware items are referred to by series, types, etc., listed in such specifications and standards, except as otherwise specified.

B. ASTM International(ASTM):

E2180-18.....Standard Test Method for Determining the Activity of Incorporated Antimicrobial Agent(s) In Polymeric or Hydrophobic Materials

C. American National Standards Institute/Builders Hardware Manufacturers Association (ANSI/BHMA):

A156.1-06.....Butts and Hinges

A156.2-03.....Bored and Pre-assembled Locks and Latches

A156.4-08.....Door Controls (Closers)

A156.5-14.....Cylinders and Input Devices for Locks.

A156.6-05.....Architectural Door Trim

A156.12-05 .....Interconnected Locks and Latches

A156.13-05.....Mortise Locks and Latches Series 1000

A156.16-08.....Auxiliary Hardware

A156.18-06.....Materials and Finishes

A156.20-06 .....Strap and Tee Hinges, and Hasps

A156.21-09.....Thresholds

A156.22-05.....Door Gasketing and Edge Seal Systems

A156.28-07 .....Master Keying Systems

A250.8-03.....Standard Steel Doors and Frames

PART 2 - PRODUCTS

2.1 BUTT HINGES

A. ANSI A156.1. Provide only three-knuckle hinges, except five-knuckle where the required hinge type is not available in a three-knuckle version (e.g., some types of swing-clear hinges). The following types of butt hinges shall be used for the types of doors listed, except where otherwise specified:

1. Exterior Doors: Type A2112/A5112 for doors 900 mm (3 feet) wide or less. Hinges for exterior outswing doors shall have non-removable pins.

B. Provide quantity and size of hinges per door leaf as follows:

1. Doors up to 1210 mm (4 feet) high: 2 hinges.
2. Doors 1210 mm (4 feet) to 2260 mm (7 feet 5 inches) high: 3 hinges minimum.
3. Doors up to 900 mm (3 feet) wide, standard weight: 114 mm x 114 mm (4-1/2 inches x 4-1/2 inches) hinges.

C. See Articles "MISCELLANEOUS HARDWARE" and "HARDWARE SETS" for pivots and hinges other than butts specified above and continuous hinges specified below.

2.2 DOOR CLOSING DEVICES

A. Closing devices shall be products of one manufacturer for each type specified.

2.3 OVERHEAD CLOSERS

A. Conform to ANSI A156.4, Grade 1.

B. Closers shall conform to the following:

1. The closer shall have minimum 50 percent adjustable closing force over minimum value for that closer and have adjustable hydraulic back check effective between 60 degrees and 85 degrees of door opening.
2. Where specified, closer shall have hold-open feature.
3. Size Requirements: Provide multi-size closers, sizes 1 through 6, except where multi-size closer is not available for the required application.
4. Material of closer body shall be forged or cast.
5. Arm and brackets for closers shall be steel, malleable iron or high strength ductile cast iron.

6. Where closers are exposed to the exterior or are mounted in rooms that experience high humidity, provide closer body and arm assembly of stainless steel material.
7. Closers shall have full size metal cover; plastic covers will not be accepted.
8. Closers shall have adjustable hydraulic back-check, separate valves for closing and latching speed, adjustable back-check positioning valve, and adjustable delayed action valve.
9. Provide closers with any accessories required for the mounting application, including (but not limited to) drop plates, special soffit plates, spacers for heavy-duty parallel arm fifth screws, bull-nose or other regular arm brackets, longer or shorter arm assemblies, and special factory templating. Provide special arms, drop plates, and templating as needed to allow mounting at doors with overhead stops and/or holders.
10. Closer arms or backcheck valve shall not be used to stop the door from overswing, except in applications where a separate wall, floor, or overhead stop cannot be used.
11. Provide parallel arm closers with heavy duty rigid arm.
12. Where closers are to be installed on the push side of the door, provide parallel arm type except where conditions require use of top jamb arm.
13. Provide all surface closers with the same body attachment screw pattern for ease of replacement and maintenance.
14. All closers shall have a 1 ½" (38mm) minimum piston diameter.

2.4 LOCKS AND LATCHES

A. Conform to ANSI A156.2. Locks and latches for doors 45 mm (1-3/4 inch) thick or over shall have beveled fronts. Lock cylinders shall have not less than six pins. Cylinders for all locksets shall be removable core type. Cylinder shall be removable by special key or tool. Construct all cores so that they will be interchangeable into the core housings of all mortise locks, rim locks, cylindrical locks, and any other type lock included in the Great Grand Master Key System. Disassembly of lever or lockset shall not be required to remove core from lockset. All locksets or latches on double doors with fire label shall have latch bolt with 19 mm (3/4 inch) throw, unless shorter throw allowed by the door manufacturer's fire label. Provide temporary keying device or

construction core to allow opening and closing during construction and prior to the installation of final cores.

B. In addition to above requirements, locks and latches shall comply with following requirements:

1. Cylindrical Lock and Latch Sets: levers shall meet ADA (Americans with Disabilities Act) requirements. Cylindrical locksets shall be series 4000 Grade I. All locks and latchsets shall be furnished with 122.55 mm (4-7/8-inch) curved lip strike and wrought box. Provide lever design to match existing lever design.

2.5 KEYS

A. Stamp all keys with change number and key set symbol. Furnish keys in quantities as follows:

Locks/Keys	**Quantity**
Cylinder locks	2 keys each

2.6 KICK PLATES

A. Conform to ANSI Standard A156.6.

B. Provide protective plates as specified below:

1. Kick plates Type J100 series.
2. Provide kick plates where specified. Kick plates shall be 254 mm (10 inches) or 305 mm (12 inches) high.Kick plates shall be minimum 1.27 mm (0.050 inches) thick. Provide kick plates beveled on all 4 edges (B4E). On push side of doors where jamb stop extends to floor, make kick plates 38 mm (1-1/2 inches) less than width of door.
3. Kick plates are not required on following door sides:
   a. Exterior side of exterior doors.

2.7 THRESHOLDS

A. Conform to ANSI A156.21, mill finish extruded aluminum, except as otherwise specified. In existing construction, thresholds shall be installed in a bed of sealant with ¼-20 stainless steel machine screws and expansion shields. Furnish thresholds for the full width of the openings.

B. At exterior doors and any interior doors exposed to moisture, provide threshold with non-slip abrasive finish.

C. Provide with miter returns where threshold extends more than 12 mm (0.5 inch) beyond face of frame.

2.8 WEATHERSTRIPS (FOR EXTERIOR DOORS)

A. Conform to ANSI A156.22. Air leakage shall not to exceed 0.50 CFM per foot of crack length (0.000774m^3/s/m).

2.9 PADLOCKS FOR VARIOUS DOORS, GATES AND HATCHES

A. ASTM E883, size 50 mm (2 inch) wide chain; furnish extended shackles as required by job conditions. Provide padlock, with key cylinders, for each door in following areas as noted.

B. Key padlocks as follows:

1. Roof Access and Scuttles: Engineer's set.
2. Ladder Guards: Engineer’s set.

2.10 FINISHES

A. Exposed surfaces of hardware shall have ANSI A156.18, finishes as specified below. Finishes on all hinges, pivots, closers, thresholds, etc., shall be as specified below under "Miscellaneous Finishes."

B. 626 or 630: All surfaces on exterior and interior of buildings, except where other finishes are specified.

C. Miscellaneous Finishes:

1. Hinges - exterior doors: 626 or 630.
2. Door Closers: Factory applied paint finish. Dull or Satin Aluminum color.
3. Thresholds: Mill finish aluminum.
4. Other primed steel hardware: 600.

D. Hardware Finishes for Existing Buildings: U.S. Standard finishes shall match finishes of hardware in (similar) existing spaces except where otherwise specified.

2.11 BASE METALS

A. Apply specified U.S. Standard finishes on different base metals as following:

Finish	**Base Metal**
652	Steel
626	Brass or bronze
630	Stainless steel

PART 3 - EXECUTION

3.1 HARDWARE HEIGHTS

A. For existing buildings locate hardware on doors at heights to match existing hardware. The Contractor shall visit the site, verify location of existing hardware and submit locations to VA COR for approval.

3.2 INSTALLATION

A. Closer devices, including those with hold-open features, shall be equipped and mounted to provide maximum door opening permitted by building construction or equipment. At exterior doors, closers shall be mounted on interior side. Where closers are mounted on doors they shall be mounted with hex nuts and bolts; foot shall be fastened to frame with machine screws.

B. Hinge leaves shall be sufficiently wide to allow doors to swing clear of door frame trim and surrounding conditions.

C. Fastenings: Suitable size and type and shall harmonize with hardware as to material and finish. Provide machine screws and lead expansion shields to secure hardware to concrete or solid masonry. Fiber or rawl plugs and adhesives are not permitted. All fastenings exposed to weather shall be of nonferrous metal.

D. After locks have been installed; show in presence of COR that keys operate their respective locks in accordance with keying requirements. (All keys, Master Key level and above shall be sent Registered Mail to the Medical Center Director along with the bitting list. Also a copy of the invoice shall be sent to the COR for his records.) Installation of locks which do not meet specified keying requirements shall be considered sufficient justification for rejection and replacement of all locks installed on project.

3.3 FINAL INSPECTION

A. Installer to provide letter to VA Resident/Project Engineer that upon completion, installer has visited the Project and has accomplished the following:

1. Re-adjust hardware.
2. Evaluate maintenance procedures and recommend changes or additions, and instruct VA personnel.
3. Identify items that have deteriorated or failed.
4. Submit written report identifying problems.

3.4 DEMONSTRATION

A. Demonstrate efficacy of mechanical hardware and electrical, and electronic hardware systems, including adjustment and maintenance procedures, to satisfaction of Resident/Project Engineer and VA Locksmith.

3.5 HARDWARE SETS

A. Following sets of hardware correspond to hardware symbols shown on drawings.

B. Hardware Consultant working on a project will be responsible for providing additional information regarding these hardware sets. The numbers shown in the following sets come from BHMA standards.

C. Basis of Design: Equal to Manufacturers listed. Architect COR approval required.

D. **EXTERIOR SINGLE DOORS**

HW 1

QTY		DESCRIPTION	CATALOG NUMBER	MFR
3	EA	HINGES	TYPE AS REQUIRED	IVE
1	EA	PASSAGE	T101-DAN	FAL
1	EA	DEADBOLT	D100	FAL
1	EA	SURFACE CLOSER	1461 PA C-N-S (C02011)	LCN
1	EA	KICK PLATE	J102	IVE
1	SET	FRAME SEALS	ROY164	
1	EA	THRESHOLD	PROFILE AS REQUIRED	ZER.
1	EA	SWEEP	R0Y416	
1	EA	DRIP	R0Y976	

HW 2

QTY		DESCRIPTION	CATALOG NUMBER	MFR
2	EA	HINGES	TYPE AS REQUIRED	IVE
1	EA	STOREROOM	T581-DAN	FAL
1	EA	GASKETING	ROY154	ZER
1	SET	FRAME SEALS	ROY164	
1	EA	DRIP	R0Y976	

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SECTION 09 22 16
NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies steel studs wall systems, fasteners, and accessories for the screw attachment of gypsum board, or other building boards.

1.2 RELATED WORK

A. Support for wall mounted items: Section 05 50 00, METAL FABRICATIONS.

1.3 TERMINOLOGY

A. Description of terms shall be in accordance with ASTM C754, ASTM C11, ASTM C841 and as specified.

B. Underside of Structure Overhead: In spaces where steel trusses or bar joists are shown, the underside of structure overhead shall be the underside of the floor or roof construction supported by beams, trusses, or bar joists. In interstitial spaces with walk-on floors the underside of the walk-on floor is the underside of structure overhead.

C. Thickness of steel specified is the minimum bare (uncoated) steel thickness.

1.4 SUBMITTALS

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

B. Manufacturer's Literature and Data:

1. Studs, runners and accessories.

5. Screws, clips and other fasteners.

1.5 DELIVERY, IDENTIFICATION, HANDLING AND STORAGE

A. In accordance with the requirements of ASTM C754.

1.6 APPLICABLE PUBLICATIONS

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

B. American Society For Testing And Materials (ASTM)

A641-09.....Zinc-Coated (Galvanized) Carbon Steel Wire

A653/653M-11.....Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.

C11-10.....Terminology Relating to Gypsum and Related Building Materials and Systems

C645-09.....Non-Structural Steel Framing Members
C754-11.....Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products
C954-10.....Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness

PART 2 - PRODUCTS

2.1 PROTECTIVE COATING

A. Galvanize steel studs and runners (track with coating designation of G40 or equivalent.

2.2 STEEL STUDS AND RUNNERS (TRACK)

A. ASTM C645, modified for thickness specified and sizes as shown.
   1. Use C 645 steel, 0.75 mm (0.0296-inch) minimum base-metal (30 mil).
   2. Runners same thickness as studs.
   3. Exception: Members that can show certified third party testing with gypsum board in accordance with ICC ES AC86 (Approved May 2012) need not meet the minimum thickness limitation or minimum section properties set forth in ASTM C 645. The submission of an evaluation report is acceptable to show conformance to this requirement. Use C 645 steel, 0.48mm (0.019 inch) minimum base-metal (19 mil).
B. Provide not less than two cutouts in web of each stud, approximately 300 mm (12 inches) from each end, and intermediate cutouts on approximately 600 mm (24-inch) centers.
D. Studs 3600 mm (12 feet) or less in length shall be in one piece.
C. Rolled Steel Channels: ASTM C754, cold rolled; or, ASTM C841, cold rolled.

2.4 FASTENERS, CLIPS, AND OTHER METAL ACCESSORIES

A. ASTM C754, except as otherwise specified.
C. Fasteners for steel studs thicker than 0.84 mm (0.033-inch) thick. Use ASTM C954 steel drill screws of size and type recommended by the manufacturer of the material being fastened.
D. Power Actuated Fasteners: Type and size as recommended by the manufacturer of the material being fastened.

PART 3 - EXECUTION

3.2 INSTALLING STUDS

A. Install studs in accordance with ASTM C754, except as otherwise shown or specified.

B. Space studs not more than 400 mm (16 inches) on center.

C. Cut studs 6 mm to 9 mm (1/4 to 3/8-inch) less than floor to underside of structure overhead.

D. Extend studs to underside of structure overhead.

E. Fastening Studs:

1. Fasten studs located adjacent to partition intersections, corners and studs at jambs of openings to flange of runner tracks with two screws through each end of each stud and flange of runner.
2. Do not fasten studs to top runner track when studs extend to underside of structure overhead.

F. Chase Wall Partitions:

1. Locate cross braces for chase wall partitions to permit the installation of pipes, conduits, carriers and similar items.
2. Use studs or runners as cross bracing not less than 63 mm (2-1/2 inches wide).

3.3 INSTALLING WALL FURRING FOR FINISH APPLIED TO ONE SIDE ONLY

A. In accordance with ASTM C754, or ASTM C841 except as otherwise specified or shown.

B. Wall furring-Stud System:

1. Framed with 63 mm (2-1/2 inch) or narrower studs, 400 mm (16 inches) on center.
2. Brace as specified in ASTM C754 for Wall Furring-Stud System or brace with sections or runners or studs placed horizontally at not less than three foot vertical intervals on side without finish.
3. Securely fasten braces to each stud with two Type S pan head screws at each bearing.

3.4 INSTALLING SUPPORTS REQUIRED BY OTHER TRADES

A. Provide for attachment and support of electrical outlets, plumbing, laboratory or heating fixtures, recessed type plumbing fixture accessories, access panel frames, wall bumpers, wood seats, toilet stall partitions, dressing booth partitions, urinal screens, chalkboards, tackboards, wall-hung casework, handrail brackets, recessed fire extinguisher cabinets and other items like auto door buttons and auto door operators supported by stud construction.

B. Provide additional studs where required. Install metal backing plates, or special metal shapes as required, securely fastened to metal studs.

3.7 TOLERANCES

A. Fastening surface for application of subsequent materials shall not vary more than 3 mm (1/8-inch) from the layout line.

B. Plumb and align vertical members within 3 mm (1/8-inch.)

C. Level or align ceilings within 3 mm (1/8-inch.)

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SECTION 09 29 00
GYPSUM BOARD

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies installation and finishing of gypsum board.

1.2 RELATED WORK

A. Installation of steel framing members for walls, partitions, furring, soffits, and ceilings: Section 09 22 16, NON-STRUCTURAL METAL FRAMING.

1.3 TERMINOLOGY

A. Definitions and description of terms shall be in accordance with ASTM C11, C840, and as specified.

B. Underside of Structure Overhead: In spaces where steel trusses or bar joists are shown, the underside of structure overhead shall be the underside of the floor or roof construction supported by the trusses or bar joists.

1.4 SUBMITTALS

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

B. Manufacturer's Literature and Data:

1. Cornerbead and edge trim.
2. Finishing materials.
4. Gypsum board, each type.

1.5 DELIVERY, IDENTIFICATION, HANDLING AND STORAGE

In accordance with the requirements of ASTM C840.

1.6 ENVIRONMENTAL CONDITIONS

In accordance with the requirements of ASTM C840.

1.7 APPLICABLE PUBLICATIONS

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

B. American Society for Testing And Materials (ASTM):

C11-15.....Terminology Relating to Gypsum and Related Building Materials and Systems

C475-15.....Joint Compound and Joint Tape for Finishing Gypsum Board

C840-13.....Application and Finishing of Gypsum Board

C919-12.....Sealants in Acoustical Applications

C954-15.....Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Stud from 0.033 in. (0.84mm) to 0.112 in. (2.84mm) in thickness

C1002-14.....Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs

C1047-14.....Accessories for Gypsum Wallboard and Gypsum Veneer Base

C1396-14.....Gypsum Board

C. Underwriters Laboratories Inc. (UL):

Latest Edition.....Fire Resistance Directory

D. Inchcape Testing Services (ITS):

Latest Editions.....Certification Listings

PART 2 - PRODUCTS

2.1 GYPSUM BOARD

A. Gypsum Board: ASTM C1396, Type X, 16 mm (5/8 inch) thick unless shown otherwise.

2.2 GYPSUM SHEATHING BOARD

A. ASTM C1396, Type X, water-resistant core, 16 mm (5/8 inch) thick.

B. ASTM C1177, Type X.

2.3 ACCESSORIES

A. ASTM C1047, except form of 0.39 mm (0.015 inch) thick zinc coated steel sheet or rigid PVC plastic.

B. Flanges not less than 22 mm (7/8 inch) wide with punchouts or deformations as required to provide compound bond.

2.4 FASTENERS

A. ASTM C1002 and ASTM C840, except as otherwise specified.

B. ASTM C954, for steel studs thicker than 0.04 mm (0.33 inch).

C. Select screws of size and type recommended by the manufacturer of the material being fastened.

2.5 FINISHING MATERIALS AND LAMINATING ADHESIVE

ASTM C475 and ASTM C840. Free of antifreeze, vinyl adhesives, preservatives, biocides and other VOC. Adhesive shall contain a maximum VOC content of 50 g/l.

PART 3 - EXECUTION

3.1 GYPSUM BOARD HEIGHTS

A. Extend gypsum board from floor to heights as follows:

1. Not less than 100 mm (4 inches) above suspended acoustical ceilings.
2. At ceiling of suspended gypsum board ceilings.
3. At existing ceilings.

3.2 INSTALLING GYPSUM BOARD

A. Coordinate installation of gypsum board with other trades and related work.

B. Install gypsum board in accordance with ASTM C840, except as otherwise specified.

C. Use gypsum boards in maximum practical lengths to minimize number of end joints.

D. Bring gypsum board into contact, but do not force into place.

E. Walls (Except Shaft Walls):

1. When gypsum board is installed parallel to framing members, space fasteners 300 mm (12 inches) on center in field of the board, and 200 mm (8 inches) on center along edges.
2. When gypsum board is installed perpendicular to framing members, space fasteners 300 mm (12 inches) on center in field and along edges.
3. Stagger screws on abutting edges or ends.
4. For single-ply construction, apply gypsum board with long dimension either parallel or perpendicular to framing members as required to minimize number of joints except gypsum board shall be applied vertically over "Z" furring channels.
7. No offset in exposed face of walls and partitions will be permitted because of single-ply and two-ply or three-ply application requirements.

F. Electrical and Telecommunications Boxes:

1. Seal annular spaces between electrical and telecommunications receptacle boxes and gypsum board partitions.

G. Accessories:

1. Set accessories plumb, level and true to line, neatly mitered at corners and intersections, and securely attach to supporting surfaces as specified.
2. Install in one piece, without the limits of the longest commercially available lengths.
3. Corner Beads:
   a. Install at all vertical and horizontal external corners and where shown.

b. Use screws only. Do not use crimping tool.

4. Edge Trim (casings Beads):
   a. At both sides of expansion and control joints unless shown otherwise.
   b. Where gypsum board terminates against dissimilar materials and at perimeter of openings, except where covered by flanges, casings or permanently built-in equipment.
   c. Where gypsum board surfaces of non-load bearing assemblies abut load bearing members.
   d. Where shown.

3.3 INSTALLING GYPSUM SHEATHING

A. Install in accordance with ASTM C840, except as otherwise specified or shown.

B. Use screws of sufficient length to secure sheathing to framing.

C. Space screws 9 mm (3/8 inch) from ends and edges of sheathing and 200 mm (8 inches) on center. Space screws a maximum of 200 mm (8 inches) on center on intermediate framing members.

D. Apply 600 mm by 2400 mm (2 foot by 8 foot) sheathing boards horizontally with tongue edge up.

E. Apply 1200 mm by 2400 mm or 2700 mm (4 ft. by 8 ft. or 9 foot) gypsum sheathing boards vertically with edges over framing.

3.5 FINISHING OF GYPSUM BOARD

A. Finish joints, edges, corners, and fastener heads in accordance with ASTM C840. Use Level 4 finish for all finished areas open to public view.

B. Before proceeding with installation of finishing materials, assure the following:
   1. Gypsum board is fastened and held close to framing or furring.
   2. Fastening heads in gypsum board are slightly below surface in dimple formed by driving tool.

C. Finish joints, fasteners, and all openings, including openings around penetrations, on that part of the gypsum board extending above suspended ceilings to seal surface of non decorated smoke barrier and fire rated gypsum board construction. After the installation of hanger rods, hanger wires, supports, equipment, conduits, piping and similar work, seal remaining openings and maintain the integrity of the smoke barrier and fire rated construction. Sanding is not required of non decorated surfaces.

3.6 REPAIRS

A. After taping and finishing has been completed, and before decoration, repair all damaged and defective work, including nondecorated surfaces.

B. Patch holes or openings 13 mm (1/2 inch) or less in diameter, or equivalent size, with a setting type finishing compound or patching plaster.

C. Repair holes or openings over 13 mm (1/2 inch) diameter, or equivalent size, with 16 mm (5/8 inch) thick gypsum board secured in such a manner as to provide solid substrate equivalent to undamaged surface.

D. Tape and refinish scratched, abraded or damaged finish surfaces including cracks and joints in non decorated surface to provide smoke tight construction and fire protection equivalent to the fire rated construction.

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SECTION 09 65 13
RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Resilient base adhered to interior walls and partitions.

1.2 APPLICABLE PUBLICATIONS

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

B. ASTM International (ASTM):

F1861-16.....Resilient Wall Base.

1.3 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. Adhesives and primers indicating manufacturer's recommendation for each application.
3. Installation instructions.

C. Samples:

1. Resilient Base: 150 mm (6 inches) long, each type and color.

1.4 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.

1.5 STORAGE AND HANDLING

A. Store products indoors in dry, weathertight facility.

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

1.6 FIELD CONDITIONS

A. Environment:

1. Product Temperature: Minimum 21 degrees C (70 degrees F) for minimum 48 hours before installation.
2. Work Area Ambient Temperature Range: 21 to 27 degrees C (70 to 80 degrees F) continuously, beginning 48 hours before installation.
3. Install products when building is permanently enclosed and when wet construction is completed, dried, and cured.

1.7 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 PRODUCTS

A. Provide each product from one manufacturer and from one production run.

2.2 RESILIENT BASE

A. Resilient Base: 3 mm (1/8 inch) thick, 100 mm (4 inches) high.
   1. Type: Rubber or vinyl; use type to match existing adjacent materials.
   2. ASTM F1861, Type TP thermoplastic rubber or Type TV thermoplastic vinyl, Group 2 - layered.

B. Applications:
   1. Carpet Flooring Locations: Style A – Straight as required to match existing adjacent materials.
   2. Other Locations: Style B – Cove as required to match existing adjacent materials.

C. Color: To match exiting adjacent materials.

2.3 ADHESIVES

A. Adhesives: Low pollutant-emitting, water based type recommended by adhered product manufacturer for each application.

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. Remove existing base to permit new installation.
   1. Dispose of removed materials.

D. Correct substrate deficiencies.
   1. Fill cracks, pits, and depressions with leveling compound.
   2. Remove protrusions; grind high spots.
   3. Apply leveling compound to achieve 3 mm (1/8 inch) in 3 m (10 feet) maximum surface variation.

E. Clean substrates. Remove contaminants capable of affecting subsequently installed product's performance.
   1. Mechanically clean concrete floor substrate according to ASTM D4259.
   2. Surface Profile: ICRI Guideline No. 310.2R.

F. Allow substrate to dry and cure.

3.2 INSTALLATION GENERAL

A. Install products according to manufacturer's instructions.

1. When instructions deviate from specifications, submit proposed resolution for Contracting Officer consideration.

3.3 RESILIENT BASE INSTALLATION

A. Applications:

1. Install resilient base in rooms as noted on Drawings.
2. Install resilient base on curb supported fixed equipment.
3. Extend resilient base into closets, alcoves, and cabinet knee spaces, and around columns within scheduled room.

B. Lay out resilient base with minimum number of joints.

1. Length: 600 mm (24 inches) minimum, each piece.
2. Locate joints 150 mm (6 inches) minimum from corners and intersection of adjacent materials.

C. Installation:

1. Apply adhesive uniformly for full contact between resilient base and substrate.
2. Set resilient base with hairline butted joints aligned along top edge.

D. Factory form corners and end stops.

E. Roll resilient base ensuring complete adhesion.

3.4 CLEANING

A. Remove excess adhesive before adhesive sets.

B. Clean exposed resilient base surfaces. Remove contaminants and stains.

1. Clean with mild detergent. Leave surfaces free of detergent residue.

C. Polish exposed resilient base to gloss sheen.

3.5 PROTECTION

A. Protect products from construction traffic and operations.

1. Maintain protection until directed by Contracting Officer's Representative.

B. Replace damaged products and re-clean.

1. Damaged Products include cut, gouged, scraped, torn, and unbonded products.

- - E N D - -

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 gypsum drywall exposed to view.
7. Painting of wood exposed to view, except items which are specified to be painted or finished under other Sections of these specifications. Back painting of all wood in contact with concrete, masonry or other moisture areas.
8. Incidental painting and touching up as required to produce proper finish for painted surfaces, including touching up of factory finished items.
9. Painting of any surface not specifically mentioned to be painted herein or on construction documents, but for which painting is obviously necessary to complete the job, or work which comes within the intent of these specifications, is to be included as though specified.

1.2 RELATED WORK

A. Section 01 35 26, SAFETY REQUIREMENTS: Activity Hazard Analysis.

B. Division 05 METALS: Shop prime painting of steel and ferrous metals.

C. Division 08 OPENINGS: Shop prime painting of steel and ferrous metals.

1.3 SUBMITTALS

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

B. Manufacturer's Literature and Data:

1. Before work is started, or sample panels are prepared, submit manufacturer's literature and technical data

C. Sample Panels:
   1. After painters' materials have been approved and before work is started, submit sample panels showing each type of finish and color specified.
   2. Panels to Show Color: Composition board, 100 x 250 mm (4 x 10 inch).
   3. Attach labels to panel stating the following:
      a. Manufacturers name and product number of paints used.
      b. Product type and color.
      c. VA project title, VA project number, and VA contract number.
   4. Strips showing not less than 50 mm (2 inch) wide strips of undercoats and 100 mm (4 inch) wide strip of finish coat.

1.4 **DELIVERY AND STORAGE**

A. Deliver materials to site in manufacturer's sealed container marked to show following:
   1. Name of manufacturer.
   2. Product type.
   3. Batch number.
   4. Instructions for use.
   5. Safety precautions.
B. In addition to manufacturer's label, provide a label legibly printed as following:
   1. Federal Specification Number, where applicable, and name of material.
   2. Surface upon which material is to be applied.
   3. Specify Coat Types: Prime; body; finish; etc.
C. Maintain space for storage, and handling of painting materials and equipment in a ventilated, neat and orderly condition to prevent spontaneous combustion from occurring or igniting adjacent items.
D. Store materials at site at least 24 hours before using, at a temperature between 7 and 30 degrees C (45 and 85 degrees F).

1.5 **QUALITY ASSURANCE**

A. Qualification of Painters: Use only qualified journeyman painters for the mixing and application of paint on exposed surfaces. Submit evidence that key personnel have successfully performed surface preparation and application of coating on a minimum of three (3) similar projects within the past three (3) years.
B. Paint Coordination: Provide finish coats which are compatible with the prime paints used. Review other Sections of these specifications in which prime paints are to be provided to ensure compatibility of the total

coatings system for the various substrates. Upon request from other subcontractors, furnish information on the characteristics of the finish materials proposed to be used, to ensure that compatible prime coats are used. Provide barrier coats over incompatible primers or remove and re-prime as required. Notify the Contracting Officer Representative (COR) in writing of any anticipated problems using the coating systems as specified with substrates primed by others.

1.6 **REGULATORY REQUIREMENTS**

A. Paint materials are to conform to the restrictions of the local Environmental and Toxic Control jurisdiction.

1. Volatile Organic Compounds (VOC) Emissions Requirements: Field-applied paints and coatings that are inside the waterproofing system to not exceed limits of authorities having jurisdiction.
2. Lead-Base Paint:
   a. Comply with Section 410 of the Lead-Based Paint Poisoning Prevention Act, as amended, and with implementing regulations promulgated by Secretary of Housing and Urban Development.
   b. Regulations concerning prohibition against use of lead-based paint in federal and federally assisted construction, or rehabilitation of residential structures are set forth in Subpart F, Title 24, Code of Federal Regulations, Department of Housing and Urban Development.
   c. Do not use coatings having a lead content over 0.06 percent by weight of non-volatile content.
3. Asbestos: Provide materials that do not contain asbestos.
4. Chromate, Cadmium, Mercury, and Silica: Provide materials that do not contain zinc-chromate, strontium-chromate, Cadmium, mercury or mercury compounds or free crystalline silica.
5. Human Carcinogens: Provide materials that do not contain any of the ACGIH-BKLT and ACGHI-DOC confirmed or suspected human carcinogens.
6. Use high performance acrylic paints in place of alkyd paints.

1.7 **SAFETY AND HEALTH**

A. Apply paint materials using safety methods and equipment in accordance with the following:

1. Comply with applicable Federal, State, and local laws and regulations, and with the ACCIDENT PREVENTION PLAN, including the Activity Hazard Analysis (AHA) as specified in Section 01 35 26, SAFETY REQUIREMENTS. The AHA is to include analyses of the potential impact of painting

operations on painting personnel and on others involved in and adjacent to the work zone.

B. Safety Methods Used During Paint Application: Comply with the requirements of SSPC PA Guide 10.

C. Toxic Materials: To protect personnel from overexposure to toxic materials, conform to the most stringent guidance of:

1. The applicable manufacturer's Material Safety Data Sheets (MSDS) or local regulation.
2. 29 CFR 1910.1000.
3. ACHIH-BKLT and ACGHI-DOC, threshold limit values.

1.8 **APPLICABLE PUBLICATIONS**

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

B. American Conference of Governmental Industrial Hygienists (ACGIH):

ACGIH TLV-BKLT-2012.....Threshold Limit Values (TLV) for Chemical Substances and Physical Agents and Biological Exposure Indices (BEIs)

ACGIH TLV-DOC-2012.....Documentation of Threshold Limit Values and Biological Exposure Indices, (Seventh Edition)

C. ASME International (ASME):

A13.1-07(R2013).....Scheme for the Identification of Piping Systems

D. Code of Federal Regulation (CFR):

40 CFR 59.....Determination of Volatile Matter Content, Water Content, Density Volume Solids, and Weight Solids of Surface Coating

E. Commercial Item Description (CID):

A-A-1272A.....Plaster Gypsum (Spackling Compound)

F. Federal Specifications (Fed Spec):

TT-P-1411A.....Paint, Copolymer-Resin, Cementitious (For Waterproofing Concrete and Masonry Walls) (CEP)

G. Master Painters Institute (MPI):

1.....Aluminum Paint

3.....Primer, Alkali Resistant, Water Based

4.....Interior/ Exterior Latex Block Filler

5.....Exterior Alkyd Wood Primer

6.....Exterior, Latex for Exterior Wood Primer

7.....Exterior Oil Wood Primer

8.....Exterior Alkyd, Flat MPI Gloss Level 1
9.....Exterior Alkyd Enamel MPI Gloss Level 6
10.....Exterior Latex, Flat
11.....Exterior Latex, Semi-Gloss
15.....Exterior Latex, Low Sheen (MPI Gloss Level 3-4)
17.....Primer, Bonding, Waterbased
18.....Organic Zinc Rich Primer
22.....Aluminum Paint, High Heat (up to 590% - 1100F)
23.....Primer, Metal, Surface Tolerant

27.....Exterior / Interior Alkyd Floor Enamel, Gloss
31.....Polyurethane, Moisture Cured, Clear Gloss
36.....Knot Sealer
39.....Primer, Latex, for Interior Wood
40.....Exterior, Latex High Build
42.....Textured Coating, Latex, Flat
43.....Interior Satin Latex, MPI Gloss Level 4
44.....Interior Low Sheen Latex, MPI Gloss Level 2
45.....Interior Primer Sealer
46.....Interior Enamel Undercoat
47.....Interior Alkyd, Semi-Gloss, MPI Gloss Level 5
48.....Interior Alkyd, Gloss, MPI Gloss Level 6
50.....Interior Latex Primer Sealer
51.....Interior Alkyd, Eggshell, MPI Gloss Level 3
52.....Interior Latex, MPI Gloss Level 3
53.....Interior Latex, Flat, MPI Gloss Level 1
54.....Interior Latex, Semi-Gloss, MPI Gloss Level 5
59.....Interior/Exterior Alkyd Porch & Floor Enamel, Low Gloss
60.....Interior/Exterior Latex Porch & Floor Paint, Low Gloss
66.....Interior Alkyd Fire Retardant, Clear Top-Coat (ULC Approved)
67.....Interior Latex Fire Retardant, Top-Coat (ULC Approved)
68.....Interior/ Exterior Latex Porch & Floor Paint, Gloss
71.....Polyurethane, Moisture Cured, Clear, Flat

77.....Epoxy Cold Cured, Gloss
79.....Marine Alkyd Metal Primer
90.....Interior Wood Stain, Semi-Transparent
91.....Wood Filler Paste
94.....Exterior Alkyd, Semi-Gloss
95.....Fast Drying Metal Primer
98.....High Build Epoxy Coating
99.....Sealer, Water-based, for Concrete Floors
101.....Epoxy Anti-Corrosive Metal Primer
107.....Primer, Rust-Inhibitive, Water-based

108.....High Build Epoxy Coating, Low Gloss
113.....Elastomeric, Pigmented, Exterior, Water-based, Flat
114.....Interior Latex, Gloss
115.....Epoxy-Modified Latex, Interior Gloss (MPI gloss level 6)
118.....Dry Fall, Latex Flat
119.....Exterior Latex, High Gloss (acrylic)
134.....Galvanized Water Based Primer
135.....Non-Cementitious Galvanized Primer
138.....Interior High Performance Latex, MPI Gloss Level 2
139.....Interior High Performance Latex, MPI Gloss Level 3
140.....Interior High Performance Latex, MPI Gloss Level 4
141.....Interior High Performance Latex (SG) MPI Gloss Level 5
144.....Latex, Interior, Institutional Low Odor / VOC, (MPI Gloss Level 2)
145.....Latex, Interior, Institutional Low Odor / VOC, (MPI Gloss Level 3)
146.....Latex, Interior, Institutional Low Odor / VOC, (MPI Gloss Level 4)
151.....Light Industrial Coating, Interior, Water-based, (MPI Gloss Level 3)
153.....Light Industrial Coating, Interior, Water-based, (MPI Gloss Level 4)
163.....Exterior Water Based Semi-Gloss Light Industrial Coating, MPI Gloss Level 5

164.....Exterior, Water Based, Gloss, Light Industrial Coating, MPI Gloss Level 6

H. Society for Protective Coatings (SSPC):

SSPC SP 1-82(R2004).....Solvent Cleaning

SSPC SP 2-82(R2004).....Hand Tool Cleaning

SSPC SP 3-28(R2004).....Power Tool Cleaning

SSPC SP 10/NACE No.2....Near-White Blast Cleaning

SSPC PA Guide 10.....Guide to Safety and Health Requirements

I. 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 gram/liter.
2. Non-flat Paints and Coatings: 150 gram/liter.
3. Primers, Sealers, and Undercoaters: 200 gram/liter.
4. Anticorrosive and Antirust Paints applied to Ferrous Metals: 250 gram/liter.
5. Zinc-Rich Industrial Maintenance Primers: 340 gram/liter.

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.

2.3 **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
Exterior Paint	20 percent biobased material

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.

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.

3.4 **SURFACE PREPARATION:**

A. General:

1. The Contractor shall be held wholly responsible for the finished appearance and satisfactory completion of painting work. Properly

prepare all surfaces to receive paint, which includes cleaning, sanding, and touching-up of all prime coats applied under other Sections of the work. Broom clean all spaces before painting is started. All surfaces to be painted or finished are to be completely dry, clean and smooth.

2. See other sections of specifications for specified surface conditions and prime coat.
3. Perform preparation and cleaning procedures in strict accordance with the paint manufacturer’s instructions and as herein specified, for each particular substrate condition.
4. Clean surfaces before applying paint or surface treatments with materials and methods compatible with substrate and specified finish. Remove any residue remaining from cleaning agents used. Do not use solvents, acid, or steam on concrete and masonry. Schedule the cleaning and painting so that dust and other contaminants from the cleaning process will not fall in wet, newly painted surfaces.
5. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
   a. Wood: 15 percent.
   b. Gypsum Board: 12 percent.

B. Wood:
1. Sand to a smooth even surface and then dust off.
2. Sand surfaces showing raised grain smooth between each coat.
3. Wipe surface with a tack rag prior to applying finish.
4. Surface painted with an opaque finish:
   a. Coat knots, sap and pitch streaks with MPI 36 (Knot Sealer) before applying paint.
   b. Apply two coats of MPI 36 (Knot Sealer) over large knots.
5. After application of prime coat, fill cracks, nail and screw holes, depressions and similar defects with wood filler paste. Sand the surface to make smooth and finish flush with adjacent surface.
6. Before applying finish coat, reapply wood filler paste if required, and sand surface to remove surface blemishes. Finish flush with adjacent surfaces.

C. Ferrous Metals:
1. Remove oil, grease, soil, drawing and cutting compounds, flux and other detrimental foreign matter in accordance with SSPC-SP 1 (Solvent Cleaning).

2. Remove loose mill scale, rust, and paint, by hand or power tool cleaning, as defined in SSPC-SP 2 (Hand Tool Cleaning) and SSPC-SP 3 (Power Tool Cleaning).
3. Fill dents, holes and similar voids and depressions in flat exposed surfaces of hollow steel doors and frames and similar items specified to have semi-gloss or gloss finish with TT-F-322D (Filler, Two-Component Type, For Dents, Small Holes and Blow-Holes). Finish flush with adjacent surfaces.
   a. Fill flat head countersunk screws used for permanent anchors.
   b. Do not fill screws of item intended for removal such as glazing beads.
4. Spot prime abraded and damaged areas in shop prime coat which expose bare metal with same type of paint used for prime coat. Feather edge of spot prime to produce smooth finish coat.
5. Spot prime abraded and damaged areas which expose bare metal of factory finished items with paint as recommended by manufacturer of item.

D. Zinc-Coated (Galvanized) Metal Surfaces Specified Painted:
1. Clean surfaces to remove grease, oil and other deterrents to paint adhesion in accordance with SSPC-SP 1 (Solvent Cleaning).
2. Spot coat abraded and damaged areas of zinc-coating which expose base metal on hot-dip zinc-coated items with MPI 18 (Organic Zinc Rich Coating). Prime or spot prime with MPI 134 (Waterborne Galvanized Primer) or MPI 135 (Non-Cementitious Galvanized Primer) depending on finish coat compatibility.

E. 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.

B. Do not thin unless necessary for application and when finish paint is used for body and prime coats. Use materials and quantities for thinning as specified in manufacturer's printed instructions.

C. Remove paint skins, then strain paint through commercial paint strainer to remove lumps and other particles.

D. Mix two (2) component and two (2) part paint and those requiring additives in such a manner as to uniformly blend as specified in manufacturer's printed instructions unless specified otherwise.

E. For tinting required to produce exact shades specified, use color pigment recommended by the paint manufacturer.

3.6 **APPLICATION:**

A. Start of surface preparation or painting will be construed as acceptance of the surface as satisfactory for the application of materials.

B. Unless otherwise specified, apply paint in three (3) coats; prime, body, and finish. When two (2) coats applied to prime coat are the same, first coat applied over primer is body coat and second coat is finish coat.

C. Apply each coat evenly and cover substrate completely.

D. Allow not less than 48 hours between application of succeeding coats, except as allowed by manufacturer's printed instructions, and approved by COR.

E. Apply by brush or roller. Spray application for new or existing occupied spaces only upon approval by acceptance from COR in writing.

1. Apply painting materials specifically required by manufacturer to be applied by spraying.

2. In new construction and in existing occupied spaces, where paint is applied by spray, mask or enclose with polyethylene, or similar air tight material with edges and seams continuously sealed including items specified in “Building and Structural Work Field Painting”; “Work not Painted”; motors, controls, telephone, and electrical equipment, fronts of sterilizes and other recessed equipment and similar prefinished items.

F. Do not paint in closed position operable items such as access doors and panels, window sashes, overhead doors, and similar items except overhead roll-up doors and shutters.

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. Wood:

1. Use same kind of primer specified for exposed face surface.
   a. Exterior wood: MPI 7 (Exterior Oil Wood Primer) for new construction and MPI 5(Exterior Alkyd Wood Primer) for repainting bare wood primer.
2. Apply one (1) coat of primer MPI 7 (Exterior Oil Wood Primer) or MPI 5 (Exterior Alkyd Wood Primer) as soon as delivered to site to surfaces of unfinished woodwork, except concealed surfaces of shop fabricated or assembled millwork.
3. Back prime and seal ends of exterior wood.

E. Metals:

1. Steel and iron: MPI 95 (Fast Drying Metal Primer).
2. Zinc-coated steel and iron: MPI 134 (Waterborne Galvanized Primer) or MPI 135 (Non-Cementitious Galvanized Primer).

F. Gypsum Board // and Hardboard //:

3.8 **1. USE MPI 149 PRIMER SEALER INTERIOR INSTITUTIONAL LOW ODOR/VOC. EXTERIOR FINISHES:**

A. Apply following finish coats where indicated.

B. Wood:

1. Do not apply finish coats on surfaces concealed after installation.
2. Two (2) coats of MPI 10 Exterior Latex, Flat).

C. Steel and Ferrous Metal:

1. Two (2) coats of MPI 9 (Exterior Alkyd Enamel, Gloss) on exposed surfaces, except on surfaces over 94 degrees C (201 degrees F).

3.9 **INTERIOR FINISHES:**

A. Apply following finish coats over prime coats in spaces indicated.

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 153 Light Industrial Coating, Interior, Water-Based, Semi-Gloss, MPI Gloss Level 5.

C. Gypsum Board:

1. Two (2) coats of MPI 147 Latex Interior Institutional Low Odor/VOC, Semi-Gloss, MPI Gloss Level 5.

3.10 **REFINISHING EXISTING PAINTED SURFACES:**

A. Clean, patch and repair existing surfaces as specified under "Surface Preparation". No "telegraphing" of lines, ridges, flakes, etc., through new surfacing is permitted. Where this occurs, sand smooth and re-finish until surface meets with COR's approval.

B. Remove and reinstall items as specified under "General Workmanship Requirements".

C. Remove existing finishes or apply separation coats to prevent non compatible coatings from having contact.

D. Patched or Replaced Areas in Surfaces and Components: Apply spot prime and body coats as specified for new work to repaired areas or replaced components.

E. Except where scheduled for complete painting apply finish coat over plane surface to nearest break in plane, such as corner, reveal, or frame.

F. Refinish areas as specified for new work to match adjoining work unless specified or scheduled otherwise.

G. Coat knots and pitch streaks showing through old finish with MPI 36 (Knot Sealer) before refinishing.

H. Sand or dull glossy surfaces prior to painting.

I. Sand existing coatings to a feather edge so that transition between new and existing finish will not show in finished work.

3.11 **PAINT COLOR:**

A. Color and gloss of finish coats shall match existing surfaces unless noted otherwise.

B. Coat Colors:

1. Color of priming coat: Lighter than body coat.
2. Color of body coat: Lighter than finish coat.
3. Color prime and body coats to not show through the finish coat and to mask surface imperfections or contrasts.

3.12 **PROTECTION CLEAN UP, AND TOUCH-UP:**

A. Protect work from paint droppings and spattering by use of masking, drop cloths, removal of items or by other approved methods.

B. Upon completion, clean paint from hardware, glass and other surfaces and items not required to be painted of paint drops or smears.

C. Before final inspection, touch-up or refinished in a manner to produce solid even color and finish texture, free from defects in work which was damaged or discolored.

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SECTION 22 05 11
COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 DESCRIPTION

A. The requirements of this Section will apply to all sections of Division 22.

B. Definitions:

1. Exposed: Piping and equipment exposed to view in finished rooms.
2. Exterior: Piping and equipment exposed to weather be it temperature, humidity, precipitation, wind or solar radiation.

C. Abbreviations/Acronyms:

1. ABS: Acrylonitrile Butadiene Styrene
2. AC: Alternating Current
3. ACR: Air Conditioning and Refrigeration
4. A/E: Architect/Engineer
5. AFF: Above Finish Floor
6. AFG: Above Finish Grade
7. AI: Analog Input
8. AISI: American Iron and Steel Institute
9. AO: Analog Output
10. ASHRAE: American Society of Heating Refrigeration, Air Conditioning Engineers
11. ASJ: All Service Jacket
12. ASME: American Society of Mechanical Engineers
13. ASPE: American Society of Plumbing Engineers
14. AWG: American Wire Gauge
15. BACnet: Building Automation and Control Network
16. BAg: Silver-Copper-Zinc Brazing Alloy
17. BAS: Building Automation System
18. BCuP: Silver-Copper-Phosphorus Brazing Alloy
19. bhp: Brake Horsepower
20. Btu: British Thermal Unit
21. Btu/h: British Thermal Unit per Hour
22. BSG: Borosilicate Glass Pipe
23. C: Celsius
24. CA: Compressed Air
25. CD: Compact Disk
26. CDA: Copper Development Association

27. CGA: Compressed Gas Association
28. CFM: Cubic Feet per Minute
29. CI: Cast Iron
30. CLR: Color
31. CO: Contracting Officer
32. COR: Contracting Officer’s Representative
33. CPVC: Chlorinated Polyvinyl Chloride
34. CR: Chloroprene
35. CRS: Corrosion Resistant Steel
36. CWP: Cold Working Pressure
37. CxA: Commissioning Agent
38. dB: Decibels
39. db(A): Decibels (A weighted)
40. DCW: Domestic Cold Water
41. DDC: Direct Digital Control
42. DFU: Drainage Fixture Units
43. DHW: Domestic Hot Water
44. DHWR: Domestic Hot Water Return
45. DHWS: Domestic How Water Supply
46. DI: Digital Input
47. DI: Deionized Water
48. DISS: Diameter Index Safety System
49. DN: Diameter Nominal
50. DO: Digital Output
51. DOE: Department of Energy
52. DVD: Digital Video Disc
53. DWG: Drawing
54. DWH: Domestic Water Heater
55. DWS: Domestic Water Supply
56. DWV: Drainage, Waste and Vent
57. ECC: Engineering Control Center
58. EL: Elevation
59. EMCS: Energy Monitoring and Control System
60. EPA: Environmental Protection Agency
61. EPACT: Energy Policy Act
62. EPDM: Ethylene Propylene Diene Monomer
63. EPT: Ethylene Propylene Terpolymer
64. ETO: Ethylene Oxide

65. F: Fahrenheit
66. FAR: Federal Acquisition Regulations
67. FD: Floor Drain
68. FDC: Fire Department (Hose) Connection
69. FED: Federal
70. FG: Fiberglass
71. FNPT: Female National Pipe Thread
72. FOR: Fuel Oil Return
73. FOS: Fuel Oil Supply
74. FOV: Fuel Oil Vent
75. FPM: Fluoroelastomer Polymer
76. FSK: Foil-Scrim-Kraft Facing
77. FSS: VA Construction & Facilities Management, Facility Standards Service
78. FU: Fixture Units
79. GAL: Gallon
80. GCO: Grade Cleanouts
81. GPD: Gallons per Day
82. GPH: Gallons per Hour
83. GPM: Gallons per Minute
84. HDPE: High Density Polyethylene
85. HEFP: Healthcare Environment and Facilities Program (replacement for OCAMES)
86. HEX: Heat Exchanger
87. Hg: Mercury
88. HOA: Hands-Off-Automatic
89. HP: Horsepower
90. HVE: High Volume Evacuation
91. Hz: Hertz
92. ID: Inside Diameter
93. IE: Invert Elevation
94. INV: Invert
95. IPC: International Plumbing Code
96. IPS: Iron Pipe Size
97. IW: Indirect Waste
98. IWH: Instantaneous Water Heater
99. Kg: Kilogram
100. kPa: Kilopascal

101. KW: Kilowatt
102. KWH: Kilowatt Hour
103. lb: Pound
104. lbs/hr: Pounds per Hour
105. LNG: Liquid Natural Gas
106. L/min: Liters per Minute
107. LOX: Liquid Oxygen
108. L/s: Liters per Second
109. m: Meter
110. MA: Medical Air
111. MAWP: Maximum Allowable Working Pressure
112. MAX: Maximum
113. MBH: 1000 Btu per Hour
114. MED: Medical
115. MER: Mechanical Equipment Room
116. MFG: Manufacturer
117. mg: Milligram
118. mg/L: Milligrams per Liter
119. ml: Milliliter
120. mm: Millimeter
121. MIN: Minimum
122. MV: Medical Vacuum
123. N2: Nitrogen
124. N20: Nitrogen Oxide
125. NC: Normally Closed
126. NF: Oil Free Dry (Nitrogen)
127. NG: Natural Gas
128. NIC: Not in Contract
129. NO: Normally Open
130. NOM: Nominal
131. NPTF: National Pipe Thread Female
132. NPS: Nominal Pipe Size
133. NPT: Nominal Pipe Thread
134. NTS: Not to Scale
135. O2: Oxygen
136. OC: On Center
137. OD: Outside Diameter
138. OSD: Open Sight Drain

139. OS&Y: Outside Stem and Yoke
140. PA: Pascal
141. PBPU: Prefabricated Bedside Patient Units
142. PD: Pressure Drop or Difference
143. PDI: Plumbing and Drainage Institute
144. PH: Power of Hydrogen
145. PID: Proportional-Integral-Differential
146. PLC: Programmable Logic Controllers
147. PP: Polypropylene
148. ppb: Parts per Billion
149. ppm: Parts per Million
150. PSI: Pounds per Square Inch
151. PSIA: Pounds per Square Inch Atmosphere
152. PSIG: Pounds per Square Inch Gauge
153. PTFE: Polytetrafluoroethylene
154. PVC: Polyvinyl Chloride
155. PVDF: Polyvinylidene Fluoride
156. RAD: Radians
157. RO: Reverse Osmosis
158. RPM: Revolutions Per Minute
159. RTD: Resistance Temperature Detectors
160. RTRP: Reinforced Thermosetting Resin Pipe
161. SAN: Sanitary Sewer
162. SCFM: Standard Cubic Feet per Minute
163. SDI: Silt Density Index
164. SMACNA: Sheet Metal and Air Conditioning Contractors National Association
165. SPEC: Specification
166. SPS: Sterile Processing Services
167. SQFT/SF: Square Feet
168. SS: Stainless Steel
169. STD: Standard
170. SUS: Saybolt Universal Second
171. SWP: Steam Working Pressure
172. TD: Temperature Difference
173. TDH: Total Dynamic Head
174. TEFC: Totally Enclosed Fan-Cooled
175. TEMP: Temperature

176. TFE: Tetrafluoroethylene
177. THERM: 100,000 Btu
178. THHN: Thermoplastic High-Heat Resistant Nylon Coated Wire
179. THWN: Thermoplastic Heat & Water Resistant Nylon Coated Wire
180. TIL: Technical Information Library
     http//www.cfm.va.gov/til/indes.asp
181. T/P: Temperature and Pressure
182. TYP: Typical
183. USDA: U.S. Department of Agriculture
184. V: Vent
185. V: Volt
186. VA: Veterans Administration
187. VA CFM: VA Construction & Facilities Management
188. VA CFM CSS: VA Construction & Facilities Management, Consulting Support Service
189. VAC: Vacuum
190. VAC: Voltage in Alternating Current
191. VAMC: Veterans Administration Medical Center
192. VHA OCAMES: This has been replaced by HEFP.
193. VSD: Variable Speed Drive
194. VTR: Vent through Roof
195. W: Waste
196. WAGD: Waste Anesthesia Gas Disposal
197. WC: Water Closet
198. WG: Water Gauge
199. WOG: Water, Oil, Gas
200. WPD: Water Pressure Drop
201. WSFU: Water Supply Fixture Units

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.
B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
C. Section 07 60 00, FLASHING AND SHEET METAL: Flashing for Wall and Roof Penetrations.
D. Section 07 84 00, FIRESTOPPING.
E. Section 07 92 00, JOINT SEALANTS.
F. Section 09 91 00, PAINTING.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below will form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standard will govern.

B. American Society of Mechanical Engineers (ASME):
B31.1-2013.....Power Piping
ASME Boiler and Pressure Vessel Code -
BPVC Section IX-2019.... Welding, Brazing, and Fusing Qualifications

C. American Society for Testing and Materials (ASTM):
A36/A36M-2019.....Standard Specification for Carbon Structural Steel
A575-96(2013)e1.....Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades
E84-2013a.....Standard Test Method for Surface Burning Characteristics of Building Materials
E119-2012a.....Standard Test Methods for Fire Tests of Building Construction and Materials

D. International Code Council, (ICC):
IBC-2018.....International Building Code
IPC-2018.....International Plumbing Code

E. Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry, Inc:
SP-58-2018.....Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application and Installation

F. Military Specifications (MIL):
P-21035B.....Paint High Zinc Dust Content, Galvanizing Repair (Metric)

G. National Electrical Manufacturers Association (NEMA):
MG 1-2016.....Motors and Generators

H. National Fire Protection Association (NFPA):
51B-2019.....Standard for Fire Prevention During Welding, Cutting and Other Hot Work
54-2018.....National Fuel Gas Code
70-2020.....National Electrical Code (NEC)
99-2018.....Healthcare Facilities Code

I. NSF International (NSF):

5-2019.....Water Heaters, Hot Water Supply Boilers, and Heat Recovery Equipment

14-2019.....Plastic Piping System Components and Related Materials

61-2019.....Drinking Water System Components - Health Effects

372-2016.....Drinking Water System Components - Lead Content

J. Department of Veterans Affairs (VA):

PG-18-102014(R18).....Plumbing Design Manual

PG-18-13-2017(R18).....Barrier Free Design Guide

1.4 SUBMITTALS

A. Submittals, including number of required copies, will be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

B. Information and material submitted under this section will be marked "SUBMITTED UNDER SECTION 22 05 11, COMMON WORK RESULTS FOR PLUMBING", with applicable paragraph identification.

C. If the project is phased, contractors will submit complete phasing plan/schedule with manpower levels prior to commencing work. The phasing plan will be detailed enough to provide milestones in the process that can be verified.

D. Contractor will make all necessary field measurements and investigations to assure that the equipment and assemblies will meet contract requirements, and all equipment that requires regular maintenance, calibration, etc are accessable from the floor or permanent work platform. It is the Contractor’s responsibility to ensure all submittals meet the VA specifications and requirements and it is assumed by the VA that all submittals do meet the VA specifications unless the Contractor has requested a variance in writing and approved by COR prior to the submittal. If at any time during the project it is found that any item does not meet the VA specifications and there was no variance approval the Contractor will correct at no additional cost or time to the Government even if a submittal was approved.

E. If equipment is submitted which differs in arrangement from that shown, provide documentation proving equivalent performance, design standards and drawings that show the rearrangement of all associated systems.

Additionally, any impacts on ancillary equipment or services such as foundations, piping, and electrical will be the Contractor’s responsibility to design, supply, and install at no additional cost or time to the Government. VA approval will be given only if all features of the equipment and associated systems, including accessibility, are equivalent to that required by the contract.

F. Prior to submitting shop drawings for approval, Contractor will certify in writing that manufacturers of all major items of equipment have each reviewed drawings and specifications, and have jointly coordinated and properly integrated their equipment and controls to provide a complete and efficient installation.

G. Submittals and shop drawings for interdependent items, containing applicable descriptive information, will be furnished together and complete in a group. Coordinate and properly integrate materials and equipment in each group to provide a completely compatible and efficient installation. Final review and approvals will be made only by groups.

H. Manufacturer's Literature and Data including: Manufacturer’s literature will be submitted under the pertinent section rather than under this section.

1. Electric motor data and variable speed drive data will be submitted with the driven equipment.
2. Equipment and materials identification.
3. Firestopping materials.
4. Hangers, inserts, supports and bracing. Provide load calculations for variable spring and constant support hangers.
5. Wall, floor, and ceiling plates.

I. Rigging Plan: Provide documentation of the capacity and weight of the rigging and equipment intended to be used. The plan will include the path of travel of the load, the staging area and intended access, and qualifications of the operator and signal person.

J. Plumbing Maintenance Data and Operating Instructions:

1. Maintenance and operating manuals in accordance with Section 01 00 00, GENERAL REQUIREMENTS, Article, INSTRUCTIONS, for systems and equipment.
2. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replacement parts, and troubleshooting guide:

a. Include complete list indicating all components of the systems.
b. Include complete diagrams of the internal wiring for each item of equipment.
c. Diagrams will have their terminals identified to facilitate installation, operation and maintenance.

3. Provide a listing of recommended replacement parts for keeping in stock supply, including sources of supply, for equipment. Include in the listing belts for equipment: Belt manufacturer, model number, size and style, and distinguished whether of multiple belt sets.

K. Provide copies of approved plumbing equipment submittals to the TAB Subcontractor.

1.5 QUALITY ASSURANCE

A. Mechanical, electrical, and associated systems will be safe, reliable, efficient, durable, easily and safely operable and maintainable, easily and safely accessible, and in compliance with applicable codes as specified. The systems will be comprised of high quality institutional-class and industrial-class products of manufacturers that are experienced specialists in the required product lines. All construction firms and personnel will be experienced and qualified specialists in industrial and institutional plumbing.

B. Products Criteria:

1. Standard Products: Material and equipment will be the standard products of a manufacturer regularly engaged in the manufacture, supply and servicing of the specified products for at least 5 years. However, digital electronics devices, software and systems such as controls, instruments, computer work station, will be the current generation of technology and basic design that has a proven satisfactory service record of at least 5 years.

2. Equipment Service: There will be permanent service organizations, authorized and trained by manufacturers of the equipment supplied, located within 160 km (100 miles) of the project. These organizations will come to the site and provide acceptable service to restore operations within 4 hours of receipt of notification by phone, e-mail or fax in event of an emergency, such as the shut-down of equipment; or within 24 hours in a non-emergency. Names, mail and e-mail addresses and phone numbers of service organizations providing service under these conditions for (as applicable to the project): pumps, compressors, water heaters, critical

instrumentation, computer workstation and programming will be submitted for project record and inserted into the operations and maintenance manual.

3. All items furnished will be free from defects that would adversely affect the performance, maintainability and appearance of individual components and overall assembly.
4. The products and execution of work specified in Division 22 will conform to the referenced codes and standards as required by the specifications. Local codes and amendments enforced by the local code official will be enforced, if required by local authorities such as the natural gas supplier. If the local codes are more stringent, then the local code will apply. Any conflicts will be brought to the attention of the Contracting Officers Representative (COR).
5. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units will be of the same manufacturer and model number, or if different models are required they will be of the same manufacturer and identical to the greatest extent possible (i.e., same model series).
6. Assembled Units: Performance and warranty of all components that make up an assembled unit will be the responsibility of the manufacturer of the completed assembly.
7. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark will be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.
8. Asbestos products or equipment or materials containing asbestos is prohibited.
9. Bio-Based Materials: For products designated by the USDA’s bio-based Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

C. Welding: Before any welding is performed, Contractor will submit a certificate certifying that welders comply with the following requirements:

1. Qualify welding processes and operators for piping according to ASME BPVC, Section IX, "Welding and Brazing Qualifications". Provide proof of current certification to CO.
2. Comply with provisions of ASME B31 series "Code for Pressure Piping".
3. Certify that each welder and welding operator has passed American Welding Society (AWS) qualification tests for the welding processes involved, and that certification is current.
4. All welds will be stamped according to the provisions of the AWS or ASME as required herein and by the association code.

D. Manufacturer's Recommendations: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations will be furnished to the COR prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.

E. Execution (Installation, Construction) Quality:

1. All items will be applied and installed in accordance with manufacturer's written instructions. Conflicts between the manufacturer's instructions and the contract documents will be referred to the COR for resolution. Printed copies or electronic files of manufacturer’s installation instructions will be provided to the COR at least 10 working days prior to commencing installation of any item.
2. All items that require access, such as for operating, cleaning, servicing, maintenance, and calibration, will be easily and safely accessible by persons standing at floor level, or standing on permanent platforms, without the use of portable ladders. Examples of these items include but are not limited to: all types of valves, filters and strainers, transmitters, and control devices. Prior to commencing installation work, refer conflicts between this requirement and contract documents to COR for resolution. Failure of the Contractor to resolve or call attention to any discrepancies or deficiencies to the COR will result in the Contractor correcting at no additional cost or time to the Government.

3. Complete layout drawings will be required by Paragraph, SUBMITTALS. Construction work will not start on any system until the layout drawings have been approved by VA.
4. Installer Qualifications: Installer will be licensed and will provide evidence of the successful completion of at least five projects of equal or greater size and complexity. Provide tradesmen skilled in the appropriate trade.
5. Workmanship/craftsmanship will be of the highest quality and standards. The VA reserves the right to reject any work based on poor quality of workmanship this work will be removed and done again at no additional cost or time to the Government.

F. Upon request by Government, provide lists of previous installations for selected items of equipment. Include contact persons who will serve as references, with current telephone numbers and e-mail addresses.

G. Guaranty: Warranty of Construction, FAR clause 52.246-21.

H. Plumbing Systems: IPC, International Plumbing Code. Unless otherwise required herein, perform plumbing work in accordance with the latest version of the IPC. For IPC codes referenced in the contract documents, advisory provisions will be considered mandatory, the word “should” will be interpreted as “will”. Reference to the “code official” or “owner” will be interpreted to mean the COR.

I. Cleanliness of Piping and Equipment Systems:
1. Care will be exercised in the storage and handling of equipment and piping material to be incorporated in the work. Debris arising from cutting, threading and welding of piping will be removed.
2. Piping systems will be flushed, blown or pigged as necessary to deliver clean systems.
3. The interior of all tanks will be cleaned prior to delivery and beneficial use by the Government. All piping will be tested in accordance with the specifications and the International Plumbing Code (IPC). All filters, strainers, fixture faucets will be flushed of debris prior to final acceptance.
4. Contractor will be fully responsible for all costs, damage, and delay arising from failure to provide clean systems.

1.6 DELIVERY, STORAGE AND HANDLING

A. Protection of Equipment:
1. Equipment and material placed on the job site will remain in the custody of the Contractor until phased acceptance, whether or not

the Government has reimbursed the Contractor for the equipment and material. The Contractor is solely responsible for the protection of such equipment and material against any damage or theft.

2. Damaged equipment will be replaced with an identical unit as determined and directed by the COR. Such replacement will be at no additional cost or additional time to the Government.
3. Interiors of new equipment and piping systems will be protected against entry of foreign matter. Both inside and outside will be cleaned before painting or placing equipment in operation.
4. Existing equipment and piping being worked on by the Contractor will be under the custody and responsibility of the Contractor and will be protected as required for new work.
5. Protect plastic piping and tanks from ultraviolet light (sunlight) while in pre-construction. Plastic piping and tanks will not be installed exposed to sunlight without metal jacketing to block ultraviolet rays.

1.7 AS-BUILT DOCUMENTATION

A. Submit manufacturer’s literature and data updated to include submittal review comments and any equipment substitutions.

B. Submit operation and maintenance data updated to include submittal review comments, VA approved substitutions and construction revisions will be in electronic version on CD or DVD inserted into a three—ring binder. All aspects of system operation and maintenance procedures, including applicable piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation will be included in the operation and maintenance manual. The operations and maintenance manual will include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices will be included. A List of recommended spare parts (manufacturer, model number, and quantity) will be furnished. Information explaining any special knowledge or tools the owner will be required to employ will be inserted into the As-Built documentation.

C. The installing Contractor will maintain as-built drawings of each completed phase for verification; and, will provide the complete set at the time of final systems certification testing. Should the installing Contractor engage the testing company to provide as-built or any

portion thereof, it will not be deemed a conflict of interest or breach of the 'third party testing company' requirement. Provide record drawings as follows:

1. Red-lined, hand-marked drawings are to be provided, with one paper copy and a scanned PDF version of the hand-marked drawings provided on CD or DVD.

D. The as-built drawings will indicate the location and type of all lockout/tagout points for all energy sources for all equipment and pumps to include breaker location and numbers, valve tag numbers, etc. Coordinate lockout/tagout procedures and practices with local VA requirements.

E. Certification documentation will be provided to COR 21 working days prior to submitting the request for final inspection. The documentation will include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and provide documentation/certification that all results of tests were within limits specified. Test results will contain written sequence of test procedure with written test results annotated at each step along with the expected outcome or setpoint. The results will include all readings, including but not limited to data on device (make, model and performance characteristics_), normal pressures, switch ranges, trip points, amp readings, and calibration data to include equipment serial numbers or individual identifications, etc.

1.8 JOB CONDITIONS – WORK IN EXISTING BUILDING

A. Building Operation: Government employees will be continuously operating and managing all facilities, including temporary facilities that serve the VAMC.

B. Maintenance of Service: Schedule all work to permit continuous service as required by the VAMC.

C. Steam and Condensate Service Interruptions: Limited steam and condensate service interruptions, as required for interconnections of new and existing systems, will be permitted by the COR during periods when the demands are not critical to the operation of the VAMC. These non-critical periods are limited to between 8 pm and 5 am in the appropriate off-season (if applicable). Provide at least 10 working days advance notice to the COR. The request will include a detailed plan on the proposed shutdown and the intended work to be done along with manpower levels. All equipment and materials must be onsite and

verified with plan 5 calendar days prior to the shutdown or it will need to be rescheduled.

D. Phasing of Work: Comply with all requirements shown on contract documents. Contractor will submit a complete detailed phasing plan/schedule with manpower levels prior to commencing work. The phasing plan will be detailed enough to provide milestones in the process that can be verified.

E. Building Working Environment: Maintain the architectural and structural integrity of the building and the working environment at all times. Maintain the interior of building at 18 degrees C (65 degrees F) minimum. Limit the opening of doors, windows or other access openings to brief periods as necessary for rigging purposes. Storm water or ground water leakage is prohibited. Provide daily clean-up of construction and demolition debris on all floor surfaces and on all equipment being operated by VA. Maintain all egress routes and safety systems/devices.

F. Acceptance of Work for Government Operation: As new equipment, systems and facilities are made available for operation and these items are deemed of beneficial use to the Government, inspections and tests will be performed. Based on the inspections, a list of contract deficiencies will be issued to the Contractor. After correction of deficiencies as necessary for beneficial use, the Contracting Officer will process necessary acceptance and the equipment will then be under the control and operation of Government personnel.

PART 2 - PRODUCTS

2.1 MATERIALS FOR VARIOUS SERVICES

A. Non-pressure PVC pipe will contain a minimum of 25 percent recycled content. Steel pipe will contain a minimum of 25 percent recycled content.

B. Plastic pipe, fittings and solvent cement will meet NSF 14 and will bear the NSF seal “NSF-PW”. Polypropylene pipe and fittings will comply with NSF 14 and NSF 61. Solder or flux containing lead will not be used with copper pipe.

C. Material or equipment containing a weighted average of greater than 0.25 percent lead will not be used in any potable water system intended

for human consumption and will be certified in accordance with NSF 61 or NSF 372.

D. In-line devices such as water meters, building valves, check valves, stops, valves, fittings, tanks and backflow preventers will comply with NSF 61 and NSF 372.

E. End point devices such as drinking fountains, lavatory faucets, kitchen and bar faucets, ice makers supply stops, and end-point control valves used to dispense drinking water must meet requirements of NSF 61 and NSF 372.

2.2 FACTORY-ASSEMBLED PRODUCTS

A. Standardization of components will be maximized to reduce spare part requirements.

B. Manufacturers of equipment assemblies that include components made by others will assume complete responsibility for final assembled unit.

1. All components of an assembled unit need not be products of same manufacturer.
2. Constituent parts that are alike will be products of a single manufacturer.
3. Components will be compatible with each other and with the total assembly for intended service.
4. Contractor will guarantee performance of assemblies of components and will repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly at no additional cost or time to the Government.

C. Components of equipment will bear manufacturer's name and trademark, model number, serial number and performance data on a name plate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment.

D. Major items of equipment, which serve the same function, will be the same make and model.

2.3 COMPATIBILITY OF RELATED EQUIPMENT

A. Equipment and materials installed will be compatible in all respects with other items being furnished and with existing items so that the result will be a complete and fully operational system that conforms to contract requirements.

2.4 SAFETY GUARDS

A. Pump shafts and couplings will be fully guarded by a sheet steel guard, covering coupling and shaft but not bearings. Material will be minimum

16-gauge sheet steel; ends will be braked and drilled and attached to pump base with minimum of four 8 mm (1/4 inch) bolts. Reinforce guard as necessary to prevent side play forcing guard onto couplings.

B. All Equipment will have moving parts protected from personal injury.

2.5 LIFTING ATTACHMENTS

A. Equipment will be provided with suitable lifting attachments to enable equipment to be lifted in its normal position. Lifting attachments will withstand any handling conditions that might be encountered, without bending or distortion of shape, such as rapid lowering and braking of load.

2.6 EQUIPMENT AND MATERIALS IDENTIFICATION

A. Use symbols, nomenclature and equipment numbers specified, shown in the drawings, or shown in the maintenance manuals. Coordinate equipment and valve identification with local VAMC shops. Identification for piping is specified in Section 09 91 00, PAINTING.

B. Interior (Indoor) Equipment: Engraved nameplates, with letters not less than 7 mm (3/16 inch) high of brass with black-filled letters, or rigid black plastic with white letters specified in Section 09 91 00, PAINTING will be permanently fastened to the equipment. Unit components such as water heaters, tanks, coils, filters, etc. will be identified.

C. Exterior (Outdoor) Equipment: Brass nameplates, with engraved black filled letters, not less than 7 mm (3/16 inch) high riveted or bolted to the equipment.

D. Control Items: All temperature, pressure, and controllers will be labeled and the component’s function identified. Identify and label each item as they appear on the control diagrams.

E. Valve Tags and Lists:

1. Plumbing: All valves will be provided with valve tags and listed on a valve list (Fixture stops not included).
2. Valve tags: Engraved black filled numbers and letters not less than 15 mm (1/2 inch) high for number designation, and not less than 8 mm (1/4 inch) for service designation on 19 gauge, 40 mm (1-1/2 inches) round brass disc, attached with brass "S" hook or brass chain.
3. Valve lists: Valve lists will be created using a word processing program and printed on plastic coated cards. The plastic-coated valve list card(s), sized 215 mm (8-1/2 inches) by 275 mm (11 inches) will show valve tag number, valve function and area of control for each service or system. The valve list will be in a

punched 3-ring binder notebook. An additional copy of the valve list will be mounted in picture frames for mounting to a wall. COR will instruct Contractor where frames will be mounted.

4. A detailed plan for each floor of the building indicating the location and valve number for each valve will be provided in the 3-ring binder notebook. Each valve location will be identified with a color-coded sticker or thumb tack in ceiling or access door.

2.7 FIRESTOPPING

A. Section 07 84 00, FIRESTOPPING specifies an effective barrier against the spread of fire, smoke and gases where penetrations occur for piping. Refer to Section 22 07 11, PLUMBING INSULATION, for pipe insulation.

2.8 GALVANIZED REPAIR COMPOUND

A. Mil. Spec. DOD-P-21035B, paint.

2.9 PIPE AND EQUIPMENT SUPPORTS AND RESTRAINTS

A. In lieu of the paragraph which follows, suspended equipment support and restraints may be designed and installed in accordance with the International Building Code (IBC) Submittals based on the International Building Code (IBC) requirements, or the following paragraphs of this Section will be stamped and signed by a professional engineer registered in the state where the project is located. The Support system of suspended equipment over 227 kg (500 pounds) will be submitted for approval of the COR in all cases. See the above specifications for lateral force design requirements.

B. Type Numbers Specified: For materials, design, manufacture, selection, application, and installation refer to MSS SP-58. Refer to Section 05 50 00, METAL FABRICATIONS, for miscellaneous metal support materials and prime coat painting.

C. For Attachment to Concrete Construction:

1. Concrete insert: Type 18, MSS SP-58.
2. Self-drilling expansion shields and machine bolt expansion anchors: Permitted in concrete not less than 100 mm (4 inches) thick when approved by the COR for each job condition.
3. Power-driven fasteners: Permitted in existing concrete or masonry not less than 100 mm (4 inches) thick when approved by the COR for each job condition.

D. For Attachment to Steel Construction: MSS SP-58.

1. Welded attachment: Type 22.

2. Beam clamps: Types 20, 21, 28 or 29. Type 23 C-clamp may be used for individual copper tubing up to 23 mm (7/8 inch) outside diameter.

E. Hanger Rods: Hot-rolled steel, ASTM A36/A36M or ASTM A575 for allowable load listed in MSS SP-58. For piping, provide adjustment means for controlling level or slope. Types 13 or 15 turn-buckles will provide 40 mm (1-1/2 inches) minimum of adjustment and incorporate locknuts. All-thread rods are acceptable.

F. Multiple (Trapeze) Hangers: Galvanized, cold formed, lipped steel channel horizontal member, not less than 43 mm by 43 mm (1-5/8 inches by 1-5/8 inches), 2.7 mm (No. 12 gauge), designed to accept special spring held, hardened steel nuts.

1. Allowable hanger load: Manufacturers rating less 91kg (200 pounds).
2. Guide individual pipes on the horizontal member of every other trapeze hanger with 8 mm (1/4 inch) U-bolt fabricated from steel rod. Provide Type 40 insulation shield, secured by two 15 mm (1/2 inch) galvanized steel bands, or insulated calcium silicate shield for insulated piping at each hanger.

G. Pipe Hangers and Supports: (MSS SP-58), use hangers sized to encircle insulation on insulated piping. Refer to Section 22 07 11, PLUMBING INSULATION for insulation thickness. To protect insulation, provide Type 39 saddles for roller type supports or insulated calcium silicate shields. Provide Type 40 insulation shield or insulated calcium silicate shield at all other types of supports and hangers including those for insulated piping.

1. General Types (MSS SP-58):
   a. Standard clevis hanger: Type 1; provide locknut.
   b. Riser clamps: Type 8.
   c. Wall brackets: Types 31, 32 or 33.
   d. Roller supports: Type 41, 43, 44 and 46.
   e. Saddle support: Type 36, 37 or 38.
   f. Turnbuckle: Types 13 or 15.
   g. U-bolt clamp: Type 24.
   h. Copper Tube:
      1) Hangers, clamps and other support material in contact with tubing will be painted with copper colored epoxy paint, copper-coated, plastic coated or taped with isolation tape to prevent electrolysis.

2) For vertical runs use epoxy painted, copper-coated or plastic coated riser clamps.
3) For supporting tube to strut: Provide epoxy painted pipe straps for copper tube or plastic inserted vibration isolation clamps.
4) Insulated Lines: Provide pre-insulated calcium silicate shields sized for copper tube.

i. Supports for plastic or glass piping: As recommended by the pipe manufacturer with black rubber tape extending 1 inch beyond steel support or clamp. //Spring Supports (Expansion and contraction of vertical piping):
1) Movement up to 20 mm (3/4 inch): Type 51 or 52 variable spring unit with integral turn buckle and load indicator.
2) Movement more than 20 mm (3/4 inch): Type 54 or 55 constant support unit with integral adjusting nut, turn buckle and travel position indicator.//

j. Spring hangers are required on all plumbing system pumps one horsepower and greater.

2. Plumbing Piping (Other Than General Types):
a. Horizontal piping: Type 1, 5, 7, 9, and 10.
b. Chrome plated piping: Chrome plated supports.
c. Hangers and supports in pipe chase: Prefabricated system ABS self-extinguishing material, not subject to electrolytic action, to hold piping, prevent vibration and compensate for all static and operational conditions.
d. Blocking, stays and bracing: Angle iron or preformed metal channel shapes, 1.3 mm (18 gauge) minimum.

H. Pre-insulated Calcium Silicate Shields:
1. Provide 360-degree water resistant high density 965 kPa (140 psig) compressive strength calcium silicate shields encased in galvanized metal.
2. Pre-insulated calcium silicate shields to be installed at the point of support during erection.
3. Shield thickness will match the pipe insulation.
4. The type of shield is selected by the temperature of the pipe, the load it must carry, and the type of support it will be used with.
a. Shields for supporting cold water will have insulation that extends a minimum of 25 mm (1 inch) past the sheet metal.

b. The insulated calcium silicate shield will support the maximum allowable water filled span as indicated in MSS SP-58. To support the load, the shields will have one or more of the following features: structural inserts 4138 kPa (600 psig) compressive strength, an extra bottom metal shield, or formed structural steel (ASTM A36/A36M) wear plates welded to the bottom sheet metal jacket.

5. Shields may be used on steel clevis hanger type supports, trapeze hangers, roller supports or flat surfaces.

2.10 PIPE PENETRATIONS

A. Pipe penetration sleeves will be installed for all pipe other than rectangular blocked out floor openings for risers in mechanical bays.

B. Pipe penetration sleeve materials will comply with all firestopping requirements for each penetration.

C. To prevent accidental liquid spills from passing to a lower level, provide the following:

1. For sleeves: Extend sleeve 25 mm (1 inch) above finished floor and provide sealant for watertight joint.
2. For blocked out floor openings: Provide 40 mm (1-1/2 inch) angle set in silicone adhesive around opening.
3. For drilled penetrations: Provide 40 mm (1-1/2 inch) angle ring or square set in silicone adhesive around penetration.

D. Penetrations are prohibited through beams or ribs, but may be installed in concrete beam flanges, with structural engineer prior approval. Any deviation from these requirements must receive prior approval of COR.

E. Sheet metal, plastic, or moisture resistant fiber sleeves will be provided for pipe passing through floors, interior walls, and partitions, unless brass or steel pipe sleeves are specifically called for below.

F. Cast iron or zinc coated pipe sleeves will be provided for pipe passing through exterior walls below grade. The space between the sleeve and pipe will be made watertight with a modular or link rubber seal. The link seal will be applied at both ends of the sleeve.

G. Galvanized steel or an alternate black iron pipe with asphalt coating sleeves will be for pipe passing through concrete beam flanges, except where brass pipe sleeves are called for. A galvanized steel sleeve will be provided for pipe passing through floor of mechanical rooms, laundry

work rooms, and animal rooms above basement. Except in mechanical rooms, sleeves will be connected with a floor plate.

H. Brass Pipe Sleeves will be provided for pipe passing through quarry tile, terrazzo or ceramic tile floors. The sleeve will be connected with a floor plate.

I. Sleeve clearance through floors, walls, partitions, and beam flanges will be 25 mm (1 inch) greater in diameter than external diameter of pipe. Sleeve for pipe with insulation will be large enough to accommodate the insulation plus 25 mm (1 inch) in diameter. Interior openings will be caulked tight with firestopping material and sealant to prevent the spread of fire, smoke, water and gases.

J. Sealant and Adhesives: Will be as specified in Section 07 92 00, JOINT SEALANTS. Bio-based materials will be utilized when possible.

K. Pipe passing through roof will be installed through a 4.9 kg per square meter copper flashing with an integral skirt or flange. Skirt or flange will extend not less than 200 mm (8 inches) from the pipe and set in a solid coating of bituminous cement. Extend flashing a minimum of 250 mm (10 inches) up the pipe. Pipe passing through a waterproofing membrane will be provided with a clamping flange. The annular space between the sleeve and pipe will be sealed watertight.

2.11 TOOLS AND LUBRICANTS

A. Furnish, and turn over to the COR, special tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.

B. Grease Guns with Attachments for Applicable Fittings: One for each type of grease required for each motor or other equipment.

C. Tool Containers: metal, permanently identified for intended service and mounted, or located, where directed by the COR.

D. Lubricants: A minimum of 0.95 L (1 quart) of oil, and 0.45 kg (1 pound) of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application. Bio-based materials will be utilized when possible.

2.12 WALL, FLOOR AND CEILING PLATES

A. Material and Type: Chrome plated brass or chrome plated steel, one piece or split type with concealed hinge, with set screw for fastening to pipe, or sleeve. Use plates that fit tight around pipes, cover openings around pipes and cover the entire pipe sleeve projection.

B. Thickness: Not less than 2.4 mm (3/32 inch) for floor plates. For wall and ceiling plates, not less than 0.64 mm (0.025 inch) for up to 75 mm (3 inch) pipe, 0.89 mm (0.035 inch) for larger pipe.

C. Locations: Use where pipe penetrates floors, walls and ceilings in exposed locations, in finished areas only. Wall plates will be used where insulation ends on exposed water supply pipe drop from overhead. A watertight joint will be provided in spaces where brass or steel pipe sleeves are specified.

2.13 ASBESTOS

A. Materials containing asbestos are prohibited.

PART 3 - EXECUTION

3.1 ARRANGEMENT AND INSTALLATION OF EQUIPMENT AND PIPING

A. Location of piping, sleeves, inserts, hangers, and equipment, access provisions will be coordinated with the work of all trades. Piping, sleeves, inserts, hangers, and equipment will be located clear of windows, doors, openings, light outlets, and other services and utilities. Equipment layout drawings will be prepared to coordinate proper location and personnel access of all facilities. The drawings will be submitted for review.

B. Manufacturer's published recommendations will be followed for installation methods not otherwise specified.

C. Operating Personnel Access and Observation Provisions: All equipment and systems will be arranged to provide clear view and easy access, without use of portable ladders, for maintenance, testing and operation of all devices including, but not limited to: all equipment items, valves, backflow preventers, filters, strainers, transmitters, sensors, meters and control devices. All gauges and indicators will be clearly visible by personnel standing on the floor or on permanent platforms. Maintenance and operating space and access provisions that are shown in the drawings will not be changed nor reduced.

D. Structural systems necessary for pipe and equipment support will be coordinated to permit proper installation.

E. Location of pipe sleeves, trenches and chases will be accurately coordinated with equipment and piping locations.

F. Cutting Holes:

1. Holes will be located to avoid interference with structural members such as beams or grade beams. Holes will be laid out in advance and

drilling done only after approval by COR. If the Contractor considers it necessary to drill through structural members, this matter will be referred to COR for approval.

2. Waterproof membrane will not be penetrated. Pipe floor penetration block outs will be provided outside the extents of the waterproof membrane.
3. Holes through concrete and masonry will be cut by rotary core drill. Pneumatic hammer, impact electric, and hand or manual hammer type drill will not be allowed, except as permitted by COR where working area space is limited.

G. Minor Piping: Generally, small diameter pipe runs from drips and drains, water cooling, and other services are not shown but must be provided.

H. Protection and Cleaning:

1. Equipment and materials will be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations and as approved by the COR. Damaged or defective items in the opinion of the COR, will be replaced at no additional cost or time to the Government.
2. Protect all finished parts of equipment, such as shafts and bearings where accessible, from rust prior to operation by means of protective grease coating and wrapping. Close pipe openings with caps or plugs during installation. Pipe openings, equipment, and plumbing fixtures will be tightly covered against dirt or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.

I. Gauges, thermometers, valves and other devices will be installed with due regard for ease in reading or operating and maintaining said devices. Thermometers and gauges will be located and positioned to be easily read by operator or staff standing on floor or walkway provided. Servicing will not require dismantling adjacent equipment or pipe work.

J. Interconnection of Controls and Instruments: Electrical interconnection is generally not shown but will be provided. This includes interconnections of sensors, transmitters, transducers, control devices, control and instrumentation panels, alarms, instruments and computer workstations. Comply with NFPA 70.

K. Work in Existing Building:
   1. Perform as specified in Article, OPERATIONS AND STORAGE AREAS, Article, ALTERATIONS, and Article, RESTORATION of the Section 01 00 00, GENERAL REQUIREMENTS for relocation of existing equipment, alterations and restoration of existing building(s).
   2. As specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, OPERATIONS AND STORAGE AREAS, make alterations to existing service piping at times that will cause the least interfere with normal operation of the facility.

L. Work in bathrooms, restrooms, housekeeping closets: All pipe penetrations behind escutcheons will be sealed with plumbers' putty.

M. Switchgear Drip Protection: Every effort will be made to eliminate the installation of pipe above data equipment, and electrical and telephone switchgear. If this is not possible, encase pipe in a second pipe with a minimum of joints. Drain valve will be provided in low point of casement pipe.

N. Inaccessible Equipment:
   1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment will be removed and reinstalled or remedial action performed as directed at no additional cost or additional time to the Government.
   2. The term "conveniently accessible" is defined as capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as electrical conduit, motors, fans, pumps, belt guards, transformers, high voltage lines, piping, and ductwork.

3.2 TEMPORARY PIPING AND EQUIPMENT

A. Continuity of operation of existing facilities may require temporary installation or relocation of equipment and piping. Temporary equipment or pipe installation or relocation will be provided to maintain continuity of operation of existing facilities.

B. The Contractor will provide all required facilities in accordance with the requirements of phased construction and maintenance of service. All piping and equipment will be properly supported, sloped to drain, operate without excessive stress, and will be insulated where injury can occur to personnel by contact with operating facilities. The requirements of paragraph 3.1 will apply.

C. Temporary facilities and piping will be completely removed back to the nearest active distribution branch or main pipe line and any openings in structures sealed. Dead legs are prohibited in potable water systems. Necessary blind flanges and caps will be provided to seal open piping remaining in service.

3.3 RIGGING

A. Openings in building structures will be planned to accommodate design scheme.

B. Alternative methods of equipment delivery may be offered and will be considered by Government under specified restrictions of phasing and service requirements as well as structural integrity of the building.

C. All openings in the building will be closed when not required for rigging operations to maintain proper environment in the facility for Government operation and maintenance of service.

D. Contractor will provide all facilities required to deliver specified equipment and place on foundations. Attachments to structures for rigging purposes and support of equipment on structures will be Contractor's full responsibility.

E. Contractor will check all clearances, weight limitations and will provide a rigging plan designed by a Registered Professional Engineer. All modifications to structures, including reinforcement thereof, will be at Contractor's cost, time and responsibility.

F. Rigging plan and methods will be referred to COR for evaluation prior to actual work.

3.4 PIPE AND EQUIPMENT SUPPORTS

A. Where hanger spacing does not correspond with joist or rib spacing, use structural steel channels secured directly to joist and rib structure that will correspond to the required hanger spacing, and then suspend the equipment and piping from the channels. Holes will be drilled or burned in structural steel ONLY with the prior written approval of the COR.

B. The use of chain pipe supports, wire or strap hangers; wood for blocking, stays and bracing, or hangers suspended from piping above will not be permitted. Rusty products will be replaced.

C. Hanger rods will be used that are straight and vertical. Turnbuckles for vertical adjustments may be omitted where limited space prevents use. A minimum of 15 mm (1/2 inch) clearance between pipe or piping covering and adjacent work will be provided.

D. For horizontal and vertical plumbing pipe supports, refer to the International Plumbing Code (IPC) and these specifications.

E. Overhead Supports:

1. The basic structural system of the building is designed to sustain the loads imposed by equipment and piping to be supported overhead.
2. Provide steel structural members, in addition to those shown, of adequate capability to support the imposed loads, located in accordance with the final approved layout of equipment and piping.
3. Tubing and capillary systems will be supported in channel troughs.

F. Floor Supports:

1. Provide concrete bases, concrete anchor blocks and pedestals, and structural steel systems for support of equipment and piping. Concrete bases and structural systems will be anchored and doweled to resist forces under operating and seismic conditions (if applicable) without excessive displacement or structural failure.
2. Bases and supports will not be located and installed until equipment mounted thereon has been approved. Bases will be sized to match equipment mounted thereon plus 50 mm (2 inch) excess on all edges. Structural drawings will be reviewed for additional requirements. Bases will be neatly finished and smoothed, will have chamfered edges at the top, and will be suitable for painting.
3. All equipment will be shimmed, leveled, firmly anchored, and grouted with epoxy grout. Anchor bolts will be placed in sleeves, anchored to the bases. Fill the annular space between sleeves and bolts with a grout material to permit alignment and realignment.

3.5 LUBRICATION

A. All equipment and devices requiring lubrication will be lubricated prior to initial operation. All devices and equipment will be field checked for proper lubrication.

B. All devices and equipment will be equipped with required lubrication fittings. A minimum of 1 liter (1 quart) of oil and 0.45 kg (1 pound) of grease of manufacturer's recommended grade and type for each different application will be provided. All materials will be delivered to COR in unopened containers that are properly identified as to application.

C. A separate grease gun with attachments for applicable fittings will be provided for each type of grease applied.

D. All lubrication points will be accessible without disassembling equipment, except to remove access plates.

E. All lubrication points will be extended to one side of the equipment.

3.6 PLUMBING SYSTEMS DEMOLITION

A. Rigging access, other than indicated in the drawings, will be provided after approval for structural integrity by the COR. Such access will be provided at no additional cost or time to the Government. Where work is in an operating plant, approved protection from dust and debris will be provided at all times for the safety of plant personnel and maintenance of plant operation and environment of the plant.

B. In an operating plant, cleanliness and safety will be maintained. The plant will be kept in an operating condition. Government personnel will be carrying on their normal duties of operating, cleaning and maintaining equipment and plant operation. Work will be confined to the immediate area concerned; maintain cleanliness and wet down demolished materials to eliminate dust. Dust and debris will not be permitted to accumulate in the area to the detriment of plant operation. All flame cutting will be performed to maintain the fire safety integrity of this plant. Adequate fire extinguishing facilities will be available at all times. All work will be performed in accordance with recognized fire protection standards including NFPA 51B. Inspections will be made by personnel of the VAMC, and the Contractor will follow all directives of the COR with regard to rigging, safety, fire safety, and maintenance of operations.

C. Unless specified otherwise, all piping, wiring, conduit, and other devices associated with the equipment not re-used in the new work will be completely removed from Government property per Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT. This includes all concrete equipment pads, pipe, valves, fittings, insulation, and all hangers including the top connection and any fastenings to building structural systems. All openings will be sealed after removal of equipment, pipes, ducts, and other penetrations in roof, walls, floors, in an approved manner and in accordance with plans and specifications where specifically covered. Structural integrity of the building system will be maintained. Reference will also be made to the drawings and specifications of the other disciplines in the project for additional facilities to be demolished or handled.

D. All valves including gate, globe, ball, butterfly and check, all pressure gauges and thermometers with wells will remain Government property and will be removed and delivered to COR and stored as directed. The Contractor will remove all other material and equipment, devices and demolition debris under these plans and specifications. Such material will be removed from Government property expeditiously and will not be allowed to accumulate. Coordinate with the COR and Infection Control.

3.7 CLEANING AND PAINTING

A. Prior to final inspection and acceptance of the plant and facilities for beneficial use by the Government, the plant facilities, equipment and systems will be thoroughly cleaned and painted. Refer to Section 09 91 00, PAINTING.

B. In addition, the following special conditions apply:

1. Cleaning will be thorough. Solvents, cleaning materials and methods recommended by the manufacturers will be used for the specific tasks. All rust will be removed prior to painting and from surfaces to remain unpainted. Scratches, scuffs, and abrasions will be repaired prior to applying prime and finish coats.
2. The following Material and Equipment will NOT be painted:
   a. Motors, controllers, control switches, and safety switches.
   b. Control and interlock devices.
   c. Regulators.
   d. Pressure reducing valves.
   e. Control valves and thermostatic elements.
   f. Lubrication devices and grease fittings.
   g. Copper, brass, aluminum, stainless steel and bronze surfaces.
   h. Valve stems and rotating shafts.
   i. Pressure gauges and thermometers.
   j. Glass.
   k. Name plates.
3. Control and instrument panels will be cleaned and damaged surfaces repaired. Touch-up painting will be made with matching paint type and color obtained from manufacturer or computer matched.
4. Pumps, motors, steel and cast-iron bases, and coupling guards will be cleaned, and will be touched-up with the same paint type and color as utilized by the pump manufacturer.

5. Temporary Facilities: Apply paint to surfaces that do not have existing finish coats per Section 09 91 00, Painting.
6. The final result will be a smooth, even-colored, even-textured factory finish on all items. The entire piece of equipment will be repainted, if necessary, to achieve this. Lead based paints will not be used.

3.8 IDENTIFICATION SIGNS

A. Laminated plastic signs, with engraved lettering not less than 7 mm (3/16 inch) high, will be provided that designates equipment function, for all equipment, switches, motor controllers, relays, meters, control devices, including automatic control valves. Nomenclature and identification symbols will correspond to that used in maintenance manual, and in diagrams specified elsewhere. Attach by chain, adhesive, or screws.

B. Factory Built Equipment: Metal plate, securely attached, with name and address of manufacturer, serial number, model number, size, and performance data will be placed on factory-built equipment.

C. Pipe Identification: Refer to Section 09 91 00, PAINTING.

3.9 STARTUP AND TEMPORARY OPERATION

A. Startup of equipment will be performed as described in the equipment specifications. Vibration within specified tolerance will be verified prior to extended operation.

3.10 OPERATING AND PERFORMANCE TESTS

A. Prior to the final inspection, all required tests will be performed as specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, TESTS and submit the test reports and records to the COR.

B. Should evidence of malfunction in any tested system, or piece of equipment or component part thereof, occur during or as a result of tests, make proper corrections, repairs or replacements, and repeat tests at no additional cost to the Government.

C. When completion of certain work or systems occurs at a time when final control settings and adjustments cannot be properly made to make performance tests, then conduct such performance tests and finalize control settings during the first actual seasonal use of the respective systems following completion of work. Rescheduling of these tests will be requested in writing to COR for approval.

3.11 OPERATION AND MAINTENANCE MANUALS

A. All new and temporary equipment and all elements of each assembly will be included.

B. Data sheet on each device listing model, size, capacity, pressure, speed, horsepower, impeller size, and other information will be included.

C. Manufacturer’s installation, maintenance, repair, and operation instructions for each device will be included. Assembly drawings and parts lists will also be included. A summary of operating precautions and reasons for precautions will be included in the Operations and Maintenance Manual.

D. Lubrication instructions, type and quantity of lubricant will be included.

E. Schematic diagrams and wiring diagrams of all control systems corrected to include all field modifications will be included.

F. Set points of all interlock devices will be listed.

G. Trouble-shooting guide for the control system troubleshooting will be inserted into the Operations and Maintenance Manual.

H. The control system sequence of operation corrected with submittal review comments will be inserted into the Operations and Maintenance Manual.

I. Emergency procedures for shutdown and startup of equipment and systems.

3.12 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer’s technical representative for 4 hours to instruct each VA personnel responsible in operation and maintenance of the system.

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SECTION 22 05 33
HEAT TRACING FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section describes the requirement for supplying, installing, and testing of the electric heat tracing system of the plumbing piping. Freeze protection shall be utilized for domestic water piping in areas subject to freezing temperatures. Ice and snow melting shall be utilized for gutters, downspouts, roof drain bodies and roof drain leaders exposed to snow and ice accumulation.

B. A complete listing of common acronyms and abbreviations are included in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standard will govern.

B. The Institute of Electrical and Electronic Engineers (IEEE):
515.1-2012.....Testing, Design, Installation, and Maintenance of Electrical Resistance Trace Heating for Commercial Applications

C. International Code Council, (ICC):
IPC-2018.....International Plumbing Code

D. National Fire Protection Association (NFPA):
70-2020.....National Electrical Code (NEC)

E. Underwriters' Laboratories, Inc. (UL):
508-2018.....Industrial Control Equipment

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 22 05 33, HEAT TRACING FOR PLUMBING PIPING", with applicable paragraph identification.

C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
   1. Rated capacity.
   2. Length of cable.
   3. Cable spacing.
   4. Electrical power requirements.
   5. Controls.
   6. Enclosures.
   7. Accessories.
D. The shop drawings shall include plans, sections, details, wiring diagrams, and attachments to other work. The wiring diagrams shall include power, signal, and control wiring.
E. Field quality control test reports shall be submitted.
F. Complete operating and maintenance manuals including wiring diagram, technical data sheets, information for ordering replaceable parts, and troubleshoot guide:
   1. Include complete list indicating all components of the systems.
   2. Include complete diagrams of the internal wiring for each item of equipment.
   3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Ten years' experience in design, engineering, manufacture and support of specified system and components.
B. Product Requirements:
   1. Pipe or tank tracing cable assembly shall be factory assembled, immersed in water for a minimum of 12 hours, and then tested for insulation resistance, high potential breakdown and continuity before leaving the factory.
   2. Factory Mutual approved heating cable that has the same wattage per lineal foot (power output), throughout its entire length.
   3. UL Listed, thermostat and contactor panel.
   4. UL Listed Control/Monitor Panel.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Bio-Based Materials: For products designated by the USDA's bio-based Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

1.6 AS-BUILT DOCUMENTATION

A. Comply with requirements in Paragraph "AS-BUILT DOCUMENTATION of Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

PART 2 - PRODUCTS

2.1 SELF-REGULATING PARALLEL RESISTANCE HEATING CABLES

A. Self-regulating parallel resistance heating cables shall comply with IEEE 515.1.

B. The heating element shall be a pair of parallel No. 16 AWG //tinned// //nickel coated// stranded copper bus wires embedded in cross linked conductive polymer core, which varies heat output in response to temperature along its length. Cables shall be terminated with waterproof, factory assembled non heating leads with connects at one and seal the opposite end watertight. The cable shall be capable of crossing over itself without overheating.

C. The electrical insulating jacket shall be flame-retardant polyolefin.

D. The cable cover shall be stainless steel braid and polyolefin outer jacket with UV inhibitor.

E. The maximum power on operating temperature shall be 65 degrees C (150 degrees F).

F. The maximum power off exposure temperature shall be 85 degrees C (185 degrees F).

G. The capacities and characteristics shall be:

1. Maximum heat output 16.4 W/m (5.0 W/foot).
2. Pipe Diameter: See drawings.
3. Number of parallel cables: See drawings.
4. Spiral wrap pitch: N/A.
5. See electrical drawings for electrical characteristics.

2.2 CONTROLS

A. Pipe mounting thermostats for Freeze protection shall have be a remote bulb unit with adjustable temperature range from minus 1 to 10 degrees C (34 to 50 degrees F). The thermostat shall be snap action, open-on-rise, single pole switch with minimum current rating adequate for the connected cable. The thermostat shall be remote bulb on capillary, resistance temperature device, or thermistor for direct sensing of pipe wall temperature. The control enclosure shall be corrosion resistant and waterproof.

B. The precipitation and temperature sensor for snow melting on roofs and in gutters shall be automatic based control with manual on, automatic, and standby/reset switches. The precipitation and temperature sensors shall sense the surface conditions of roof and/or gutters and shall be programmed to energize the cable as follows:

1. Temperature span between 1 to 7 degrees C (34 to 44 degrees F).
2. Adjustable delay off span between 30 and 90 minutes.
3. Following a two minute delay, the cables shall be energized if ambient temperature is below set-point and precipitation is detected.
4. The cables shall be de-energized upon detection of a dry surface plus a time delay of 15 minutes.

C. The enclosure shall be the NEMA 4X type.

D. A minimum 30 amp contactor shall be provided to energize cable or close other contactors. Provide relay with contacts to indicate operational status, on/off, and for interface with central energy management and control system.

2.3 ACCESSORIES

A. Cable Installation Accessories: Fiberglass tape, heat-conductive putty, cable ties, silicone end seals and splice kits, and installation clips all furnished by manufacturer, or as recommended in writing by manufacturer.

B. Warning Labels: Shall comply with NFPA 70.

C. Warning Tape: Continuously printed "Electrical Tracing"; vinyl, at least 0.08 mm (3 mils) thick, and with pressure-sensitive, permanent, waterproof, self-adhesive back.

1. Width for Warning Tape on Pipes with Outside Dimension, Including Insulation, Less Than 150 mm (6 inches): 19 mm (3/4 inch) minimum.

2. Width for Warning Tape on Pipes with Outside Dimension, Including Insulation, 150 mm (6 inches) or Greater: 38 mm (1-1/2 inches) minimum.

PART 3 - EXECUTION

3.1 GENERAL

A. Inspect surfaces and substrates of electric heating cables for compliance with requirements of this specification. Ensure surfaces and pipes in contact with electric heating cables are free of burrs and sharp protrusions.

B. Notify COR if the existing substrate conditions are unsuitable for application of heating cables in accordance with manufacturer's recommendations.

C. If the installation of the heat tracing is unsatisfactory, then the Contractor shall correct the installation at no additional cost or time to the Government.

3.2 INSTALLATION

A. Electric heating cable shall be installed for the following applications:

1. Snow and ice melting on roofs, in gutters and downspouts, roof drain bodies, and roof drain leaders: Self-regulating parallel-resistance heating cable.
2. Freeze protection of plumbing piping: Self-regulating parallel-resistance heating cable.

B. Electric heating cable shall be installed across expansion, construction, and control joints according to the manufacturer's recommendations using cable protection conduit and slack cable to allow for movement without damage to cable.

C. The installation of electric heating cable for snow and ice melting on roofs, gutters and downspouts, and roof drain leaders shall be provided with clips furnished by the manufacturer that are compatible with roof, gutters and downspouts and roof drain leaders.

D. Electric heating cable for pipe freeze protection shall be installed according to the following:

1. Electric heating cables shall be installed after piping has been tested and before insulation is installed.
2. Electric heat cables shall be installed according to IEEE 515.1
3. Insulation shall be installed or applied over piping with electric cables. Refer to Section 22 07 11, PLUMBING INSULATION.

4. Warning tape shall be installed on pipe insulation where piping is equipped with electric heating cables.
5. Provide current transducer to monitor power in heating tape and monitor and alarm from BAS.

E. Field adjustable switches and circuit breaker trip ranges shall be set.

F. Heating cables including leads shall be protected from damage.

G. Equipment shall be grounded according to Section 26 05 19, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.

H. Wiring shall be connected according to Section 26 05 19, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.

3.3 TESTS

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections //with the assistance of a factory-authorized service representative//:

1. Perform tests after cable installation but before application of coverings such as insulation, wall or ceiling construction, or concrete.
2. Test cables for electrical continuity and insulation integrity before energizing.
3. Test cables to verify rating and power input. Energize and measure voltage and current simultaneously.

C. Repeat tests for continuity, insulation resistance, and input power after applying thermal insulation on pipe-mounted cables.

D. If deficiency is found, Contractor shall correct all deficiencies at no addition cost or time to the Government.

E. Prepare test and inspection reports.

3.4 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer’s technical representative for 4 hours to instruct each VA personnel responsible in operation and maintenance of the system.

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SECTION 22 07 11
PLUMBING INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Field applied insulation for thermal efficiency and condensation control for the following:
   1. Plumbing piping and equipment.
   2. Re-insulation of plumbing piping and equipment after asbestos abatement and or replacement of any part of existing insulation system (insulation, vapor retarder jacket, protective coverings/jacket) damaged during construction.

B. Definitions:
   1. ASJ: All Service Jacket, Kraft paper, white finish facing or jacket.
   2. Air conditioned space: Space having air temperature and/or humidity controlled by mechanical equipment.
   3. All insulation systems installed within supply, return, exhaust, relief and ventilation air plenums shall be limited to uninhabited crawl spaces, areas above a ceiling or below the floor, attic spaces, interiors of air conditioned or heating ducts, and mechanical equipment rooms shall be noncombustible or shall be listed and labeled as having a flame spread indexes of not more than 25 and a smoke-developed index of not more than 50 when tested in accordance with ASTM E84 or UL 723. Note: ICC IMC, Section 602.2.1.
   4. Cold: Equipment or piping handling media at design temperature of 15 degrees C (60 degrees F) or below.
   5. Concealed: Piping above ceilings and in chases and pipe spaces.
   6. Exposed: Piping and equipment exposed to view in finished areas including mechanical equipment rooms or exposed to outdoor weather. Shafts, chases, unfinished attics, crawl spaces and pipe basements are not considered finished areas.
   7. FSK: Foil-scrim-Kraft facing.
   8. Hot: Plumbing equipment or piping handling media above 40 degrees C (104 degrees F).
   9. Density: kg/m^3 - kilograms per cubic meter (Pcf - pounds per cubic foot).

10. Thermal conductance: Heat flow rate through materials.
    a. Flat surface: Watts per square meter (BTU per hour per square foot).
    b. Pipe or Cylinder: Watts per linear meter (BTU per hour per linear foot) for a given outside diameter.
11. Thermal Conductivity (k): Watts per meter, per degree K (BTU - inch thickness, per hour, per square foot, per degree F temperature difference).
12. Vapor Retarder (Vapor Barrier): A material which retards the transmission (migration) of water vapor. Performance of the vapor retarder is rated in terms of permeance (perms). For the purpose of this specification, vapor retarders/vapor barriers shall have a maximum published permeance of .02 perms.
13. HWR: Hot water recirculating.
14. CW: Cold water.
15. SW: Soft water.
16. HW: Hot water.
17. PVDC: Polyvinylidene chloride vapor retarder jacketing, white.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING: General mechanical requirements and items, which are common to more than one section of Division 22.

D. Section 22 05 33, HEAT TRACING FOR PLUMBING PIPING: Insulation over heating cables.

1.3 APPLICABLE PUBLICATIONS

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

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

B209-2014.....Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

C411-2011.....Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation

C449-2007 (R2013).....Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement

C450-2008 (R2014).....Standard Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging

Adjunct to C450.....Compilation of Tables that Provide Recommended Dimensions for Prefab and Field Thermal Insulating Covers, etc.

C533-2013.....Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation

C534/C534M-2014.....Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form

C547-2015.....Standard Specification for Mineral Fiber Pipe Insulation

C552-2014.....Standard Specification for Cellular Glass Thermal Insulation

C553-2013.....Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications

C591-2013.....Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation

C680-2014.....Standard Practice for Estimate of the Heat Gain or Loss and the Surface Temperatures of Insulated Flat, Cylindrical, and Spherical Systems by Use of Computer Programs

C612-2014.....Standard Specification for Mineral Fiber Block and Board Thermal Insulation

C1126-2014.....Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation

C1136-2012.....Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation

C1710-2011.....Standard Guide for Installation of Flexible Closed Cell Preformed Insulation in Tube and Sheet Form

D1668/D1668M-1997a (2014)e1 Standard Specification for Glass Fabrics (Woven and Treated) for Roofing and Waterproofing

E84-2015a.....Standard Test Method for Surface Burning Characteristics of Building Materials

E2231-2015.....Standard Practice for Specimen Preparation and Mounting of Pipe and Duct Insulation to Assess Surface Burning Characteristics

C. Federal Specifications (Fed. Spec.):

L-P-535E-1979.....Plastic Sheet (Sheeting): Plastic Strip; Poly (Vinyl Chloride) and Poly (Vinyl Chloride - Vinyl Acetate), Rigid.

D. International Code Council, (ICC):

IMC-2012.....International Mechanical Code

E. Military Specifications (Mil. Spec.):

MIL-A-3316C (2)-1990....Adhesives, Fire-Resistant, Thermal Insulation

MIL-A-24179A (2)-1987...Adhesive, Flexible Unicellular-Plastic Thermal Insulation

MIL-PRF-19565C (1)-1988.Coating Compounds, Thermal Insulation, Fire-and Water-Resistant, Vapor-Barrier

MIL-C-20079H-1987.....Cloth, Glass; Tape, Textile Glass; and Thread, Glass and Wire-Reinforced Glass

F. National Fire Protection Association (NFPA):

90A-2015.....Standard for the Installation of Air-Conditioning and Ventilating Systems

G. Underwriters Laboratories, Inc (UL):

723-2008 (R2013).....Standard for Test for Surface Burning Characteristics of Building Materials

1887-2004 (R2013).....Standard for Fire Test of Plastic Sprinkler Pipe for Visible Flame and Smoke Characteristics

H. 3E Plus® version 4.1 Insulation Thickness Computer Program: Available from NAIMA with free download; https://insulationinstitute.org/tools-resources/

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 22 07 11, PLUMBING INSULATION", with applicable paragraph identification.

C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.

D. Shop Drawings:

1. All information, clearly presented, shall be included to determine compliance with drawings and specifications and ASTM Designation, Federal and Military specifications.
   a. Insulation materials: Specify each type used and state surface burning characteristics.
   b. Insulation facings and jackets: Each type used and state surface burning characteristics.
   c. Insulation accessory materials: Each type used.
   d. Manufacturer's installation and fitting fabrication instructions for flexible unicellular insulation shall follow the guidelines in accordance with ASTM C1710.
   e. Make reference to applicable specification paragraph numbers for coordination.
   f. All insulation fittings (exception flexible unicellular insulation) shall be fabricated in accordance with ASTM C450 and the referenced Adjunct to ASTM C450.

1.5 QUALITY ASSURANCE

A. Refer to article QUALITY ASSURANCE, in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

B. Criteria:

1. Comply with NFPA 90A, particularly paragraphs 4.3.3.1 through 4.3.3.6, 4.3.11.2.6, parts of which are quoted as follows:

   4.3.3.1 Pipe and duct insulation and coverings, duct linings, vapor retarder facings, adhesives, fasteners, tapes, and supplementary materials added to air ducts, plenums, panels and duct silencers used in duct systems shall have, in the form in which they are used, a maximum flame spread index of 25 without evidence of continued progressive combustion and a maximum smoke developed index of 50 when tested in accordance with ASTM E84 and appropriate mounting practice, e.g. ASTM E2231.

   4.3.3.3 Coverings and linings for air ducts, pipes, plenums and panels including all pipe and duct insulation materials shall not flame, glow, smolder, or smoke when tested in accordance with a

similar test for pipe covering, ASTM C411, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation, at the temperature to which they are exposed in service. In no case shall the test temperature be below 121 degrees C (250 degrees F).

4.3.11.2.6.3 Nonferrous fire sprinkler piping shall be listed as having a maximum peak optical density of 0.5 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.5 m (5 ft) or less when tested in accordance with UL 1887, Standard for Safety Fire Test of Plastic Sprinkler Pipe for Visible Flame and Smoke Characteristics.

4.3.11.2.6.8 Smoke detectors shall not be required to meet the provisions of Section 4.3.

2. Test methods: ASTM E84, UL 723, and ASTM E2231.
3. Specified k factors are at 24 degrees C (75 degrees F) mean temperature unless stated otherwise. Where optional thermal insulation material is used, select thickness to provide thermal conductance no greater than that for the specified material. For pipe, use insulation manufacturer's published heat flow tables. For domestic hot water supply and return, run out insulation and condensation control insulation, no thickness adjustment need be made.
4. All materials shall be compatible and suitable for service temperature, and shall not contribute to corrosion or otherwise attack surface to which applied in either the wet or dry state.

C. Bio-Based Materials: For products designated by the USDA’s Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

1.6 AS-BUILT DOCUMENTATION

A. Submit manufacturer’s literature and data updated to include submittal review comments and any equipment substitutions.

B. Submit operation and maintenance data updated to include submittal review comments, substitutions and construction revisions shall be // in electronic version on compact disc or DVD // inserted into a three ring binder. All aspects of system operation and maintenance procedures, including piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and

maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices such as damper and door closure interlocks shall be included. A List of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.

C. The installing contractor shall maintain as-built drawings of each completed phase for verification; and, shall provide the complete set at the time of final systems certification testing. As-built drawings are to be provided, and a copy of them in Auto-CAD version //____// provided on compact disk or DVD. Should the installing contractor engage the testing company to provide as-built or any portion thereof, it shall not be deemed a conflict of interest or breach of the 'third party testing company' requirement.

D. Certification documentation shall be provided prior to submitting the request for final inspection. The documentation shall include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and certification that all results of tests were within limits specified.

1.7 STORAGE AND HANDLING OF MATERIAL

A. Store materials in clean and dry environment, pipe insulation jackets shall be clean and unmarred. Place adhesives in original containers. Maintain ambient temperatures and conditions as required by printed instructions of manufacturers of adhesives, mastics and finishing cements.

PART 2 - PRODUCTS

2.1 MINERAL FIBER OR FIBER GLASS

A. ASTM C612 (Board, Block), Class 1 or 2, density 48 kg/m^3 (nominal 3 pcf), k = 0.037 (.26) at 24 degrees C (75 degrees F), external insulation for temperatures up to 204 degrees C (400 degrees F).

B. ASTM C553 (Blanket, Flexible) Type I, // Class B-3, Density 16 kg/m^3 (nominal 1 pcf), k = 0.045 (0.31) // Class B-5, Density 32 kg/m^3 (nominal 2 pcf), k = 0.04 (0.27) // at 24 degrees C (75 degrees F), for use at temperatures up to 204 degrees C (400 degrees F).

C. ASTM C547 (Pipe Fitting Insulation and Preformed Pipe Insulation), Class 1, k = 0.037 (0.26) at 24 degrees C (75 degrees F), for use at temperatures up to 230 degrees C (446 degrees F) with an all service vapor retarder jacket (ASJ) and with polyvinyl chloride (PVC) premolded fitting covering.

2.2 MINERAL WOOL OR REFRACTORY FIBER

A. Comply with Standard ASTM C612, Class 3, 450 degrees C (842 degrees F).

2.3 RIGID CELLULAR PHENOLIC FOAM

A. Preformed (molded) pipe insulation, ASTM C1126, Type III, grade 1, k = 0.021(0.15) at 10 degrees C (50 degrees F), for use at temperatures up to 121 degrees C (250 degrees F) with vapor retarder and all service vapor retarder jacket (ASJ) and with PVC premolded fitting covering.

B. Equipment Insulation, ASTM C1126, Type II, grade 1, k = 0.021 (0.15) at 10 degrees C (50 degrees F), for use at temperatures up to 121 degrees C (250 degrees F) with rigid cellular phenolic insulation and covering, and all service vapor retarder jacket (ASJ).

2.4 CELLULAR GLASS CLOSED-CELL

A. Comply with Standard ASTM C552, density 120 kg/m^3 (7.5 pcf) nominal, k = 0.033 (0.29) at 24 degrees C (75 degrees F).

B. Pipe insulation for use at process temperatures below ambient air to 482 degrees C (900 degrees F) with or without all service vapor retarder jacket (ASJ).

C. Pipe insulation for use at process temperatures for pipe and tube below ambient air temperatures or where condensation control is necessary are to be installed with a vapor retarder/barrier system of with or without all service vapor retarder sealed jacket (ASJ) system. Without ASJ shall require all longitudinal and circumferential joints to be vapor sealed with vapor barrier mastic.

D. Cellular glass thermal insulation intended for use on surfaces operating at temperatures between -268 and 482 degrees C (-450 and 900 degrees F). It is possible that special fabrication or techniques for pipe insulation, or both, shall be required for application in the temperature range from 121 to 427 degrees C (250 to 800 degrees F).

2.5 FLEXIBLE ELASTOMERIC CELLULAR THERMAL

A. ASTM C534/C534M, k = 0.039 (0.27) at 24 degrees C (75 degrees F), flame spread not over 25, smoke developed not over 50, for temperatures from minus 4 degrees C (40 degrees F) to 93 degrees C (199 degrees F). Under

high humidity exposures for condensation control an external vapor retarder/barrier jacket is required. Consult ASTM C1710.

2.6 CALCIUM SILICATE

A. Preformed pipe Insulation: ASTM C533, Type I and Type II with indicator denoting asbestos-free material.

B. Premolded Pipe Fitting Insulation: ASTM C533, Type I and Type II with indicator denoting asbestos-free material.

C. Equipment Insulation: ASTM C533, Type I and Type II.

D. Characteristics:

Insulation Characteristics		
ITEMS	**TYPE I**	**TYPE II**
Surface Temperature, maximum degrees C (degrees F)	649 (1200)	927 (1700)
Density (dry), Kg/m^3 (lb/ ft3)	240 (15)	352 (22)
Thermal conductivity: Min W/ m K (Btu in/h ft^2 degrees F)@ mean temperature of 93 degrees C (199 degrees F)	0.065 (0.45)	0.078 (0.540)
Surface burning characteristics: Flame spread Index, Maximum	0	0
Smoke Density index, Maximum	0	0

2.7 INSULATION FACINGS AND JACKETS

A. Vapor Retarder, higher strength with low water permeance = 0.02 or less perm rating, Beach puncture 50 units for insulation facing on pipe insulation jackets. Facings and jackets shall be ASJ or PVDC Vapor Retarder jacketing.

B. ASJ shall be white finish (kraft paper) bonded to 0.025 mm (1 mil) thick aluminum foil, fiberglass reinforced, with pressure sensitive adhesive closure. Comply with ASTM C1136. Beach puncture is 50 units, suitable for painting without sizing. Jackets shall have minimum 40 mm (1-1/2 inch) lap on longitudinal joints and minimum 75 mm (3 inch) butt strip on end joints. Butt strip material shall be same as the jacket. Lap and butt strips shall be self-sealing type with factory-applied pressure sensitive adhesive.

C. Vapor Retarder medium strength with low water vapor permeance of 0.02 or less perm rating), Beach puncture 25 units: FSK or PVDC type for concealed ductwork and equipment.

D. Except for flexible elastomeric cellular thermal insulation (not for high humidity exposures), field applied vapor barrier jackets shall be provided, in addition to the specified facings and jackets, on all exterior piping as well as on interior piping exposed to outdoor air (i.e.; in ventilated attics, piping in ventilated (not air conditioned) spaces, etc.)in high humidity locations conveying fluids below ambient temperature. The vapor barrier jacket shall consist of a multi-layer laminated cladding with a maximum water vapor permeance of 0.001 perms. The minimum puncture resistance shall be 35 cm-kg (30 inch-pounds) for interior locations and 92 cm-kg (80 inch-pounds) for exterior or exposed locations or where the insulation is subject to damage.

E. Except for cellular glass thermal insulation, when all longitudinal and circumferential joints are vapor sealed with a vapor barrier mastic or caulking, vapor barrier jackets may not be provided. For aesthetic and physical abuse applications, exterior jacketing is recommended. Otherwise field applied vapor barrier jackets shall be provided, in addition to the applicable specified facings and jackets, on all exterior piping as well as on interior piping //exposed to outdoor air (i.e.; in ventilated attics, piping in ventilated (not air conditioned) spaces, etc.) in high humidity locations //conveying fluids below ambient temperature//. The vapor barrier jacket shall consist of a multi-layer laminated cladding with a maximum water vapor permeance of 0.001 perms. The minimum puncture resistance shall be 35 cm-kg (30 inch-pounds) for interior locations and 92 cm-kg (80 inch-pounds) for exterior or exposed locations or where the insulation is subject to damage.

F. Glass Cloth Jackets: Presized, minimum 0.18 kg per square meter (7.8 ounces per square yard), 2070 kPa (300 psig) bursting strength with integral vapor retarder where required or specified. Weather proof if utilized for outside service.

G. Pipe fitting insulation covering (jackets): Fitting covering shall be premolded to match shape of fitting and shall be PVC conforming to Fed Spec L-P-535E, composition A, Type II Grade GU, and Type III, minimum thickness 0.7 mm (0.03 inches). Provide color matching vapor retarder pressure sensitive tape. Staples, tacks, or any other attachment that penetrates the PVC covering is not allowed on any form of a vapor barrier system in below ambient process temperature applications.

H. Aluminum Jacket-Piping systems and circular breeching and stacks: ASTM B209, 3003 alloy, H-14 temper, 0.6 mm (0.023 inch) minimum thickness with locking longitudinal joints. Jackets for elbows, tees and other fittings shall be factory-fabricated or with cut aluminum gores to match shape of fitting and of 0.6 mm (0.024 inch) minimum thickness aluminum. Aluminum fittings shall be of same construction with an internal moisture barrier as straight run jackets but need not be of the same alloy. Factory-fabricated stainless steel bands with wing seals shall be installed on all circumferential joints. Bands shall be 15 mm (0.5 inch) wide on 450 mm (18 inch) centers. System shall be weatherproof if utilized for outside service.

I. Aluminum jacket-Rectangular breeching: ASTM B209, 3003 alloy, H-14 temper, 0.5 mm (0.020 inches) thick with 32 mm (1-1/4 inch) corrugations or 0.8 mm (0.032 inches) thick with no corrugations. System shall be weatherproof if used for outside service.

2.8 PIPE COVERING PROTECTION SADDLES

A. Cold pipe support: Premolded pipe insulation 180 degrees (half-shells) on bottom half of pipe at supports. Material shall be cellular glass or high density Polyisocyanurate insulation of the same thickness as adjacent insulation. Density of Polyisocyanurate insulation shall be a minimum of 48 kg/m^3 (3.0 pcf).

Nominal Pipe Size and Accessories Material (Insert Blocks)	
Nominal Pipe Size mm (inches)	**Insert Blocks mm (inches)**
Up through 125 (5)	150 (6) long
150 (6)	150 (6) long
200 (8), 250 (10), 300 (12)	225 (9) long
350 (14), 400 (16)	300 (12) long
450 through 600 (18 through 24)	350 (14) long

B. Warm or hot pipe supports: Premolded pipe insulation (180 degree half-shells) on bottom half of pipe at supports. Material shall be high density Polyisocyanurate (for temperatures up to 149 degrees C (300 degrees F)), cellular glass or calcium silicate. Insulation at supports shall have same thickness as adjacent insulation. Density of Polyisocyanurate insulation shall be a minimum of 48 kg/m^3 (3.0 pcf).

2.9 ADHESIVE, MASTIC, CEMENT

A. Mil. Spec. MIL-A-3316, Class 1: Jacket and lap adhesive and protective finish coating for insulation.

B. Mil. Spec. MIL-A-3316, Class 2: Adhesive for laps and for adhering insulation to metal surfaces.

C. Mil. Spec. MIL-A-24179A, Type II Class 1: Adhesive for installing flexible unicellular insulation and for laps and general use.

D. Mil. Spec. MIL-PRF-19565C, Type I: Protective finish for outdoor use.

E. Mil. Spec. MIL-PRFC-19565C, Type I or Type II: Vapor barrier compound for indoor use.

F. ASTM C449: Mineral fiber hydraulic-setting thermal insulating and finishing cement.

G. Other: Insulation manufacturers' published recommendations.

2.10 MECHANICAL FASTENERS

A. Pins, anchors: Welded pins, or metal or nylon anchors with galvanized steel or fiber washer, or clips. Pin diameter shall be as recommended by the insulation manufacturer.

B. Staples: Outward clinching galvanized steel. Staples are not allowed for below ambient vapor barrier applications.

C. Wire: 1.3 mm thick (18 gage) soft annealed galvanized or 1.9 mm (14 gage) copper clad steel or nickel copper alloy or stainless steel.

D. Bands: 13 mm (1/2 inch) nominal width, brass, galvanized steel, aluminum or stainless steel.

E. Tacks, rivets, screws or any other attachment device capable of penetrating the vapor retarder shall NOT be used to attach/close the any type of vapor retarder jacketing. Thumb tacks sometimes used on PVC jacketing and preformed fitting covers closures are not allowed for below ambient vapor barrier applications.

2.11 REINFORCEMENT AND FINISHES

A. Glass fabric, open weave: ASTM D1668/D1668M, Type III (resin treated) and Type I (asphalt or white resin treated).

B. Glass fiber fitting tape: Mil. Spec MIL-C-20079H, Type II, Class 1.

C. Tape for Flexible Elastomeric Cellular Insulation: As recommended by the insulation manufacturer.

D. Hexagonal wire netting: 25 mm (one inch) mesh, 0.85 mm thick (22 gage) galvanized steel.

E. Corner beads: 50 mm (2 inch) by 50 mm (2 inch), 0.55 mm thick (26 gage) galvanized steel; or, 25 mm (1 inch) by 25 mm (1 inch), 0.47 mm thick

(28 gage) aluminum angle adhered to 50 mm (2 inch) by 50 mm (2 inch) Kraft paper.

F. PVC fitting cover: Fed. Spec L-P-535E, Composition A, 11-86 Type II, Grade GU, with Form B Mineral Fiber insert, for media temperature 10 to 121 degrees C (50 to 250 degrees F). Below 10 degrees C (50 degrees F) and above 121 degrees C (250 degrees F) provide mitered pipe insulation of the same type as insulating straight pipe. Provide double layer insert. Provide vapor barrier pressure sensitive tape matching the color of the PVC jacket.

2.12 FIRESTOPPING MATERIAL

A. Other than pipe insulation, refer to Section 07 84 00, FIRESTOPPING.

2.13 FLAME AND SMOKE

A. Unless shown otherwise all assembled systems shall meet flame spread 25 and smoke developed 50 rating as developed under ASTM and UL standards and specifications. See paragraph "Quality Assurance".

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Required pressure tests of piping joints and connections shall be completed and the work approved by the Contracting Officer’s Representative (COR) for application of insulation. Surface shall be clean and dry with all foreign materials, such as dirt, oil, loose scale and rust removed.

B. Except for specific exceptions or as noted, insulate all specified equipment, and piping (pipe, fittings, valves, accessories). Insulate each pipe individually. Do not use scrap pieces of insulation where a full length section will fit.

D. Insulation materials shall be installed with smooth and even surfaces, with jackets and facings drawn tight and smoothly cemented down and sealed at all laps. Insulation shall be continuous through all sleeves and openings, except at fire dampers and duct heaters (NFPA 90A).

E. Vapor retarders shall be continuous and uninterrupted throughout systems with operating temperature 15 degrees C (60 degrees F) and below. Lap and seal vapor barrier over ends and exposed edges of insulation. Anchors, supports and other metal projections through insulation on cold surfaces shall be insulated and vapor sealed for a minimum length of 150 mm (6 inches).

F. Install vapor stops with operating temperature 15 degrees C (60 degrees F) and below at all insulation terminations on either side of valves, pumps, fittings, and equipment and particularly in straight lengths every 4.6 to 6.1 meters (approx. 15 to 20 feet) of pipe insulation. The annular space between the pipe and pipe insulation of approx. 25 mm (1 inch) in length at every vapor stop shall be sealed with appropriate vapor barrier sealant. Bio-based materials shall be utilized when possible.

G. Construct insulation on parts of equipment such as cold water pumps and heat exchangers that must be opened periodically for maintenance or repair, so insulation can be removed and replaced without damage. Install insulation with bolted 1 mm thick (20 gage) galvanized steel or aluminum covers as complete units, or in sections, with all necessary supports, and split to coincide with flange/split of the equipment. Do not insulate over equipment nameplate data.

H. Insulation on hot piping and equipment shall be terminated square at items not to be insulated, access openings and nameplates. Cover all exposed raw insulation with white sealer coating (caution about coating’s maximum temperature limit) or jacket material.

I. Protect all insulations outside of buildings with aluminum jacket using lock joint or other approved system for a continuous weather tight system. Access doors and other items requiring maintenance or access shall be removable and sealable.

J. Plumbing work not to be insulated unless otherwise noted:
   1. Piping and valves of fire protection system.
   2. Chromium plated brass piping.
   3. Water piping in contact with earth.
   4. Distilled water piping.

K. Apply insulation materials subject to the manufacturer's recommended temperature limits. Apply adhesives, mastic and coatings at the manufacturer's recommended minimum wet or dry film thickness. Bio-based materials shall be utilized when possible.

L. Elbows, flanges and other fittings shall be insulated with the same material as is used on the pipe straights. Use of polyurethane or polyisocyanurate spray-foam to fill a PVC elbow jacket is prohibited on cold applications.

M. Firestop Pipe insulation:
   1. Provide firestopping insulation at fire and smoke barriers through penetrations. Firestopping insulation shall be UL listed as defined in Section 07 84 00, FIRESTOPPING.
   2. Pipe penetrations requiring fire stop insulation including, but not limited to the following:
      a. Pipe risers through floors
      b. Pipe chase walls and floors
      c. Smoke partitions
      d. Fire partitions
      e. Hourly rated walls
O. Provide vapor barrier systems as follows:
   1. All piping exposed to outdoor weather
P. Provide metal jackets over insulation as follows:
   1. All plumbing piping exposed to outdoor weather.
   2. Piping exposed in building, within 1829 mm (6 feet) of the floor, that connects to sterilizers, kitchen and laundry equipment. Jackets may be applied with pop rivets except for cold pipe or tubing applications. Provide aluminum angle ring escutcheons at wall, ceiling or floor penetrations.
   3. A 50 mm (2 inch) jacket overlap is required at longitudinal and circumferential joints with the overlap at the bottom.
Q. Provide PVC jackets over insulation as follows:
   1. Piping exposed in building, within 1829 mm (6 feet) of the floor, on piping that is not precluded in previous sections.
   2. A 50 mm (2 inch) jacket overlap is required at longitudinal and circumferential joints with the overlap at the bottom.

3.2 INSULATION INSTALLATION

A. Mineral Fiber Board:
   1. Vapor retarder faced board: Apply board on pins spaced not more than 300 mm (12 inches) on center each way, and not less than 75 mm (3 inches) from each edge of board. In addition to pins, apply insulation bonding adhesive to entire underside of horizontal metal surfaces. (Bio-based materials shall be utilized when possible.) Butt insulation edges tightly and seal all joints with laps and butt strips. After applying speed clips cut pins off flush and apply vapor seal patches over clips.

2. Plain unfaced board:
   a. Insulation shall be scored, beveled or mitered to provide tight joints and be secured to equipment with bands spaced 225 mm (9 inches) on center for irregular surfaces or with pins and clips on flat surfaces. Use corner beads to protect edges of insulation.
   b. For hot equipment: Stretch 25 mm (1 inch) mesh wire, with edges wire laced together, over insulation and finish with insulating and finishing cement applied in one coat, 6 mm (1/4 inch) thick, trowelled to a smooth finish.
   c. For cold equipment: Apply meshed glass fabric in a tack coat 1.5 to 1.7 square meter per liter (60 to 70 square feet per gallon) of vapor mastic and finish with mastic at 0.3 to 0.4 square meter per liter (12 to 15 square feet per gallon) over the entire fabric surface.
3. Cold equipment: 40 mm (1-1/2inch) thick insulation faced with vapor retarder ASJ or FSK. Seal all facings, laps, and termination points and do not use staples or other attachments that may puncture ASJ or FSK.
   a. Water filter, chemical feeder pot or tank.
   b. Pneumatic, cold storage water and surge tanks.
4. Hot equipment: 40 mm (1-1/2 inch) thick insulation faced with unsealed ASJ or FSK.
   a. Domestic water heaters and hot water storage tanks (not factory insulated).
   b. Booster water heaters for dietetics dish and pot washers and for washdown grease-extracting hoods.

B. Molded Mineral Fiber Pipe and Tubing Covering:
1. Fit insulation to pipe, aligning all longitudinal joints. Seal longitudinal joint laps and circumferential butt strips by rubbing hard with a nylon sealing tool to assure a positive seal. Staples may be used to assist in securing insulation except for cold piping. Seal all vapor retarder penetrations on cold piping with a generous application of vapor barrier mastic. Provide cellar glass inserts and install with metal insulation shields at outside pipe supports. Install freeze protection insulation over heating cable.

2. Contractor's options for fitting, flange and valve insulation:
   a. Insulating and finishing cement for sizes less than 100 mm (4 inches) operating at surface temperature of 15 degrees C (60 degrees F) or more.
   b. Factory premolded, one piece PVC covers with mineral fiber, (Form B), inserts surface temperature of above 4 degrees C (40 degrees F) to 121 degrees C (250 degrees F). Provide mitered preformed insulation of the same type as the installed straight pipe insulation for pipe temperatures below 4 degrees C (40 degrees F). Secure first layer of mineral fiber insulation with twine. Seal seam edges with vapor barrier mastic and secure with fitting tape.
   c. Factory preformed, ASTM C547 or fabricated mitered sections, joined with adhesive or (hot only) wired in place. (Bio-based materials shall be utilized when possible.) For hot piping finish with a smoothing coat of finishing cement. For cold fittings, 15 degrees C (60 degrees F) or less, vapor seal with a layer of glass fitting tape imbedded between two 2 mm (1/16 inch) coats of vapor barrier mastic.
   d. Fitting tape shall extend over the adjacent pipe insulation and overlap on itself at least 50 mm (2 inches).
3. Nominal thickness in millimeters and inches specified in the schedule at the end of this section.

C. Rigid Cellular Phenolic Foam:
1. Rigid closed cell phenolic insulation may be provided, exterior only, for piping, ductwork and equipment for temperatures up to 121 degrees C (250 degrees F).
2. Note the ASTM E84 or UL 723 surface burning characteristics requirements of maximum 25/50 indexes in paragraph "Quality Assurance".
3. Provide secure attachment facilities such as welding pins.
4. Apply insulation with joints tightly drawn together.
5. Apply adhesives, coverings, neatly finished at fittings, and valves.
6. Final installation shall be smooth, tight, neatly finished at all edges.
7. Minimum thickness in millimeters (inches) specified in the schedule at the end of this section.

8. Condensation control insulation: Minimum 25 mm (1 inch) thick for all pipe sizes depending on high humidity exposures.
   a. Body of roof and overflow drains horizontal runs and offsets (including elbows) of interior downspout piping in all areas above pipe basement.
   b. Waste piping from electric water coolers and icemakers to drainage system.
   c. Waste piping located above basement floor from ice making and film developing equipment and air handling units, from equipment (including trap) to main vertical waste pipe.
   d. MRI quench vent piping.
   e. Bedpan sanitizer atmospheric vent
   f. Reagent grade water piping.
   g. Cold water piping, exterior only.

D. Cellular Glass Insulation:
   1. Pipe and tubing, covering nominal thickness in millimeters and inches as specified in the schedule at the end of this section.

F. Flexible Elastomeric Cellular Thermal Insulation:
   1. Apply insulation and fabricate fittings in accordance with the manufacturer's installation instructions and finish with two coats of weather resistant finish as recommended by the insulation manufacturer. External vapor barrier jacketing may be required for expected or anticipated high humidity exposures. See ASTM C1710.
   2. Pipe and tubing insulation:
      a. Use proper size material. Do not stretch or strain insulation.
      b. To avoid undue compression of insulation, use supports as recommended by the elastomeric insulation manufacturer. Insulation shields are specified under Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
      c. Where possible, slip insulation over the pipe or tubing prior to connection, and seal the butt joints with adhesive. Where the slip-on technique is not possible, slit the insulation and apply it to the pipe sealing the seam and joints with contact adhesive. Optional tape sealing, as recommended by the manufacturer, may be employed. Bio-based materials shall be utilized when possible.

3. Apply sheet insulation to flat or large curved surfaces with 100 percent adhesive coverage. For fittings and large pipe, apply adhesive to seams only.
4. Pipe insulation: nominal thickness in millimeters (inches as specified in the schedule at the end of this section.

G. Calcium Silicate:

1. Minimum thickness in millimeter (inches) specified below for piping other than in boiler plant.

Nominal Thickness Of Calcium Silicate Insulation (Non-Boiler Plant)				
Nominal Pipe Size Millimeters (Inches)	Thru 25 (1)	32 to 75 (1-1/4 to 3)	100-200 (4 to 8)	Greater than 200 (8)
93-260 degrees C (199-500 degrees F)(HPS, HPR)	100(4)	125(5)	150(6)	Greater than 150(6)

2. MRI Quench Vent Insulation: Type I, class D, 150 mm (6 inch) nominal thickness.

3.4 PIPE INSULATION SCHEDULE

A. Provide insulation for piping systems as scheduled below:

Insulation Thickness Millimeters (Inches)					
		Nominal Pipe Size Millimeters (Inches)			
Operating Temperature Range/Service	**Insulation Material**	**Less than 25 (1)**	**25 - 32 (1 - 1¼)**	**38 - 75 (1½ - 3)**	**100 (4) and Greater**
38-60 degrees C (100-140 degrees F) (Domestic Hot Water Supply and Return)	Mineral Fiber (Above ground piping only)	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)
38-60 degrees C (100-140 degrees F) (Domestic Hot Water Supply and Return)	Rigid Cellular Phenolic Foam (Above ground piping only) (exterior locations only)	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)
38-60 degrees C (100-140 degrees F) (Domestic Hot Water Supply and Return)	Flexible Elastomeric Cellular Thermal (Above ground piping only)	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)

38-60 degrees C (100-140 degrees F) (Domestic Hot Water Supply and Return)	Cellular Glass Thermal	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)
4-15 degrees C (40-60 degrees F) (Ice water piping)	Rigid Cellular Phenolic Foam (Above ground piping only) (exterior locations only)	25 (1.0)	25(1.0)	25 (1.0)	25 (1.0)
(4-15 degrees C (40-60 degrees F) (Ice water piping)	Flexible Elastomeric Cellular Thermal (Above ground piping only)	25 (1.0)	25(1.0)	25 (1.0)	25 (1.0)
4-15 degrees C (40-60 degrees F) (Ice water piping)	Cellular Glass Thermal	38 (1.5)	38 (1.5)	38 (1.5)	38 (1.5)

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SECTION 22 14 00
FACILITY STORM DRAINAGE

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section describes the requirements for storm drainage systems, including piping and all necessary accessories as designated in this section.

B. A complete listing of all acronyms and abbreviations are included in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Section 07 84 00, FIRESTOPPING: Penetrations in rated enclosures.

D. Section 07 92 00, JOINT SEALANTS.

E. Section 09 91 00, PAINTING: Preparation and finish painting and identification of piping systems.

F. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING: Pipe Hangers and Supports, Materials Identification.

G. Section 22 05 33, HEAT TRACING FOR PLUMBING PIPING.

H. Section 22 07 11, PLUMBING INSULATION.

1.3 APPLICABLE PUBLICATIONS

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

B. American Society of Mechanical Engineers (ASME):

A112.6.4-2003 (R2012) ..Roof, Deck, and Balcony Drains

A13.1-2007 (R2013).....Scheme for Identification of Piping Systems

B1.20.1-2013.....Pipe Threads, General Purpose, Inch

B16.3-2011.....Malleable Iron Threaded Fittings: Classes 150 and 300

B16.9-2012.....Factory-Made Wrought Buttwelding Fittings

B16.11-2011.....Forged Fittings, Socket-Welding and Threaded

B16.12-2009 (R2014).....Cast Iron Threaded Drainage Fittings

B16.15-2013.....Cast Copper Alloy Threaded Fittings: Classes 125 and 250

B16.18-2012.....Cast Copper Alloy Solder-Joint Pressure Fittings

B16.22-2013.....Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings

B16.23-2011.....Cast Copper Alloy Solder Joint Drainage Fittings - DWV

B16.29-2012.....Wrought Copper and Wrought Copper Alloy Solder-Joint Drainage Fittings - DWV

C. American Society of Sanitary Engineering (ASSE)

1079-2012.....Performance Requirements for Dielectric Pipe Unions

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

A47/A47M-1999 (R2014)...Standard Specification for Ferritic Malleable Iron Castings

A53/A53M-2012.....Standard Specification for Pipe, Steel, Black And Hot-Dipped, Zinc-coated Welded and Seamless

A74-2013a.....Standard Specification for Cast Iron Soil Pipe and Fittings

A183-2014.....Standard Specification for Carbon Steel Track Bolts and Nuts

A312/A312M-2015.....Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes

A536-1984(R2014).....Standard Specification for Ductile Iron Castings

A733-2013.....Standard Specification for Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples

A888-2013a.....Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

B32-2008 (R2014).....Standard Specification for Solder Metal

B61-2008 (R2013).....Standard Specification for Steam or Valve Bronze Castings

B62-2009.....Standard Specification for Composition Bronze or Ounce Metal Castings

B75/B75M-2011.....Standard Specification for Seamless Copper Tube

B88-2014.....Standard Specification for Seamless Copper Water Tube

B306-2013.....Standard Specification for Copper Drainage Tube (DWV)

B584-2014.....Standard Specification for Copper Alloy Sand Castings for General Applications

B687-1999 (R2011).....Standard Specification for Brass, Copper, and Chromium-Plated Pipe Nipples

B828-2002 (R2010).....Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings

B813-2010.....Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube

C564-2014.....Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings

C1173-2010 (R2014).....Standard Specification for Flexible Transition Couplings for Underground Piping Systems

D1785-2012.....Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80 and 120

D2000-2012.....Standard Classification System for Rubber Products in Automotive Applications

D2321-2014e1.....Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

D2564-2012.....Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems

D2665-2014.....Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings

D2855-1996 (R2010).....Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings

D4101-2014.....Standard Specification for Polypropylene Injection and Extrusion Materials

D5926-2011.....Standard for Poly (Vinyl Chloride) (PVC) Gaskets for Drain, Waste, and Vent (DWV), Sewer, Sanitary, and Storm Plumbing Systems

F477-2014.....Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

F656-2010.....Standard Specification for Primers for Use in Solvent Cement Joints of Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings

F1545-2015.....Standard Specification for Plastic-Lined Ferrous Metal Pipe, Fittings, and Flanges

E. American Welding Society (AWS):

A5.8M/A5.8 AMD1-2011....Specification for Filler Metals for Brazing and Braze Welding

F. Copper Development Association (CDA):

A4015-2011.....Copper Tube Handbook

G. Cast Iron Soil Pipe Institute (CISPI):

301-2012.....Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

310-2012.....Standard Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

H. International Code Council (ICC):

IPC-2012.....International Plumbing Code

I. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS):

SP-72-2010a.....Ball Valves with Flanged or Butt-Welding Ends for General Service

SP-110-2010.....Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 22 14 00, FACILITY STORM DRAINAGE", with applicable paragraph identification.

C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights,

materials, applications, standard compliance, model numbers, size, and capacity.

1. Pipe and Fittings.
2. Specialty Pipe Fittings.
3. Cleanouts.
4. Roof Drains.
5. Expansion Joints.
6. Downspout Nozzles.
7. Sleeve Flashing Devices.

D. Detailed shop drawing of clamping device and extensions when required in connection with the waterproofing membrane.

1.5 QUALITY ASSURANCE

A. Bio-Based Materials: For products designated by the USDA's Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

1.6 AS-BUILT DOCUMENTATION

A. Submit manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.

B. Submit operation and maintenance data updated to include submittal review comments, substitutions and construction revisions shall be in electronic version on compact disc or DVD inserted into a three ring binder. All aspects of system operation and maintenance procedures, including piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices such as damper and door closure interlocks shall be included. A List of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.

C. The installing contractor shall maintain as-built drawings of each completed phase for verification; and, shall provide the complete set at the time of final systems certification testing. As-built drawings

are to be provided, and a copy of them in Auto-CAD provided on compact disk or DVD. Should the installing contractor engage the testing company to provide as-built or any portion thereof, it shall not be deemed a conflict of interest or breach of the 'third party testing company' requirement.

D. Certification documentation shall be provided to COR 10 working days prior to submitting the request for final inspection. The documentation shall include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and certification that all results of tests were within limits specified.

PART 2 - PRODUCTS

2.1 STORM WATER DRAIN PIPING

A. Cast Iron Storm Pipe and Fittings:

1. Cast iron storm pipe and fittings shall be used for the following applications:
   a. Pipe buried in or in contact with earth.
   b. Extension of pipe to a distance of approximately 1500 mm (5 feet) outside of building walls.
   c. Interior storm piping above grade.
   d. All mechanical equipment rooms or other areas containing mechanical air handling equipment.
2. The cast iron storm pipe shall be bell and spigot, or hubless (plain end or no-hub) as required by selected jointing method.
3. The material for all pipe and fittings shall be cast iron soil pipe and fittings and shall conform to the requirements of CISPI 301, ASTM A888, or ASTM A74.
4. Joints for hubless pipe and fittings shall conform to the manufacturer's installation instructions. Couplings for hubless joints shall conform to CISPI 310. Joints for hub and spigot pipe shall be installed with compression gaskets conforming to the requirements of ASTM C564.

B. Copper Tube, (DWV): May be used for piping above ground.

1. The copper DWV tube shall be drainage type, drawn temper conforming to ASTM B306.
2. The copper drainage fittings shall be cast copper or wrought copper conforming to ASME B16.23 or ASME 16.29.

3. The joints shall be lead free, using a water flushable flux, and conforming to ASTM B32.

C. Roof drain piping and body of drain in locations where the outdoor conditions are subject to freezing shall be insulated.

2.2 PUMPED DRAIN PIPING

A. Pumped drain piping 75 mm (3 inches) and less shall be copper tube conforming to ASTM B88, type K or L. For pumped drain piping 100 mm (4 inches) and greater, galvanized steel conforming to ASTM A53/A53M, seamless, schedule 40 may be used.

B. Pumped drain pipe fittings shall comply with the following:

1. Wrought copper or bronze castings for use with copper tube conforming to ASME B16.18 and B16.22.
2. Unions, for use with copper tube up to 50 mm (2 inches) shall be cast with bronze, conforming to ASME B16.18 and ASTM B584 with solder or braze joints.
3. Grooved fittings, for use with copper tube 65 mm to 100 mm (2-1/2 to 4 inch) shall be wrought copper conforming to ASTM B75/B75M, alloy C12200, 125 to 150 mm (5 to 6 inch) bronze castings conforming to ASTM B584.
4. Mechanical grooved couplings shall have a ductile iron housing conforming to ASTM A536 (Grade 65-45-12) elastomer gasket suitable for potable water service and process temperature and steel track head bolts conforming to ASTM A183, housing shall be coated with colored alkyd enamel paint.

C. Adapters shall be provided for joining pipe with different end connections.

D. The solder shall be lead free using a water flushable, non-corrosive flux conforming to ASTM B32.

E. Dielectric fittings and specialties shall be provided when joining pipe of dissimilar metals.

2.3 SPECIALTY PIPE FITTINGS

A. Transition pipe couplings shall join piping with small differences in outside diameters or be of different materials. End connections shall be of the same size and compatible with the pipes being joined. The transition coupling shall be unshielded, elastomeric, sleeve type reducing or transition pattern conforming with ASTM C1173 and include shear ring and corrosion resistant metal tension band and tightening

mechanism on each end. The transition coupling sleeve coupling shall be of the following material:

1. For cast iron soil pipes, the sleeve material shall be rubber conforming to ASTM C564.
2. For PVC soil pipes, the sleeve material shall be elastomeric seal conforming to ASTM F477 or PVC conforming to ASTM D5926.
3. dissimilar pipes, the sleeve material shall be PVC conforming to ASTM D5926, or other material compatible with the pipe materials being joined.

B. Dielectric fittings shall conform to ASSE 1079 with a pressure rating of 1035 kPa (150 psig) at a minimum temperature of 82 degrees C (180 degrees F). The end connection shall be solder joint copper alloy and threaded ferrous.

C. Dielectric flanges shall conform to ASSE 1079 with a pressure rating of 1200 kPa (175 psig). The flange shall be a factory fabricated, bolted, companion flange assembly. The end connection shall be threaded or solder-joint copper alloy and threaded ferrous.

D. Dielectric flange insulating kits shall be of non-conducting materials for field assembly of companion flanges with a pressure rating of 1035 kPa (150 psig). The gasket shall be neoprene or phenolic. The bolt sleeves shall be phenolic or polyethylene. The washers shall be phenolic with steel backing washers.

E. Dielectric nipples shall be electroplated steel and shall conform with ASTM F1545 with a pressure ratings of 2070 kPa (300 psig) at 107 degrees C (225 degrees F). The end connection shall be male threaded. The lining shall be inert and noncorrosive propylene. Bio-based materials shall be utilized when possible.

2.4 CLEANOUTS

A. Cleanouts shall be the same size as the pipe, up to 100 mm (4 inches); not less than 100 mm (4 inches) for larger pipe. Cleanouts shall be easily accessible and shall be gastight and watertight. A minimum clearance of 600 mm (24 inches) shall be provided for clearing a clogged storm sewer line.

B. Floor cleanouts shall be gray iron housing with clamping device and round, secured, scoriated, gray iron cover conforming to ASME A112.36.2M. A gray iron ferrule with hubless, socket, inside caulk or spigot connection and counter sunk, taper-thread, brass or bronze closure plug shall be included. The frame and cover material and finish

shall be nickel-bronze copper alloy with a square shape. The cleanout shall be vertically adjustable for a minimum of 50 mm (2 inches). When a waterproof membrane is used in the floor system, clamping collars shall be provided on the cleanouts. Cleanouts shall consist of wye fittings and eighth bends with brass or bronze screw plugs. Cleanouts in the resilient tile floors, quarry tile and ceramic tile floors shall be provided with square top covers recessed for tile insertion. In the carpeted areas, carpet cleanout markers shall be provided. Two way cleanouts shall be provided where indicated on the drawings and at each building exit. The loading classification for cleanouts in sidewalk areas or subject to vehicular traffic shall be heavy duty.

C. Cleanouts shall be provided at or near the base of the vertical stacks with the cleanout plug located approximately 600 mm (24 inches) above the floor. The cleanouts shall be extended to the wall access cover. Cleanout shall consist of sanitary tees. Nickel bronze square frame and stainless steel cover with minimum opening of 150 mm by 150 mm (6 inch by 6 inch) shall be provided at each wall cleanout.

D. In horizontal runs above grade, cleanouts shall consist of cast brass tapered screw plug in fitting or caulked/no hub cast iron ferrule. Plain end (no-hub) piping in interstitial space or above ceiling may use plain end (no-hub) blind plug and clamp.

2.5 ROOF DRAINS AND CONNECTIONS

A. Roof Drains: Roof Drains (RD) shall be cast iron with clamping device for making watertight connection and shall conform with ASME A112.6.4. Free openings through strainer shall be twice area of drain outlet. For roof drains not installed in connection with a waterproof membrane, a soft copper membrane shall be provided 300 mm (12 inches) in diameter greater than outside diameter of drain collar. An integral gravel stop shall be provided for drains installed on roofs having built up roofing covered with gravel or slag. Integral no-hub, soil pipe gasket or threaded outlet connection shall be provided.

1. Flat Roofs: The roof drain shall have a beehive or dome shaped strainer with integral flange not less than 300 mm (12 inches) in diameter. For an insulated roof, a roof drain with an adjustable drainage collar shall be provided, which can be raised or lowered to meet required insulation heights, sump receiver and deck clamp. The bottom section shall serve as roof drain during construction before insulation is installed.

2. Canopy Roofs: The roof drain shall have a beehive or dome shaped strainer with the integral flange no greater than 200 mm (8 inches) in diameter. For an insulated roof, the roof drain shall be provided with an adjustable drainage collar, which can be raised or lowered to meet the required insulation heights, sump receiver and deck clamp. Bottom section shall serve as roof drain during construction before insulation is installed.
3. Promenade Decks: the roof drain shall be the same as for canopy roofs, except decks shall have flat, round, loose, non-slip, bronze grate set in square, non-slip, bronze frame.
4. Portico Roofs and Gutters: Roof drains shall be horizontal angle type drain with flat bottom and horizontal outlet at the same elevation as the pipe to which it is connected. Strainer shall be removable angle grate type.
5. Protective Roof Membrane Insulation Assembly: The roof drain shall have a perforated stainless steel extension filter, non-puncturing clamp ring, large sump with extra wide roof flange and deck clamp.
   a. Non pedestrian Roofs: The roof drain shall have large polypropylene or aluminum locking dome.
   b. Pedestrian Roof: The roof drain shall have a bronze promenade top 356 mm (14 inches) square, set in square secured frame support collar.
6. Roof Drains, Overflow or Secondary (Emergency): Roof Drains identified as overflow or secondary (emergency) drains shall have a 50 mm (2 inch) water dam integral to the drain body.
7. Roof drains in areas subject to freezing shall have heat tape and shall be insulated.

B. Expansion Joints: Expansions joints shall be heavy cast iron with cast brass or PVC expansion sleeve having smooth bearing surface working freely against a packing ring held in place and under pressure of a bolted gland ring, forming a water and air tight flexible joint. Asbestos packing is prohibited.

C. Interior Downspouts: An expansion joint shall be provided, specified above, at top of run on straight, vertical runs of downspout piping 12 m (40 feet) long or greater.

D. Downspout Nozzle: The downspout nozzle fitting shall be of brass, unfinished, with internal pipe thread for connection to downspout.

2.6 WATERPROOFING

A. A sleeve flashing device shall be provided at points where pipes pass through membrane waterproofed floors or walls. The sleeve flashing device shall be manufactured, cast iron fitting with clamping device that forms a sleeve for the pipe floor penetration of the floor membrane. A galvanized steel pipe extension shall be included in the top of the fitting that will extend 50 mm (2 inches) above finished floor and galvanized steel pipe extension in the bottom of the fitting that will extend through the floor slab. A waterproofed caulked joint shall be provided at the top hub.

PART 3 - EXECUTION

3.1 PIPE INSTALLATION

A. The pipe installation shall comply with the requirements of the IPC and these specifications.

B. Branch piping shall be installed from the piping system and connect to all drains and outlets.

C. Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe, except for glass, shall be reamed to remove burrs and a clean smooth finish restored to full pipe inside diameter.

D. All pipe runs shall be laid out to avoid interference with other work/trades.

E. The piping shall be installed above accessible ceilings to allow for ceiling panel removal.

F. Unless otherwise stated on the documents, minimum horizontal slope shall be one inch for every 2.44 m (8 feet) (1 percent slope) of pipe length.

G. The piping shall be installed free of sags and bends.

H. Seismic restraint shall be installed where required by code.

I. Changes in direction for storm drainage piping shall be made using appropriate branches, bends and long sweep bends. Sanitary tees and short sweep ¼ bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Long turn double wye branch and 1/8 bend fittings shall be used if two drains are installed back to back or side by side with common drain pipe. Do not change direction of flow more than 90 degrees. Proper size of standard increaser and reducers shall be used if pipes of different sizes are

connected. Reducing size of drainage piping in direction of flow is prohibited.

J. Buried storm drainage piping shall be laid beginning at the low point of each system. Piping shall be installed true to grades and alignment indicated with unbroken continuity of invert. Hub ends shall be placed upstream. Required gaskets shall be installed according to manufacturer's written instruction for use of lubricants, cements, and other installation requirements. Bio-based materials shall be utilized when possible.

K. Cast iron piping shall be installed according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings"

L. Aboveground copper tubing shall be installed according to CDA A4015.

M. Aboveground PVC piping shall be installed according to ASTM D2665. Underground PVC piping shall be installed according to ASTM D2321.

3.2 JOINT CONSTRUCTION

A. Hub and spigot, cast iron piping with gasket joints shall be joined in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Hub and spigot, cast iron piping with calked joints shall be joined in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.

C. Hubless, cast iron piping shall be joined in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless piping coupling joints.

D. For threaded joints, thread pipe with tapered pipe threads according to ASME B1.20.1. The threads shall be cut full and clean using sharp disc cutters. Threaded pipe ends shall be reamed to remove burrs and restored to full pipe inside diameter. Pipe fittings and valves shall be joined as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is required by the pipe service
2. Pipe sections with damaged threads shall be replaced with new undamaged sections of pipe at no additional time or cost to Government.

E. Copper tube and fittings with soldered joints shall be joined according to ASTM B828. A water flushable, lead free flux conforming to ASTM B813 and a lead free alloy solder conforming to ASTM B32 shall be used.

F. For PVC piping, solvent cement joints shall be used for joints. All surfaces shall be cleaned and dry prior to applying the primer and solvent cement. Installation practices shall comply with ASTM F402. The joint shall conform to ASTM D2855 and ASTM D2665 appendices.

3.3 SPECIALTY PIPE FITTINGS

A. Transition coupling shall be installed at pipe joints with small differences in pipe outside diameters.

B. Dielectric fittings shall be installed at connections of dissimilar metal piping and tubing.

3.4 PIPE HANGERS, SUPPORTS AND ACCESSORIES

A. All piping shall be supported according to the IPC, Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, and these specifications.

B. Hangers, supports, rods, inserts and accessories used for Pipe supports shall be shop coated with zinc Chromate primer paint. Electroplated copper hanger rods, hangers and accessories may be used with copper tubing.

C. Horizontal piping and tubing shall be supported within 300 mm (12 inches) of each fitting or coupling.

D. Horizontal cast iron piping shall be supported with the following maximum horizontal spacing and minimum hanger rod diameters:

1. NPS 1-1/2 to NPS 2 (DN 40 to DN 50): 1500 mm (60 inches) with 10 mm (3/8 inch) rod.
2. NPS 3 (DN 80): 1500 mm (60 inches) with 15 mm (1/2 inch) rod.
3. NPS 4 to NPS 5 (DN 100 to DN 125): 1500 mm (60 inches) with 18 mm (5/8 inch) rod.
4. NPS 6 to NPS 8 (DN 150 to DN 200): 1500 mm (60 inches) with 20 mm (3/4 inch) rod.
5. NPS 10 to NPS 12 (DN 250 to DN 300): 1500 mm (60 inches) with 23 mm (7/8 inch) rod.

E. The maximum support spacing for horizontal plastic shall be 1.22 m (4 feet).

F. Vertical piping and tubing shall be supported at the base, at each floor, and at intervals no greater than 4.6 m (15 feet).

G. In addition to the requirements in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, floor, wall and ceiling plates shall have the following characteristics:

1. Solid or split unplated cast iron.
2. All plates shall be provided with set screws.

3. Height adjustable clevis type pipe hangers.
4. Adjustable Floor Rests and Base Flanges shall be steel.
5. Hanger Rods shall be low carbon steel, fully threaded or threaded at each end with two removable nuts at each end for positioning rod and hanger and locking each in place.
6. Riser Clamps shall be malleable iron or steel.
7. Roller shall be cast iron.
8. Hangers and supports utilized with insulated pipe and tubing shall have 180 degree (minimum) metal protection shield centered on and welded to the hanger and support. The shield shall be 100 mm (4 inches) in length and be 1.6 mm (16 gage) steel. The shield shall be sized for the insulation.

H. Miscellaneous materials shall be provided as specified, required, directed or as noted on the drawings for proper installation of hangers, supports and accessories. If the vertical distance exceeds 6.1 m (20 feet) for cast iron pipe additional support shall be provided in the center of that span. All necessary auxiliary steel shall be provided to provide that support.

I. Cast escutcheon with set screw shall be installed at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.

J. Penetrations:

1. Fire Stopping: Where pipes pass through fire partitions, fire walls, smoke partitions, or floors, a fire stop shall be installed that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING. Clearances between raceways and openings shall be completely filled and sealed with the fire stopping materials.
2. Water proofing: At floor penetrations, Clearances around the pipe shall be completely sealed and made watertight with sealant as specified in Section 07 92 00, JOINT SEALANTS. Bio-based materials shall be utilized when possible.

3.5 INSULATION

A. Insulate horizontal sections and 600 mm (2 feet) past changes of direction to vertical sections for interior section of roof drains. Install insulation in accordance with the requirements of Section 22 07 11, PLUMBING INSULATION.

3.6 TESTS

A. Storm sewer system shall be tested either in its entirety or in sections.

B. Storm Water Drain tests shall be conducted before trenches are backfilled or fixtures are connected. A water test or air test shall be conducted, as directed.

1. If entire system is tested with water, tightly close all openings in pipes except the highest opening, and fill system with water to point of overflow. If system is tested in sections, tightly plug each opening except highest opening of section under test, fill each section with water and test with at least a 3 m (10 foot) head of water. In testing successive sections, test at least upper 3 m (10 feet) of next preceding section so that each joint or pipe except upper most 3 m (10 feet) of system has been submitted to a test of at least a 3 m (10 foot) head of water. Water shall be kept in the system, or in portion under test, for at least 15 minutes before inspection starts. System shall then be tight at all joints.
2. For an air test, an air pressure of 34 kPa (5 psig) gage shall be maintained for at least 15 minutes without leakage. A force pump and mercury column gage shall be used for the test.
3. Final Tests: While either one of the following tests may be used, Contractor shall check with VA as to which test will be performed.
   a. Smoke Test: After fixtures are permanently connected and traps are filled with water, fill entire drainage and vent systems with smoke under pressure of 0.25 kPa (1 inch of water) with a smoke machine. **Chemical smoke is prohibited.**
   b. Peppermint Test: Introduce .06 liters (2 ounces) of peppermint into each line or stack.

C. COR shall witness all tests. Contractor shall coordinate schedules with the COR and CxA. Contractor shall provide a minimum of 10 working days prior to flushing, disinfection/sterilization, startup, and testing.

3.8 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer’s technical representative for four hours to instruct VA Personnel in operation and maintenance of the system.

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SECTION 23 05 11
COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 DESCRIPTION

A. The requirements of this Section apply to all sections of Division 23.

B. Definitions:

1. Exposed: Piping, ductwork, and equipment exposed to view in finished rooms.
2. Exterior: Piping, ductwork, and equipment exposed to weather be it temperature, humidity, precipitation, wind, or solar radiation.

C. Abbreviations/Acronyms:

1. ac: Alternating Current
2. AC: Air Conditioning
3. ACU: Air Conditioning Unit
4. ACR: Air Conditioning and Refrigeration
5. AI: Analog Input
6. AISI: American Iron and Steel Institute
7. AO: Analog Output
8. ASJ: All Service Jacket
9. AWG: American Wire Gauge
10. BACnet: Building Automation and Control Networking Protocol
11. BAg: Silver-Copper-Zinc Brazing Alloy
12. BAS: Building Automation System
13. BCuP: Silver-Copper-Phosphorus Brazing Alloy
14. bhp: Brake Horsepower
15. Btu: British Thermal Unit
16. Btu/h: British Thermal Unit Per Hour
17. CDA: Copper Development Association
18. C: Celsius
19. CD: Compact Disk
20. CFM: Cubic Foot Per Minute
21. CH: Chilled Water Supply
22. CHR: Chilled Water Return
23. CLR: Color
24. CO: Carbon Monoxide
25. COR: Contracting Officer’s Representative
26. CPD: Condensate Pump Discharge
27. CPM: Cycles Per Minute

28. CPVC: Chlorinated Polyvinyl Chloride
29. CRS: Corrosion Resistant Steel
30. CTPD: Condensate Transfer Pump Discharge
31. CTPS: Condensate Transfer Pump Suction
32. CW: Cold Water
33. CWP: Cold Working Pressure
34. CxA: Commissioning Agent
35. dB: Decibels
36. dB(A): Decibels (A weighted)
37. DDC: Direct Digital Control
38. DI: Digital Input
39. DO: Digital Output
40. DVD: Digital Video Disc
41. DN: Diameter Nominal
42. DWV: Drainage, Waste and Vent
43. EPDM: Ethylene Propylene Diene Monomer
44. EPT: Ethylene Propylene Terpolymer
45. ETO: Ethylene Oxide
46. F: Fahrenheit
47. FAR: Federal Acquisition Regulations
48. FD: Floor Drain
49. FED: Federal
50. FG: Fiberglass
51. FGR: Flue Gas Recirculation
52. FOS: Fuel Oil Supply
53. FOR: Fuel Oil Return
54. FSK: Foil-Scrim-Kraft facing
55. FWPD: Feedwater Pump Discharge
56. FWPS: Feedwater Pump Suction
57. GC: Chilled Glycol Water Supply
58. GCR: Chilled Glycol Water Return
59. GH: Hot Glycol Water Heating Supply
60. GHR: Hot Glycol Water Heating Return
61. gpm: Gallons Per Minute
62. HDPE: High Density Polyethylene
63. Hg: Mercury
64. HOA: Hands-Off-Automatic
65. hp: Horsepower

66. HPS: High Pressure Steam (414 kPa (60 psig) and above)
67. HPR: High Pressure Steam Condensate Return
68. HW: Hot Water
69. HWH: Hot Water Heating Supply
70. HWHR: Hot Water Heating Return
71. Hz: Hertz
72. ID: Inside Diameter
73. IPS: Iron Pipe Size
74. kg: Kilogram
75. klb: 1000 lb
76. kPa: Kilopascal
77. lb: Pound
78. lb/hr: Pounds Per Hour
79. L/s: Liters Per Second
80. L/min: Liters Per Minute
81. LPS: Low Pressure Steam (103 kPa (15 psig) and below)
82. LPR: Low Pressure Steam Condensate Gravity Return
83. MAWP: Maximum Allowable Working Pressure
84. MAX: Maximum
85. MBtu/h: 1000 Btu/h
86. MBtu: 1000 Btu
87. MED: Medical
88. m: Meter
89. MFG: Manufacturer
90. mg: Milligram
91. mg/L: Milligrams Per Liter
92. MIN: Minimum
93. MJ: Megajoules
94. ml: Milliliter
95. mm: Millimeter
96. MPS: Medium Pressure Steam (110 kPa (16 psig) through 414 kPa (60 psig))
97. MPR: Medium Pressure Steam Condensate Return
98. MW: Megawatt
99. NC: Normally Closed
100. NF: Oil Free Dry (Nitrogen)
101. Nm: Newton Meter
102. NO: Normally Open

103. NOx: Nitrous Oxide
104. NPT: National Pipe Thread
105. NPS: Nominal Pipe Size
106. OD: Outside Diameter
107. OSD: Open Sight Drain
108. OS&Y: Outside Stem and Yoke
109. PC: Pumped Condensate
110. PID: Proportional-Integral-Differential
111. PLC: Programmable Logic Controllers
112. PP: Polypropylene
113. PPE: Personal Protection Equipment
114. ppb: Parts Per Billion
115. ppm: Parts Per Million
116. PRV: Pressure Reducing Valve \
117. PSIA: Pounds Per Square Inch Absolute
118. psig: Pounds Per Square Inch Gauge
119. PTFE: Polytetrafluoroethylene
120. PVC: Polyvinyl Chloride
121. PVDC: Polyvinylidene Chloride Vapor Retarder Jacketing, White
122. PVDF: Polyvinylidene Fluoride
123. rad: Radians
124. RH: Relative Humidity
125. RO: Reverse Osmosis
126. rms: Root Mean Square
127. RPM: Revolutions Per Minute
128. RS: Refrigerant Suction
129. RTD: Resistance Temperature Detectors
130. RTRF: Reinforced Thermosetting Resin Fittings
131. RTRP: Reinforced Thermosetting Resin Pipe
132. SCFM: Standard Cubic Feet Per Minute
133. SPEC: Specification
134. SPS: Sterile Processing Services
135. STD: Standard
136. SDR: Standard Dimension Ratio
137. SUS: Saybolt Universal Second
138. SW: Soft water
139. SWP: Steam Working Pressure
140. TAB: Testing, Adjusting, and Balancing

141. TDH: Total Dynamic Head
142. TEFC: Totally Enclosed Fan-Cooled
143. TFE: Tetrafluoroethylene
144. THERM: 100,000 Btu
145. THHN: Thermoplastic High-Heat Resistant Nylon Coated Wire
146. THWN: Thermoplastic Heat & Water-Resistant Nylon Coated Wire
147. T/P: Temperature and Pressure
148. USDA: U.S. Department of Agriculture
149. V: Volt
150. VAC: Vacuum
151. VA: Veterans Administration
152. VAC: Voltage in Alternating Current
153. VA CFM: VA Construction & Facilities Management
154. VA CFM CSS: VA Construction & Facilities Management, Consulting Support Service
155. VAMC: Veterans Administration Medical Center
156. VHA OCAMES: Veterans Health Administration - Office of Capital Asset Management Engineering and Support
157. VR: Vacuum condensate return
158. WCB: Wrought Carbon Steel, Grade B
159. WG: Water Gauge or Water Column
160. WOG: Water, Oil, Gas

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.
B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
C. Section 05 50 00, METAL FABRICATIONS.
D. Section 07 84 00, FIRESTOPPING.
E. Section 07 92 00, JOINT SEALANTS.
F. Section 09 91 00, PAINTING.
G. Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standard will govern.
B. Air Movement and Control Association (AMCA):
410-1996.....Recommended Safety Practices for Users and Installers of Industrial and Commercial Fans

C. American Society of Mechanical Engineers (ASME):
B31.1-2018.....Power Piping
B31.9-2014.....Building Services Piping
ASME Boiler and Pressure Vessel Code:
BPVC Section IX-2019 Welding, Brazing, and Fusing Qualifications

D. American Society for Testing and Materials (ASTM):
A36/A36M-2014.....Standard Specification for Carbon Structural Steel
A575-1996(R2018).....Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades

E. Military Specifications (MIL):
MIL-P-21035B-2013.....Paint High Zinc Dust Content, Galvanizing Repair (Metric)

F. National Fire Protection Association (NFPA):
70-2017.....National Electrical Code (NEC)
101-2018.....Life Safety Code

G. Department of Veterans Affairs (VA):
PG-18-10-2016.....Physical Security and Resiliency Design Manual

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 23 05 11, COMMON WORK RESULTS FOR HVAC", with applicable paragraph identification.

C. If the project is phased submit complete phasing plan/schedule with manpower levels prior to commencing work. The phasing plan shall be detailed enough to provide milestones in the process that can be verified.

D. Contractor shall make all necessary field measurements and investigations to assure that the equipment and assemblies will meet contract requirements, and all equipment that requires regular maintenance, calibration, etc are accessable from the floor or permanent work platform. It is the Contractor's responsibility to ensure all submittals meet the VA specifications and requirements and it is assumed by the VA that all submittals do meet the VA specifications unless the Contractor has requested a variance in writing and approved by COR prior to the submittal. If at any time

during the project it is found that any item does not meet the VA specifications and there was no variance approval the Contractor shall correct at no additional cost or time to the Government even if a submittal was approved.

E. If equipment is submitted which differs in arrangement from that shown, provide documentation proving equivalent performance, design standards and drawings that show the rearrangement of all associated systems. Additionally, any impacts on ancillary equipment or services such as foundations, piping, and electrical shall be the Contractor’s responsibility to design, supply, and install at no additional cost or time to the Government. VA approval will be given only if all features of the equipment and associated systems, including accessibility, are equivalent to that required by the contract.

F. Prior to submitting shop drawings for approval, Contractor shall certify in writing that manufacturers of all major items of equipment have each reviewed contract documents, and have jointly coordinated and properly integrated their equipment and controls to provide a complete and efficient installation.

G. Submittals and shop drawings for interdependent items, containing applicable descriptive information, shall be furnished together. Coordinate and properly integrate materials and equipment to provide a completely compatible and efficient installation.

H. Manufacturer's Literature and Data: Include full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity. Submit under the pertinent section rather than under this section.

   1. Submit belt drive with the driven equipment. Submit selection data for specific drives when requested by the COR.
   2. Submit electric motor data and variable speed drive data with the driven equipment.
   3. Equipment and materials identification.
   4. Fire-stopping materials.
   5. Hangers, inserts, supports and bracing. Provide complete stress analysis for variable spring and constant support hangers.
   6. Wall, floor, and ceiling plates.

I. Rigging Plan: Provide documentation of the capacity and weight of the rigging and equipment intended to be used. The plan shall include the

path of travel of the load, the staging area and intended access, and qualifications of the operator and signal person.

J. HVAC Maintenance Data and Operating Instructions:

1. Maintenance and operating manuals in accordance with Section 01 00 00, GENERAL REQUIREMENTS, Article, INSTRUCTIONS, for systems and equipment.
2. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replacement parts, and troubleshooting guide:
   a. Include complete list indicating all components of the systems.
   b. Include complete diagrams of the internal wiring for each item of equipment.
   c. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.
3. Provide a listing of recommended replacement parts for keeping in stock supply, including sources of supply, for equipment. Include in the listing belts for equipment: Belt manufacturer, model number, size and style, and distinguished whether of multiple belt sets.

K. Provide copies of approved HVAC equipment submittals to the TAB Subcontractor.

L. Completed System Readiness Checklist provided by the Commissioning Agent and completed by the Contractor, signed by a qualified technician and dated on the date of completion.

1.5 QUALITY ASSURANCE

A. Mechanical, electrical and associated systems shall be safe, reliable, efficient, durable, easily and safely operable and maintainable, easily and safely accessible, and in compliance with applicable codes as specified. The systems shall be comprised of high quality institutional-class and industrial-class products of manufacturers that are experienced specialists in the required product lines. All construction firms and personnel shall be experienced and qualified specialists in industrial and institutional HVAC.

B. Flow Rate Tolerance for HVAC Equipment: Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC.

C. Products Criteria:

1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of

the products for at least 3 years (or longer as specified elsewhere). The design, model and size of each item shall have been in satisfactory and efficient operation on at least three installations for approximately three years. However, digital electronics devices, software and systems such as controls, instruments, computer work station, shall be the current generation of technology and basic design that has a proven satisfactory service record of at least three years. See other specification sections for any exceptions and/or additional requirements.

2. Refer to all other sections for quality assurance requirements for systems and equipment specified therein.
3. All items furnished shall be free from defects that would adversely affect the performance, maintainability and appearance of individual components and overall assembly.
4. The products and execution of work specified in Division 23 shall conform to the referenced codes and standards as required by the specifications. Local codes and amendments shall be enforced, along with requirements of local utility companies. The most stringent requirements of these specifications, local codes, or utility company requirements shall always apply. Any conflicts shall be brought to the attention of the COR.
5. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be of the same manufacturer and model number, or if different models are required they shall be of the same manufacturer and identical to the greatest extent possible (i.e., same model series).
6. Assembled Units: Performance and warranty of all components that make up an assembled unit shall be the responsibility of the manufacturer of the completed assembly.
7. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.
8. Use of asbestos products or equipment or materials containing asbestos is prohibited.

D. HVAC Equipment Service Providers: Service providers shall be authorized and trained by the manufacturers of the equipment supplied. These

providers shall be capable of responding onsite and provide acceptable service to restore equipment operations within 4 hours of receipt of notification by phone, e-mail or fax in event of an emergency, such as the shutdown of equipment; or within 24 hours in a non-emergency. Submit names, mail and e-mail addresses and phone numbers of service personnel and companies providing service under these conditions for (as applicable to the project): fans, air handling units, chillers, cooling towers, control systems, pumps, critical instrumentation, computer workstation and programming.

E. HVAC Mechanical Systems Welding: Before any welding is performed, Contractor shall submit a certificate certifying that welders comply with the following requirements:
   1. Qualify welding processes and operators for piping according to ASME BPVC Section IX. Provide proof of current certification.
   2. Comply with provisions of ASME B31 series "Code for Pressure Piping".
   3. Certify that each welder and welding operator has passed American Welding Society (AWS) qualification tests for the welding processes involved, and that certification is current.
   4. All welds shall be stamped according to the provisions of the AWS or ASME as required herein and by the associated code.

F. Manufacturer's Recommendations: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the COR with submittals. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material and removal by the Contractor and no additional cost or time to the Government.

G. Execution (Installation, Construction) Quality:
   1. Apply and install all items in accordance with manufacturer's written instructions. Refer conflicts between the manufacturer's instructions and the contract documents to the COR for resolution. Provide written hard copies and computer files on CD or DVD of manufacturer’s installation instructions to the COR with submittals prior to commencing installation of any item. Installation of the item will not be allowed to proceed until the recommendations are received and approved by the VA. Failure to

furnish these recommendations is a cause for rejection of the material.

2. All items that require access, such as for operating, cleaning, servicing, maintenance, and calibration, shall be easily and safely accessible by persons standing at floor level, or standing on permanent platforms, without the use of portable ladders. Examples of these items include, but are not limited to, all types of valves, filters and strainers, transmitters, control devices. Prior to commencing installation work, refer conflicts between this requirement and contract documents to the COR for resolution. Failure of the Contractor to resolve, or point out any issues will result in the Contractor correcting at no additional cost or time to the Government.
3. Complete coordination/shop drawings shall be required in accordance with Article, SUBMITTALS. Construction work shall not start on any system until the coordination/shop drawings have been approved by VA.
4. Workmanship/craftsmanship will be of the highest quality and standards. The VA reserves the right to reject any work based on poor quality of workmanship this work shall be removed and done again at no additional cost or time to the Government.

H. Upon request by Government, provide lists of previous installations for selected items of equipment. Include contact persons who will serve as references, with current telephone numbers and e-mail addresses.

I. Guaranty: Warranty of Construction, FAR Clause 52.246-21.

1.6 DELIVERY, STORAGE AND HANDLING

A. Protection of Equipment:

1. Equipment and material placed on the job site shall remain in the custody of the Contractor until phased acceptance, whether or not the Government has reimbursed the Contractor for the equipment and material. The Contractor is solely responsible for the protection of such equipment and material against any damage or theft.
2. Large equipment such as boilers, chillers, cooling towers, fans, and air handling units if shipped on open trailer trucks shall be covered with shrink on plastics or water proof tarpaulins that provide protection from exposure to rain, road salts and other transit hazards. Protection shall be kept in place until equipment is moved into a building or installed as designed.

3. Repair damaged equipment in first class, new operating condition and appearance; or, replace same as determined and directed by the COR. Such repair or replacement shall be at no additional cost or time to the Government.
4. Protect interiors of new equipment and piping systems against entry of foreign matter. Clean both inside and outside before painting or placing equipment in operation.
5. Existing equipment and piping being worked on by the Contractor shall be under the custody and responsibility of the Contractor and shall be protected as required for new work.
6. Protect plastic piping and tanks from ultraviolet light (sunlight).

B. Cleanliness of Piping and Equipment Systems:
1. Exercise care in storage and handling of equipment and piping material to be incorporated in the work. Remove debris arising from cutting, threading and welding of piping.
2. Piping systems shall be flushed, blown or pigged as necessary to deliver clean systems.
3. Clean interior of all tanks prior to delivery for beneficial use by the Government.
4. Boilers shall be left clean following final internal inspection by Government insurance representative or inspector.
5. Contractor shall be fully responsible for all costs, damage, and delay arising from failure to provide clean systems.

1.7 AS-BUILT DOCUMENTATION

A. Submit manufacturer’s literature and data updated to include submittal review comments and any equipment substitutions.

B. Submit operation and maintenance data updated to include submittal review comments, VA approved substitutions and construction revisions shall be in electronic version on CD or DVD inserted into a three-ring binder. All aspects of system operation and maintenance procedures, including applicable piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices shall be included. A List of recommended spare parts (manufacturer, model number, and quantity)

shall be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.

C. The installing Contractor shall maintain as-built drawings of each completed phase for verification; and, shall provide the complete set at the time of final systems certification testing. Should the installing Contractor engage the testing company to provide as-built or any portion thereof, it shall not be deemed a conflict of interest or breach of the 'third party testing company' requirement. Provide record drawings as follows:
   1. Red-lined, hand-marked drawings are to be provided, with one paper copy and a scanned PDF version of the hand-marked drawings provided on CD or DVD.

D. The as-built drawings shall indicate the location and type of all lockout/tagout points for all energy sources for all equipment and pumps to include breaker location and numbers, valve tag numbers, etc. Coordinate lockout/tagout procedures and practices with local VA requirements.

E. Certification documentation shall be provided to COR 21 working days prior to submitting the request for final inspection. The documentation shall include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and provide documentation/certification that all results of tests were within limits specified. Test results shall contain written sequence of test procedure with written test results annotated at each step along with the expected outcome or setpoint. The results shall include all readings, including but not limited to data on device (make, model and performance characteristics_), normal pressures, switch ranges, trip points, amp readings, and calibration data to include equipment serial numbers or individual identifications, etc.

1.8 JOB CONDITIONS – WORK IN EXISTING BUILDING

A. Building Operation: Government employees will be continuously operating and managing all facilities, including temporary facilities that serve the VAMC.

B. Maintenance of Service: Schedule all work to permit continuous service as required by the VAMC.

C. Steam and Condensate Service Interruptions: Limited steam and condensate service interruptions, as required for interconnections of new and existing systems, will be permitted by the COR during periods when the demands are not critical to the operation of the VAMC. These non-critical periods are limited to between 8 pm and 5 am in the appropriate off-season (if applicable). Provide at least 10 working days advance notice to the COR. The request shall include a detailed plan on the proposed shutdown and the intended work to be done along with manpower levels. All equipment and materials must be onsite and verified with plan 5 days prior to the shutdown or it will need to be rescheduled.

D. Phasing of Work: Comply with all requirements shown on contract documents. Contractor shall submit a complete detailed phasing plan/schedule with manpower levels prior to commencing work. The phasing plan shall be detailed enough to provide milestones in the process that can be verified.

E. Building Working Environment: Maintain the architectural and structural integrity of the building and the working environment at all times. Maintain the interior of building at 18 degrees C (65 degrees F) minimum. Limit the opening of doors, windows or other access openings to brief periods as necessary for rigging purposes. Storm water or ground water leakage is prohibited. Provide daily clean-up of construction and demolition debris on all floor surfaces and on all equipment being operated by VA. Maintain all egress routes and safety systems/devices.

F. Acceptance of Work for Government Operation: As new equipment, systems and facilities are made available for operation and these items are deemed of beneficial use to the Government, inspections will be made and tests will be performed. Based on the inspections, a list of contract deficiencies will be issued to the Contractor. After correction of deficiencies as necessary for beneficial use, the Contracting Officer will process necessary acceptance and the equipment will then be under the control and operation of Government personnel.

PART 2 - PRODUCTS

2.1 FACTORY-ASSEMBLED PRODUCTS

A. Provide maximum standardization of components to reduce spare part requirements.

B. Performance and warranty of all components that make up an assembled unit shall be the responsibility of the manufacturer of the completed assembly.
   1. All components of an assembled unit need not be products of same manufacturer.
   2. Constituent parts that are alike shall be products of a single manufacturer.
   3. Components shall be compatible with each other and with the total assembly for intended service.
   4. Contractor shall guarantee performance of assemblies of components, and shall repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly.

C. Equipment and components of equipment shall bear manufacturer's name and trademark, model number, serial number and performance data on a nameplate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment.

D. Major items of equipment, which serve the same function, must be the same make and model. Exceptions must be approved by the VA, but may be permitted if performance requirements cannot be met.

2.2 COMPATIBILITY OF RELATED EQUIPMENT

A. Equipment and materials installed shall be compatible in all respects with other items being furnished and with existing items so that the result will be a complete and fully operational plant that conforms to contract requirements.

2.3 V-BELT DRIVES

A. Type: ARPM standard V-belts with proper motor pulley and driven sheave. Belts shall be constructed of reinforced cord and rubber.

B. Dimensions, rating and selection standards: ARPM IP-20 and ARPM IP-21.

C. Minimum Horsepower Rating: Motor horsepower plus recommended ARPM service factor (not less than 20 percent) in addition to the ARPM allowances for pitch diameter, center distance, and arc of contact.

D. Maximum Speed: 25 m/s (5000 feet per minute).

E. Adjustment Provisions: For alignment and ARPM standard allowances for installation and take-up.

F. Drives may utilize a single V-Belt (any cross section) when it is the manufacturer's standard.

G. Multiple Belts: Matched to ARPM specified limits by measurement on a belt measuring fixture. Seal matched sets together to prevent mixing or partial loss of sets. Replacement, when necessary, shall be an entire set of new matched belts.

H. Sheaves and Pulleys:

1. Material: Pressed steel, or close-grained cast iron.
2. Bore: Fixed or bushing type for securing to shaft with keys.
3. Balanced: Statically and dynamically.
4. Groove spacing for driving and driven pulleys shall be the same.

I. Drive Types, Based on ARI 435:

1. Provide adjustable-pitch //or fixed-pitch// drive as follows:
   a. Fan speeds up to 1800 RPM: 7.5 kW (10 horsepower) and smaller.
   b. Fan speeds over 1800 RPM: 2.2 kW (3 horsepower) and smaller.
2. Provide fixed-pitch drives for drives larger than those listed above.
3. The final fan speeds required to just meet the system CFM and pressure requirements, without throttling the design air flow branch, shall be determined by adjustment of a temporary adjustable-pitch motor sheave or by fan law calculation if a fixed-pitch drive is used initially.

J. Final Drive Set: If adjustment is required beyond the capabilities of the factory drive set, the final drive set shall be provided as part of this contract at no additional cost or time to the Government.

2.4 SYNCHRONOUS BELT DRIVES

A. Type: ARPM synchronous belts with proper motor pulley and driven sheave. Belts shall be constructed of reinforced cord and rubber.

B. Dimensions, rating and selection standards: ARPM IP-24 and ARPM IP-27.

C. Minimum Horsepower Rating: Motor horsepower plus recommended ARPM service factor (not less than 20 percent) in addition to the ARPM allowances for pitch diameter, center distance, and arc of contact.

D. Maximum Speed: 25 m/s (5000 feet per minute).

E. Adjustment Provisions: For alignment and ARPM standard allowances for installation and take-up.

F. Drives may utilize a single belt of manufacturer’s standard width for the application.

G. Multiple Belts: Matched to ARPM specified limits by measurement on a belt measuring fixture. Seal matched sets together to prevent mixing or

partial loss of sets. Replacement, when necessary, shall be an entire set of new matched belts.

H. Sheaves and Pulleys:
   1. Material: Pressed steel, or close-grained cast iron.
   2. Bore: Fixed or bushing type for securing to shaft with keys.
   3. Balanced: Statically and dynamically.

I. Final Drive Set: The final fan speeds required to just meet the system CFM and pressure requirements, without throttling the design air flow branch, shall be determined by fan law calculation. If adjustment is required beyond the capabilities of the factory drive set, the final drive set shall be provided as part of this contract at no additional cost or time to the Government.

2.5 DRIVE GUARDS

A. For machinery and equipment, provide guards as shown in AMCA 410 for belts, chains, couplings, pulleys, sheaves, shafts, gears and other moving parts regardless of height above the floor to prevent damage to equipment and injury to personnel. Drive guards may be excluded where motors and drives are inside factory-fabricated air handling unit casings.

B. Pump shafts and couplings shall be fully guarded by a sheet steel guard, covering coupling and shaft but not bearings. Material shall be minimum 16-gauge sheet steel; all edges shall be hemmed and ends shall be bent into flanges and the flanges shall be drilled and attached to pump base with minimum of four 6 mm (1/4 inch) bolts. Reinforce guard as necessary to prevent side play forcing guard onto couplings.

C. V-belt and sheave assemblies shall be totally enclosed, firmly mounted, non-resonant. Guard shall be an assembly of minimum 22-gauge sheet steel and expanded or perforated metal to permit observation of belts. 25 mm (1 inch) diameter hole shall be provided at each shaft centerline to permit speed measurement.

D. Materials: Sheet steel, expanded metal or wire mesh rigidly secured so as to be removable without disassembling pipe, duct, or electrical connections to equipment.

E. Access for Speed Measurement: 25 mm (1 inch) diameter hole at each shaft center.

2.6 LIFTING ATTACHMENTS

A. Provide equipment with suitable lifting attachments to enable equipment to be lifted in its normal position. Lifting attachments shall

withstand any handling conditions that might be encountered, without bending or distortion of shape, such as rapid lowering and braking of load.

2.7 ELECTRIC MOTORS

A. All material and equipment furnished and installation methods shall conform to the requirements of Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES. Provide all electrical wiring, conduit, and devices necessary for the proper connection, protection and operation of the systems. Provide special energy efficient premium efficiency type motors as scheduled.

2.8 VARIABLE SPEED MOTOR CONTROLLERS

A. Refer to Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS

B. Provide variable speed motor controllers with or without a bypass contactor as indicated in contract drawings.

C. The combination of controller and motor shall be provided by the manufacturer of the driven equipment, such as pumps and fans, and shall be rated for 100 percent output performance. Multiple units of the same class of equipment, i.e. air handlers, fans, pumps, shall be product of a single manufacturer.

D. Motors shall be premium efficiency type and be approved by the motor controller manufacturer. The controller-motor combination shall be guaranteed to provide full motor nameplate horsepower in variable frequency operation. Both driving and driven motor/fan sheaves shall be fixed pitch.

E. Controller shall not add any current or voltage transients to the input ac power distribution system, DDC controls, sensitive medical equipment, etc., nor shall be affected from other devices on the ac power system.

2.9 EQUIPMENT AND MATERIALS IDENTIFICATION

A. Use symbols, nomenclature and equipment numbers specified, shown on the contract documents and shown in the maintenance manuals. Identification for piping is specified in Section 09 91 00, PAINTING.

B. Interior (Indoor) Equipment: Engraved nameplates, with letters not less than 5 mm (3/16 inch) high of brass with black-filled letters, or rigid black plastic with white letters specified in Section 09 91 00, PAINTING permanently fastened to the equipment. Identify unit components such as coils, filters, fans, etc.

C. Exterior (Outdoor) Equipment: Brass nameplates, with engraved black filled letters, not less than 5 mm (3/16 inch) high riveted or bolted to the equipment.

D. Control Items: Label all instrumentation, temperature and humidity sensors, controllers and control dampers. Identify and label each item as they appear on the control diagrams.

E. Valve Tags and Lists:

1. Valve tags: Engraved black filled numbers and letters not less than 15 mm (1/2 inch) high for number designation, and not less than 6 mm (1/4 inch) for service designation on 19-gauge 40 mm (1-1/2 inches) round brass disc, attached with brass "S" hook or brass chain.
2. Valve lists: Typed or printed plastic coated card(s), sized 215 mm (8-1/2 inches) by 275 mm (11 inches) showing tag number, valve function and area of control, for each service or system. Punch sheets for a 3-ring notebook.
3. Provide detailed plan for each floor of the building indicating the location and valve number for each valve. Identify location of each valve with a color-coded thumb tack in ceiling.

F. Ceiling Grid Labels:

1. 50 mm (2 inch) long by 15 mm (1/2 inch) wide by 0.025 mm (1 mil) thick UV resistant metalized polyester label with red border color and black custom lettering on white background interior. Peel and stick adhesive backing. Label and adhesive manufactured specifically for use in equipment inventory tagging.
2. Custom print labels with above ceiling HVAC equipment numbers.

2.10 FIRESTOPPING

A. Section 07 84 00, FIRESTOPPING specifies an effective barrier against the spread of fire, smoke and gases where penetrations occur for piping and ductwork.

2.11 GALVANIZED REPAIR COMPOUND

A. Mil-P-21035B, paint form.

2.12 HVAC PIPE AND EQUIPMENT SUPPORTS AND RESTRAINTS

A. Supports for Roof Mounted Items:

1. Equipment: Equipment rails shall be galvanized steel, minimum 1.3 mm (18 gauge), with integral baseplate, continuous welded corner seams, factory installed 50 by 100 mm (2 by 4 inches) treated wood nailer, 1.3 mm (18 gauge) galvanized steel counter flashing cap

with screws, built-in cant strip, (except for gypsum or tectum deck), minimum height 275 mm (11 inches). For surface insulated roof deck, provide raised cant strip to start at the upper surface of the insulation.

2. Pipe/duct pedestals: Provide a galvanized Unistrut channel welded to U-shaped mounting brackets which are secured to side of rail with galvanized lag bolts.

B. Pipe Supports: Comply with MSS SP-58. Type Numbers specified refer to this standard. For selection and application comply with MSS SP-58. Refer to Section 05 50 00, METAL FABRICATIONS, for miscellaneous metal support materials and prime coat painting requirements.

C. Attachment to Concrete Building Construction:

1. Concrete insert: MSS SP-58, Type 18.
2. Self-drilling expansion shields and machine bolt expansion anchors: Permitted in concrete not less than 100 mm (4 inches) thick when approved by the COR for each job condition.
3. Power-driven fasteners: Permitted in existing concrete or masonry not less than 100 mm (4 inches) thick when approved by the COR for each job condition.

D. Attachment to Steel Building Construction:

1. Welded attachment: MSS SP-58, Type 22.
2. Beam clamps: MSS SP-58, Types 20, 21, 28 or 29. Type 23 C-clamp may be used for individual copper tubing up to 23 mm (7/8 inch) outside diameter.

E. Hanger Rods: Hot-rolled steel, ASTM A36/A36M or ASTM A575 for allowable load listed in MSS SP-58. For piping, provide adjustment means for controlling level or slope. Types 13 or 15 turn-buckles shall provide 40 mm (1-1/2 inches) minimum of adjustment and incorporate locknuts. All-thread rods are acceptable.

F. Hangers Supporting Multiple Pipes (Trapeze Hangers): Galvanized, cold formed, lipped steel channel horizontal member, not less than 41 mm by 41 mm (1-5/8 inches by 1-5/8 inches), 2.7 mm (12 gauge), designed to accept special spring held, hardened steel nuts. Trapeze hangers are prohibited for use for steam supply and condensate piping.

1. Allowable hanger load: Manufacturers rating less 91 kg (200 pounds).
2. Guide individual pipes on the horizontal member of every other trapeze hanger with 6 mm (1/4 inch) U-bolt fabricated from steel

rod. Provide Type 40 insulation shield, secured by two 15 mm (1/2 inch) galvanized steel bands, or preinsulated calcium silicate shield for insulated piping at each hanger.

G. Supports for Piping Systems:

1. Select hangers sized to encircle insulation on insulated piping. To protect insulation, provide Type 39 saddles for roller type supports or preinsulated calcium silicate shields. Provide Type 40 insulation shield or preinsulated calcium silicate shield at all other types of supports and hangers including those for preinsulated piping.
2. Piping Systems except High and Medium Pressure Steam (MSS SP-58):
   a. Standard clevis hanger: Type 1; provide locknut.
   b. Riser clamps: Type 8.
   c. Wall brackets: Types 31, 32 or 33.
   d. Roller supports: Type 41, 43, 44 and 46.
   e. Saddle support: Type 36, 37 or 38.
   f. Turnbuckle: Types 13 or 15. Preinsulate.
   g. U-bolt clamp: Type 24.
   h. Copper Tube:
      1) Hangers, clamps and other support material in contact with tubing shall be painted with copper colored epoxy paint, plastic coated or taped with non-adhesive isolation tape to prevent electrolysis.
      2) For vertical runs use epoxy painted or plastic-coated riser clamps.
      3) For supporting tube to strut: Provide epoxy painted pipe straps for copper tube or plastic inserted vibration isolation clamps.
      4) Insulated Lines: Provide pre-insulated calcium silicate shields sized for copper tube.
   i. Supports for plastic piping: As recommended by the pipe manufacturer with black rubber tape extending one inch beyond steel support or clamp.
3. High and Medium Pressure Steam (MSS SP-58):
   a. Provide eye rod or Type 17 eye nut near the upper attachment.
   b. Piping 50 mm (2 inches) and larger: Type 43 roller hanger. For roller hangers requiring seismic bracing provide a Type 1 clevis hanger with Type 41 roller attached by flat side bars.

c. Piping with Vertical Expansion and Contraction:
   1) Movement up to 20 mm (3/4 inch): Type 51 or 52 variable spring unit with integral turn buckle and load indicator.
   2) Movement more than 20 mm (3/4 inch): Type 54 or 55 constant support unit with integral adjusting nut, turn buckle and travel position indicator.

4. Convertor and Expansion Tank Hangers: May be Type 1 sized for the shell diameter. Insulation where required will cover the hangers.

H. Pre-insulated Calcium Silicate Shields:
1. Provide 360-degree water resistant high density 965 kPa (140 psig) compressive strength calcium silicate shields encased in galvanized metal.
2. Pre-insulated calcium silicate shields to be installed at the point of support during erection.
3. Shield thickness shall match the pipe insulation.
4. The type of shield is selected by the temperature of the pipe, the load it must carry, and the type of support it will be used with.
   a. Shields for supporting chilled or cold water shall have insulation that extends a minimum of 25 mm (1 inch) past the sheet metal. Provide for an adequate vapor barrier in chilled lines.
   b. The pre-insulated calcium silicate shield shall support the maximum allowable water filled span as indicated in MSS SP-58. To support the load, the shields may have one or more of the following features: structural inserts 4138 kPa (600 psig) compressive strength, an extra bottom metal shield, or formed structural steel (ASTM A36/A36M) wear plates welded to the bottom sheet metal jacket.
5. Shields may be used on steel clevis hanger type supports, roller supports or flat surfaces.

2.13 PIPE PENETRATIONS

A. Install sleeves during construction for other than blocked out floor openings for risers in mechanical bays.
B. To prevent accidental liquid spills from passing to a lower level, provide the following:
1. For sleeves: Extend sleeve 25 mm (1 inch) above finished floor and provide sealant for watertight joint.

2. For blocked out floor openings: Provide 40 mm (1-1/2 inch) angle set in silicone adhesive around opening.
3. For drilled penetrations: Provide 40 mm (1-1/2 inch) angle ring or square set in silicone adhesive around penetration.

C. Penetrations through beams or ribs are prohibited, but may be installed in concrete beam flanges. Any deviation from these requirements must receive prior approval of COR.

D. Sheet Metal, Plastic, or Moisture-resistant Fiber Sleeves: Provide for pipe passing through floors, interior walls, and partitions, unless brass or steel pipe sleeves are specifically called for below.

E. Cast Iron or Zinc Coated Pipe Sleeves: Provide for pipe passing through exterior walls below grade. Make space between sleeve and pipe watertight with a modular or link rubber seal. Seal shall be applied at both ends of sleeve.

F. Galvanized Steel or an alternate Black Iron Pipe with asphalt coating Sleeves: Provide for pipe passing through concrete beam flanges, except where brass pipe sleeves are called for. Provide sleeve for pipe passing through floor of mechanical rooms, laundry work rooms, and animal rooms above basement. Except in mechanical rooms, connect sleeve with floor plate.

G. Brass Pipe Sleeves: Provide for pipe passing through quarry tile, terrazzo or ceramic tile floors. Connect sleeve with floor plate.

H. Sleeves are not required for wall hydrants for fire department connections or in drywall construction.

I. Sleeve Clearance: Sleeve through floors, walls, partitions, and beam flanges shall be one inch greater in diameter than external diameter of pipe. Sleeve for pipe with insulation shall be large enough to accommodate the insulation. Interior openings shall be caulked tight with fire stopping material and sealant to prevent the spread of fire, smoke, and gases.

J. Sealant and Adhesives: Shall be as specified in Section 07 92 00, JOINT SEALANTS.

2.14 DUCT PENETRATIONS

A. Provide curbs for roof mounted piping, ductwork and equipment. Curbs shall be 450 mm (18 inches) high with continuously welded seams, built-in cant strip, interior baffle with acoustic insulation, curb bottom, hinged curb adapter.

B. Provide firestopping for openings through fire and smoke barriers, maintaining minimum required rating of floor, ceiling or wall assembly. See section 07 84 00, FIRESTOPPING.

2.15 SPECIAL TOOLS AND LUBRICANTS

A. Furnish, and turn over to the COR, tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.

B. Grease Guns with Attachments for Applicable Fittings: One for each type of grease required for each motor or other equipment.

C. Refrigerant Tools: Provide system charging/Evacuation equipment, gauges, fittings, and tools required for maintenance of furnished equipment.

D. Tool Containers: Hardwood or metal, permanently identified for intended service and mounted, or located, where directed by the COR.

E. Lubricants: A minimum of 0.95 L (1 quart) of oil, and 0.45 kg (1 pound) of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application.

2.16 WALL, FLOOR AND CEILING PLATES

A. Material and Type: Chrome plated brass or chrome plated steel, one piece or split type with concealed hinge, with set screw for fastening to pipe, or sleeve. Use plates that fit tight around pipes, cover openings around pipes and cover the entire pipe sleeve projection.

B. Thickness: Not less than 2.4 mm (3/32 inch) for floor plates. For wall and ceiling plates, not less than 0.64 mm (0.025 inch) for up to 80 mm (3-inch pipe), 0.89 mm (0.035 inch) for larger pipe.

C. Locations: Use where pipe penetrates floors, walls and ceilings in exposed locations, in finished areas only. Provide a watertight joint in spaces where brass or steel pipe sleeves are specified.

2.17 ASBESTOS

A. Materials containing asbestos are prohibited.

PART 3 - EXECUTION

3.1 GENERAL

A. If an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no additional cost or time to the Government.

3.2 ARRANGEMENT AND INSTALLATION OF EQUIPMENT AND PIPING

A. Location of piping, sleeves, inserts, hangers, and equipment, access provisions shall be coordinated with the work of all trades. The coordination/shop drawings shall be submitted for review. Locate piping, sleeves, inserts, hangers, ductwork and equipment clear of windows, doors, openings, light outlets, and other services and utilities. Equipment coordination/shop drawings shall be prepared to coordinate proper location and personnel access of all facilities. The drawings shall be submitted for review. Follow manufacturer's published recommendations for installation methods not otherwise specified.

B. Operating Personnel Access and Observation Provisions: Select and arrange all equipment and systems to provide clear view and easy access, without use of portable ladders, for maintenance and operation of all devices including, but not limited to: all equipment items, valves, filters, strainers, transmitters, sensors, control devices. All gauges and indicators shall be clearly visible by personnel standing on the floor or on permanent platforms. Do not reduce or change maintenance and operating space and access provisions that are shown on the contract documents.

C. Equipment and Piping Support: Coordinate structural systems necessary for pipe and equipment support with pipe and equipment locations to permit proper installation.

D. Location of pipe sleeves, trenches and chases shall be accurately coordinated with equipment and piping locations.

E. Cutting Holes:

1. Cut holes through concrete and masonry by rotary core drill. Pneumatic hammer, impact electric, and hand or manual hammer type drill is prohibited, except as permitted by COR where working area space is limited.
2. Locate holes to avoid interference with structural members such as slabs, columns, ribs, beams or reinforcing. Holes shall be laid out in advance and drilling done only after approval by COR. If the Contractor considers it necessary to drill through structural members, this matter shall be referred to COR for approval.
3. Do not penetrate membrane waterproofing.

F. Minor Piping: Generally, small diameter pipe runs from drips and drains, water cooling, and other service are not shown but must be provided.

G. Electrical Interconnection of Instrumentation or Controls: This generally not shown but must be provided. This includes interconnections of sensors, transmitters, transducers, control devices, control and instrumentation panels, instruments and computer workstations. Devices shall be located so they are easily accessible for testing, maintenance, calibration, etc. The COR has the final determination on what is accessible and what is not. Comply with NFPA 70.

H. Protection and Cleaning:

1. Equipment and materials shall be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations and as approved by the COR. Damaged or defective items in the opinion of the COR, shall be replaced.
2. Protect all finished parts of equipment, such as shafts and bearings where accessible, from rust prior to operation by means of protective grease coating and wrapping. Close pipe openings with caps or plugs during installation. Tightly cover and protect fixtures and equipment against dirt, water chemical, or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.

I. Concrete and Grout: Use concrete and non-shrink grout 20 MPa (3000 psig) minimum.

J. Install gauges, thermometers, valves and other devices with due regard for ease in reading or operating and maintaining said devices. Locate and position thermometers and gauges to be easily read by operator or staff standing on floor or walkway provided. Servicing shall not require dismantling adjacent equipment or pipe work.

K. Work in Existing Building:

1. Perform as specified in Article, OPERATIONS AND STORAGE AREAS, Article, ALTERATIONS, and Article, RESTORATION of the Section 01 00 00, GENERAL REQUIREMENTS for relocation of existing equipment, alterations and restoration of existing building(s).
2. As specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, OPERATIONS AND STORAGE AREAS, make alterations to existing service piping at times that will least interfere with normal operation of the facility.

L. Switchgear/Electrical Equipment Drip Protection: Every effort shall be made to eliminate the installation of pipe above electrical and data/telephone switchgear. If this is not possible, encase pipe in a second pipe with a minimum of joints. Installation of piping, ductwork, leak protection apparatus or other installations foreign to the electrical installation shall not be located in the space equal to the width and depth of the equipment and extending from to a height of 1.8 m (6 feet) above the equipment or to ceiling structure, whichever is lower (NFPA 70).

M. Inaccessible Equipment:

1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance or inspections, equipment shall be removed and reinstalled or remedial action performed as directed at no additional cost or time to the Government.
2. The term "conveniently accessible" is defined as capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as, but not limited to motors, fans, pumps, belt guards, transformers, high voltage lines, conduit and raceways, piping, hot surfaces, and ductwork. The COR has final determination on whether an installation meets this requirement or not.

3.3 TEMPORARY PIPING AND EQUIPMENT

A. Continuity of operation of existing facilities will generally require temporary installation or relocation of equipment and piping.

B. The Contractor shall provide all required facilities in accordance with the requirements of phased construction and maintenance of service. All piping and equipment shall be properly supported, sloped to drain, operate without excessive stress, and shall be insulated where injury can occur to personnel by contact with operating facilities. The requirements of Article, ARRANGEMENT AND INSTALLATION OF EQUIPMENT AND PIPING apply.

C. Temporary facilities and piping shall be completely removed and any openings in structures sealed. Provide necessary blind flanges and caps to seal open piping remaining in service.

3.4 RIGGING

A. Design is based on application of available equipment. Openings in building structures are planned to accommodate design scheme.

B. Alternative methods of equipment delivery may be offered by Contractor and will be considered by Government under specified restrictions of phasing and maintenance of service requirements as well as structural integrity of the building.

C. Close all openings in the building when not required for rigging operations to maintain proper environment in the facility for Government operation and maintenance of service.

D. Contractor shall provide all facilities required to deliver specified equipment and place on foundations. Attachments to structures for rigging purposes and support of equipment on structures shall be Contractor's full responsibility. Upon request, the Government will check structure adequacy and advise Contractor of recommended restrictions.

E. Contractor shall check all clearances, weight limitations and shall offer a rigging plan designed by a Registered Professional Engineer. All modifications to structures, including reinforcement thereof, shall be at Contractor's cost, time and responsibility.

F. Follow approved rigging plan.

G. Restore building to original condition upon completion of rigging work.

3.5 PIPE AND EQUIPMENT SUPPORTS

A. Where hanger spacing does not correspond with joist or rib spacing, use structural steel channels designed by a structural engineer, secured directly to joist and rib structure that will correspond to the required hanger spacing, and then suspend the equipment and piping from the channels. Drill or burn holes in structural steel only with the prior approval of the COR.

B. Use of chain pipe supports; wire or strap hangers; wood for blocking, stays and bracing; or, hangers suspended from piping above are prohibited. Replace or thoroughly clean rusty products and paint with zinc primer.

C. Hanger rods shall be used that are straight and vertical. Turnbuckles for vertical adjustments may be omitted where limited space prevents use. Provide a minimum of 15 mm (1/2 inch) clearance between pipe or piping covering and adjacent work.

D. HVAC Horizontal Pipe Support Spacing: Refer to MSS SP-58. Provide additional supports at valves, strainers, in-line pumps and other heavy components. Provide a support within one foot of each elbow.

E. HVAC Vertical Pipe Supports:
   1. Up to 150 mm (6-inch pipe), 9 m (30 feet) long, bolt riser clamps to the pipe below couplings, or welded to the pipe and rests supports securely on the building structure.
   2. Vertical pipe larger than the foregoing, support on base elbows or tees, or substantial pipe legs extending to the building structure.

F. Overhead Supports:
   1. Provide steel structural members, in addition to those shown, of adequate capability to support the imposed loads, located in accordance with the final approved layout of equipment and piping.
   2. Tubing and capillary systems shall be supported in channel troughs.

G. Floor Supports:
   1. Provide concrete bases, concrete anchor blocks and pedestals, and structural steel systems for support of equipment and piping. Concrete bases and structural systems shall be anchored and doweled to resist forces under operating and seismic conditions (if applicable) without excessive displacement or structural failure.
   2. Bases and supports shall not be located and installed until equipment mounted thereon has been approved. Bases shall be sized to match equipment mounted thereon plus 50 mm (2 inch) excess on all edges. Chiller foundations shall have horizontal dimensions that exceed chiller base frame dimensions by at least 150 mm (6 inches) on all sides. Structural contract documents shall be reviewed for additional requirements. Bases shall be neatly finished and smoothed, shall have chamfered edges at the top, and shall be suitable for painting.
   3. All equipment shall be shimmed, leveled, firmly anchored, and grouted with epoxy grout. Anchor bolts shall be placed in sleeves, anchored to the bases. Fill the annular space between sleeves and bolts with a granular material to permit alignment and realignment.

3.6 MECHANICAL DEMOLITION

A. Rigging access, other than indicated on the contract documents, shall be provided by the Contractor after approval for structural integrity by the COR. Such access shall be provided without additional cost or

time to the Government. Where work is in an operating plant, provide approved protection from dust and debris at all times for the safety of plant personnel and maintenance of plant operation and environment of the plant.

B. In an operating facility, maintain the operation, cleanliness and safety. Government personnel will be carrying on their normal duties of operating, cleaning and maintaining equipment and plant operation. Confine the work to the immediate area concerned; maintain cleanliness and wet down demolished materials to eliminate dust. Debris accumulated in the area to the detriment of plant operation is prohibited. Perform all flame cutting to maintain the fire safety integrity of this plant. Adequate fire extinguishing facilities shall be available at all times. Perform all work in accordance with recognized fire protection standards. Inspection will be made by personnel of the VAMC, and Contractor shall follow all directives of the COR with regard to rigging, safety, fire safety, and maintenance of operations.

C. Unless specified otherwise, all piping, wiring, conduit, and other devices associated with the equipment not re-used in the new work shall be completely removed from Government property per Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT. This includes all concrete pads, pipe, valves, fittings, insulation, and all hangers including the top connection and any fastenings to building structural systems. All openings shall be sealed after removal of equipment, pipes, ducts, and other penetrations in roof, walls, floors, in an approved manner and in accordance with contract documents where specifically covered. Structural integrity of the building system shall be maintained. Reference shall also be made to the contract documents of the other disciplines in the project for additional facilities to be demolished or handled.

D. All indicated valves including gate, globe, ball, butterfly and check, all pressure gauges and thermometers with wells shall remain Government property and shall be removed and delivered to COR and stored as directed. The Contractor shall remove all other material and equipment, devices and demolition debris under these contract documents. Such material shall be removed from Government property expeditiously and shall not be allowed to accumulate.

3.7 CLEANING AND PAINTING

A. Prior to final inspection and acceptance of the plant and facilities for beneficial use by the Government, the plant facilities, equipment and systems shall be thoroughly cleaned and painted. Refer to Section 09 91 00, PAINTING.

B. In addition, the following special conditions apply:

1. Cleaning shall be thorough. Solvents, cleaning materials and methods recommended by the manufacturers shall be used for the specific tasks. All rust shall be removed prior to painting and from surfaces to remain unpainted. Repair scratches, scuffs, and abrasions prior to applying prime and finish coats.
2. The following material and equipment shall not be painted:
   a. Motors, controllers, control switches, and safety switches.
   b. Control and interlock devices.
   c. Regulators.
   d. Pressure reducing valves.
   e. Control valves and thermostatic elements.
   f. Lubrication devices and grease fittings.
   g. Copper, brass, aluminum, stainless steel and bronze surfaces.
   h. Valve stems and rotating shafts.
   i. Pressure gauges and thermometers.
   j. Glass.
   k. Nameplates.
3. Control and instrument panels shall be cleaned, damaged surfaces repaired, and shall be touched-up with matching paint obtained from panel manufacturer.
4. Pumps, motors, steel and cast-iron bases, and coupling guards shall be cleaned, and shall be touched-up with the same paint type and color as utilized by the pump manufacturer.
5. Temporary Facilities: Apply paint to surfaces that do not have existing finish coats. This may include painting exposed metals where hangers were removed or where equipment was moved or removed.
6. Paint shall withstand the following temperatures without peeling or discoloration:
   a. Condensate and Feedwater: 38 degrees C (100 degrees F) on insulation jacket surface and 121 degrees C (250 degrees F) on metal pipe surface.

b. Steam: 52 degrees C (125 degrees F) on insulation jacket surface and 190 degrees C (374 degrees F) on metal pipe surface.

7. Final result shall be smooth, even-colored, even-textured factory finish on all items. Completely repaint the entire piece of equipment if necessary to achieve this.

8. Lead based paints are prohibited.

3.8 IDENTIFICATION SIGNS

A. Provide laminated plastic signs, with engraved lettering not less than 5 mm (3/16 inch) high, designating functions, for all equipment, switches, motor controllers, relays, meters, control devices, including automatic control valves. Nomenclature and identification symbols shall correspond to that used in maintenance manual, and in diagrams specified elsewhere. Attach by chain, adhesive, or screws.

B. Factory Built Equipment: Metal plate, securely attached, with name and address of manufacturer, serial number, model number, size, performance.

C. Pipe Identification: Refer to Section 09 91 00, PAINTING.

D. Attach ceiling grid label on ceiling grid location directly underneath above-ceiling air terminal, control system component, valve, filter unit, fan etc.

3.9 MOTOR AND DRIVES

A. Use synchronous belt drives only on equipment controlled by soft starters or variable frequency drive motor controllers without a bypass contactor. Use V-belt drives on all other applications.

B. Alignment of V-Belt Drives: Set driving and driven shafts parallel and align so that the corresponding grooves are in the same plane.

C. Alignment of Synchronous Belt Drives: Set driving and driven shafts parallel and align so that the corresponding pulley flanges are in the same plane.

D. Alignment of Direct-Connect Drives: Securely mount motor in accurate alignment so that shafts are per coupling manufacturer’s tolerances when both motor and driven machine are operating at normal temperatures.

3.10 LUBRICATION

A. All equipment and devices requiring lubrication shall be lubricated prior to initial operation. Field-check all devices for proper lubrication.

B. All devices and equipment shall be equipped with required lubrication fittings or devices. A minimum of 0.95 liter (1 quart) of oil and 0.45 kg (1 pound) of grease of manufacturer's recommended grade and type for each different application shall be provided; also provide 12 grease sticks for lubricated plug valves. Deliver all materials to COR in unopened containers that are properly identified as to application.

C. All lubrication points shall be accessible without disassembling equipment, except to remove access plates.

D. All lubrication points shall be extended to one side of the equipment.

3.11 STARTUP, TEMPORARY OPERATION AND TESTING

A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

C. Startup of equipment shall be performed as described in equipment specifications. Vibration within specified tolerance shall be verified prior to extended operation. Temporary use of equipment is specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT.

3.12 OPERATING AND PERFORMANCE TESTS

A. Prior to the final inspection, perform required tests as specified in Section 01 00 00, GENERAL REQUIREMENTS Article, TESTS, and in individual Division 23 specification sections and submit the test reports and records to the COR.

B. Should evidence of malfunction in any tested system, or piece of equipment or component part thereof, occur during or as a result of tests, make proper corrections, repairs or replacements, and repeat tests at no additional cost or time to the Government.

C. When completion of certain work or system occurs at a time when final control settings and adjustments cannot be properly made to make performance tests, then conduct such performance tests and finalize control settings for heating systems and for cooling systems respectively during first actual seasonal use of respective systems following completion of work. Rescheduling of these tests shall be requested in writing to COR for approval.

D. No adjustments may be made during the acceptance inspection. All adjustments shall have been made by this point.

3.13 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer’s technical representative for 4 hours to instruct each VA personnel responsible in operation and maintenance of the system.

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SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 DESCRIPTION

A. Testing, adjusting, and balancing (TAB) of heating, ventilating and air conditioning (HVAC) systems. TAB includes the following:

1. Planning systematic TAB procedures.
2. Design Review Report.
3. Systems Inspection report.
4. Duct Air Leakage test report.
5. Systems Readiness Report.
6. Balancing air and water distribution systems; adjustment of total system to provide design performance; and testing performance of equipment and automatic controls.
7. Vibration and sound measurements.
8. Recording and reporting results.
9. Document critical paths of flow on reports.

B. Definitions:

1. Basic TAB used in this Section: Chapter 39, "Testing, Adjusting and Balancing" of 2019 ASHRAE Handbook, "HVAC Applications".
2. TAB: Testing, Adjusting and Balancing; the process of checking and adjusting HVAC systems to meet design objectives.
3. AABC: Associated Air Balance Council.
4. NEBB: National Environmental Balancing Bureau.
5. TABB: Testing Adjusting and Balancing Bureau
6. SMACNA: Sheet Metal Contractors National Association
7. Hydronic Systems: Includes chilled water, condenser water, heating hot water and glycol-water systems.
8. Air Systems: Includes all outside air, supply air, return air, exhaust air and relief air systems.
9. Flow rate tolerance: The allowable percentage variation, minus to plus, of actual flow rate from values (design) in the contract documents.

1.2 RELATED WORK

A. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

C. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

1.3 QUALITY ASSURANCE

B. Qualifications:

1. TAB Agency: The TAB agency shall be a subcontractor of the General Contractor and shall report to and be paid by the General Contractor.
2. The TAB agency shall be either a certified member of AABC, NEEB, TABB or NEBB to perform TAB service for HVAC, water balancing and vibrations and sound testing of equipment. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the agency loses subject certification during this period, the General Contractor shall immediately notify the COR and submit another qualified TAB firm for approval. Any agency that has been the subject of disciplinary action by either the AABC, TABB or NEBB within the five years preceding Contract Award shall not be eligible to perform any work related to the TAB. All work performed in this Section and in other related Sections by the TAB agency shall be considered invalid if the TAB agency loses its certification prior to Contract completion, and the successor agency’s review shows unsatisfactory work performed by the predecessor agency.
3. TAB Specialist: The TAB specialist shall be either a member of AABC or TABB or an experienced technician of the Agency certified by NEBB. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the Specialist loses subject certification during this period, the General Contractor shall immediately notify the Resident Engineer and submit another TAB Specialist for approval. Any individual that has been the subject of disciplinary action by either the AABC or the NEBB within the five years preceding Contract Award shall not be eligible to perform any duties related to the HVAC systems, including TAB. All work specified in this Section and in other related Sections performed by the TAB specialist shall be considered invalid if the TAB Specialist loses its certification prior to Contract completion and must be performed by an approved successor.
4. TAB Specialist shall be identified by the General Contractor within 60 days after the notice to proceed. The TAB specialist will be coordinating, scheduling and reporting all TAB work and related activities and will provide necessary information as required by the Resident Engineer. The responsibilities would specifically include:
   a. Shall directly supervise all TAB work.

b. Shall sign the TAB reports that bear the seal of the TAB standard. The reports shall be accompanied by report forms and schematic drawings required by the TAB standard, AABC, TABB or NEBB.
c. Would follow all TAB work through its satisfactory completion.
d. Shall provide final markings of settings of all HVAC adjustment devices.
e. Permanently mark location of duct test ports.
f. Shall document critical paths from the fan or pump. These critical paths are ones in which are 100% open from the fan or pump to the terminal device. This will show the least amount of restriction is being imposed on the system by the TAB firm.

5. All TAB technicians performing actual TAB work shall be experienced and must have done satisfactory work on a minimum of 3 projects comparable in size and complexity to this project. Qualifications must be certified by the TAB agency in writing. The lead technician shall be certified by AABC, TABB or NEBB

C. Test Equipment Criteria: The instrumentation shall meet the accuracy/calibration requirements established by AABC National Standards, TABB/SMACNA International Standards, or by NEBB Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems and instrument manufacturer. Provide calibration history of the instruments to be used for test and balance purpose.

D. TAB Criteria:

1. One or more of the applicable AABC, NEBB, TABB or SMACNA publications, supplemented by ASHRAE Handbook "2019 HVAC Applications" Chapter 39, and requirements stated herein shall be the basis for planning, procedures, and reports.
2. Flow rate tolerance: Following tolerances are allowed. For tolerances not mentioned herein follow 2011 ASHRAE Handbook "2019 HVAC Applications", Chapter 39, as a guideline. Air Filter resistance during tests, artificially imposed if necessary, shall be at least 100 percent of manufacturer recommended change over pressure drop values for pre-filters and after-filters.
   a. Air handling unit and all other fans, cubic meters/min (cubic feet per minute): Minus 0 percent to plus 10 percent.
   b. Air terminal units (maximum values): Minus 2 percent to plus 10 percent.

c. Exhaust hoods/cabinets: 0 percent to plus 10 percent.
d. Minimum outside air: 0 percent to plus 10 percent.
e. Individual room air outlets and inlets, and air flow rates not mentioned above: Minus 5 percent to plus 10 percent except if the air to a space is 100 CFM or less the tolerance would be minus 5 to plus 5 percent.
f. Heating hot water pumps and hot water coils: Minus 5 percent to plus 5 percent.
g. Chilled water and condenser water pumps: Minus 0 percent to plus 5 percent.
h. Chilled water coils: Minus 0 percent to plus 5 percent.

3. Systems shall be adjusted for energy efficient operation as described in PART 3.
4. Typical TAB procedures and critical path results shall be demonstrated to the Resident Engineer for one air distribution system (including all fans, three terminal units, three rooms randomly selected by the COR one of which shall be a critical path) and one hydronic system (pumps and three coils) as follows:
   a. When field TAB work begins.
   b. During each partial final inspection and the final inspection for the project if requested by VA.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
B. Submit names and qualifications of TAB agency and TAB specialists within 60 days after the notice to proceed. Submit information on three recently completed projects and a list of proposed test equipment.
C. For use by the Resident Engineer staff, submit one complete set of applicable AABC, NEBB or TABB publications that will be the basis of TAB work.
D. Submit Following for Review and Approval:
   1. Design Review Report within 90 days for conventional design projects after the system layout on air and water side is completed by the Contractor.
   2. Systems inspection report on equipment and installation for conformance with design.
   3. Duct Air Leakage Test Report.
   4. Systems Readiness Report.

5. Intermediate and Final TAB reports covering flow balance and adjustments, performance tests, vibration tests and sound tests.
6. Include in final reports uncorrected installation deficiencies noted during TAB and applicable explanatory comments on test results that differ from design requirements.
7. Include in each report the critical path for each balanced branch (air and hydronic. Every branch shall have at least one terminal device damper 100% open.

E. Prior to request for Final or Partial Final inspection, submit completed Test and Balance report for the area with noted critical paths.

1.5 APPLICABLE PUBLICATIONS

A. The following publications form a part of this specification to the extent indicated by the reference thereto. In text the publications are referenced to by the acronym of the organization.

B. American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE):

Handbook 2019.....HVAC Applications ASHRAE Handbook, Chapter 39, Testing, Adjusting, and Balancing and Chapter 49, Sound and Vibration Control

C. Associated Air Balance Council (AABC):

7th Edition 2016 .....AABC National Standards for Total System Balance

D. National Environmental Balancing Bureau (NEBB):

9th Edition 2019 .....Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems

3rd Edition 2015 .....Procedural Standards for the Measurement of Sound and Vibration

2rd Edition 2019 ... Standard for Whole Building Technical Commissioning of New Construction

E. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):

3rd Edition 2005 .....HVAC SYSTEMS Testing, Adjusting and Balancing TABB- TAB Procedural Guide

PART 2 - PRODUCTS

2.1 PLUGS

Provide plastic plugs to seal holes drilled in ductwork for test purposes.

PART 3 - EXECUTION

3.1 GENERAL

A. Refer to TAB Criteria in Article, Quality Assurance.

B. Obtain applicable contract documents and copies of approved submittals for HVAC equipment and automatic control systems.

3.2 DESIGN REVIEW REPORT

The TAB Specialist shall review the Contract Plans and specifications and advise the Resident Engineer of any design deficiencies that would prevent the HVAC systems from effectively operating in accordance with the sequence of operation specified or prevent the effective and accurate TAB of the system. The TAB Specialist shall provide a report individually listing each deficiency and the corresponding proposed corrective action necessary for proper system operation.

3.3 SYSTEMS INSPECTION REPORT

A. Inspect equipment and installation for conformance with design.

B. The inspection and report is to be done after air distribution equipment is on site and duct installation has begun, but well in advance of performance testing and balancing work. The purpose of the inspection is to identify and report deviations from design and ensure that systems will be ready for TAB at the appropriate time.

C. Reports: Follow check list format developed by AABC, NEBB or SMACNA (TABB), supplemented by narrative comments, with emphasis on air handling units and fans. Check for conformance with submittals. Verify that diffuser and register sizes are correct. Check air terminal unit installation including their duct sizes and routing.

3.5 SYSTEM READINESS REPORT

A. The TAB Contractor shall measure existing air and water flow rates associated with existing systems utilized to serve renovated areas as indicated on drawings. Submit report of findings to resident engineer.

B. Inspect each System to ensure that it is complete including installation and operation of controls. Submit report to RE in standard format and forms prepared and or approved by the Commissioning Agent.

C. Verify that all items such as ductwork piping, dampers, valves, ports, terminals, connectors, etc., that is required for TAB are installed. Provide a report to the Resident Engineer.

3.6 TAB REPORTS

A. The TAB contractor shall provide raw data immediately in writing to the Resident Engineer if there is a problem in achieving intended results before submitting a formal report.

3.7 TAB PROCEDURES

A. TAB shall be performed in accordance with the requirement of the Standard under which TAB agency is certified by either AABC, TABB or NEBB. Balancing shall be done proportionally to all applicable systems.
   1. At least one trunk damper shall be 100% open.
   2. At least one branch damper shall be 100%open per trunk.
   3. At least one terminal device duct be 100% open per branch.

B. General: During TAB all related system components shall be in full operation. Fan and pump rotation, motor loads and equipment vibration shall be checked and corrected as necessary before proceeding with TAB. Set controls and/or block off parts of distribution systems to simulate design operation of variable volume air or water systems for test and balance work.

C. Coordinate TAB procedures with existing systems and any phased construction completion requirements for the project. Provide TAB reports for pre-construction air and water flow rate and for each phase of the project prior to partial final inspections of each phase of the project. Return existing areas outside the work area to pre constructed conditions.

E. Air Balance and Equipment Test: Include air handling units, fans, terminal units, fan coil units, room diffusers/outlets/inlets, computer room AC units, and laboratory fume hoods and biological safety cabinets.
   1. Artificially load air filters by partial blanking to produce static air pressure drop of manufacturer’s recommended pressure drop.
   2. Adjust fan speeds to provide design air flow. V-belt drives, including fixed pitch pulley requirements, are specified in Section 23 05 11, COMMON WORK RESULTS FOR HVAC
   3. Test and balance systems in all specified modes of operation, including variable volume, economizer, and fire emergency modes. Verify that dampers and other HVAC controls function properly.
   4. Variable air volume (VAV) systems:
      a. Balance air distribution from ATU on full cooling maximum scheduled cubic meters per minute (cubic feet per minute). Reset

room thermostats and check ATU operation from maximum to minimum cooling, to the heating mode, and back to cooling. Record and report the heating coil leaving air temperature when the ATU is in the maximum heating mode. Record and report outdoor air flow rates under all operating conditions (The test shall demonstrate that the minimum outdoor air ventilation rate shall remain constant under al operating conditions).

b. Adjust operating pressure control setpoint to maintain the design flow to each space with the lowest setpoint.

5. Record final measurements for air handling equipment performance data sheets.

F. Water Balance and Equipment Test: Include circulating pumps, convertors, coils, coolers and condensers:

1. Adjust flow rates for equipment. Set coils and evaporator to values on equipment submittals, if different from values on contract drawings.
2. Record final measurements for hydronic equipment on performance data sheets. Include entering and leaving water temperatures for heating and cooling coils, and for convertors. Include entering and leaving air temperatures (DB/WB for cooling coils) for air handling units and reheat coils. Make air and water temperature measurements at the same time.

3.8 MARKING OF SETTINGS

Following approval of Tab final Report, the setting of all HVAC adjustment devices including valves, splitters and dampers shall be permanently marked by the TAB Specialist so that adjustment can be restored if disturbed at any time. Style and colors used for markings shall be coordinated with the Resident Engineer.

3.9 IDENTIFICATION OF TEST PORTS

The TAB Specialist shall permanently and legibly identify the location points of duct test ports. If the ductwork has exterior insulation, the identification shall be made on the exterior side of the insulation. All penetrations through ductwork and ductwork insulation shall be sealed to prevent air leaks and maintain integrity of vapor barrier.

3.10 PHASING

A. Phased Projects: Testing and Balancing Work to follow project with areas shall be completed per the project phasing. Upon completion of

the project all areas shall have been tested and balanced per the contract documents.

B. Existing Areas: Systems that serve areas outside of the project scope shall not be adversely affected. Measure existing parameters where shown to document system capacity.

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SECTION 26 05 11
REQUIREMENTS FOR ELECTRICAL INSTALLATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section applies to all sections of Division 26.

B. Furnish and install electrical systems, materials, equipment, and accessories in accordance with the specifications and drawings. Capacities and ratings of motors, transformers, conductors and cable, switchboards, switchgear, panelboards, motor control centers, generators, automatic transfer switches, and other items and arrangements for the specified items are shown on the drawings.

C. Electrical service entrance equipment and arrangements for temporary and permanent connections to the electric utility company’s system shall conform to the electric utility company's requirements. Coordinate fuses, circuit breakers and relays with the electric utility company’s system, and obtain electric utility company approval for sizes and settings of these devices.

D. Conductor ampacities specified or shown on the drawings are based on copper conductors, with the conduit and raceways sized per NEC. Aluminum conductors are prohibited.

1.2 MINIMUM REQUIREMENTS

A. The latest International Building Code (IBC), Underwriters Laboratories, Inc. (UL), Institute of Electrical and Electronics Engineers (IEEE), and National Fire Protection Association (NFPA) codes and standards are the minimum requirements for materials and installation.

B. The drawings and specifications shall govern in those instances where requirements are greater than those stated in the above codes and standards.

1.3 TEST STANDARDS

A. All materials and equipment shall be listed, labeled, or certified by a Nationally Recognized Testing Laboratory (NRTL) to meet Underwriters Laboratories, Inc. (UL), standards where test standards have been established. Materials and equipment which are not covered by UL standards will be accepted, providing that materials and equipment are listed, labeled, certified or otherwise determined to meet the safety requirements of a NRTL. Materials and equipment which no NRTL accepts,

certifies, lists, labels, or determines to be safe, will be considered if inspected or tested in accordance with national industrial standards, such as ANSI, NEMA, and NETA. Evidence of compliance shall include certified test reports and definitive shop drawings.

B. Definitions:

1. Listed: Materials and equipment included in a list published by an organization that is acceptable to the Authority Having Jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production or listed materials and equipment or periodic evaluation of services, and whose listing states that the materials and equipment either meets appropriate designated standards or has been tested and found suitable for a specified purpose.
2. Labeled: Materials and equipment to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the Authority Having Jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled materials and equipment, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.
3. Certified: Materials and equipment which:
   a. Have been tested and found by a NRTL to meet nationally recognized standards or to be safe for use in a specified manner.
   b. Are periodically inspected by a NRTL.
   c. Bear a label, tag, or other record of certification.
4. Nationally Recognized Testing Laboratory: Testing laboratory which is recognized and approved by the Secretary of Labor in accordance with OSHA regulations.

1.4 QUALIFICATIONS (PRODUCTS AND SERVICES)

A. Manufacturer’s Qualifications: The manufacturer shall regularly and currently produce, as one of the manufacturer's principal products, the materials and equipment specified for this project, and shall have manufactured the materials and equipment for at least three years.

B. Product Qualification:

1. Manufacturer's materials and equipment shall have been in satisfactory operation, on three installations of similar size and type as this project, for at least three years.

2. The Government reserves the right to require the Contractor to submit a list of installations where the materials and equipment have been in operation before approval.

C. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within four hours of receipt of notification that service is needed. Submit name and address of service organizations.

1.5 APPLICABLE PUBLICATIONS

A. Applicable publications listed in all Sections of Division 26 shall be the latest issue, unless otherwise noted.

B. Products specified in all sections of Division 26 shall comply with the applicable publications listed in each section.

1.6 MANUFACTURED PRODUCTS

A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, and for which replacement parts shall be available. Materials and equipment furnished shall be new, and shall have superior quality and freshness.

B. When more than one unit of the same class or type of materials and equipment is required, such units shall be the product of a single manufacturer.

C. Equipment Assemblies and Components:

1. Components of an assembled unit need not be products of the same manufacturer.
2. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.
3. Components shall be compatible with each other and with the total assembly for the intended service.
4. Constituent parts which are similar shall be the product of a single manufacturer.

D. Factory wiring and terminals shall be identified on the equipment being furnished and on all wiring diagrams.

E. When Factory Tests are specified, Factory Tests shall be performed in the factory by the equipment manufacturer, and witnessed by the

contractor. In addition, the following requirements shall be complied with:

1. The Government shall have the option of witnessing factory tests. The Contractor shall notify the Government through the COR a minimum of thirty (30) days prior to the manufacturer's performing of the factory tests.
2. When factory tests are successful, contractor shall furnish four (4) copies of the equipment manufacturer's certified test reports to the COR fourteen (14) days prior to shipment of the equipment, and not more than ninety (90) days after completion of the factory tests.
3. When factory tests are not successful, factory tests shall be repeated in the factory by the equipment manufacturer, and witnessed by the Contractor. The Contractor shall be liable for all additional expenses for the Government to witness factory re-testing.

1.7 VARIATIONS FROM CONTRACT REQUIREMENTS

A. Where the Government or the Contractor requests variations from the contract requirements, the connecting work and related components shall include, but not be limited to additions or changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels and installation methods.

1.8 MATERIALS AND EQUIPMENT PROTECTION

A. Materials and equipment shall be protected during shipment and storage against physical damage, vermin, dirt, corrosive substances, fumes, moisture, cold, freeze and rain.
   1. Store materials and equipment indoors in clean dry space with uniform temperature to prevent condensation.
   2. During installation, equipment shall be protected against entry of foreign matter, and be vacuum-cleaned both inside and outside before testing and operating. Compressed air shall not be used to clean equipment. Remove loose packing and flammable materials from inside equipment.
   3. Damaged equipment shall be repaired or replaced, as determined by the COR.
   4. Painted surfaces shall be protected with factory installed removable heavy kraft paper, sheet vinyl or equal.

5. Damaged paint on equipment shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.

1.9 WORK PERFORMANCE

A. All electrical work shall comply with requirements of the latest NFPA 70 (NEC), NFPA 70B, NFPA 70E, NFPA 99, NFPA 110, NFPA 780, OSHA Part 1910 subpart J - General Environmental Controls, OSHA Part 1910 subpart K - Medical and First Aid, and OSHA Part 1910 subpart S - Electrical, in addition to other references required by contract.

B. Job site safety and worker safety is the responsibility of the Contractor.

C. Electrical work shall be accomplished with all affected circuits or equipment de-energized. However, energized electrical work may be performed only for the non-destructive and non-invasive diagnostic testing(s), or when scheduled outage poses an imminent hazard to patient care, safety, or physical security. In such case, all aspects of energized electrical work, such as the availability of appropriate/correct personal protective equipment (PPE) and the use of PPE, shall comply with the latest NFPA 70E, as well as the following requirements:

1. Only Qualified Person(s) shall perform energized electrical work. Supervisor of Qualified Person(s) shall witness the work of its entirety to ensure compliance with safety requirements and approved work plan.
2. At least two weeks before initiating any energized electrical work, the Contractor and the Qualified Person(s) who is designated to perform the work shall visually inspect, verify and confirm that the work area and electrical equipment can safely accommodate the work involved.
3. At least two weeks before initiating any energized electrical work, the Contractor shall develop and submit a job specific work plan, and energized electrical work request to the COR, and Medical Center’s Chief Engineer or his/her designee. At the minimum, the work plan must include relevant information such as proposed work schedule, area of work, description of work, name(s) of Supervisor and Qualified Person(s) performing the work, equipment to be used, procedures to be used on and near the live electrical equipment,

barriers to be installed, safety equipment to be used, and exit pathways.

4. Energized electrical work shall begin only after the Contractor has obtained written approval of the work plan, and the energized electrical work request from the COR, and Medical Center's Chief Engineer or his/her designee. The Contractor shall make these approved documents present and available at the time and place of energized electrical work.
5. Energized electrical work shall begin only after the Contractor has invited and received acknowledgment from the COR, and Medical Center's Chief Engineer or his/her designee to witness the work.

D. For work that affects existing electrical systems, arrange, phase and perform work to assure minimal interference with normal functioning of the facility. Refer to Article OPERATIONS AND STORAGE AREAS under Section 01 00 00, GENERAL REQUIREMENTS.

E. New work shall be installed and connected to existing work neatly, safely and professionally. Disturbed or damaged work shall be replaced or repaired to its prior conditions, as required by Section 01 00 00, GENERAL REQUIREMENTS.

F. Coordinate location of equipment and conduit with other trades to minimize interference.

1.10 EQUIPMENT INSTALLATION AND REQUIREMENTS

A. Equipment location shall be as close as practical to locations shown on the drawings.

B. Working spaces or working clearances shall comply with NEC's requirements, at a minimum.

C. Inaccessible Equipment:

1. Where the Government determines that the Contractor has installed equipment not readily accessible for operation and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the Government.
2. "Readily accessible" is defined as being capable of being reached quickly for operation, maintenance, or inspections without the use of ladders, or without climbing or crawling under or over obstacles such as, but not limited to, motors, pumps, belt guards, transformers, piping, ductwork, conduit and raceways.

D. Electrical service entrance equipment and arrangements for temporary and permanent connections to the electric utility company's system

shall conform to the electric utility company's requirements. Coordinate fuses, circuit breakers and relays with the electric utility company’s system, and obtain electric utility company approval for sizes and settings of these devices.

1.11 EQUIPMENT IDENTIFICATION

A. In addition to the requirements of the NEC, install an identification sign which clearly indicates information required for use and maintenance of items such as switchboards and switchgear, panelboards, cabinets, motor controllers, fused and non-fused safety switches, generators, automatic transfer switches, separately enclosed circuit breakers, individual breakers and controllers in switchboards, switchgear and motor control assemblies, control devices and other significant equipment.

B. Identification signs for Normal Power System equipment shall be laminated black phenolic resin with a white core with engraved lettering. Identification signs for Essential Electrical System (EES) equipment, as defined in the NEC, shall be laminated red phenolic resin with a white core with engraved lettering. Lettering shall be a minimum of 12 mm (1/2 inch) high. Identification signs shall indicate equipment designation, rated bus amperage, voltage, number of phases, number of wires, and type of EES power branch as applicable. Secure nameplates with screws.

C. Install adhesive arc flash warning labels on all equipment as required by the latest NFPA 70E. Label shall show specific and correct information for specific equipment based on its arc flash calculations. Label shall show the followings:

1. Nominal system voltage.
2. Equipment/bus name, date prepared, and manufacturer name and address.
3. Arc flash boundary.
4. Available arc flash incident energy and the corresponding working distance.
5. Minimum arc rating of clothing.
6. Site-specific level of PPE.

1.12 SUBMITTALS

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

B. The Government's approval shall be obtained for all materials and equipment before delivery to the job site. Delivery, storage or installation of materials and equipment which has not had prior approval will not be permitted.

C. All submittals shall include six copies of adequate descriptive literature, catalog cuts, shop drawings, test reports, certifications, samples, and other data necessary for the Government to ascertain that the proposed materials and equipment comply with drawing and specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify specific materials and equipment being submitted.

D. Submittals for individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered for approval.

1. Mark the submittals, "SUBMITTED UNDER SECTION_____".
2. Submittals shall be marked to show specification reference including the section and paragraph numbers.
3. Submit each section separately.

E. The submittals shall include the following:

1. Information that confirms compliance with contract requirements. Include the manufacturer's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, manuals, pictures, nameplate data, and test reports as required.

3. Elementary and interconnection wiring diagrams for communication and signal systems, control systems, and equipment assemblies. All terminal points and wiring shall be identified on wiring diagrams.
4. Parts list which shall include information for replacement parts and ordering instructions, as recommended by the equipment manufacturer.

F. Maintenance and Operation Manuals:

1. Submit as required for systems and equipment specified in the technical sections. Furnish in hardcover binders or an approved equivalent.
2. Inscribe the following identification on the cover: the words "MAINTENANCE AND OPERATION MANUAL," the name and location of the system, material, equipment, building, name of Contractor, and contract name and number. Include in the manual the names,

addresses, and telephone numbers of each subcontractor installing the system or equipment and the local representatives for the material or equipment.

3. Provide a table of contents and assemble the manual to conform to the table of contents, with tab sheets placed before instructions covering the subject. The instructions shall be legible and easily read, with large sheets of drawings folded in.
4. The manuals shall include:
   a. Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of the equipment.
   b. A control sequence describing start-up, operation, and shutdown.
   c. Description of the function of each principal item of equipment.
   d. Installation instructions.
   e. Safety precautions for operation and maintenance.
   f. Diagrams and illustrations.
   g. Periodic maintenance and testing procedures and frequencies, including replacement parts numbers.
   h. Performance data.
   i. Pictorial "exploded" parts list with part numbers. Emphasis shall be placed on the use of special tools and instruments. The list shall indicate sources of supply, recommended spare and replacement parts, and name of servicing organization.
   j. List of factory approved or qualified permanent servicing organizations for equipment repair and periodic testing and maintenance, including addresses and factory certification qualifications.

G. Approvals will be based on complete submission of shop drawings, manuals, test reports, certifications, and samples as applicable.

H. After approval and prior to installation, furnish the COR with one sample of each of the following:
   1. A minimum 300 mm (12 inches) length of each type and size of wire and cable along with the tag from the coils or reels from which the sample was taken. The length of the sample shall be sufficient to show all markings provided by the manufacturer.
   2. Each type of conduit coupling, bushing, and termination fitting.
   3. Conduit hangers, clamps, and supports.
   4. Duct sealing compound.

5. Each type of receptacle, toggle switch, lighting control sensor, outlet box, manual motor starter, device wall plate, engraved nameplate, wire and cable splicing and terminating material, and branch circuit single pole molded case circuit breaker.

1.13 SINGULAR NUMBER

A. Where any device or part of equipment is referred to in these specifications in the singular number (e.g., "the switch"), this reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the drawings.

1.15 ACCEPTANCE CHECKS AND TESTS

A. The Contractor shall furnish the instruments, materials, and labor for tests.

B. Where systems are comprised of components specified in more than one section of Division 26, the Contractor shall coordinate the installation, testing, and adjustment of all components between various manufacturer’s representatives and technicians so that a complete, functional, and operational system is delivered to the Government.

C. When test results indicate any defects, the Contractor shall repair or replace the defective materials or equipment, and repeat the tests for the equipment. Repair, replacement, and re-testing shall be accomplished at no additional cost to the Government.

1.16 WARRANTY

A. All work performed and all equipment and material furnished under this Division shall be free from defects and shall remain so for a period of one year from the date of acceptance of the entire installation by the Contracting Officer for the Government.

1.17 INSTRUCTION

A. Instruction to designated Government personnel shall be provided for the particular equipment or system as required in each associated technical specification section.

B. Furnish the services of competent and factory-trained instructors to give full instruction in the adjustment, operation, and maintenance of the specified equipment and system, including pertinent safety requirements. Instructors shall be thoroughly familiar with all aspects of the installation, and shall be factory-trained in operating theory as well as practical operation and maintenance procedures.

C. A training schedule shall be developed and submitted by the Contractor and approved by the COR at least 30 days prior to the planned training.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

---END---

SECTION 26 05 19
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, connection, and testing of the electrical conductors and cables for use in electrical systems rated 600 V and below, indicated as cable(s), conductor(s), wire, or wiring in this section.

1.2 RELATED WORK

A. Section 07 84 00, FIRESTOPPING: Sealing around penetrations to maintain the integrity of fire-resistant rated construction.

B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.

C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

D. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits for conductors and cables.

1.3 QUALITY ASSURANCE

A. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit in accordance with Paragraph, SUBMITTALS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:

1. Shop Drawings:
   a. Submit sufficient information to demonstrate compliance with drawings and specifications.
   b. Submit the following data for approval:
      1) Electrical ratings and insulation type for each conductor and cable.
      2) Splicing materials and pulling lubricant.
2. Certifications: Two weeks prior to final inspection, submit the following.
   a. Certification by the manufacturer that the conductors and cables conform to the requirements of the drawings and specifications.

b. Certification by the Contractor that the conductors and cables have been properly installed, adjusted, and tested.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are reference in the text by designation only.

B. American Society of Testing Material (ASTM):

D2301-10.....Standard Specification for Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape

D2304-18.....Test Method for Thermal Endurance of Rigid Electrical Insulating Materials

D3005-17.....Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape

C. National Electrical Manufacturers Association (NEMA):

WC 70-21.....Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy

D. National Fire Protection Association (NFPA):

70-23.....National Electrical Code (NEC)

E. Underwriters Laboratories, Inc. (UL):

44-18.....Thermoset-Insulated Wires and Cables

83-17.....Thermoplastic-Insulated Wires and Cables

467-13.....Grounding and Bonding Equipment

486A-486B-18.....Wire Connectors

486C-18.....Splicing Wire Connectors

486D-15.....Sealed Wire Connector Systems

486E-15.....Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors

493-18.....Thermoplastic-Insulated Underground Feeder and Branch Circuit Cables

514B-12.....Conduit, Tubing, and Cable Fittings

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Conductors and cables shall be in accordance with ASTM, NEMA, NFPA, UL, as specified herein, and as shown on the drawings.

B. Conductors shall be copper.

C. Single Conductor:

1. No. 12 AWG: Minimum size, except where smaller sizes are specified herein or shown on the drawings.
2. No. 8 AWG and larger: Stranded.
3. No. 10 AWG and smaller: Solid; except shall be stranded for final connection to motors, transformers, and vibrating equipment.
4. Insulation: THHN-THWN and XHHW-2. XHHW-2 shall be used for isolated power systems.

E. Conductor Color Code:

1. No. 10 AWG and smaller: Solid color insulation or solid color coating.
2. No. 8 AWG and larger: Color-coded using one of the following methods:
   a. Solid color insulation or solid color coating.
   b. Stripes, bands, or hash marks of color specified.
   c. Color using 19 mm (0.75 inches) wide tape.
4. For modifications and additions to existing wiring systems, color coding shall conform to the existing wiring system.
5. Conductors shall be color-coded as follows:

208/120 V	Phase	480/277 V
Black	A	Brown
Red	B	Orange
Blue	C	Yellow
White	Neutral	Gray *
* or white with colored (other than green) tracer.		

6. Lighting circuit “switch legs”, and 3-way and 4-way switch “traveling wires,” shall have color coding that is unique and distinct (e.g., pink and purple) from the color coding indicated above. The unique color codes shall be solid and in accordance with the NEC. Coordinate color coding in the field with the COR.

2.2 SPLICES

A. Splices shall be in accordance with NEC and UL.

B. Above Ground Splices for No. 10 AWG and Smaller:

1. Solderless, screw-on, reusable pressure cable type, with integral insulation, approved for copper and aluminum conductors.
2. The integral insulator shall have a skirt to completely cover the stripped conductors.

3. The number, size, and combination of conductors used with the connector, as listed on the manufacturer's packaging, shall be strictly followed.

C. Above Ground Splices for No. 8 AWG to No. 4/0 AWG:
1. Compression, hex screw, or bolt clamp-type of high conductivity and corrosion-resistant material, listed for use with copper and aluminum conductors.
2. Insulate with materials approved for the particular use, location, voltage, and temperature. Insulation level shall be not less than the insulation level of the conductors being joined.
3. Splice and insulation shall be product of the same manufacturer.
4. All bolts, nuts, and washers used with splices shall be zinc-plated steel.

D. Above Ground Splices for 250 kcmil and Larger:
1. Long barrel "butt-splice" or "sleeve" type compression connectors, with minimum of two compression indents per wire, listed for use with copper and aluminum conductors.
2. Insulate with materials approved for the particular use, location, voltage, and temperature. Insulation level shall be not less than the insulation level of the conductors being joined.
3. Splice and insulation shall be product of the same manufacturer.

2.3 CONNECTORS AND TERMINATIONS

A. Mechanical type of high conductivity and corrosion-resistant material, listed for use with copper and aluminum conductors.

B. Long barrel compression type of high conductivity and corrosion-resistant material, with minimum of two compression indents per wire, listed for use with copper and aluminum conductors.

C. All bolts, nuts, and washers used to connect connections and terminations to bus bars or other termination points shall be zinc-plated steel.

2.4 CONTROL WIRING

A. Unless otherwise specified elsewhere in these specifications, control wiring shall be as specified herein, except that the minimum size shall be not less than No. 14 AWG, or as required by the control wiring equipment manufacturer.

B. Control wiring shall be sized such that the voltage drop under in-rush conditions does not adversely affect operation of the controls.

2.5 WIRE LUBRICATING COMPOUND

A. Lubricating compound shall be suitable for the wire insulation and conduit, and shall not harden or become adhesive.

B. Shall not be used on conductors for isolated power systems.

PART 3 - EXECUTION

3.1 GENERAL

A. Installation shall be in accordance with the NEC, as shown on the drawings, and manufacturer's instructions.

B. Install conductors in raceway systems.

C. Splice conductors only in outlet boxes, junction boxes, or pullboxes.

D. Conductors of different systems (e.g., 120 V and 277 V) shall not be installed in the same raceway.

E. For conductors installed in vertical raceways, provide conductor support (also known as cable support), to counter gravity pull on conductor weight. Conductor support shall be split-wedge conductor support type. Prior to installing the conductor support plug, remove all pulling compound from conductors where they pass through the conductor support body. After installing the conductor support plug, tap the conductor support plug firmly in the conductor support body.

F. In panelboards, cabinets, wireways, switches, enclosures, and equipment assemblies, neatly form, train, and tie the conductors with non-metallic "zip" ties.

G. For connections to motors, transformers, and vibrating equipment, stranded conductors shall be used only from the last fixed point of connection to the motors, transformers, or vibrating equipment.

H. Use expanding foam or non-hardening duct-seal to seal conduits entering a building, after installation of conductors.

I. Conductor Pulling:

1. Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling. Use lubricants approved for the cable.
2. Use nonmetallic pull ropes.
3. Attach pull ropes by means of either woven basket grips or pulling eyes attached directly to the conductors.
4. All conductors in a single conduit shall be pulled simultaneously.
5. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

J. Number of conductors for branch circuits shall not exceed more than three branch circuits in any one conduit.

K. When stripping stranded conductors, use a tool that does not damage the conductor or remove conductor strands.

3.3 SPLICE AND TERMINATION INSTALLATION

A. Splices and terminations shall be mechanically and electrically secure, and tightened to manufacturer's published torque values using a torque screwdriver or wrench.

B. Where the Government determines that unsatisfactory splices or terminations have been installed, replace the splices or terminations at no additional cost to the Government.

3.4 CONDUCTOR IDENTIFICATION

A. When using colored tape to identify phase, neutral, and ground conductors larger than No. 8 AWG, apply tape in half-overlapping turns for a minimum of 75 mm (3 inches) from terminal points, and in junction boxes, pullboxes, and manholes. Apply the last two laps of tape with no tension to prevent possible unwinding. Where markings are covered by tape, apply tags to conductors, stating size and insulation type.

3.5 FEEDER CONDUCTOR IDENTIFICATION

A. In each interior pullbox and each underground manhole and handhole, install brass tags on all feeder conductors to clearly designate their circuit identification and voltage. The tags shall be the embossed type, 40 mm (1-1/2 inches) in diameter and 40 mils thick. Attach tags with plastic ties.

3.6 EXISTING CONDUCTORS

A. Unless specifically indicated on the plans, existing conductors shall not be reused.

3.7 CONTROL WIRING INSTALLATION

A. Unless otherwise specified in other sections, install control wiring and connect to equipment to perform the required functions as specified or as shown on the drawings.

B. Install a separate power supply circuit for each system, except where otherwise shown on the drawings.

3.8 CONTROL WIRING IDENTIFICATION

A. Install a permanent wire marker on each wire at each termination.

B. Identifying numbers and letters on the wire markers shall correspond to those on the wiring diagrams used for installing the systems.

C. Wire markers shall retain their markings after cleaning.

3.10 ACCEPTANCE CHECKS AND TESTS

A. Perform in accordance with the manufacturer's recommendations. In addition, include the following:

1. Visual Inspection and Tests: Inspect physical condition.
2. Electrical tests:
   a. After installation but before connection to utilization devices, such as fixtures, motors, or appliances, test conductors phase-to-phase and phase-to-ground resistance with an insulation resistance tester. Existing conductors to be reused shall also be tested.
   b. Applied voltage shall be 500 V DC for 300 V rated cable, and 1000 V DC for 600 V rated cable. Apply test for one minute or until reading is constant for 15 seconds, whichever is longer. Minimum insulation resistance values shall not be less than 25 megohms for 300 V rated cable and 100 megohms for 600 V rated cable.
   c. Perform phase rotation test on all three-phase circuits.

---END---

SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, connection, and testing of grounding and bonding equipment, indicated as grounding equipment in this section.

B. "Grounding electrode system" refers to grounding electrode conductors and all electrodes required or allowed by NEC, as well as made, supplementary, and lightning protection system grounding electrodes.

C. The terms "connect" and "bond" are used interchangeably in this section and have the same meaning.

1.2 RELATED WORK

A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.

B. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Low-voltage conductors.

C. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduit and boxes.

O. Section 26 41 00, FACILITY LIGHTNING PROTECTION: Lightning protection.

1.3 QUALITY ASSURANCE

A. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit in accordance with Paragraph, SUBMITTALS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:

1. Shop Drawings:
   a. Submit sufficient information to demonstrate compliance with drawings and specifications.
   b. Submit plans showing the location of system grounding electrodes and connections, and the routing of aboveground and underground grounding electrode conductors.
2. Test Reports:
   a. Two weeks prior to the final inspection, submit ground resistance field test reports to the COR.

3. Certifications:
   a. Certification by the Contractor that the grounding equipment has been properly installed and tested.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

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

B1-13.....Standard Specification for Hard-Drawn Copper Wire

B3-13(R2018).....Standard Specification for Soft or Annealed Copper Wire

B8-11(R2017).....Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

C. Institute of Electrical and Electronics Engineers, Inc. (IEEE):

81-12.....IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System Part 1: Normal Measurements

D. National Fire Protection Association (NFPA):

70-23.....National Electrical Code (NEC)

70E-21.....National Electrical Safety Code

99-21.....Health Care Facilities

E. Underwriters Laboratories, Inc. (UL):

44-18 .....Thermoset-Insulated Wires and Cables

83-17 .....Thermoplastic-Insulated Wires and Cables

467-13 .....Grounding and Bonding Equipment

PART 2 - PRODUCTS

2.1 GROUNDING AND BONDING CONDUCTORS

A. Equipment grounding conductors shall be insulated stranded copper, except that sizes No. 10 AWG and smaller shall be solid copper. Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes No. 4 AWG and larger shall be identified per NEC.

B. Bonding conductors shall be bare stranded copper, except that sizes No. 10 AWG and smaller shall be bare solid copper. Bonding conductors

shall be stranded for final connection to motors, transformers, and vibrating equipment.

C. Conductor sizes shall not be less than shown on the drawings, or not less than required by the NEC, whichever is greater.

D. Insulation: THHN-THWN and XHHW-2. XHHW-2 shall be used for isolated power systems.

2.4 GROUND CONNECTIONS

B. Above Grade:

1. Bonding Jumpers: Listed for use with aluminum and copper conductors. For wire sizes No. 8 AWG and larger, use compression-type connectors. For wire sizes smaller than No. 8 AWG, use mechanical type lugs. Connectors or lugs shall use zinc-plated steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.
2. Connection to Building Steel: Exothermic-welded type connectors.
3. Connection to Grounding Bus Bars: Listed for use with aluminum and copper conductors. Use mechanical type lugs, with zinc-plated steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.
4. Connection to Equipment Rack and Cabinet Ground Bars: Listed for use with aluminum and copper conductors. Use mechanical type lugs, with zinc-plated steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.

2.5 EQUIPMENT RACK AND CABINET GROUND BARS

A. Provide solid copper ground bars designed for mounting on the framework of open or cabinet-enclosed equipment racks. Ground bars shall have minimum dimensions of 6.3 mm (0.25 inch) thick x 19 mm (0.75 inch) wide, with length as required or as shown on the drawings. Provide insulators and mounting brackets.

2.6 GROUND TERMINAL BLOCKS

A. At any equipment mounting location (e.g., backboards and hinged cover enclosures) where rack-type ground bars cannot be mounted, provide mechanical type lugs, with zinc-plated steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.

2.7 GROUNDING BUS BAR

A. Pre-drilled rectangular copper bar with stand-off insulators, minimum 6.3 mm (0.25 inch) thick x 100 mm (4 inches) high in cross-section, length as shown on the drawings, with hole size, quantity, and spacing

per detail shown on the drawings. Provide insulators and mounting brackets.

PART 3 - EXECUTION

3.1 GENERAL

A. Installation shall be in accordance with the NEC, as shown on the drawings, and manufacturer's instructions.

B. System Grounding:

1. Secondary service neutrals: Ground at the supply side of the secondary disconnecting means and at the related transformer.
2. Separately derived systems (transformers downstream from the service entrance): Ground the secondary neutral.

C. Equipment Grounding: Metallic piping, building structural steel, electrical enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits, shall be bonded and grounded.

D. For patient care area electrical power system grounding, conform to the latest NFPA 70 and 99.

3.2 INACCESSIBLE GROUNDING CONNECTIONS

A. Make grounding connections, which are normally buried or otherwise inaccessible, by exothermic weld.

3.4 SECONDARY VOLTAGE EQUIPMENT AND CIRCUITS

A. Main Bonding Jumper: Bond the secondary service neutral to the ground bus in the service equipment.

B. Metallic Piping, Building Structural Steel, and Supplemental Electrode(s):

1. Provide a grounding electrode conductor sized per NEC between the service equipment ground bus and all metallic water pipe systems, building structural steel, and supplemental or made electrodes. Provide jumpers across insulating joints in the metallic piping.
2. Provide a supplemental ground electrode as shown on the drawings and bond to the grounding electrode system.

C. Electrical equipment:

1. Connect the equipment grounding conductors to the ground bus.
2. Connect metallic conduits by grounding bushings and equipment grounding conductor to the equipment ground bus.

3.5 RACEWAY

A. Conduit Systems:

1. Ground all metallic conduit systems. All metallic conduit systems shall contain an equipment grounding conductor.
2. Non-metallic conduit systems, except non-metallic feeder conduits that carry a grounded conductor from exterior transformers to interior or building-mounted service entrance equipment, shall contain an equipment grounding conductor.
3. Metallic conduit that only contains a grounding conductor, and is provided for its mechanical protection, shall be bonded to that conductor at the entrance and exit from the conduit.
4. Metallic conduits which terminate without mechanical connection to an electrical equipment housing by means of locknut and bushings or adapters, shall be provided with grounding bushings. Connect bushings with a equipment grounding conductor to the equipment ground bus.

B. Feeders and Branch Circuits: Install equipment grounding conductors with all feeders, and all branch circuits.

C. Boxes, Cabinets, Enclosures, and Panelboards:
1. Bond the equipment grounding conductor to each pullbox, junction box, outlet box, device box, cabinets, and other enclosures through which the conductor passes (except for special grounding systems for intensive care units and other critical units shown).
2. Provide lugs in each box and enclosure for equipment grounding conductor termination.

D. Wireway Systems:
1. Bond the metallic structures of wireway to provide electrical continuity throughout the wireway system, by connecting a No. 6 AWG bonding jumper at all intermediate metallic enclosures and across all section junctions.
2. Install insulated No. 6 AWG bonding jumpers between the wireway system, bonded as required above, and the closest building ground at each end and approximately every 16 M (50 feet).
3. Use insulated No. 6 AWG bonding jumpers to ground or bond metallic wireway at each end for all intermediate metallic enclosures and across all section junctions.
4. Use insulated No. 6 AWG bonding jumpers to ground cable tray to column-mounted building ground plates (pads) at each end and approximately every 15 M (49 feet).

E. Receptacles shall not be grounded through their mounting screws. Ground receptacles with a jumper from the receptacle green ground terminal to the device box ground screw and a jumper to the branch circuit equipment grounding conductor.

F. Ground lighting fixtures to the equipment grounding conductor of the wiring system. Fixtures connected with flexible conduit shall have a green ground wire included with the power wires from the fixture through the flexible conduit to the first outlet box.

G. Fixed electrical appliances and equipment shall be provided with a ground lug for termination of the equipment grounding conductor.

I. Panelboard Bonding in Patient Care Areas: The equipment grounding terminal buses of the normal and essential branch circuit panel boards serving the same individual patient vicinity shall be bonded together with an insulated continuous copper conductor not less than No. 10 AWG, installed in rigid metal conduit.

3.7 CORROSION INHIBITORS

A. When making grounding and bonding connections, apply a corrosion inhibitor to all contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between the metals used.

3.8 CONDUCTIVE PIPING

A. Bond all conductive piping systems, interior and exterior, to the grounding electrode system. Bonding connections shall be made as close as practical to the equipment ground bus.

B. In operating rooms and at intensive care and coronary care type beds, bond the medical gas piping and medical vacuum piping at the outlets directly to the patient ground bus.

3.9 LIGHTNING PROTECTION SYSTEM

A. Bond the lightning protection system to the electrical grounding electrode system.

3.12 GROUND RESISTANCE

A. Grounding system resistance to ground shall not exceed 5 ohms. Make any modifications or additions to the grounding electrode system necessary for compliance without additional cost to the Government. Final tests shall ensure that this requirement is met.

B. Grounding system resistance shall comply with the electric utility company ground resistance requirements.

3.13 GROUND ROD INSTALLATION

A. For outdoor installations, drive each rod vertically in the earth, until top of rod is 610 mm (24 inches) below final grade.

B. For indoor installations, leave 100 mm (4 inches) of each rod exposed.

C. Where buried or permanently concealed ground connections are required, make the connections by the exothermic process, to form solid metal joints. Make accessible ground connections with mechanical pressure-type ground connectors.

D. Where rock or impenetrable soil prevents the driving of vertical ground rods, install angled ground rods or grounding electrodes in horizontal trenches to achieve the specified ground resistance.

3.14 ACCEPTANCE CHECKS AND TESTS

B. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

---END---

SECTION 26 05 33
RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, and connection of conduit, fittings, and boxes, to form complete, coordinated, grounded raceway systems. Raceways are required for all wiring unless shown or specified otherwise.

B. Definitions: The term conduit, as used in this specification, shall mean any or all of the raceway types specified.

1.2 RELATED WORK

A. Section 06 10 00, ROUGH CARPENTRY: Mounting board for telephone closets.

B. Section 07 60 00, FLASHING AND SHEET METAL: Fabrications for the deflection of water away from the building envelope at penetrations.

C. Section 07 84 00, FIRESTOPPING: Sealing around penetrations to maintain the integrity of fire rated construction.

D. Section 07 92 00, JOINT SEALANTS: Sealing around conduit penetrations through the building envelope to prevent moisture migration into the building.

E. Section 09 91 00, PAINTING: Identification and painting of conduit and other devices.

G. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.

H. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

1.3 QUALITY ASSURANCE

A. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit in accordance with Paragraph, SUBMITTALS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:

1. Shop Drawings:

a. Size and location of main feeders.
b. Size and location of panels and pull-boxes.
c. Layout of required conduit penetrations through structural elements.
d. Submit the following data for approval:
1) Raceway types and sizes.
2) Conduit bodies, connectors and fittings.
3) Junction and pull boxes, types and sizes.

2. Certifications: Two weeks prior to final inspection, submit the following:
a. Certification by the manufacturer that raceways, conduits, conduit bodies, connectors, fittings, junction and pull boxes, and all related equipment conform to the requirements of the drawings and specifications.
b. Certification by the Contractor that raceways, conduits, conduit bodies, connectors, fittings, junction and pull boxes, and all related equipment have been properly installed.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

B. American Iron and Steel Institute (AISI):
S100-16.....North American Specification for the Design of Cold-Formed Steel Structural Members

C. National Electrical Manufacturers Association (NEMA):
C80.1-20.....Electrical Rigid Steel Conduit
C80.3-20.....Steel Electrical Metal Tubing
C80.6-18.....Electrical Intermediate Metal Conduit
FB1-14.....Fittings, Cast Metal Boxes and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable
FB2.10-21.....Selection and Installation Guidelines for Fittings for use with Non-Flexible Conduit or Tubing (Rigid Metal Conduit, Intermediate Metallic Conduit, and Electrical Metallic Tubing)

FB2.20-21.....Selection and Installation Guidelines for Fittings for use with Flexible Electrical Conduit and Cable

TC-2-20.....Electrical Polyvinyl Chloride (PVC) Tubing and Conduit

TC-3-21.....PVC Fittings for Use with Rigid PVC Conduit and Tubing

D. National Fire Protection Association (NFPA):

70-23.....National Electrical Code (NEC)

E. Underwriters Laboratories, Inc. (UL):

1-05.....Flexible Metal Conduit

5-16.....Surface Metal Raceway and Fittings

6-07.....Electrical Rigid Metal Conduit - Steel

50-15.....Enclosures for Electrical Equipment

360-13.....Liquid-Tight Flexible Steel Conduit

467-13.....Grounding and Bonding Equipment

514A-13.....Metallic Outlet Boxes

514B-12.....Conduit, Tubing, and Cable Fittings

514C-14.....Nonmetallic Outlet Boxes, Flush-Device Boxes and Covers

651-11.....Schedule 40 and 80 Rigid PVC Conduit and Fittings

651A-11.....Type EB and A Rigid PVC Conduit and HDPE Conduit

797-07.....Electrical Metallic Tubing

1242-06.....Electrical Intermediate Metal Conduit - Steel

PART 2 - PRODUCTS

2.1 MATERIAL

A. Conduit Size: In accordance with the NEC, but not less than 13 mm (0.5-inch) unless otherwise shown. Where permitted by the NEC, 13 mm (0.5-inch) flexible conduit may be used for tap connections to recessed lighting fixtures.

B. Conduit:

1. Size: In accordance with the NEC, but not less than 13 mm (0.5-inch).
2. Rigid Steel Conduit (RMC): Shall conform to UL 6 and NEMA C80.1.

4. Rigid Intermediate Steel Conduit (IMC): Shall conform to UL 1242 and NEMA C80.6.
5. Electrical Metallic Tubing (EMT): Shall conform to UL 797 and NEMA C80.3. Maximum size not to exceed 105 mm (4 inches) and shall be permitted only with cable rated 600 V or less.
6. Flexible Metal Conduit: Shall conform to UL 1.
7. Liquid-tight Flexible Metal Conduit: Shall conform to UL 360.
9. Surface Metal Raceway: Shall conform to UL 5.

C. Conduit Fittings:

1. Rigid Steel and Intermediate Metallic Conduit Fittings:
   a. Fittings shall meet the requirements of UL 514B and NEMA FB1.
   b. Standard threaded couplings, locknuts, bushings, conduit bodies, and elbows: Only steel or malleable iron materials are acceptable. Integral retractable type IMC couplings are also acceptable.
   c. Locknuts: Bonding type with sharp edges for digging into the metal wall of an enclosure.
   d. Bushings: Metallic insulating type, consisting of an insulating insert, molded or locked into the metallic body of the fitting. Bushings made entirely of metal or nonmetallic material are not permitted.
   e. Erickson (Union-Type) and Set Screw Type Couplings: Approved for use in concrete are permitted for use to complete a conduit run where conduit is installed in concrete. Use set screws of case-hardened steel with hex head and cup point to firmly seat in conduit wall for positive ground. Tightening of set screws with pliers is prohibited.
   f. Sealing Fittings: Threaded cast iron type. Use continuous drain-type sealing fittings to prevent passage of water vapor. In concealed work, install fittings in flush steel boxes with blank cover plates having the same finishes as that of other electrical plates in the room.
3. Electrical Metallic Tubing Fittings:
   a. Fittings and conduit bodies shall meet the requirements of UL 514B, NEMA C80.3, and NEMA FB1.
   b. Only steel or malleable iron materials are acceptable.
   c. Set Screw Couplings and Connectors: Use setscrews of case-hardened steel with hex head and cup point, to firmly seat in

3. Electrical Metallic Tubing Fittings:
   a. Fittings and conduit bodies shall meet the requirements of UL 514B, NEMA C80.3, and NEMA FB1.
   b. Only steel or malleable iron materials are acceptable.
   c. Set Screw Couplings and Connectors: Use setscrews of case-hardened steel with hex head and cup point, to firmly seat in wall of conduit for positive grounding. Connector shall have insulated throat.
   d. Indent-type connectors or couplings are prohibited.
   e. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.
4. Flexible Metal Conduit Fittings:
   a. Conform to UL 514B. Only steel or malleable iron materials are acceptable.
   b. Clamp-type, with insulated throat.
5. Liquid-tight Flexible Metal Conduit Fittings:
   a. Fittings shall meet the requirements of UL 514B and NEMA FB1.
   b. Only steel or malleable iron materials are acceptable.
   c. Fittings must incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening. Connectors shall have insulated throats.
7. Surface Metal Raceway Fittings: As recommended by the raceway manufacturer. Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, conduit entry fittings, accessories, and other fittings as required for complete system.
8. Expansion and Deflection Couplings:
   a. Conform to UL 467 and UL 514B.
   b. Accommodate a 19 mm (0.75-inch) deflection, expansion, or contraction in any direction, and allow 30 degree angular deflections.
   c. Include internal flexible metal braid, sized to guarantee conduit ground continuity and a low-impedance path for fault currents, in accordance with UL 467 and the NEC tables for equipment grounding conductors.
   d. Jacket: Flexible, corrosion-resistant, watertight, moisture and heat-resistant molded rubber material with stainless steel jacket clamps.

D. Conduit Supports:

7. Surface Metal Raceway Fittings: As recommended by the raceway manufacturer. Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, conduit entry fittings, accessories, and other fittings as required for complete system.
8. Expansion and Deflection Couplings:
   a. Conform to UL 467 and UL 514B.
   b. Accommodate a 19 mm (0.75-inch) deflection, expansion, or contraction in any direction, and allow 30 degree angular deflections.
   c. Include internal flexible metal braid, sized to guarantee conduit ground continuity and a low-impedance path for fault currents, in accordance with UL 467 and the NEC tables for equipment grounding conductors.
   d. Jacket: Flexible, corrosion-resistant, watertight, moisture and heat-resistant molded rubber material with stainless steel jacket clamps.

D. Conduit Supports:
1. Parts and Hardware: Zinc-coat or provide equivalent corrosion protection.
2. Individual Conduit Hangers: Designed for the purpose, having a pre-assembled closure bolt and nut, and provisions for receiving a hanger rod.
3. Multiple Conduit (Trapeze) Hangers: Not less than 38 mm x 38 mm (1.5 x 1.5 inches), 12-gauge steel, cold-formed, lipped channels; with not less than 9 mm (0.375-inch) diameter steel hanger rods.
4. Solid Masonry and Concrete Anchors: Self-drilling expansion shields, or machine bolt expansion.

E. Outlet, Junction, and Pull Boxes:
1. Comply with UL-50 and UL-514A.
2. Rustproof cast metal where required by the NEC or shown on drawings.
3. Sheet Metal Boxes: Galvanized steel, except where shown on drawings.

F. Metal Wireways: Equip with hinged covers, except as shown on drawings. Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for a complete system.

F. Metal Wireways: Equip with hinged covers, except as shown on drawings. Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for a complete system.

PART 3 - EXECUTION

3.1 PENETRATIONS

A. Cutting or Holes:

1. Cut holes in advance where they should be placed in the structural elements, such as ribs or beams. Obtain the approval of the COR prior to drilling through structural elements.
2. Cut holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw. Pneumatic hammers, impact electric, hand, or manual hammer-type drills are not allowed, except when permitted by the COR where working space is limited.

B. Firestop: Where conduits, wireways, and other electrical raceways pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING.

C. Waterproofing: At floor, exterior wall, and roof conduit penetrations, completely seal the gap around conduit to render it watertight, as specified in Section 07 92 00, JOINT SEALANTS.

3.2 INSTALLATION, GENERAL

A. In accordance with NEC, NEMA, UL, as shown on drawings, and as specified herein.

B. Raceway systems used for Essential Electrical Systems (EES) shall be entirely independent of other raceway systems.

C. Install conduit as follows:

1. In complete mechanically and electrically continuous runs before pulling in cables or wires.
2. Unless otherwise indicated on the drawings or specified herein, installation of all conduits shall be concealed within finished walls, floors, and ceilings.
3. Flattened, dented, or deformed conduit is not permitted. Remove and replace the damaged conduits with new conduits.

4. Assure conduit installation does not encroach into the ceiling height head room, walkways, or doorways.
5. Cut conduits square, ream, remove burrs, and draw up tight.
6. Independently support conduit at 2.4 M (8 feet) on centers with specified materials and as shown on drawings.
7. Do not use suspended ceilings, suspended ceiling supporting members, lighting fixtures, other conduits, cable tray, boxes, piping, or ducts to support conduits and conduit runs.
8. Support within 300 mm (12 inches) of changes of direction, and within 300 mm (12 inches) of each enclosure to which connected.
9. Close ends of empty conduits with plugs or caps at the rough-in stage until wires are pulled in, to prevent entry of debris.
10. Conduit installations under fume and vent hoods are prohibited.
11. Secure conduits to cabinets, junction boxes, pull-boxes, and outlet boxes with bonding type locknuts. For rigid steel and IMC conduit installations, provide a locknut on the inside of the enclosure, made up wrench tight. Do not make conduit connections to junction box covers.
12. Flashing of penetrations of the roof membrane is specified in Section 07 60 00, FLASHING AND SHEET METAL.
13. Conduit bodies shall only be used for changes in direction, and shall not contain splices.

D. Conduit Bends:
1. Make bends with standard conduit bending machines.
2. Conduit hickey may be used for slight offsets and for straightening stubbed out conduits.
3. Bending of conduits with a pipe tee or vise is prohibited.

E. Layout and Homeruns:
1. Install conduit with wiring, including homeruns, as shown on drawings.
2. Deviations: Make only where necessary to avoid interferences and only after drawings showing the proposed deviations have been submitted and approved by the COR.

3.3 CONCEALED WORK INSTALLATION

A. In Concrete:
1. Conduit: Rigid steel, IMC, or EMT. Do not install EMT in concrete slabs that are in contact with soil, gravel, or vapor barriers.
2. Align and run conduit in direct lines.

1. Conduit: Rigid steel, IMC, or EMT. Do not install EMT in concrete slabs that are in contact with soil, gravel, or vapor barriers.
2. Align and run conduit in direct lines.
3. Install conduit through concrete beams only:
   a. Where shown on the structural drawings.
   b. As approved by the COR prior to construction, and after submittal of drawing showing location, size, and position of each penetration.
4. Installation of conduit in concrete that is less than 75 mm (3 inches) thick is prohibited.
   a. Conduit outside diameter larger than one-third of the slab thickness is prohibited.
   b. Space between conduits in slabs: Approximately six conduit diameters apart, and one conduit diameter at conduit crossings.
   c. Install conduits approximately in the center of the slab so that there will be a minimum of 19 mm (0.75-inch) of concrete around the conduits.
5. Make couplings and connections watertight. Use thread compounds that are UL approved conductive type to ensure low resistance ground continuity through the conduits. Tightening setscrews with pliers is prohibited.

B. Above Furred or Suspended Ceilings and in Walls:
   2. Conduit for Conductors 600 V and Below: Rigid steel, IMC, or EMT. Mixing different types of conduits in the same system is prohibited.
   3. Align and run conduit parallel or perpendicular to the building lines.
   4. Connect recessed lighting fixtures to conduit runs with maximum 1.8 M (6 feet) of flexible metal conduit extending from a junction box to the fixture.
   5. Tightening set screws with pliers is prohibited.
   6. For conduits running through metal studs, limit field cut holes to no more than 70% of web depth. Spacing between holes shall be at least 457 mm (18 inches). Cuts or notches in flanges or return lips shall not be permitted.

3.4 EXPOSED WORK INSTALLATION

A. Unless otherwise indicated on drawings, exposed conduit is only permitted in mechanical and electrical rooms.

least 457 mm (18 inches). Cuts or notches in flanges or return lips shall not be permitted.

3.4 EXPOSED WORK INSTALLATION

A. Unless otherwise indicated on drawings, exposed conduit is only permitted in mechanical and electrical rooms.

C. Conduit for Conductors 600 V and Below: Rigid steel, IMC, or EMT. Mixing different types of conduits in the system is prohibited.

D. Align and run conduit parallel or perpendicular to the building lines.

E. Install horizontal runs close to the ceiling or beams and secure with conduit straps.

F. Support horizontal or vertical runs at not over 2.4 M (8 feet) intervals.

G. Surface Metal Raceways: Use only where shown on drawings.

H. Painting:

1. Paint exposed conduit as specified in Section 09 91 00, PAINTING.
2. Paint all conduits containing cables rated over 600 V safety orange. Refer to Section 09 91 00, PAINTING for preparation, paint type, and exact color. In addition, paint legends, using 50 mm (2 inch) high black numerals and letters, showing the cable voltage rating. Provide legends where conduits pass through walls and floors and at maximum 6 M (20 feet) intervals in between.

3.7 WET OR DAMP LOCATIONS

A. Use rigid steel or IMC conduits unless as shown on drawings.

B. Provide sealing fittings to prevent passage of water vapor where conduits pass from warm to cold locations, i.e., refrigerated spaces, constant-temperature rooms, air-conditioned spaces, building exterior walls, roofs, or similar spaces.

C. Use rigid steel or IMC conduit within 1.5 M (5 feet) of the exterior and below concrete building slabs in contact with soil, gravel, or vapor barriers, unless as shown on drawings. Conduit shall be half-lapped with 10 mil PVC tape before installation. After installation, completely recoat or retape any damaged areas of coating.

D. Conduits run on roof shall be supported with integral galvanized lipped steel channel, attached to UV-inhibited polycarbonate or polypropylene blocks every 2.4 M (8 feet) with 9 mm (3/8-inch) galvanized threaded rods, square washer and locknut. Conduits shall be attached to steel channel with conduit clamps.

C. Use rigid steel or IMC conduit within 1.5 M (5 feet) of the exterior and below concrete building slabs in contact with soil, gravel, or vapor barriers, unless as shown on drawings. Conduit shall be half-lapped with 10 mil PVC tape before installation. After installation, completely recoat or retape any damaged areas of coating.

D. Conduits run on roof shall be supported with integral galvanized lipped steel channel, attached to UV-inhibited polycarbonate or polypropylene blocks every 2.4 M (8 feet) with 9 mm (3/8-inch) galvanized threaded rods, square washer and locknut. Conduits shall be attached to steel channel with conduit clamps.

3.8 MOTORS AND VIBRATING EQUIPMENT

A. Use flexible metal conduit for connections to motors and other electrical equipment subject to movement, vibration, misalignment, cramped quarters, or noise transmission.

B. Use liquid-tight flexible metal conduit for installation in exterior locations, moisture or humidity laden atmosphere, corrosive atmosphere, water or spray wash-down operations, inside airstream of HVAC units, and locations subject to seepage or dripping of oil, grease, or water.

C. Provide a green equipment grounding conductor with flexible and liquid-tight flexible metal conduit.

3.9 EXPANSION JOINTS

A. Conduits 75 mm (3 inch) and larger that are secured to the building structure on opposite sides of a building expansion joint require expansion and deflection couplings. Install the couplings in accordance with the manufacturer's recommendations.

B. Provide conduits smaller than 75 mm (3 inch) with junction boxes on both sides of the expansion joint. Connect flexible metal conduits to junction boxes with sufficient slack to produce a 125 mm (5 inch) vertical drop midway between the ends of the flexible metal conduit. Flexible metal conduit shall have a green insulated copper bonding jumper installed. In lieu of this flexible metal conduit, expansion and deflection couplings as specified above are acceptable.

C. Install expansion and deflection couplings where shown.

3.10 CONDUIT SUPPORTS

A. Safe working load shall not exceed one-quarter of proof test load of fastening devices.

B. Use pipe straps or individual conduit hangers for supporting individual conduits.

3.10 CONDUIT SUPPORTS

A. Safe working load shall not exceed one-quarter of proof test load of fastening devices.

B. Use pipe straps or individual conduit hangers for supporting individual conduits.

C. Support multiple conduit runs with trapeze hangers. Use trapeze hangers that are designed to support a load equal to or greater than the sum of the weights of the conduits, wires, hanger itself, and an additional 90 kg (200 lbs). Attach each conduit with U-bolts or other approved fasteners.

D. Support conduit independently of junction boxes, pull-boxes, fixtures, suspended ceiling T-bars, angle supports, and similar items.

E. Fasteners and Supports in Solid Masonry and Concrete:

1. New Construction: Use steel or malleable iron concrete inserts set in place prior to placing the concrete.
2. Existing Construction:
   a. Steel expansion anchors not less than 6 mm (0.25-inch) bolt size and not less than 28 mm (1.125 inch) in embedment.
   b. Power set fasteners not less than 6 mm (0.25-inch) diameter with depth of penetration not less than 75 mm (3 inch).
   c. Use vibration and shock-resistant anchors and fasteners for attaching to concrete ceilings.

F. Hollow Masonry: Toggle bolts.

G. Bolts supported only by plaster or gypsum wallboard are not acceptable.

H. Metal Structures: Use machine screw fasteners or other devices specifically designed and approved for the application.

I. Attachment by wood plugs, rawl plug, plastic, lead or soft metal anchors, or wood blocking and bolts supported only by plaster is prohibited.

J. Chain, wire, or perforated strap shall not be used to support or fasten conduit.

K. Spring steel type supports or fasteners are prohibited for all uses except horizontal and vertical supports/fasteners within walls.

L. Vertical Supports: Vertical conduit runs shall have riser clamps and supports in accordance with the NEC and as shown. Provide supports for cable and wire with fittings that include internal wedges and retaining collars.

3.11 BOX INSTALLATION

A. Boxes for Concealed Conduits:
   1. Flush-mounted.
   2. Provide raised covers for boxes to suit the wall or ceiling, construction, and finish.

B. In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling-in operations or where more than the equivalent of 4-90 degree bends are necessary.

C. Locate pullboxes so that covers are accessible and easily removed. Coordinate locations with piping and ductwork where installed above ceilings.

D. Remove only knockouts as required. Plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.

E. Outlet boxes mounted back-to-back in the same wall are prohibited. A minimum 600 mm (24 inch) center-to-center lateral spacing shall be maintained between boxes.

F. Flush-mounted wall or ceiling boxes shall be installed with raised covers so that the front face of raised cover is flush with the wall. Surface-mounted wall or ceiling boxes shall be installed with surface-style flat or raised covers.

G. Minimum size of outlet boxes for ground fault circuit interrupter (GFCI) receptacles is 100 mm (4 inches) square x 55 mm (2.125 inches) deep, with device covers for the wall material and thickness involved.

H. Stencil or install phenolic nameplates on covers of the boxes identified on riser diagrams; for example "ELECTRICAL PB No. 1."

I. On all branch circuit junction box covers, identify the circuits with black marker.

- - - E N D - - -

SECTION 26 41 00
FACILITY LIGHTNING PROTECTION

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing and installation of a complete UL master labeled lightning protection system.

1.2 RELATED WORK

A. Section 07 60 00, FLASHING AND SHEET METAL: Penetrations through the roof.

B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.

C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path to ground for possible ground faults.

1.3 QUALITY ASSURANCE

A. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit in accordance with Paragraph, SUBMITTALS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:

1. Shop Drawings:
   a. Submit sufficient information to demonstrate compliance with drawings and specifications.
   b. Show locations of air terminals, connections to required metal surfaces, down conductors, and grounding means.
   c. Show the mounting hardware and materials used to attach air terminals and conductors to the structure.
2. Certifications: Two weeks prior to final inspection, submit the following.
   a. Certification by the manufacturer that the lightning protection system conforms to the requirements of the drawings and specifications.
   b. Certification by the Contractor that the lightning protection system has been properly installed and inspected.

c. Certification that the lightning protection system has been inspected by a UL representative and has been approved by UL without variation.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

B. National Fire Protection Association (NFPA):

70-23.....National Electrical Code (NEC)

780-23.....Standard for the Installation of Lightning Protection Systems

C. Underwriters Laboratories, Inc. (UL):

96-16.....Lightning Protection Components

96A-16.....Installation Requirements for Lightning Protection Systems

467-22.....Standard for Grounding and Bonding Equipment

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Lightning protection components shall conform to NFPA 780 and UL 96, for use on Class Istructures. Copper materials are required.

1. Class Iconductors: Copper.
2. Class I air terminals: Solid copper, 460 mm (18 inches) long, not less than 9.5 mm (3/8 inch) diameter, with sharp nickel-plated points.
4. Ground rods: Copper-clad steel0.75 in (19 mm) diameter by 3 m (10 feet) long.

5. Ground plates: Solid copper, not less than 20 gauge.
6. Bonding plates: Bronze, 50 square cm (8 square inches).
7. Through roof connectors: Solid copper riser bar, length and type as required to accommodate roof structure and flashing requirements.
8. Down conductor guards: Stiff copper or brass.
9. Anchors and fasteners: Bronze bolt and clamp type shall be used for all applications except for membrane roof. Adhesive type are allowed only for attachment to membrane roof materials, using adhesive that is compatible with the membrane material.

10. Connectors: Bronze clamp-type connectors shall be used for roof conductor splices, and the connection of the roof conductor to air terminals and bonding plates. Crimp-type connectors are not allowed.
11. Exothermic welds: Exothermic welds shall be used for splicing the roof conductor to the down conductors, splices of the down conductors, and for connection of the down conductors to ground rods, ground plates, and the ground ring.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with the NEC, as shown on the drawings, and manufacturer's instructions.
B. Coordinate installation with the roofing manufacturer and roofing installer.
C. Install the conductors as inconspicuously as practical.
D. Install the down conductors within the concealed cavity of exterior walls where practical. Run the down conductors to the exterior at elevations below the finished grade.
E. Where down conductors are subject to damage or are accessible near grade, protect with down conductor guards to 2.4 m (8 feet) above grade. Bond down conductors guards to down conductor at both ends.
F. Make connections of dissimilar metal with bimetallic type fittings to prevent electrolytic action.
G. Install ground rods and ground plates not less than 600 mm (2 feet) deep and a distance not less than 900 mm (3 feet) nor more than 2.5 m (8 feet) from the nearest point of the structure. Exothermically weld the down conductors to ground rods and ground plates in the presence of the COR.
H. Bond down conductors to metal main water piping where applicable.
I. Bond down conductors to building structural steel.

J. Connect roof conductors to all metallic projections and equipment above the roof as indicated on the drawings.
K. Connect exterior metal surfaces, located within 900 mm (3 feet) of the conductors, to the conductors to prevent flashovers.
L. Maintain horizontal or downward coursing of main conductor and insure that all bends have at least an 200 mm (8 inches) radius and do not exceed 90 degrees.

M. Conductors shall be rigidly fastened every 900 mm (3 feet) along the roof and down to the building to ground.

N. Air terminals shall be secured against overturning either by attachment to the object to be protected or by means of a substantial tripod or other braces permanently and rigidly attached to the building or structure.

O. Install air terminal bases, cable holders and other roof-system supporting means without piercing membrane or metal roofs.

P. Use through-roof connectors for penetration of the roof system. Flashing shall be provided by roofing contractor in accordance with Section 07 60 00, FLASHING AND SHEET METAL.

Q. Down conductors coursed on or in reinforced concrete columns or on structural steel columns shall be connected to the reinforcing steel or the structural steel member at its upper and lower extremities. In the case of long vertical members an additional connection shall be made at intervals not exceeding 30 M (100 feet).

R. A counterpoise or ground ring, where shown, shall be of No. 1/0 copper cable having suitable resistance to corrosion and shall be laid around the perimeter of the structure in a trench not less than 600 mm (2 feet) deep at a distance not less than 900 mm (3 feet) nor more than 2.5 M (8 feet) from the nearest point of the structure.

S. On construction utilizing post tensioning systems to secure precast concrete sections, the post tension rods shall not be used as a path for lightning to ground.

T. Where shown, use the structural steel framework or reinforcing steel as the down conductor.

   1. Weld or bond the non-electrically-continuous sections together and make them electrically continuous.
   2. Verify the electrical continuity by measuring the ground resistances to earth at the ground level, at the top of the building or stack, and at intermediate points with a sensitive ohmmeter. Compare the resistance readings.
   3. Connect the air terminals together with an exterior conductor connected to the structural steel framework at not more than 18 M (60 feet) intervals.
   4. Install ground connections to earth at not more than 18 M (60 feet) intervals around the perimeter of the building.

5. Weld or braze bonding plates to cleaned sections of the steel and connect the conductors to the plates.
6. Do not pierce the structural steel in any manner. Connections to the structural steel shall conform to UL 96A.

3.2 ACCEPTANCE CHECKS AND TESTS

A. Test the ground resistance to earth by standard methods, and conform to the ground resistance requirements specified in Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

B. A UL representative shall inspect the lightning protection system. Obtain and install a UL numbered master label for each of the lightning protection systems at the location directed by the UL representative and the COR.

---END---

SECTION 31 20 11
EARTHWORK (SHORT FORM)

PART 1 - GENERAL

1.1:DESCRIPTION:

This section specifies the requirements for furnishing all equipment, materials, labor and techniques for earthwork including excavation, fill, backfill and site restoration utilizing fertilizer, seed and/or sod.

1.2 DEFINITIONS:

A. Unsuitable Materials:

1. Fills: Topsoil, frozen materials; construction materials and materials subject to decomposition; clods of clay and stones larger than 75 mm (3 inches); organic materials, including silts, which are unstable; and inorganic materials, including silts, too wet to be stable.
2. Existing Subgrade (except footings): Same materials as above paragraph, that are not capable of direct support of slabs, pavement, and similar items, with the possible exception of improvement by compaction, proofrolling, or similar methods of improvement.
3. Existing Subgrade (footings only): Same as Paragraph 1, but no fill or backfill. If materials differ from design requirements, excavate to acceptable strata subject to Resident Engineer's approval.

B. Earthwork: Earthwork operations required within the new construction area. It also includes earthwork required for auxiliary structures and buildings and sewer and other trenchwork throughout the job site.

C. Degree of Compaction: Degree of compaction is expressed as a percentage of maximum density obtained by the test procedure presented in ASTM D698.

D. The term fill means fill or backfill as appropriate.

1.3 RELATED WORK:

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

B. Safety Requirements: Section 00 72 00, GENERAL CONDITIONS, Article, ACCIDENT PREVENTION.

C. Protection of existing utilities, fire protection services, existing equipment, roads, and pavements: Section 01 00 00, GENERAL REQUIREMENTS.

D. Subsurface Investigation: Section 01 00 00, GENERAL REQUIREMENTS, Article, PHYSICAL DATA.

1.4 CLASSIFICATION OF EXCAVATION:

A. Unclassified Excavation: Removal and disposal of pavements and other man-made obstructions visible on the surface; utilities, and other items including underground structures indicated to be demolished and removed; together with any type of materials regardless of character of material and obstructions encountered.

C. Rock Excavation:

1. Solid ledge rock (igneous, metamorphic, and sedimentary rock).
2. Bedded or conglomerate deposits so cemented as to present characteristics of solid rock which cannot be excavated without blasting; or the use of a modern power excavator (shovel, backhoe, or similar power excavators) of no less than 0.75 m3 (1 cubic yard) capacity, properly used, having adequate power and in good running condition.
3. Boulders or other detached stones each having a volume of 0.4 m3 (1/2 cubic yard) or more.

1.5 MEASUREMENT AND PAYMENT FOR EXCAVATION:

Measurement: The unit of measurement for excavation and borrow will be the cubic yard, computed by the average end area method from cross sections taken before and after the excavation and borrow operations, including the excavation for ditches, gutters, and channel changes, when the material is acceptably utilized or disposed of as herein specified. Quantities should be computed by a Registered Professional Land Surveyor or Registered Civil Engineer, specified in Section 01 00 00, GENERAL REQUIREMENTS. The measurement will include authorized excavation of satisfactory subgrade soil. The measurement will not include the volume of subgrade material or other material used for purposes other than directed. The volume of overburden stripped from borrow pits and the volume of excavation for ditches to drain borrow its, unless used as borrow material, will not be measured for payment. The measurement will not include the volume of any excavation performed

prior to taking of elevations and measurements of the undisturbed grade.

1.6 MEASUREMENT AND PAYMENT FOR ROCK EXCAVATION:

A. Measurement: Cross section and measure the uncovered and separated materials, and compute quantities by the Registered Professional Land Surveyor or Registered Civil Engineer, specified in Section 01 00 00, GENERAL REQUIREMENTS. Do not measure quantities beyond the following limits:

1. 300 mm (12 inches) outside of the perimeter of formed footings.
2. 600 mm (24 inches) outside the face of concrete work for which forms are required, except for footings.
3. 150 mm (6 inches) below the bottom of pipe and not more than the pipe diameter plus 600 mm (24 inches) in width for pipe trenches.
4. The outside dimensions of concrete work for which no forms are required (trenches, conduits, and similar items not requiring forms).

B. Payment: No separate payment shall be made for rock excavation quantities shown. The contract price and time will be adjusted for overruns or underruns in accordance with Articles, DIFFERING SITE CONDITIONS, CHANGES and CHANGES-SUPPLEMENT of the GENERAL CONDITIONS as applicable.

1.7 SUBMITTALS:

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

B. Rock Excavation Report:

1. Certification of rock quantities excavated.
2. Excavation method.
3. Labor.
4. Equipment.
5. Land Surveyor's or Civil Engineer's name and official registration stamp.
6. Plot plan showing elevations.

C. Contractor shall submit procedure and location for disposal of unused satisfactory material. Proposed source of borrow material. Notification of encountering rock in the project. Advance notice on the opening of excavation or borrow areas. Advance notice on shoulder construction for rigid pavements.

1.8 APPLICABLE PUBLICATIONS:

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

B. American Nursery and Landscape Association (ANLA):

2004.....American Standard for Nursery Stock

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

T99-10.....Moisture-Density Relations of Soils Using a 2.5 kg (5.5 lb) Rammer and a 305 mm (12 inch) Drop

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 inch) Drop

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

C33-03.....Concrete Aggregate

D698-e1.....Laboratory Compaction Characteristics of Soil Using Standard Effort

D1140-00.....Amount of Material in Soils Finer than the No. 200 (75-micrometer) Sieve

D1556-00.....Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method

D1557-09.....Laboratory Compaction Characteristics of Soil Using Modified Effort

D2167-94 (2001).....Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method

D2487-06.....Standard Classification of Soil for Engineering Purposes (Unified Soil Classification System)

D6938-10.....Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

E. Standard Specifications of South Dakota State Department of Transportation, latest revision.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Fills: Materials approved from on site and off site sources having a minimum dry density of 1760 kg/m3 (110 pcf), a maximum Plasticity Index of 6, and a maximum Liquid Limit of 30.

B. Granular Fill:

1. Under concrete slab, granular fill shall consist of clean, poorly graded crushed rock, crushed gravel, or uncrushed gravel placed beneath a building slab with or without a vapor barrier to cut off the capillary flow of pore water to the area immediately below. Fine aggregate grading shall conform to ASTM C33 with a maximum of 3 percent by weight passing ASTM D1140, 75 micrometers (No. 200) sieve, and no more than 2 percent by weight passing the 4.75 mm (No. 4) size sieve.
2. Bedding for sanitary and storm sewer pipe, crushed stone or gravel graded from 13 mm (1/2 inch) to 4.75 mm (No. 4).

C. Fertilizer: (5-10-5) delivered to site in unopened containers that clearly display the manufacturer's label, indicating the analysis of the contents.

D. Seed: Grass mixture comparable to existing turf delivered to site in unopened containers that clearly display the manufacturer's label, indicating the analysis of the contents.

E. Sod: Comparable species with existing turf. Use State Certified or State Approved sod when available. Deliver sod to site immediately after cutting and in a moist condition. Thickness of cut must be 19 mm to 32 mm (3/4 inch to 1 1/4 inches) excluding top growth. There shall be no broken pads and torn or uneven ends

F. Requirements For Offsite Soils: Offsite soils brought in for use as backfill shall be tested for TPH, BTEX and full TCLP including ignitability, corrosivity and reactivity. Backfill shall contain less than 100 parts per million (ppm) of total hydrocarbons (TPH) and less than 10 ppm of the sum of Benzene, Toleune, Ethyl Benzene, and Xylene (BTEX)and shall not fail the TCLP test. TPH concentrations shall be determined by using EPA 600/4-79/020 Method 418.1. BTEX concentrations shall be determined by using EPA SW-846.3-3a Method5030/8020. TCLP shall be performed in accordance with EPA SW-846.3-3a Method 1311. Provide Borrow Site Testing for TPH, BTEX and TCLP from a composite sample of material from the borrow site, with at least one test from

each borrow site. Material shall not be brought on site until tests have been approved by the Resident Engineer.

G. Buried Warning and Identification Tape: Polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 3 inch minimum width, color coded as specific below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Color and printing shall be permanent, Unaffected by moisture or soil. Warning tape color codes:

Red:	Electric
Yellow:	Gas, Oil, Dangerous Materials
Orange:	Telephone and Other Communications
Blue:	Water Systems
Green:	Sewer Systems
White:	Steam Systems
Gray:	Compressed Air

H. Warning Tape for Metallic Piping: Acid and alkali-resistant polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of tape shall be 0.076 mm (0.003 inch). Tape shall have a minimum strength of 10.3 MPa (1500 psi) lengthwise, and 8.6 MPa (1250 psi) crosswise, with a maximum 350 percent elongation.

I. Detectable Warning Tape for Non-Metallic Piping: Polyethylene plastictape conforming to the width, color, and printing requirements specified above. Minimum thickness of the tape shall be 0.102 mm (0.004 inch). Tape shall have a minimum strength of 10.3 MPa (1500 psi) lengthwise and 8.6 MPa (1250 psi) crosswise. Tape shall be manufactured with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 0.9 m(3 feet) deep. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection.

J. Detection Wire For Non-Metallic Piping: Detection wire shall be Insulated single strand, solid copper with a minimum of 12 AWG.

PART 3 - EXECUTION

3.1 SITE PREPARATION:

A. Clearing: Clearing within the limits of earthwork operations as described or designated by the Resident Engineer. Work includes removal of trees, shrubs, fences, foundations, incidental structures, paving, debris, trash and any other obstructions. Remove materials from the Medical Center.

B. Grubbing: Remove stumps and roots 75 mm (3 inches) and larger diameter. Undisturbed sound stumps, roots up to 75 mm (3 inches) diameter, and nonperishable solid objects which will be a minimum of 900 mm (3 feet) below subgrade or finished embankment may be left.

C. Trees and Shrubs: Trees and shrubs, not shown for removal, may be removed from the areas within 4500 mm (15 feet) of new construction and 2250 mm (7’-6”) of utility lines if such removal is approved in advance by the Resident Engineer. Remove materials from the Medical Center . Box, and otherwise protect from damage, existing trees and shrubs which are not shown to be removed in the construction area. Repair immediately damage to existing trees and shrubs by trimming, cleaning and painting damaged areas, including the roots, in accordance with standard industry horticultural practice for the geographic area and plant species. Building materials shall not be stored closer to trees and shrubs that are to remain, than the farthest extension of their limbs.

D. Stripping Topsoil: Unless otherwise indicated on the drawings, the limits of earthwork operations shall extend anywhere the existing grade is filled or cut or where construction operations have compacted or otherwise disturbed the existing grade or turf. Strip topsoil as defined herein, or as indicated in the geotechnical report, from within the limits of earthwork operations as specified above unless specifically indicated or specified elsewhere in the specifications or shown on the drawings. Topsoil shall be fertile, friable, natural topsoil of loamy character and characteristic of the locality. Topsoil shall be capable of growing healthy horticultural crops of grasses. Stockpile topsoil and protect as directed by the Resident Engineer. Eliminate foreign material, such as weeds, roots, stones, subsoil, frozen clods, and similar foreign materials, larger than 0.014 m3 (1/2 cubic foot) in volume, from soil as it is stockpiled. Retain topsoil on the station. Remove foreign materials larger than 50 mm (2 inches) in

any dimension from topsoil used in final grading. Topsoil work, such as stripping, stockpiling, and similar topsoil work, shall not, under any circumstances, be carried out when the soil is wet so that the tilth of the soil will be destroyed.

1. Concrete Slabs and Paving: Score deeply or saw cut to insure a neat, straight cut, sections of existing concrete slabs and paving to be removed where excavation or trenching occurs. Extend pavement section to be removed a minimum of 300 mm (12 inches) on each side of widest part of trench excavation and insure final score lines are approximately parallel unless otherwise indicated. Remove material from the Medical Center.

E. Disposal: All materials removed from the property shall be disposed of at a legally approved site, for the specific materials, and all removals shall be in accordance with all applicable Federal, State and local regulations. No burning of materials is permitted onsite.

3.2 EXCAVATION:

A. Shoring, Sheeting and Bracing: Shore, brace, or slope to it's angle of repose banks of excavations to protect workmen, banks, adjacent paving, structures, and utilities, in compliance with OSHA requirements.

1. Extend shoring and bracing to the bottom of the excavation. Shore excavations that are carried below the elevations of adjacent existing foundations.

B. Excavation Drainage: Operate pumping equipment, and/or provide other materials, means and equipment as required, to keep excavations free of water and subgrades dry, firm, and undisturbed until approval of permanent work has been received from Resident Engineer. Approval by the Resident Engineer is also required before placement of the permanent work on all subgrades. When subgrade for foundations has been disturbed by water, remove the disturbed material to firm undisturbed material after the water is brought under control. Replace disturbed subgrade in trenches by mechanically tamped sand or gravel. When removed disturbed material is located where it is not possible to install and properly compact disturbed subgrade material with mechanically compacted sand or gravel, the Resident Engineer should be contacted to consider the use of flowable fill. Groundwater flowing toward or into excavations shall be controlled to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation and to eliminate interference with orderly progress of construction.

French drains, sumps, ditches or trenches will not be permitted within 0.9 m (3 feet) of the foundation of any structure, except with specific written approval, and after specific contractual provisions for restoration of the foundation area have been made. Control measures shall be taken by the time the excavation reaches the water level in order to maintain the integrity of the in situ material. While the excavation is open, the water level shall be maintained continuously, at least 1.83 m (6 feet) below the working level. Operate dewatering system continuously until construction work below existing water levels is complete. Submit performance records weekly. Measure and record performance of dewatering system at same time each day by use of observation wells or piezometers installed in conjunction with the dewatering system. Relieve hydrostatic head in pervious zones below subgrade elevation in layered soils to prevent uplift.

C. Blasting: Blasting shall not be permitted. the

D. Building Earthwork:

1. Excavation shall be accomplished as required by drawings and specifications.
2. Excavate foundation excavations to solid undisturbed subgrade.
3. Remove loose or soft material to solid bottom.
4. Fill excess cut under footings or foundations with 25 MPa (3000 psi) concrete, poured separately from the footings.
3. Do not tamp earth for backfilling in footing bottoms, except as specified.

E. Trench Earthwork:

1. Utility trenches (except sanitary and storm sewer):
   a. Excavate to a width as necessary for sheeting and bracing and proper performance of the work.
   b. Grade bottom of trenches with bell-holes, scooped-out to provide a uniform bearing.
   c. Support piping on suitable undisturbed earth unless a mechanical support is shown. Unstable material removed from the bottom of the trench or excavation shall be replaced with select granular material placed in layers not exceeding 150 mm (6 inches) loose thickness.
   d. The length of open trench in advance of pipe laying shall not be greater than is authorized by the Resident Engineer.

e. Provide buried utility lines with utility identification tape. Bury tape 300 mm (12 inches) below finished grade; under pavements and slabs, bury tape 150 mm (6 inches) below top of subgrade

f. Bury detection wire directly above non-metallic piping at a distance not to exceed 300 mm (12 inches) above the top of pipe. The wire shall extend continuously and unbroken, from manhole to manhole. The ends of the wire shall terminate inside the manholes at each end of the pipe, with a minimum of 0.9 m (3 feet) of wire, coiled, remaining accessible in each manhole. The wire shall remain insulated over it's entire length. The wire shall enter manholes between the top of the corbel and the frame, and extend up through the chimney seal between the frame and the chimney seal. For force mains, the wire shall terminate in the valve pit at the pump station end of the pipe.

g. Bedding shall be of the type and thickness shown. Initial backfill material shall be placed and compacted with approved tampers to a height of at least one foot above the utility pipe or conduit. The backfill shall be brought up evenly on both sides of the pipe for the full length of the pipe. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe. Except as specified otherwise in the individual piping section, provide bedding for buried piping in accordance with AWWA C600, Type 4, except as specified herein. Backfill to top of pipe shall be compacted to 95 percent of ASTM D 698maximum density. Plastic piping shall have bedding to spring line of pipe. Provide materials as follows:

1) Class I: Angular, 6 to 40 mm (0.25 to 1.5 inches), graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone, and crushed shells.

2) Class II: Coarse sands and gravels with maximum particle size of 40 mm (1.5 inches), including various graded sands and gravels containing small percentages of fines, generally granular and noncohesive, either wet or dry. Soil Types GW, GP, SW, and SP are included in this class as specified in ASTM D 2487.

3) Clean, coarse-grained sand classified SW by ASTM D 2487 for bedding and backfill as indicated.
4) Clean, coarsely graded natural gravel, crushed stone or a combination thereof identified as GW in accordance with ASTM D 2487 for bedding and backfill as indicated. Maximum particle size shall not exceed 75 mm (3 inches).

2. Sanitary and storm sewer trenches:
   a. Trench width below a point 150 mm (6 inches) above top of the pipe shall be 600 mm (24 inches) for up to and including 300 mm (12 inches) diameter and four-thirds diameter of pipe plus 200 mm (8 inches) for pipe larger than 300 mm (12 inches). Width of trench above that level shall be as necessary for sheeting and bracing and proper performance of the work.
   b. The bottom quadrant of the pipe shall be bedded on suitable undisturbed soil or granular fill. Unstable material removed from the bottom of the trench or excavation shall be replaced with select granular material placed in layers not exceeding 150 mm (6 inches) loose thickness.
      1) Undisturbed: Bell holes shall be no larger than necessary for jointing. Backfill up to a point 300 mm (12 inches) above top of pipe shall be clean earth placed and tamped by hand.
      2) Granular Fill: Depth of fill shall be a minimum of 75 mm (3 inches) plus one-sixth of pipe diameter below the pipe of 300 mm (12 inches) above top of pipe. Place and tamp fill material by hand.
   c. Place and compact as specified the remainder of backfill using acceptable excavated materials. Do not use unsuitable materials.
   d. Use granular fill for bedding where rock or rocky materials are excavated.
   e. Provide buried utility lines with utility identification tape. Bury tape 300 mm (12 inches) below finished grade; under pavements and slabs, bury tape 150 mm (6 inches) below top of subgrade
   f. Bury detection wire directly above non-metallic piping at a distance not to exceed 300 mm (12 inches) above the top of pipe. The wire shall extend continuously and unbroken, from manhole to manhole. The ends of the wire shall terminate inside the manholes at each end of the pipe, with a minimum of 0.9 m (3

feet) of wire, coiled, remaining accessible in each manhole. The wire shall remain insulated over its entire length. The wire shall enter manholes between the top of the corbel and the frame, and extend up through the chimney seal between the frame and the chimney seal. For force mains, the wire shall terminate in the valve pit at the pump station end of the pipe.

g. Bedding shall be of the type and thickness shown. Initial backfill material shall be placed and compacted with approved tampers to a height of at least one foot above the utility pipe or conduit. The backfill shall be brought up evenly on both sides of the pipe for the full length of the pipe. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe. Except as specified otherwise in the individual piping section, provide bedding for buried piping in accordance with AWWA C600, Type 4, except as specified herein. Backfill to top of pipe shall be compacted to 95 percent of ASTM D698 maximum density. Plastic piping shall have bedding to spring line of pipe. Provide materials as follows:

1) Class I: Angular, 6 to 40 mm (0.25 to 1.5 inches), graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone, and crushed shells.
2) Class II: Coarse sands and gravels with maximum particle size of 40 mm (1.5 inches), including various graded sands and gravels containing small percentages of fines, generally granular and noncohesive, either wet or dry. Soil Types GW, GP, SW, and SP are included in this class as specified in ASTM D2487.
3) Clean, coarse-grained sand classified as SW by ASTM D 487 for bedding and backfill as indicated.
4) Clean, coarsely graded natural gravel, crushed stone or a combination thereof identified as GW in accordance with ASTM D2487 for bedding and backfill as indicated. Maximum particle size shall not exceed 75 mm (3 inches).

F. Site Earthwork: Excavation shall be accomplished as required by drawings and specifications. Remove subgrade materials that are determined by the Resident Engineer as unsuitable, and replace with

acceptable material. If there is a question as to whether material is unsuitable or not, the Contractor shall obtain samples of the material, under the direction of the Resident Engineer, and the materials shall be examined by an independent testing laboratory for soil classification to determine whether it is unsuitable or not. When unsuitable material is encountered and removed, the contract price and time will be adjusted in accordance with Articles, DIFFERING SITE CONDITIONS, CHANGES and CHANGES-SUPPLEMENT of the GENERAL CONDITIONS as applicable. Adjustments to be based on meters (yardage) in cut section only.

G. Finished elevation of subgrade shall be as follows:
   1. Pavement Areas - bottom of the pavement or base course as applicable.
   2. Planting and Lawn Areas - 100 mm (4 inches) below the finished grade, unless otherwise specified or indicated on the drawings.

3.3 FILLING AND BACKFILLING:

A. General: Do not fill or backfill until all debris, unsatisfactory soil materials, obstructions, and deleterious materials have been removed from the excavation. Proof-roll exposed subgrades with a fully loaded dump truck. Use excavated materials or borrow for fill and backfill, as applicable. Do not use unsuitable excavated materials. Do not backfill until foundation walls have been completed above grade and adequately braced, waterproofing or dampproofing applied, and pipes coming in contact with backfill have been installed, and inspected and approved by Resident Engineer.

B. Proof-rolling Existing Subgrade: - Proof rolling shall be done on an exposed subgrade free of surface water (wet conditions resulting from rainfall) which would promote degradation of an otherwise acceptable subgrade. After stripping, proof roll the existing subgrade of the paving areas with six passes of a dump truck loaded with 6 cubic meters (4 cubic yards) of soil. Operate the truck in a systematic manner to ensure the number of passes over all areas, and at speeds between 4 to 5.5 km/hour (2 1/2 to 3 1/2 mph). When proof rolling, one-half of the passes made with the roller shall be in a direction perpendicular to the other passes. Notify the Resident Engineer a minimum of 3 days prior to proof rolling. Proof rolling shall be performed in the presence of the Resident Engineer. Rutting or pumping of material shall be undercut as directed by the Resident Engineer to a depth of

304.8 mm (12 inches) and replaced with fill and backfill select material.

C. Placing: Place material in horizontal layers not exceeding 200 mm (8 inches) in loose depth and then compacted. Do not place material on surfaces that are muddy, frozen, or contain frost.

D. Compaction: Use approved equipment (hand or mechanical) well suited to the type of material being compacted. Do not operate mechanized vibratory compaction equipment within 3000 mm (10 feet) of new or existing building walls without the prior approval of the Resident Engineer. Moisten or aerate material as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used. Compact each layer to not less than 95 percent of the maximum density determined in accordance with the following test method ASTM D698. Backfill adjacent to any and all types of structures shall be placed and compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials to prevent wedging action or eccentric loading upon or against the structure.

E. Borrow Material: Borrow material shall be selected to meet the requirements and conditions of the particular fill or embankment for which it is to be used. Borrow material shall be obtained from approved private sources. Unless otherwise provided in the contract, the Contractor shall obtain from the owners the right to procure material, pay royalties and other charges involved, and bear the expense of developing the sources, including rights-of-way for hauling. Borrow material from approved sources on Government-controlled land may be obtained without payment of royalties. Unless specifically provided, no borrow shall be obtained within the limits of the project site without prior written approval. Necessary clearing, grubbing, and satisfactory drainage of borrow pits and the disposal of debris thereon shall be considered related operations to the borrow excavation.

F. Opening and Drainage of Excavation and Borrow Pits: The Contractor shall notify the Resident Engineer sufficiently in advance of the opening of any excavation or borrow pit to permit elevations and measurements of the undisturbed ground surface to be taken. Except as otherwise permitted, borrow pits and other excavation areas shall be excavated providing adequate drainage. Overburden and other spoil material shall be transported to designated spoil areas or otherwise

disposed of as directed. Borrow pits shall be neatly trimmed and drained after the excavation is completed. The Contractor shall ensure that excavation of any area, operation of borrow pits, or dumping of spoil material results in minimum detrimental effects on natural environmental conditions.

3.4 GRADING:

A. General: Uniformly grade the areas within the limits of this section, including adjacent transition areas. Smooth the finished surface within specified tolerance. Provide uniform levels or slopes between points where elevations are indicated, or between such points and existing finished grades. Provide a smooth transition between abrupt changes in slope.

B. Cut rough or sloping rock to level beds for foundations. In unfinished areas fill low spots and level off with coarse sand or fine gravel.

C. Slope backfill outside the building away from the building walls for a minimum distance of 3048 mm (10 feet)at a minimum five percent (5%) slope.

D. The finished grade shall be 150 mm (6 inches) below bottom line of windows or other building wall openings unless greater depth is shown.

E. Place crushed stone or gravel fill under concrete slabs on grade tamped and leveled. The thickness of the fill shall be 150 mm (6 inches), unless otherwise indicated.

F. Finish subgrade in a condition acceptable to the Resident Engineer at least one day in advance of the paving operations. Maintain finished subgrade in a smooth and compacted condition until the succeeding operation has been accomplished. Scarify, compact, and grade the subgrade prior to further construction when approved compacted subgrade is disturbed by contractor's subsequent operations or adverse weather.

G. Grading for Paved Areas: Provide final grades for both subgrade and base course to +/- 6 mm (0.25 inches) of indicated grades.

3.5 LAWN AREAS:

A. General: Harrow and till to a depth of 100 mm (4 inches), new or existing lawn areas to remain, which are disturbed during construction. Establish existing or design grades by dragging or similar operations. Do not carry out lawn areas earthwork out when the soil is wet so that the tilth of the soil will be destroyed. Plant bed must be approved by Resident Engineer before seeding or sodding operation begins.

B. Finished Grading: Begin finish grading after rough grading has had sufficient time for settlement. Scarify subgrade surface in lawn areas to a depth of 100 mm (4 inches). Apply topsoil so that after normal compaction, dragging and raking operations (to bring surface to indicated finish grades) there will be a minimum of 100 mm (4 inches) of topsoil over all lawn areas; make smooth, even surface and true grades, which will not allow water to stand at any point. Shape top and bottom of banks to form reverse curves in section; make junctions with undisturbed areas to conform to existing topography. Solid lines within grading limits indicate finished contours. Existing contours, indicated by broken lines are believed approximately correct but are not guaranteed.

C. Fertilizing: Incorporate fertilizer into the soil to a depth of 100 mm (4 inches) at a rate of 12 kg/100 m2 (25 pounds per 1000 square feet).

D. Seeding: Seed at a rate of 2 kg/100 m2 (4 pounds per 1000 square feet) and accomplished only during periods when uniform distribution may be assured. Lightly rake seed into bed immediately after seeding. Roll seeded area immediately with a roller not to exceed 225 kg/m (150 pounds per foot) of roller width.

E. Sodding: Topsoil shall be firmed by rolling and during periods of high temperature the topsoil shall be watered lightly immediately prior to laying sod. Sod strips shall be tightly butted at the ends and staggered in a running bond fashion. Placement on slopes shall be from the bottom to top of slope with sod strips running across slope. Secure sodded slopes by pegging or other approved methods. Roll sodded area with a roller not to exceed 225 kg/m (150 pounds per foot) of the roller width to improve contact of sod with the soil.

F. Watering: The Resident Engineer is responsible for having adequate water available at the site. As sodding is completed in any one section, the entire sodded area shall be thoroughly irrigated by the contractor, to a sufficient depth, that the underside of the new sod pad and soil, immediately below sod, is thoroughly wet. Resident Engineer will be responsible for sod after installation and acceptance.

3.6 DISPOSAL OF UNSUITABLE AND EXCESS EXCAVATED MATERIAL:

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Medical Center property.

1. Remove waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Medical Center property.

B. Place excess excavated materials suitable for fill and/or backfill on site where directed.

C. Remove from site and dispose of any excess excavated materials after all fill and backfill operations have been completed.

D. Segregate all excavated contaminated soil designated by the Resident Engineer from all other excavated soils, and stockpile on site on two 0.15 mm (6 mil) polyethylene sheets with a polyethylene cover. A designated area shall be selected for this purpose. Dispose of excavated contaminated material in accordance with State and Local requirements.

3.7 CLEAN-UP:

Upon completion of earthwork operations, clean areas within contract limits, remove tools, and equipment. Provide site clear, clean, free of debris, and suitable for subsequent construction operations. Remove debris, rubbish, and excess material from the Medical Center Property.

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SECTION 33 40 00

STORM SEWER UTILITIES

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies materials and procedures for construction of outside, underground storm sewer systems that are complete and ready for operation. This includes piping, structures and all other incidentals.

1.2 RELATED WORK

A. Excavation, Trench Widths, Pipe Bedding, Backfill, Shoring, Sheeting, Bracing: Section 31 20 11, EARTH WORK (SHORT FORM).

B. General plumbing, protection of Materials and Equipment, and quality assurance: Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

C. Fabrication of Steel Ladders: Section 05 50 00, METAL FABRICATIONS.

D. Materials and Testing Report Submittals: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

E. Erosion and Sediment Control: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.

1.3 DEFINITIONS

1.4 ABBREVIATIONS

A. HDPE: High-density polyethylene

B. PE: Polyethylene

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

B. Handle stormwater inlets according to manufacturer's written rigging instructions.

1.6 COORDINATION

A. Coordinate connection to storm sewer main with the Public Agency providing storm sewer off-site drainage.

B. Coordinate exterior utility lines and connections to building services up to the actual extent of building wall.

1.7 QUALITY ASSURANCE:

A. Products Criteria:

1. When two or more units of the same type or class of materials or equipment are required, these units shall be products of one manufacturer.

2. A nameplate bearing manufacturer's name or trademark, including model number, shall be securely affixed in a conspicuous place on equipment. In addition, the model number shall be either cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.

1.8 SUBMITTALS

A. Manufacturers' Literature and Data shall be submitted, as one package, for pipes, fittings and appurtenances, including jointing materials, hydrants, valves and other miscellaneous items.

1.9 APPLICABLE PUBLICATIONS

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

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

A185/A185M-07.....Steel Welded Wire Reinforcement, Plain, for Concrete

A242/A242M-04(2009).....High-Strength Low-Alloy Structural Steel

A536-84(2009).....Ductile Iron Castings

A615/A615M-09b.....Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

C1173-08.....Flexible Transition Couplings for Underground Piping Systems

D448-08.....Sizes of Aggregate for Road and Bridge Construction

D698-07e1.....Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft3 (600 kN-m/m3))

D1056-07.....Flexible Cellular Materials—Sponge or Expanded Rubber

D1785-06.....Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120

D2321-11.....Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

D2751-05.....Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings

D3034-08.....Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings

D3350-10.....Polyethylene Plastics Pipe and Fittings Materials

D3753-05e1.....Glass-Fiber-Reinforced Polyester Manholes and Wetwells

D4101-11.....Polypropylene Injection and Extrusion Materials

D5926-09.....Poly (Vinyl Chloride) (PVC) Gaskets for Drain, Waste, and Vent (DWV), Sewer, Sanitary, and Storm Plumbing Systems

F477-10.....Elastomeric Seals (Gaskets) for Joining Plastic Pipe

F679-08.....Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings

F714-10.....Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter

F794-03(2009).....Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter

F891-10.....Coextruded Poly(Vinyl Chloride) (PVC) Plastic Pipe With a Cellular Core

F894-07.....Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe

F949-10.....Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe With a Smooth Interior and Fittings

F1417-11.....Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air

F1668-08.....Construction Procedures for Buried Plastic Pipe

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

M252-09.....Corrugated Polyethylene Drainage Pipe

M294-10.....Corrugated Polyethylene Pipe, 12 to 60 In. (300 to 1500 mm) Diameter

D. American Water Works Association(AWWA):

C900-07.....Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution

M23-2nd ed.....PVC Pipe ”Design And Installation”

E. American Society of Mechanical Engineers (ASME):

A112.6.3-2001.....Floor and Trench Drains

A112.14.1-2003.....Backwater Valves

A112.36.2M-1991.....Cleanouts

F. National Stone, Sand and Gravel Association (NSSGA): Quarried Stone for Erosion and Sediment Control

1.10 WARRANTY

The Contractor shall remedy any defect due to faulty material or workmanship and pay for any damage to other work resulting therefrom within a period of one year from final acceptance. Further, the Contractor will furnish all manufacturers’ and suppliers’ written guarantees and warranties covering materials and equipment furnished under this Contract.

PART 2 - PRODUCTS

2.1 FACTORY-ASSEMBLED PRODUCTS

A. Standardization of components shall be maximized to reduce spare part requirements. The Contractor shall guarantee performance of assemblies of components, and shall repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly.

2.2 PE PIPE AND FITTINGS

A. PVC Corrugated Sewer Piping

1. Pipe: ASTM F949, PVC, corrugated pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM F949, PVC molded or fabricated, socket type.
3. Gaskets: ASTM F477, elastomeric seals.

B. PVC Profile Sewer Piping
1. Pipe: ASTM F794, PVC profile, gravity sewer pipe with bell-and-spigot ends.
2. Fittings: ASTM D3034, PVC with bell ends.
3. Gaskets: ASTM F477, elastomeric seals.

C. PVC Type PSM Sewer Piping
1. Pipe: ASTM D3034, PVC Type PSM sewer pipe with bell-and-spigot ends.
2. Fittings: ASTM D3034, PVC with bell ends.
3. Gaskets: ASTM F477, elastomeric seals.

2.3 NONPRESSURE TRANSITION COUPLINGS

A. Comply with ASTM C1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground non-pressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials
1. For plastic pipes: ASTM F477, elastomeric seal or ASTM D5926, PVC.
2. For dissimilar pipes: ASTM D5926, PVC or other material compatible with pipe materials being joined.

C. Shielded, flexible couplings shall be elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

D. Ring-Type, flexible couplings shall be elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

2.4 CLEANOUTS

A. Cast-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
1. Top-Loading Classification(s): Light Duty
2. Pipe fitting and riser to cleanout shall be same material as main pipe line.

B. Plastic Cleanouts shall have PVC body with PVC threaded plug. Pipe fitting and riser to cleanout shall be of same material as main line pipe.

2.5 DRAINS

A. Cast-Iron Area Drains: ASME A112.6.3, gray-iron round body with anchor flange and round grate. Include bottom outlet with inside calk or spigot connection, of sizes indicated.

1. Top-Loading Classification(s): Medium Duty

B. Grate openings shall be 3/8 inch (9.5 mm) circular.

2.6 RESILIENT CONNECTORS AND DOWNSPOUT BOOTS FOR BUILDING ROOF DRAINS

A. Resilient connectors and downspout boots: Flexible, watertight connectors used for connecting pipe to manholes and inlets, and shall conform to ASTM C923.

2.7 WARNING TAPE

A. Standard, 4-Mil polyethylene 3 inch (76 mm) wide tape detectable type, green with black letters, and imprinted with “CAUTION BURIED STORM DRAIN LINE BELOW”.

PART 3 - EXECUTION

3.1 PIPE BEDDING

A. The bedding surface of the pipe shall provide a firm foundation of uniform density throughout the entire length of pipe. Concrete pipe requirements are such that when no bedding class is specified, concrete pipe shall be bedded in a soil foundation accurately shaped and rounded to conform with the lowest one-fourth of the outside portion of circular pipe. When necessary, the bedding shall be tamped. Bell holes and depressions for joints shall not be more than the length, depth, and width required for properly making the particular type of joint. Plastic pipe bedding requirements shall meet the requirements of ASTM D2321. Bedding, haunching and initial backfill shall be either Class IB or Class II material. Corrugated metal pipe bedding requirements shall conform to ASTM A798.

3.2 PIPING INSTALLATION

A. Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping with 18 inch (458 mm) minimum cover as shown on the Drawings.

C. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

1. Do not lay pipe on unstable material, in wet trench or when trench and weather conditions are unsuitable for the work.
2. Support pipe on compacted bedding material. Excavate bell holes only large enough to properly make the joint.
3. Inspect pipes and fittings, for defects before installation. Defective materials shall be plainly marked and removed from the site. Cut pipe shall have smooth regular ends at right angles to axis of pipe.
4. Clean interior of all pipe thoroughly before installation. When work is not in progress, open ends of pipe shall be closed securely to prevent entrance of storm water, dirt or other substances.
5. Lower pipe into trench carefully and bring to proper line, grade, and joint. After jointing, interior of each pipe shall be thoroughly wiped or swabbed to remove any dirt, trash or excess jointing materials.
6. Do not walk on pipe in trenches until covered by layers of shading to a depth of 12 inches (300 mm) over the crown of the pipe.
7. Warning tape shall be continuously placed 12 inches (300 mm) above storm sewer piping.

D. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

E. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

F. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

G. Install gravity-flow, nonpressure drainage piping according to the following:

1. Install piping pitched down in direction of flow.

2. Install piping NPS 6 (DN 150) and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fittings; or cast in-place concrete supports or anchors.
3. Install PVC cellular-core piping, PVC sewer piping, and PVC profile gravity sewer piping, according to ASTM D2321 and ASTM F1668.

3.3 REGRADING

A. Raise or lower existing manholes and structures frames and covers in regraded areas to finish grade. Carefully remove, clean and salvage cast iron frames and covers. Adjust the elevation of the top of the manhole or structure as detailed on the drawings. Reset cast iron frame and cover, grouting below and around the frame. Install concrete collar around reset frame and cover as specified for new construction.

B. During periods when work is progressing on adjusting manholes or structures cover elevations, the Contractor shall install a temporary cover above the bench of the structure or manhole. The temporary cover shall be installed above the high flow elevation within the structure, and shall prevent debris from entering the wastewater stream.

3.4 CONNECTIONS TO EXISTING VA-OWNED MANHOLES

A. Make pipe connections and alterations to existing manholes so that finished work will conform as nearly as practicable to the applicable requirements specified for new manholes, including concrete and masonry work, cutting, and shaping.

3.5 CONNECTIONS TO EXISTING PUBLIC UTILITY MANHOLES

A. Comply with all rules and regulations of the public utility.

B. Backwater Valve Installation

C. Install horizontal-type backwater valves in piping where indicated.

D. Cleanout Installation

1. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast iron soil pipe fittings in sewer pipes at branches for cleanouts and cast iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
   a. Use Light-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
   b. Use Medium-Duty, top-loading classification cleanouts in paved foot-traffic areas.

c. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.

d. Use Extra-Heavy-Duty, top-loading classification cleanouts in roads.

2. Set cleanout frames and covers in earth in cast in-place concrete block, 18 by 18 by 12 inches (450 by 450 by 300 mm) deep. Set with tops 1 inch (25 mm) above surrounding earth grade.

E. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.6 DRAIN INSTALLATION

A. Install type of drains in locations indicated.

1. Use Light-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.

2. Use Medium-Duty, top-loading classification cleanouts in paved foot-traffic areas.

3. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.

4. Use Extra-Heavy-Duty, top-loading classification cleanouts in roads.

B. Embed drains in 4 inch (102 mm) minimum concrete around bottom and sides.

C. Set drain frames and covers with tops flush with pavement surface.

D. Assemble trench sections with flanged joints and embed trench sections in 4 inch (102 mm) minimum concrete around bottom and sides.

3.7 CATCH BASIN INSTALLATION

A. Construct catch basins to sizes and shapes indicated.

B. Set frames and grates to elevations indicated.

3.8 STORMWATER INLET AND OUTLET INSTALLATION

A. Construct inlet head walls, aprons, and sides of reinforced concrete.

B. Construct riprap of broken stone.

C. Install outlets that spill onto grade, anchored with concrete.

D. Install outlets that spill onto grade, with flared end sections that match pipe.

E. Construct energy dissipaters at outlets.

3.9 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping in building's storm building drains specified in Division 22 Section FACILITY STORM DRAINAGE PIPING.

B. Encase entire connection fitting, plus 6 inch (150 mm) overlap, with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).

C. Make connections to existing piping and underground manholes.

1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping.
2. Make branch connections from side into existing piping, NPS 4 to NPS 20 (DN 100 to DN 500). Remove section of existing pipe, install wye fitting into existing piping.
3. Make branch connections from side into existing piping, NPS 21 (DN 525) or larger, or to underground manholes and structures by cutting into existing unit and creating an opening large enough to allow 3 inches (76 mm) of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe, manhole, or structure wall, use epoxy-bonding compound as interface between new and existing concrete and piping materials.
4. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

D. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.
   a. Shielded flexible couplings for same or minor difference OD pipes.
   b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
   c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.
2. Use pressure-type pipe couplings for force-main joints.

3.10 CLOSING ABANDONED STORM DRAINAGE SYSTEMS

A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to

withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:

1. Close open ends of piping with at least 8 inch (203 mm) thick, brick masonry bulkheads.
2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.

B. Abandoned Manholes and Structures: Excavate around manholes and structures as required and use one procedure below:

1. Remove manhole or structure and close open ends of remaining piping.
2. Remove top of manhole or structure down to at least 36 inches (915 mm) below final grade. Fill to within 12 inches (300 mm) of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.

C. Backfill to grade according to Division 31 Section EARTH MOVING.

3.11 IDENTIFICATION

A. Install green warning tape directly over piping and at outside edge of underground structures.

3.12 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Prior to final acceptance, provide a video record of all piping from the building to the municipal connection to show the lines are free from obstructions, properly sloped and joined.

1. Submit separate reports for each system inspection.
2. Defects requiring correction include the following:
   a. Alignment: Less than full diameter of inside of pipe is visible between structures.
   b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
   c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
   d. Infiltration: Water leakage into piping.
   e. Exfiltration: Water leakage from or around piping.
3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

3.13 TESTING OF STORM SEWERS:

A. Submit separate report for each test.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
   1. Do not enclose, cover, or put into service before inspection and approval.
   2. Test completed piping systems according to requirements of authorities having jurisdiction.
   3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours advance notice.
   4. Submit separate report for each test.
   5. Air test gravity sewers. Concrete Pipes conform to ASTM C924, Plastic Pipes conform to ASTM F1417, all other pipe material conform to ASTM C828 or C924, after consulting with pipe manufacturer. Testing of individual joints shall conform to ASTM C1103.
   6. Test force-main storm drainage piping. Perform hydrostatic test after thrust blocks, supports, and anchors have hardened. Test at pressure not less than 1-1/2 times the maximum system operating pressure, but not less than 150 psi (1035 kPa).
      a. Ductile iron Piping: Test according to AWWA C600, "Hydraulic Testing" Section.
      b. PVC Piping: Test according to AWWA M23, "Testing and Maintenance" Chapter.

C. Leaks and loss in test pressure constitute defects that must be repaired. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.14 CLEANING

A. Clean interior of piping of dirt and superfluous materials. Flush with water.

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