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SECTION 00 01 15
LIST OF DRAWINGS

The drawings listed below accompany the Specifications and form a part of the contract.

<u>Sheet No.</u>	<u>Drawing No.</u>	<u>Title</u>
1	01	Maintenance Floor Plan
2	02	Maintenance Floor/Elevation Plan
3	03	Maintenance Site Plan
4	04	Maintenance Electrical Plan
5	05	Maintenance Structural Plan

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SECTION 00 11 21
REQUEST FOR PROPOSAL TO DESIGN BUILD
Demo
851CM3046
Houston National Cemetery

A. PART I - GENERAL

A1. Statement of work

Provide all labor, materials, tools and equipment, and design-build services necessary for demolition of the existing maintenance building and design and construction of a maintenance building at Houston National Cemetery, Houston, Texas, in accordance with scope of work listed below, specifications, drawings, terms and conditions described herein other specific tasks as further defined by this request for proposal (RFP).

Scope of Work shall include the following: This design/build project will demolish and replace the existing maintenance building 3002. The intent is to follow the existing floor plan while construction the new building to the latest code requirements and modify the existing features of the current building. The current building is 4000 sf with two (2) offices, one (1) restroom and one (1) storage area. Above the offices is caged mezzanine storage areas access by stairs. The current building will demolished down to the concrete pad. It is not the intent to salvage any for the existing building structure for reuse on this project.

The building to be demolished is next to an active maintenance yard. The contractor will need to fence in the area of demolition.

The basic design of the building will include the following;

- Four (4) 14' wide by 16' high garage door will operate both mechanically and electrically with door sensor.
- Insulated with two ventilation fan in the peak at each end of the building.
- 110 volt electrical service throughout the building.
- 220 volt electrical serve for an air compressor and welding equipment.
- Compress air lines throughout the building.
- Lighting throughout the building will be high efficiency.

The offices will be as followed.

- Insulated
- Temperature controlled
- Both data and communication outlets

- High efficiency lighting
- Electrical outlet.
- Lockable doors.(provide a master key)
- Windows with views into the garage area.
- The office to the south side of the building will have a storage room will be accessible from the office. Provide a secure door and lock.

The restroom will include the following:

- Insulated
- Temperature controlled
- One (1) sink
- One (1) water closet.
- Mirror, wash receptacle, soap dispenser
- High efficiency lighting
- GFI electrical outlet
- Lockable door

The building shall meet all of the latest state and federal code requirements.

Sustainable Design. The sustainable design program strives to enhance VA's mission by incorporating sustainable design practices into the design and construction of VA facilities. Driven by numerous Federal mandates and VA policies, the program encourages design strategies that reduce energy and water consumption, integrate cost-effective renewable energy, promote healthy work environments, and protect vital natural resources.

<http://www.cfm.va.gov/til/sustain.asp>.

Historic Compliance. The A/E shall be responsible for coordinating all historic reviews and compliance required by the State Historic Preservation Officer (SHPO). VA will review and approve all material prepared on its behalf for submission to State agencies.

Topographic, Utilities and Landscape (Site) Survey. The Architect/Engineer (A/E) shall obtain professional surveying services from licensed surveyors to provide a topographic and survey of the entire site.

Geotechnical Soil Survey Report. A detailed requirement for this survey is an appendix to this Statement of Work. The A/E shall obtain a report of subsurface investigations to include seismic data and geologic formations, analysis of soil fertility, organic content, and pH measurement.

A2. Definitions

- A. Design-Build (DB) as defined by the Department of Veterans Affairs (VA) is the procurement by the Government, under one contract, with one firm or joint venture (JV) for both design and construction services for a specific project.
- 1. Contracting Officer: The services to be performed under this contract are subject to the general supervision, direction, control and approval of the Contracting Officer.
- 2. Project Manager: The Contracting Officer's representative responsible for administering contracts under the immediate direction of the Contracting Officer.
- 3. Contract office Technical Representative:
- 4. Design Build Contract: This term, as used herein, refers to the Contract(s) to perform the design and construction of the project.
- 5. Contractor: This term, as used herein, refers to the contractor under this contract or the DB team.
- 6. AE: This term, as used herein, refers to the Architect-Engineer firms that are a part of the DB team, also referred to as DB/AE.

A3. Cost Range

The anticipated cost range for this project is between \$500K and \$1MK.

A4. Schedule

The anticipated completion of this project is 360 days from NTP.

- A5.** A pre-proposal conference will be held on _____, 2016 Time: _____, arranged by the contracting officer in charge. All Offerors, consultants, subcontractors, manufactures and suppliers are invited to attend.

B. PART II - RESPONSIBILITIES

B1. VA Team

- A. Not Used

B2. Design-Build Team:

- A. The DB team includes all J/V partners, consultants and sub contractors to the one firm. The DB team shall provide Architectural and Engineering disciplines for the preparation of construction documents, and construction contractor capabilities for construction of the project.
- B. If the DB Team A/E and contractor are a J/V (not one and the same firm) engineering and other technical consultants shall be subcontractors of the J/V

Architect - not the Design-Build construction contractor or sub contractors. If the DB Team A/E and contractor are one and the same firm (not a J/V) those consultants shall be subcontractors of DB firm not the construction subcontractors.

- C. The RFP documents are intended to define existing conditions, certain required items, and design parameters to be included in the project. It is the DB Team's responsibility to complete the documents and construction in a manner consistent with the intent of the RFP documents within the required time period (contract length).

C. PART III - PROPOSAL REQUIREMENTS

C1. General

- A. Proposals shall be based on solicitation documents issued for RFP Solicitation Number _____,

D. PART IV - POST AWARD REQUIREMENTS

D1. Construction Document Preparation:

A. Design Review Submissions:

1. The Design-Build Team A/E (DB A/E) shall prepare and submit 35 %, 65%, 95% 100% construction documents for review and approval by the VA in accordance with standard professional practice, the Department of Veterans Affairs RFP (VA RFP), and prevailing codes. The specifications must be edited to represent the specific design and construction proposed by the Contractor. A commercial level of design, materials and construction quality is required.
2. All submission packages will be reviewed at (35%), (65%) and (95%) completion stages. The (95%) review submission packages will incorporate the final review comments from the (65%) review. If any package is not complete for the required stage a post review may be required the cost of which will be borne by the DB team.
3. A minimum of five (5) review submission packages (see table 2 for submission requirement) shall be sent out for each review. Each review submission package shall include hard copy each drawing set, the cost estimate, and specifications and 1 CD-ROM (VA PM only) with one drawing set, cost estimate and specifications. The packages will include an index of drawings (by sheet number and title) and specifications (by section number and title) submitted. The a package will be distributed to the VA Project Manager, District Engineer, Cemetery Director, Chief,

Cemetery Development & Improvement Service and others as determined to be appropriate by the VA Project Manager.

B. Submittal Requirements:

1. Drawing Sheets and Labeling Requirements:

- a) All plans are to use the standard VA base sheet. Sheet size is 30" x 42".
- b) All drawings shall be bound, along the left margin, into sets in the order of the drawing symbol list contained in this scope. The binding must not obscure any information on the drawings.
- c) Each set of drawings will have a cover sheet which indicates: project name, project number, and index of drawings in the set, names and addresses of all associated A/E firms, vicinity map, and site location map. Project location map and other pertinent project information.
- d) Each sheet as well as all materials submitted will be clearly labeled above the title block, what submission it is, corresponding to the required submissions in this SOW i.e., "100% Construction Documents Submittal". This label will be appropriately revised after the review.
- e) Drawing symbol Identification shall match V% of the National CAD standards.

2. Graphic Standards

- a) Plans must clearly demonstrate what new work is, what is existing and what is to be demolished. New work must be graphically bolder (darker than existing conditions. Dashed lines shall show demolition work. All lettering must be a minimum of 1/8-inch high.
- b) All sheets will have the same north arrow orientation. North shall be oriented to the top of each plan sheet. Each sheet having a drawing that requires it will have a north arrow on the sheet. Drawing scales must be indicated on each sheet in both written and graphic form. Each sheet will have a key map for locating and orienting individual drawing sheets to the whole site.
- c) All plans will show drafting symbols and abbreviations.
- d) Drawings using match lines must not overlap information. All information must stop at the match line and resume at the corresponding match line.
- e) Detail sheets will be organized logically and present the material intended in an orderly manner. Items with plan, front and side views will be arranged in that context to one another. Each detail must be clearly labeled and scale indicated.
- f) Specifications:

Submit 8 1/2" x 11" copies of all required calculations and specifications. All letter reports will be labeled with the project name, project number, name(s) of the A/E firm(s), date and title of the report or estimate. Final submittal of specifications shall be in Microsoft Word and PDF formats on CDROM.

g) Submission package will be reviewed by VA for completion at each stage. If the submission package is not complete, a post review may be required, the cost of which will be borne by the DB team.

h) The Design Review Submission package shall include hard copy sets with the following distribution:

VA STAFF	DRAWINGS	COST ESTIMATE	CALCS.	SPECS	CD
Project Manager	1 full size & 1/2 size sets	1 set	1 set	1 set	1
Continental District Engineer	1 full set	1 set	1 set	2 set	
Cemetery Director	1 full set			1 set	
Cemetery Coordinator	1/2 size sets	1 set		1 set	

Table 1

Submittal addresses and contact information:

VA STAFF	MAILING ADDRESS	PHONE /FAX/ E-MAIL
Project Manager:	Department of Veterans Affairs National Cemetery Administration (43B) 425 Eye Street, N.W. Washington, DC 20001 Attn: Stephen Davis	Phone: (202) 632-4833 steve.davis@va.gov
Continental District Engineer:	Department of Veterans Affairs Continental District 155 Van Gordon Street Lakewood, CO 80228 Attn: Rodney Duich	Phone: (303) 914-5702 FAX: (303) 914-5715
Cemetery Director:	Houston National Cemetery 10410 Veterans Memorial Drive Houston, TX 77038 Attn: Mat Williams	Phone: (281) 447-8686 Fax: (281) 447-0580

VA STAFF	MAILING ADDRESS	PHONE /FAX/ E-MAIL
Chief, Cemetery Development & Improvement Service	Department of Veterans Affairs National Cemetery Administration 575 N. Pennsylvania Street, Suite 495 Indianapolis, IN 46204 Attn: Glenn Madderom	Phone: (317) 916-3797 Fax: (317) 226-0206

Table 2

i. All VA comments made on the Design Review Submission will be incorporated in this final submission. The final packages will be distributed the same as the Design Review Submission above.

C. Design Review Meetings:

1. A review meeting to resolve design issues will be held as determined necessary by the project manager to resolve design issues.
2. The DB team shall allow a minimum of fourteen (14) calendar days for each review cycle. A cycle includes:
 - a. The VA's receipt of the design review submission package.
 - b. DB teams receipt of comments from the VA, either electronically, by fax, or by hard copy delivery.
 - c. Scheduling of review meeting (optional by project manager)
3. Coordination of the review meeting schedules will be the responsibility of the VA Project Manager and the DB Project Manager (for the DB team). See section H. Quality Assurance/Quality Control.

D. Electronic Media:

1. Design review submission drawings will be full size hard copy. Final Construction Document submission drawings will be a hard copy (on mylar) and executed in electronic format. All drawings will be in AutoCAD version 2007 format in accordance with the latest version of CADD standards these standards can be downloaded from the internet at <http://www.cfm.va.gov/til/nca.asp>.
2. Design review submission specifications and other 8 1/2 by 11 formatted material and final Construction Document submission specifications and other 8 1/2 by 11 formatted materials will be executed in electronic format Microsoft Word.
3. At the DB Team's request, the drawings included in the VA RFP will be available to the DB team in hard copy only for use in preparing the construction drawings. Drawings are provided without warranty or obligation on the part of VA as to

- accuracy or information contained therein. The user shall independently verify all information in the files. Any user shall agree to indemnify and hold VA harmless from any and all claims, damages, losses, and expenses including, but not limited to, attorney's fee arising out of the use of the drawings.
4. The specifications included in the VA RFP shall be available to the DB team in hardcopy for use in preparing the construction specifications.
- E. Professional Licensing:
1. The DB A/E who prepares the construction documents shall be a professional architect or engineer licensed in the state in which the design work is completed.
 2. The professional seal indicating such license by the state shall appear on the final construction documents. The architect whose seal is shown will be known as the Architect of Record. The DB AE shall certify compliance with the VA RFP and all applicable codes.
- F. Approved Construction Documents:
1. The final construction document submission package will be submitted by the DB team for approval by the VA after completion of the 100% review cycle for the final package to be submitted by the DB team. The VA will have 14 calendar days to take approval action.
 2. The final construction documents submission package will include a full set of construction documents including all disciplines.
 3. The final construction documents submission package will incorporate all VA supplied comments from the earlier submissions and comply with the VA RFP.
 4. If the final construction documents submission package is not complete a post submittal may be required the cost of which will be borne by the DB team.
 5. The approved final construction documents include such details that the project can be constructed and will be used for construction of the project.
 6. See PART IV, D2 for Approved Construction Document distribution.
- G. Construction Drawing Preparation: Mandatory material and equipment schedules and details may be indicated either on the drawings or in the specifications, at the option of the DB team. The construction drawings shall include a coordinated set of the following.
1. Civil engineering drawings including demolition plans, grading and drainage plans, paving plans, utility plans, schedules calculations and details.

2. Landscape drawings including demolition plans, landscape plans, plant schedule and list, special landscape elements, proposed materials to be used for each special landscape element, calculations and details.
- H. Construction: - Project specifications shall include specifications for all products, materials, equipment, methods, and systems shown on the construction drawings in accordance with standard professional practice and the VA RFP. The specification submitted for review shall include:
1. The name of the manufacturer, the product name, model number, or other identification as appropriate to clearly identify the product that will be used in the construction of the project;
 2. Other data as appropriate to clearly identify the product that will be used in the construction of the project i.e. shop drawings, product data, and samples as required by the VA RFP documents; and
 3. The required stamp of the licensed architect or engineer of record will be considered as certification of compliance with the RFP requirements.
- I. Design Requirements - Compliance with codes and standards.
1. Project design shall be in compliance with applicable standards and codes described in VA Program Guides and design materials included or referenced in the solicitation materials.
 2. See Section D. Approved Construction documents, above, for required inclusion of design review comments.
 3. The DB team shall identify all permitting requirements associate with the proposed project.
 4. In the design of new work under this contract, the DB team shall consider all requirements (other than procedural requirements) of:
 - 1) Zoning laws;
 - 2) Environmental and erosion control regulations; and
 - 3) Laws relating to landscaping, open space, minimum distance of a building from the property line, maximum height of a building, historic preservation, and esthetic qualities of a building. In addition, similar laws, of the State and local political division, which would apply to the building if it, were not to be constructed or altered by the U.S. Government.
 - 4) Identify all permits need for the project and the requirements for the permits.

5. The DB team shall consult with appropriate officials of the Federal, state, and political subdivision, and submit plans under the rules prescribed by those reviewing authorities. The DB team and VA shall give due consideration to the recommendations of the referenced building officials. VA will also permit inspection by the officials described above during the construction period in accordance with the customary schedule of inspections in the locality of the building construction. Such officials shall provide VA with a copy of the schedule before construction begins or give reasonable notice of their intention to inspect before conducting an inspection.
 6. The DB team shall provide prompt, written notification to the Contracting Officer concerning conflicts with, or recommended deviations from codes, laws, regulations, standards, and opinions of review officials as described above. No work altering the scope of this contract shall be undertaken prior to receipt of written approval from the Contracting Officer.
 7. No action may be brought against the DB team or VA and no fine or penalty may be imposed for failure to carry out any of the previously described recommendations of Federal, state, or local officials. VA and its contractors, including SOW A/E, shall not be required to pay any amount for any action taken by a state or political division of a state in carrying out functions described in this article, including reviewing plans, carrying out on-site inspections, issuing permits, and making recommendations.
 8. The DB team shall advise the Contracting Officer of any variances with the applicable Department of Labor, Occupational Safety and Health Standards, for occupancy requirements.
- J. Quality Assurance/Quality Control:
1. To reduce design errors and omissions, the AE shall develop and execute a QA/QC plan that demonstrates the project plans and specifications have gone through a rigorous, thorough review and coordination effort.
- I. Quality Assurance/Quality Control:
1. To reduce design errors and omissions, the DB team shall develop and execute a QA/QC plan that demonstrates the project plans and specifications have gone through a rigorous, thorough review and coordination effort.
 2. Within 2 weeks of receipt of Notice to Proceed, the DB Team will submit a detailed QA/QC plan describing each QA/QC task that will be taken during the development

of the various design submission packages and the name of the DB Team member responsible for QA/QC.

- a. Upon its completion each task shall be initialed and dated by the responsible DB Team member.
- b. A 100% completed QA/QC plan shall be submitted with the final construction document submission package.

D2. Construction Period Submittals

- A. The DB contractor shall distribute a total of 6 sets of the approved construction documents prepared by the DB Team to the VA and CPIS AE, as directed by the VA Project Manager.
- B. Other submittals - The DB team shall submit test results, certificates, manufacturer's instructions, manufacturers field reports, etc. as required by the VA RFP specifications, to the VA PM and CPIS AE.
- C. Project record drawings - The DB team will maintain a set of construction documents (field as-built drawings) to record actual construction changes during the construction process as required by the VA RFP specifications. The project record drawings will be available for review by the VA Project Manager at all times.
- D. Shop drawings and submittals - The DB A/E shall check government furnished and/or the DB construction contractor's shop drawings, detail drawings, schedules, descriptive literature and samples, testing labor-laboratory reports, field test data and review the color, texture and suitability of materials for conformity with the RFP Documents and construction documents. The DB A/E shall recommend approval, disapproval, or other suitable disposition to the VA PM. The VA PM will have final approval authority. The DB AE shall evaluate the submittals with reference to any companion submittals that constitute a system. When necessary, the DB A/E will request the DB Construction Contractor to submit related components of a system before acting on a single component. Should this procedure be inappropriate, the DB A/E shall review all prior submittals for related components of the system before acting on a single component. The DB A/E may be required to hold joint reviews with the VA technical staff and /or the CPIS AE on complicated system submittals. The DB A/E shall notify the VA Project Manager (PM) in writing of any and all deviations from the requirements of the construction documents that he has found in the submittals.

D3. Project Close-Out

The DB team shall comply with the requirements in the contract documents for submission of final VA RFP as built drawings, manuals, and other documents as noted. Required as built drawings and specifications will be submitted in the same format required for the construction documents.

D4. Site Visits and Inspections

During the construction period the DB A/E shall make weekly visits to the project site as part of the QC/QA process. The Contracting Officer (CO), Project Manager (PM) or COTR may also request visits for special purposes. Only registered architects and engineers thoroughly familiar with the project may make these site visits. The Contracting Officer (CO) or Project Manager (PM) has the prerogative to determine the professional discipline(s) required for any visit. The DB A/E shall observe the construction, advise the Project Manager or COTR of any deviations or deficiencies or solutions to issues discussed. A site inspection report which includes the purpose of the inspection, items reviewed, deficiencies observed, recommendations and additional actions required, shall be furnished to the Contracting Officer (CO), Project Manager (PM) and COTR within three work days following the site visit date.

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**SECTION 01 00 00
GENERAL REQUIREMENTS (MINOR NCA PROJECTS)**

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SECTION 01 00 00
GENERAL REQUIREMENTS (MINOR NCA PROJECTS)

1.1 GENERAL INTENTION

The Contractor shall completely prepare site for construction operations, furnish labor and materials and perform work as required by the Drawings and Specifications, including: earthwork; 1,264 double depth pre-placed crypt burial plots, 4 buildings; water, sanitary sewerage and storm drainage utility systems; asphalt-paved roadways and parking lots; landscaping, irrigation; other site improvements; and grassing and other site stabilization.

- B. Not used
- C. All Testing Laboratory services shall be retained and paid for by the Contractor (see Spec. Section 01 45 29 Testing Laboratory Services). However, the NCA may elect to retain its own Testing Laboratory for any purpose. Before placement and installation of work subject to tests by testing laboratory retained by NCA, the Contractor shall notify the COTR in sufficient time to enable testing laboratory personnel to be present at the site in time for proper taking and testing of specimens and field inspection. Such prior notice shall not be less than three working days unless otherwise designated by the COTR.
- D. All employees of the Contractor and subcontractors shall comply with NCA security management program and obtain permission of the NCA police, be identified by project and employer, and shall be restricted from unauthorized access.
- E. Prior to commencing work, the Contractor shall provide proof that an OSHA certified "competent person" (CP) as defined in 29 CFR 1926.20(b)(2) will maintain a presence at the work site whenever the Contractor or subcontractors are present.
- F. Training:
 - 1. All employees of the Contractor or subcontractors having supervisory responsibilities shall have the 30-hour OSHA certified Construction Safety course and/or other relevant competency training, as determined by the NCA.
 - 2. All other employees of the Contractor or subcontractors shall have the 10-hour OSHA certified Construction Safety course and/or other relevant competency training. Relevant competency training shall be as determined acceptable by the NCA.
 - 3. Submit training records of all such employees for approval before the start of work.

1.2 STATEMENT OF BID ITEM(S)

- A. CLIN 001, BASE BID, GENERAL CONSTRUCTION: Work of the Contract includes general construction, alterations, roads, grading, drainage, crypt installation, building construction, mechanical and electrical work, utility systems, storm drainage system, and other construction in accordance with the Drawings and Specifications.
- B. CLIN 002, Manufacture and deliver to the site 1,264 pre-placed crypts.

1.3 SPECIFICATIONS AND DRAWINGS FOR CONTRACTOR

- A. Additional sets of drawings may be made by the Contractor, at Contractor's expense from CD furnished by the NCA. The CD shall be returned to the NCA immediately after printing is completed.

1.4 FIRE SAFETY

- A. Applicable Publications: Publications listed below form part of this Article to the extent referenced. Publications are referenced in text by basic designations only.
 - 1. American Society for Testing and Materials (ASTM):
 - E84-2009a Surface Burning Characteristics of Building Materials
 - 2. National Fire Protection Association (NFPA):
 - 10-2010 Standard for Portable Fire Extinguishers
 - 30-2008 Flammable and Combustible Liquids Code
 - 51B-2009 Standard for Fire Prevention During Welding, Cutting and Other Hot Work
 - 70-2008 National Electrical Code
 - 241-2009 Standard for Safeguarding Construction, Alteration, and Demolition Operations
 - 3. Occupational Safety and Health Administration (OSHA):
 - 29 CFR 1926 Safety and Health Regulations for Construction
- B. Fire Safety Plan: Establish and maintain a fire protection program in accordance with 29 CFR 1926. Prior to start of work, prepare a plan detailing project-specific fire safety measures, including periodic status reports, and submit to RE/COR/Cemetery Director for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. Prior to any worker for the contractor or subcontractor's beginning work, they shall undergo a safety briefing provided by the General Contractor's competent person per OSHA requirements. This

briefing shall include information on the construction limits, safety guidelines, means of egress, break areas, work hours, locations of restrooms, use of NCA equipment, etc. Documentation shall be provided to the RE/COR that individuals have undergone the Contractor's safety briefing.

- C. Site and Building Access: Maintain free and unobstructed access to emergency services and for fire, police and other emergency response forces in accordance with NFPA 241.
- D. Separate temporary facilities, such as trailers, storage sheds, and dumpsters, from existing buildings and new construction by distances in accordance with NFPA 241. For small facilities with less than 6 m (20 feet) exposing overall length, separate by 3m (10 feet).
- E. Temporary 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 RE/COR/Cemetery Director.
- G. Egress Routes for Construction Workers: Maintain free and unobstructed egress. Inspect daily. Report findings and corrective actions weekly to RE/COR.
- 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. Fire Hazard Prevention and Safety Inspections: Inspect entire construction areas weekly. Coordinate with, and report findings and corrective actions weekly to RE/COR.
- K. 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.
- L. Dispose of waste and debris in accordance with NFPA 241. Remove from buildings daily and site weekly.
- M. Perform other construction, alteration and demolition operations in accordance with 29 CFR 1926.

1.6 OPERATIONS AND STORAGE AREAS

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

- B. Temporary buildings (e.g., storage trailers, office trailers) and utilities may be erected by the Contractor only with the approval of the COTR and shall be built with labor and materials furnished by the Contractor without expense to the NCA. 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 COTR, the buildings and utilities may be abandoned and need not be removed.
- C. The Contractor shall, under regulations prescribed by the COTR, use only established roadways, or use temporary roadways constructed by the Contractor when and as authorized by the COTR. 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 COTR.
- E. Workmen are subject to rules of the NCA regarding their conduct and dress code.
- F. Execute work so as to interfere as little as possible with normal functioning of the Medical Center as a whole, including operations of utility services, fire protection systems and any existing equipment, and with work being done by others.
 - 1. Do not store materials and equipment in other than assigned areas.
 - 2. Provide unobstructed access, for the Medical Center personnel, to areas that are required to remain in operation during the construction of the project.
- G. Phasing: To insure such executions, the Contractor shall furnish the COTR 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, notify the COTR two weeks in advance of the proposed date of starting work in each specific area of site, building or portion thereof. Arrange such dates to insure accomplishment of this work in successive and/or concurrent phases as is mutually agreeable to the NCA Director, COTR and Contractor.
- H. The Contractor shall take all measures and provide all material necessary for protecting existing equipment and property in affected areas of construction against dust and debris, so that equipment and affected areas to be used in the Medical Center's operations will not be hindered. Permit access to the NCA personnel through other

construction areas which serve as routes of access to such affected areas and equipment.

- I. Construction Fence: Before construction operations begin, the Contractor shall provide a chain link construction fence, seven feet minimum height, around the construction area indicated on the Drawings. Provide gates as required for access with necessary hardware, including hasps and padlocks. Fasten fence fabric to terminal posts with tension bands and to line posts and top and bottom rails with tie wires spaced at maximum 15 inches. Bottom of fences shall extend to one inch above grade. Remove the fence when directed by COTR.
- J. Utilities Services: Maintain existing utility services for the Medical Center at all times. Meet with the RE and appropriate Medical Center operations staff to walk the proposed work areas and discuss any known or potential underground systems that are indicated or not shown on the construction drawings, prior to starting the work.
 - 1. Provide an underground utility locating service to locate any existing underground lines and other underground facilities within the work area that are to remain in service. Any new information, not clearly indicated on the bid documents shall be passed on to the Contractor's underground locating service staff. Any new information discovered by the underground locating service staff shall be turned over to the COTR for dissemination to the NCA.
- K. Utilities Services: Maintain existing utility services for the Cemetery at all times. Provide temporary facilities, labor, materials, equipment, connections, and utilities to assure uninterrupted services. Where necessary to cut existing water, 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 RE/COR. All such actions shall be coordinated with the Utility Company involved.
 - 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 RE/COR. Electrical work shall be accomplished with all affected circuits or equipment de-energized. When an electrical outage cannot be accomplished, work on any energized circuits or equipment shall not commence without the RE/COR, and Cemetery Director's prior knowledge and written approval. Refer to specification Sections 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, 27 05 11 REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS and 28 05 11,

REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY INSTALLATIONS
for additional requirements.

2. The Contractor shall submit a request to interrupt any such services to both RE/COR and the Cemetery Director in writing, 48 hours in advance of proposed interruption. Request shall state reason, date, exact time of, and approximate duration of such interruption.
 3. The 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 the Cemetery. Interruption time approved by the Cemetery and RE/COR 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 RE/COR.
 5. In case of a contract construction emergency, service will be interrupted on approval of RE/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. To minimize interference of construction activities with flow of Medical Center traffic, comply with the following:
1. Keep roads, walks and entrances to grounds, to parking and to occupied areas of buildings clear of construction materials, debris and standing construction equipment and vehicles. Wherever excavation for new utility lines cross existing roads, at least one lane must be open to traffic at all times.
 2. Method and scheduling of required cutting, altering and removal of existing roads, walks and entrances must be approved by the COTR.
- M. Coordinate the work for this contract with other construction operations as directed by COTR. This includes the scheduling of traffic and the use of roadways, as specified.

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

- A. The Contractor shall preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass) on or adjacent to the work site, which are not to be removed and which do not unreasonably interfere with the work required under this contract. The Contractor shall only remove trees when specifically authorized to do so,

and shall avoid damaging vegetation that will remain in place. If any limbs or branches of trees are broken during contract performance, or by the careless operation of equipment, or by workmen, the Contractor shall trim those limbs or branches with a clean cut and paint the cut with a tree-pruning compound as directed by the RE/COR.

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

(FAR 52.236-9)

- C. Refer to Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS, for additional requirements on protecting vegetation, soils and the environment. Refer to Articles, "Alterations", "Restoration", and "Operations and Storage Areas" for additional instructions concerning repair of damage to structures and site improvements.
- D. Refer to FAR clause 52.236-7, "Permits and Responsibilities," which is included in General Conditions. A National Pollutant Discharge Elimination System (NPDES) permit is required for this project. The Contractor is considered an "operator" under the permit and has extensive responsibility for compliance with permit requirements. VA will make the permit application available at the (appropriate NCA Central/Cemetery) office. The contractor and affected subcontractors shall furnish all information and certifications that are required to comply with the permit process and permit requirements. Many of the permit requirements will be satisfied by completing construction as shown and specified. Some requirements involve the Contractor's method of operations and operations planning and the Contractor is responsible for employing best management practices. The affected activities often include, but are not limited to the following:
1. Designating areas for equipment maintenance and repair;
 2. Providing waste receptacles at convenient locations and provide regular collection of wastes;
 3. Locating equipment wash down areas on site, and provide appropriate control of wash-waters;

4. Providing protected storage areas for chemicals, paints, solvents, fertilizers, and other potentially toxic materials; and
5. Providing adequately maintained sanitary facilities.

1.8 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 COTR. Existing work to be altered or extended and is found to be defective in any way, shall be reported to the COTR 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 the Contractor's own expense, immediately restore to service and repair any damage caused by the Contractor's workmen to any operational existing piping and conduits, wires, cables, etc. The above is applicable for all owner operated systems with underground elements or those of utility services or of fire protection systems and communications systems (including telephone) which are indicated on the Drawings and which are not scheduled for discontinuance or abandonment.
- D. Expense of repairs to such utilities and systems not shown on the Drawings or locations of which are unknown will be covered by adjustment to contract time and price in accordance with clause entitled "CHANGES" (FAR 52.243-4 and VAAR 852.236-88) and "DIFFERING SITE CONDITIONS" (FAR 52.236-2).

1.9 PHYSICAL DATA

- A. Data and information furnished or referred to below is for the Contractor's information. The NCA shall not be responsible for any interpretation of or conclusion drawn from the data or information by the Contractor.
 1. The indications of physical conditions on the Drawings and in the Specifications are the result of site investigations by Amec Foster Wheeler Environment & Infrastructure, Inc..

- B. Subsurface conditions have been developed by soil borings and test pits. Logs of subsurface exploration are shown diagrammatically on the Drawings.
- C. A copy of the soil report will be made available for inspection by bidders upon request to the Contracting Officer.
- D. The NCA does not guarantee that other materials will not be encountered nor that proportions, conditions or character of several materials will not vary from those indicated by explorations. Bidders are expected to examine the site of work and logs of borings and, after investigation, decide for themselves the character of materials and make their bids accordingly. Upon proper application to the NCA, bidders will be permitted to make subsurface explorations of their own at site.

1.10 PROFESSIONAL SURVEYING SERVICES

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

1.11 LAYOUT OF WORK

- A. The Contractor shall lay out the work from Government established base lines and bench marks indicated on the drawings, and shall be responsible for all measurements in connection with the layout. The Contractor shall furnish, at the 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 RE/COR. The Contractor shall also be responsible for maintaining and preserving all stakes and other marks established by the RE/COR until authorized to remove them. If such marks are destroyed by the Contractor or through Contractor's negligence before their removal is authorized, the RE/COR may replace them and deduct the expense of the replacement from any amounts due or to become due to the Contractor.

(FAR 52.236-17)

- B. Establish and plainly mark center lines for each building and/or addition to each existing building, lines for each gravesite control monument, and such other lines and grades that are reasonably necessary to properly assure that location, orientation, and elevations established for each such structure and/or addition, roads, parking lots,

gravesite control monuments, 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. The 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 RE/COR before any work (such as footings, floor slabs, columns, walls, utilities and other major controlling features) is placed.
- D. During progress of work, the Contractor shall have lines, grades, locations and plumbness of all major form work checked and certified by a registered land surveyor or registered civil engineer as meeting requirements of contract drawings. Furnish such certification to the RE/COR before any major items of concrete work are placed. In addition, furnish to the RE/COR certificates from a registered land surveyor or registered civil engineer that the following work is complete in every respect as required by contract drawings.
1. Lines of each building and/or addition.
 2. Elevations of bottoms of footings and tops of floors of each building and/or addition.
 3. Lines and elevations of sewers and of all outside distribution systems.
 4. Lines of grave plot documentation.
 5. Lines of elevations of all swales and interment areas.
 6. Lines and elevations of roads, streets and parking lots.
 7. Lines and elevations and location of top of pre-placed crypts within their respective plots.
 8. Lines and elevations of grade over pre-placed crypts.
 9. Northing/Easting coordinate locations and elevation depth below finished grade// of all water, sanitary, storm, gas and irrigation structures, directional fittings, control wire and lines.
 10. Northing/Easting coordinate locations//and elevation// for each gravesite grid monument.

- E. Upon completion of the work, the Contractor shall furnish the RE/COR with reproducible drawings, in AutoCAD form, at the scale of the contract drawings, showing the finished grade on the grid developed for constructing the work. These drawings shall bear the seal of the registered land surveyor or registered civil engineer.
- F. The Contractor shall perform the surveying and layout work of this and other articles and specifications in accordance with the provisions of Article "Professional Surveying Services".

1.12 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, which will include all contract changes, modifications and clarifications.
- B. All variations shall be shown in the same general detail as used in the contract drawings. To insure compliance, as-built drawings shall be made available for the RE/COR's review, as often as requested.
- C. The Contractor shall deliver two approved completed sets of as-built drawings to the RE/COR within 15 calendar days after acceptance of the project by the RE/COR.
- D. Paragraphs A, B, & C shall also apply to all shop drawings.

1.13 USE OF ROADWAYS

- A. When materials are transported in prosecution of the work, use only established public roads and roads on Medical Center property and, when authorized by the COTR, such temporary roads which are necessary in the performance of contract work. Temporary roads not specifically indicated and detailed on the drawings shall be constructed and maintained by the Contractor at the Contractor's expense including all necessary erosion and sediment control facilities. When necessary to cross new or existing curbing, sidewalks, or similar construction, the Contractor must furnish install, maintain and remove adequate protection by well-constructed bridges.

SPEC WRITERS NOTES:

- B. When new permanent roads are to be a part of this contract, the Contractor may construct them immediately to facilitate building operations. These roads may be used by all who have business thereon within zone of building operations.
- C. When certain buildings (or parts of certain buildings) are required to be completed in advance of general date of completion, all roads leading thereto must be completed and available for use at the time set for completion of such buildings or parts thereof.

1.14 TEMPORARY TOILETS

- A. Provide (for use of all Contractor's workmen) ample temporary sanitary toilet accommodations with suitable sewer and water connections, or when approved by COTR provide suitable dry closets. 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.

1.15 AVAILABILITY AND USE OF UTILITY SERVICES

- A. The NCA 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 NCA. The Contractor shall carefully conserve any utilities furnished without charge.
- B. The Contractor, at Contractor's expense and in a workmanlike manner satisfactory to the COTR, 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 NCA, remove all the temporary connections, distribution lines, meters, and associated paraphernalia.
- C. Heat: Furnish temporary heat necessary to prevent injury to work and materials through dampness and cold. Use of open salamanders or any temporary heating devices which may be fire hazards or may smoke and damage finished work, will not be permitted. Maintain minimum temperatures as specified for various materials by their respective manufacturers as required to prevent damage due to dampness or cold.
- D. Electricity (for Construction and Testing): Furnish all temporary electric services.
 - 1. Obtain electricity by connecting to the Medical Center electrical distribution system. Meter and pay for electricity required for electric cranes and hoisting devices, electrical welding devices and any electrical heating devices providing temporary heat. Where not available the Contractor shall supply power via portable generators or temporary electric service from the electric utility company at own expense.
- 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 to the existing potable water system. The Contractor shall meter and pay for water required during construction.

2. Maintain connections, pipe, fittings and fixtures and conserve water use so that none is wasted. Failure to stop leakage or other wastes, or causing unacceptable adverse impacts on the existing system, will be cause for immediate revocation (at COTR's discretion) of use of water from the Medical Center's system and will require or result in the Contractor's connection(s) being immediately shut-off.

1.16 NEW TELEPHONE EQUIPMENT

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

1.17 TESTS

- A. Pre-test mechanical and electrical equipment and systems and make corrections required for proper operation of such systems before requesting final tests. Final test will not be conducted unless pre-tested.
- B. Conduct final tests required in various sections of specifications in presence of an authorized representative of the RE/COTR. Contractor shall furnish all labor, materials, equipment, instruments, and forms, to conduct and record such tests.
- C. Mechanical and electrical systems shall be balanced, controlled and coordinated. A system is defined as the entire complex which must be coordinated to work together during normal operation to produce results for which the system is designed. For example, air conditioning supply; air is only one part of entire system which provides comfort conditions for a building. Other related components are return air, exhaust air, hot water, controls and electricity, etc. Another example of a complex which involves several components of different disciplines is a burner installation. Efficient and acceptable burner operation depends upon the coordination and proper operation of fuel, combustion air, controls, and other related components.
- D. All related components as defined above shall be functioning when any system component is tested. Tests shall be completed within a reasonably short period of time during which operating and environmental conditions remain reasonably constant.
- E. Individual test result of any component, where required, will only be accepted when submitted with the test results of related components and of the entire system.

1.18 INSTRUCTIONS

- A. The Contractor shall furnish Maintenance and Operating manuals and verbal instructions when required by the various sections of the specifications and as hereinafter specified.
- B. Manuals: Maintenance and operating manuals (four copies each) for each separate piece of equipment shall be delivered to the RE/COR coincidental with the delivery of the

equipment to the job site. Manuals shall be complete, detailed guides for the maintenance and operation of equipment. They shall include complete information necessary for starting, adjusting, maintaining in continuous operation for long periods of time and dismantling and reassembling of the complete units and sub-assembly components. Manuals shall include an index covering all component parts clearly cross-referenced to diagrams and illustrations. Illustrations shall include "exploded" views showing and identifying each separate item. Emphasis shall be placed on the use of special tools and instruments. The function of each piece of equipment, component, accessory and control shall be clearly and thoroughly explained. All necessary precautions for the operation of the equipment and the reason for each precaution shall be clearly set forth. Manuals must reference the exact model, style and size of the piece of equipment and system being furnished. Manuals referencing equipment similar to but of a different model, style, and size than that furnished will not be accepted.

- C. Instructions: the Contractor shall provide qualified, factory-trained manufacturers' representatives to give detailed instructions to assigned Department of Veterans Affairs personnel in the operation and complete maintenance for each piece of equipment. All such training will be at the job site. These requirements are more specifically detailed in the various technical sections. Instructions for different items of equipment that are component parts of a complete system; shall be given in an integrated, progressive manner. All instructors for every piece of component equipment in a system shall be available until instructions for all items included in the system have been completed. This is to assure proper instruction in the operation of inter-related systems. All instruction periods shall be at such times as scheduled by the RE/COR and shall be considered concluded only when the RE/COR is satisfied in regard to complete and thorough coverage. The Department of Veterans Affairs reserves the right to request the removal of, and substitution for, any instructor who, in the opinion of the RE/COR, does not demonstrate sufficient qualifications in accordance with requirements for instructors above.

1.19 GOVERNMENT-FURNISHED PROPERTY

- A. The NCA will deliver to the Contractor, the NCA-furnished property shown on the Drawings and specified.
- B. Equipment furnished by the NCA to be installed by the Contractor will be furnished to the Contractor at the Medical Center.

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

1.20 CONSTRUCTION SIGN

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

- D. Detail drawing of construction sign showing required legend and other characteristics of sign is shown on the Drawings.

1.21 SAFETY SIGN

- A. Provide a Safety Sign where directed by COTR. Face of sign shall be 3/4 inch thick exterior grade plywood. Provide two four by four inch posts extending full height of sign and three feet into ground. Set bottom of sign level at four feet above ground.
- B. Paint all surfaces of Safety Sign and posts with one prime coat and two coats of white gloss paint. Letters and design shall be painted with gloss paint of colors noted.
- C. Maintain sign and remove it when directed by COTR.
- D. Detail Drawing Number 45 of safety sign showing required legend and other characteristics of sign is shown on the Drawings.
- E. Post the number of accident free days on a daily basis.

1.22 CONSTRUCTION DIGITAL IMAGES

- A. During construction period through completion, furnish Department of Veterans Affairs weekly color digital photographs of construction progress (8 to 10 images per week.) Photographs of the reinforcing steel shall be taken after all reinforcing steel, sleeves, inserts, etc. are in place but prior to setting of runways. Photographs must show distinctly, at as large a scale as possible, all parts of work embraced in picture.
- B. Photographs are to be taken with a high-resolution digital camera, minimum 6 megapixels, with good wide-angle capability. The images shall be recorded in JPEG format with a minimum of 24-bit color and no reduction in actual picture size.
 - 1. Compressed size of the file shall be no less than 80% of the original with no loss of information.
 - 2. File names shall contain the Project number, the date the image was taken, and a unique sequential identifier, for example: 101CM3202_10-01-2013_0001. Use underscore, not spaces in digital file names.
- C. The digital photo files shall become property of Government and will be both e-mailed and submitted on CD-ROM.
 - 1. The images shall be forwarded electronically to the COR/Project Manager via email to NAME@va.gov within 2 days of when the photo was taken. Identify the content of each picture by a caption incorporated in the photo.

2. The digital photo files shall also be submitted on CD-ROM to the COR/Project Manager at the conclusion of the project. The CD-ROM shall also contain an index of all the images contained therein in either a TXT or Microsoft Word format.

1.23 FINAL ELEVATION PHOTOGRAPHS

- A. Final photographs shall be taken by a commercial/professional photographer. They shall be taken upon completion, including landscaping. They shall be taken on a clear sunny day at as large a scale as possible to obtain sufficient detail to show depth and to provide clear, sharp pictures. All images shall become property of the Government.
- B. Photographs shall be artistically composed showing full front elevations of new columbarium court(s), memorial wall, ossuary, bridge, site features and surrounding landscapes. A minimum of thirty six (36) images shall be taken as per these specifications.
- C. Minimum digital photo file size for final photos is 20 mb un-interpolated, preferably 52 mb. Submit proofs, via e-mail or web photo gallery, from which the COR/Project Manager will select the final images for printing.
- D. Pictures selected by the COR/Project Manager for printing shall be printed on regular weight paper, matte finish archival grade photographic paper and produced by a RA4 process from the digital image with a minimum 300 PPI. Photographs shall have full picture print with no margin.
- E. Submit two (2) 400 mm x 500 mm (16 x 20) framed prints and three (3) 8 x 10 prints of the final selected photos. Deliver to the COR/Project Manager, in boxes suitable for shipping,
- F. Submit a CD-ROM to the COR/Project Manager containing all (minimum 36) final digital photo files.
 1. Images on CD-ROM shall be recorded in JPEG format with a minimum of 24 bit color and no reduction in actual picture size. Compressed size of the file shall be no less than 80% of the original with no loss of information.
 2. File names shall contain the date the image was taken, the Project number and a unique sequential identifier.
 3. The CD-ROM shall also contain an index of all the images contained therein in either a TXT or Microsoft Word format.
- G. Each of the selected 16 x 20 prints shall be placed in a frame with a minimum 2 inches, maximum 3 inches, of appropriate matting as a border. Provide a selection of

- 3 different mats and 3 different frames from which the COR will select one mat and one frame style to frame both prints. Preferred frame style is wood molding, matte black finish, box frame, 1-1/8" wide x 7/8-inch deep.
- H. Place a typewritten self-adhesive identity label on the back of each final print without damage to photograph. PHOTO NUMBER shall be included in both the digital file name on the CD and on the photo print label.
- I. The following information shall be on the identity-label for photographs:
1. PHOTO NUMBER;
 2. CEMETERY NAME
 3. LOCATION;
 4. PROJECT TITLE;
 5. PROJECT NUMBER;
 6. DATE TAKEN;
 7. CONSTRUCTION COMPANY;
 8. CONTRACT NUMBER.

1.24 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 RE/COR verbally, and then with a written follow up.

1.25 PROJECT HEALTH AND SAFETY PLAN

- A. Prior to commencing any construction, the Contractor shall submit a site specific Project Health and Safety Plan (PHSP). At a minimum, the PHSP shall cover the following topics:
1. Organizational structure (including Responsible Persons)
 2. Site Characterization and Job Hazard Identification
 3. Site Control and Security
 4. Training
 5. PPE
 6. Heat Stress
 7. Spill Containment
 8. Decontamination
 9. Emergency Response
 10. Trench Safety

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**SECTION 01 32 17
NETWORK ANALYSIS SCHEDULES
(MICROSOFT PROJECT GANTT CHART)**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The Contractor shall develop a Microsoft Project 2003 (or later) Gantt Chart (bar chart) schedule demonstrating fulfillment of the Contract requirements. The Contractor shall keep the network analysis schedule up-to-date in accordance with the requirements of this section. The Contractor shall utilize the plan for scheduling, coordinating and monitoring work under this Contract (including all activities of subcontractors, equipment vendors and suppliers). The Gantt Chart will be utilized to satisfy time applications.

1.2 CONTRACTOR'S REPRESENTATIVE

- A. The Contractor shall designate an in-house representative who will be responsible to prepare the schedule, review the schedule and report progress of the project to the COTR.
- B. The Contractor's in-house representative shall be given authority to act on behalf of the Contractor in fulfilling the requirements of this specification section. Such authority shall not be interrupted throughout the duration of the project.

1.3 COMPUTER PRODUCED SCHEDULES

- A. The Contractor shall provide to NCA monthly computer processing of all computer produced schedules generated from monthly project updates. The Contractor shall provide to VA two (2) copies of the updated Microsoft Project Gantt Chart and an electronic copy of this data. This must be submitted with and substantively support the Contractor's monthly payment request.
- B. The Contractor is responsible for the correctness and timeliness of the computer-produced reports. The Contractor is also responsible for the accurate and timely submittal of the updated project schedule.
- C. VA shall report errors in computer-produced reports to the Contractor's representative within ten (10) calendar days from receipt of reports. The Contractor shall reprocess the Gantt Chart and associated CDs, when requested by the COTR, to correct errors that affect the schedule for the project.

1.4 THE COMPLETE PROJECT GANTT CHART SUBMITTAL

- A. The Complete Project Microsoft Project Gantt Chart will contain // SPEC WRITER
NOTE: SPECIFY QUANTITY //work activities/events as necessary to fully detail the project schedule.
- B. Within ten (10) calendar days after receipt of the Notice to Proceed, the Contractor shall submit for the Contracting Officer's review, a Microsoft Project Gantt Chart and a CD. Each activity/event on the Gantt Chart schedule shall contain as a minimum, but not limited to, activity/event description, duration, start dates and finish dates. Activity constraints, not required by the Contract, will not be accepted. Logic events (non-work) will be permitted where necessary to reflect proper sequence among work events, but must have zero duration.
- C. The complete working Gantt Chart shall reflect the Contractor's approach to scheduling the complete project. The final Gantt Chart in its original form shall contain no Contract changes or delays that may have been incurred during the final Gantt Chart development period. It shall reflect the Contractors "AS BID" or "DAY 1" schedule. Changes and /or delays shall be entered at the first monthly update after the final Gantt Chart has been approved. The Contractor should provide their requests for time and supporting time extension analysis for Contract time as a result of Contract changes/delays, after this update, and in accordance with Article, ADJUSTMENT OF CONTRACT COMPLETION.
- D. Within ten (10) calendar days after receipt of the complete project Gantt Chart, 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. Schedule a meeting with the Contractor at, or near the job site, for joint review, correction or adjustment of the proposed plan. Within ten (10) calendar days after the joint review, the Contractor shall revise and shall submit two (2) copies of the revised Gantt Chart and a revised CD as specified to 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.

1.5 WORK ACTIVITY/EVENT AND COST DATA INFORMATION

- A. The Contractor shall not be required to "cost load" the computerized Microsoft Project Gantt Chart. As part of this submission, the Contractor shall provide a separate **Schedule of Costs** on AIA document G703. This Schedule of Costs shall reflect and contain all the same activities/events identified on the Gantt Chart.

- B. The Contractor and the Contracting Officer shall use this Schedule of Costs for monthly payment purposes as referenced in the General Conditions of this agreement.
- C. The Contractor and Contracting Officer shall agree on percentages for monthly work accomplished. The cumulative total amount of all cost loaded activities/events (including alternates) shall equal the total Contract price.
- D. Prorate overhead, profit and general conditions on all work activities/events for the entire project. Negative work activity/event cost data will not be acceptable, except on VA issued Contract changes.

1.6 GANTT CHART REQUIREMENTS

- A. Show on the Gantt Chart the sequence and interdependence of work activities/events required for complete performance of all items of work. In preparing the Gantt Chart, the Contractor shall:
 - 1. Show the following on each work activity/event:
 - a. Concise description of the work represented by the activity/event.
 - b. Duration (in work days.)
 - 2. 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 Representative's and Architect-Engineer's review and approval of shop drawings, equipment schedules, samples, template, or similar items.
 - c. Interruption of VA Cemetery utilities, delivery of NCA furnished equipment, project phasing and any other specification requirements.
 - d. Test, balance and adjust various systems and pieces of equipment.
 - 3. Break up the work into activities/events of durations no longer than thirty (30) work days each, except as to non-construction activities/events (i.e., procurement of materials, delivery of equipment, concrete and asphalt curing) and any other activities/events for which the Contracting Officer may approve the showing of a longer duration. The construction time as determined by the Gantt Chart schedule from start to finish for any sub-phase, phase or the entire project shall not exceed the total Contract duration. 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.

4. Exterior Label Information: Provide the following information on an external label attached to each CD:
 - a. VA project number and project location.
 - b. Name and telephone number of a point of contact, preferably the person who created the CD
 - c. The CD number and total number of CDs in the set
 - d. The project data status date.

1.7 PAYMENT TO THE CONTRACTOR

- A. Monthly, the Contractor shall submit the Gantt Chart updated for remaining activity durations and a Schedule of Costs updated for costs. AIA application and certification for payment documents G702 and G703 will be used. The payment request should reflect and be in accordance with the provisions of the following Article, PAYMENT AND PROGRESS REPORTING, as the basis upon which progress payments will be made pursuant to Article, PAYMENT UNDER FIXED-PRICE CONSTRUCTION CONTRACTS of Section GENERAL CONDITIONS. The Contractor is entitled to a monthly progress payment upon approval of estimates as determined from the currently approved updated Schedule of Costs unless, in special situations, the Contracting Officer permits an exception to this requirement. Monthly payment requests shall include: two (2) copies of the updated Microsoft Project Gantt Chart, a listing of all project schedule changes, and associated data, made at the update. These must be submitted with and substantively support the Contractor's monthly application and certificate for payment request documents.
- B. When the Contractor fails or refuses to furnish to the Contracting Officer the information and the associated updated Gantt Chart data, which, in the sole judgment of the Contracting Officer, are necessary for validating the monthly progress payment, the Contractor shall not be deemed to have provided supporting schedule data upon which progress payment may be reasonably determined.

1.8 PAYMENT AND PROGRESS REPORTING

- A. Monthly job site progress meetings shall be held on dates mutually agreed to by the Contracting Officer (or Contracting Officer's Representative) and the Contractor. Presence of subcontractors during the progress meeting is optional unless required by the Contracting Officer (or Contracting Officer's Representative). Job progress will be reviewed to verify:
 1. Actual start and/or finish dates for updated/completed activities/events.

2. Remaining duration, required to complete each activity/event started, or scheduled to start, but not completed.
 3. Time and cost data for change orders, and supplemental agreements that are to be incorporated into the Gantt Chart.
 4. Percentage for completed and partially completed activities/events.
 5. Logic and duration revisions required by this section of the specifications.
 6. Activity/event duration and percent complete shall be updated independently.
- B. The Contractor shall submit a narrative report as a part of his monthly review and update, in a form agreed upon by the Contracting Officer. The narrative report shall include a description of problem areas; current and anticipated delaying factors and their estimated impact on performance of other activities/events and completion dates; and an explanation of corrective action taken or proposed. This report is in addition to the daily reports pursuant to the provisions of Article, DAILY REPORT OF WORKERS AND MATERIALS in the GENERAL CONDITIONS.
- C. As part of the monthly jobsite progress meeting, the General Contractor, specifically requested subcontractors and the Contracting Officers Representative 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.

1.9 RESPONSIBILITY FOR COMPLETION

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

1.10 CHANGES TO GANTT CHART SCHEDULE

- A. Within ten (10) calendar days after VA acceptance and approval of any updated computer-produced schedule, the Contractor shall submit a revised Gantt Chart, the associated CDs, 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 indicate an extension of the project completion by twenty (20) working days or 10 percent of the remaining project duration, whichever is less. Such delays which may be involved with Contract changes, strikes, unusual weather, and other delays will not relieve the Contractor from the requirements specified unless the conditions are shown on the Gantt Chart 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 of the network diagram regardless of the cause for these revisions.
- B. Revisions made under this paragraph, which affect the previously approved computer-produced schedules for NCA furnished equipment, Contract phase(s) and sub phase(s), utilities furnished by the NCA to the Contractor, or any other previously contracted item, must be furnished in writing to the Contracting Officer for approval.
- C. Contracting Officer's approval for the revised Gantt Chart 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 Contracting Officer's Representative.
- D. The cost of revisions to the Gantt Chart resulting from Contract changes will be included in the cost of the change.
- E. The cost of revisions to the Gantt Chart not resulting from Contract changes is the responsibility of the Contractor.

1.11 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, Gantt Chart data and supporting evidence as the Contracting Officer may deem necessary for determination as to whether or not the

Contractor is entitled to an extension of time under the provisions of the Contract.

Submission of proof based on revised activity/event logic, durations (in work days) and costs is obligatory to any approvals.

- B. The Contracting Officer's determination as to the total number of days of Contract extension will be based upon the current computer-produced Gantt Chart schedule for the time period when the change took place and all other relevant information. The Contracting Officer will, within thirty (30) calendar days after receipt of such justification and supporting evidence, advise the Contractor in writing of his decision on the matter.
- C. The Contractor shall submit each request for a change in the Contract completion date to the Contracting Officer in accordance with the provisions specified under Article, CHANGES, in the Section, GENERAL CONDITIONS. The Contractor shall include, as a part of each change order proposal, a sketch showing all 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 Refer to Articles titled SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FAR 52.236-21) and, SPECIAL NOTES (VAAR 852.236-91), in GENERAL CONDITIONS.
- 1.2 For the purposes of this contract, samples (including laboratory samples to be tested), test reports, certificates, and manufacturers' literature and data shall also be subject to the previously referenced requirements. The following text refers to all items collectively as SUBMITTALS.
- 1.3 Submit for approval, all of the items specifically mentioned under the separate sections of the Specification, with information sufficient to evidence full compliance with contract requirements. Materials, fabricated articles and the like to be installed in permanent work shall equal those of approved submittals. After an item has been approved, no change in brand or make will be permitted unless:
 - A. Satisfactory written evidence is presented to, and approved by Contracting Officer, that manufacturer cannot make scheduled delivery of approved item or;
 - B. Item delivered has been rejected and substitution of a suitable item is an urgent necessity or;
 - C. Other conditions become apparent which indicates approval of such substitute item to be in best interest of the NCA.
- 1.4 Forward submittals in sufficient time to permit proper consideration and approval action by NCA. Time submission to assure adequate lead time for procurement of contract-required items. Delays attributable to untimely and rejected submittals (including any laboratory samples to be tested) will not serve as a basis for extending contract time for completion.
- 1.5 Submittals will be reviewed for compliance with contract requirements by Engineer, and action thereon will be taken by the Contracting Officer.
- 1.6 Upon receipt of submittals, COTR will assign a file number thereto. Contractor, in any subsequent correspondence, shall refer to this file and identification number to expedite replies relative to previously approved or disapproved submittals.

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

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

samples that are not requested for return by Contractor will be discarded after completion of contract.

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

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

VA Project Manager/COR

- 1.11. The Contractor shall also send a copy of the complete submittal directly to the Resident Engineer.

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SECTION 01 42 19 REFERENCE STANDARDS

PART 1 - GENERAL

1.1 DESCRIPTION

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

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

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

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

- A. The specifications and standards cited in this solicitation can be examined at the following location:
United States Department of Veteran Affairs
Technical Information Library
<http://www.cfm.va.gov/til/>

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

- A. The specifications cited in this solicitation may be obtained from the associations or organizations listed below.
- | | |
|------|---|
| AA | Aluminum Association, Inc.
http://www.aluminum.org |
| AABC | Associated Air Balance Council
http://www.aabchq.com |
| AADM | American Association of Automatic Door Manufacturers
http://www.aaadm.com |

AATC	American Association of Textile Chemists and Colorist http://www.aatcc.org
AAMA	American Architectural Manufacturer's Association http://www.aamanet.org
AAN	American Nursery and Landscape Association http://www.anla.org
AASHTO	American Association of State Highway and Transportation Officials http://www.transportation.org/Pages/default.aspx
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
ADA	American with Disabilities Act http://www.access-board.gov/guidelines-and-standards/buildings-and-sites/about-the-ada-standards/background/adaag
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
AHA	American Hardboard Association http://www.domensino.com/AHA/
AIHA	American National Standards Institute/American Industrial Hygiene Association http://www.aiha.org/Pages/default.aspx
AISC	American Institute of Steel Construction http://www.aisc.org
AISI	American Iron and Steel Institute http://www.steel.org

AITC	American Institute of Timber Construction http://www.aitc-glulam.org
ALI	Automotive Lift Institute http://www.autolift.org/
AMCA	Air Movement and Control Association http://www.amca.org/
ANLA	American Nursery & Landscape Association http://www.anla.org
ANSI	American National Standards Institute, Inc. http://www.ansi.org
APA	Architectural Precast Association http://www.archprecast.org/
APA	The Engineered Wood Association http://www.apawood.org
ARI	Air-Conditioning and Refrigeration Institute http://www.lightindustries.com/ARI/
ARMA	Asphalt Roofing Manufacturers Association http://www.asphaltroofing.org/
ASAE	American Society of Agricultural Engineers http://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 http://www.asse-plumbing.org
ASTM	ASTM International http://www.astm.org
AWI	Architectural Woodwork Institute http://www.awinet.org

AWS	American Welding Society http://www.aws.org
AWPA	American Wood Protection Association http://www.awpa.com
AWWA	American Water Works Association http://www.awwa.org
BHMA	Builders Hardware Manufacturers Association http://www.buildershardware.com
BIAThe	Brick Industry Association http://www.bia.org
CAGI	Compressed Air and Gas Institute http://www.cagi.org
CARB	California Environmental Protection Agency Air Resources Board http://arb.ca.gov/hompage.html/
CFR	Code of Federal Regulations http://www.gpo.gov/fdsys/browse/collectionCfr.action?collectionCode=CFR
CGA	Compressed Gas Association, Inc. http://www.cganet.com
CID	Commercial Item Description http://www.gsa.gov/portal/content/100847
CISCA	Ceilings and Interior Systems Construction Association http://www.cisca.org
CISPI	Cast Iron Soil Pipe Institute http://www.cispi.org
CLFMI	Chain Link Fence Manufacturers Institute http://www.chainlinkinfo.org
CPA	Composite Panel Association http://www.compositepanel.org/
CRA	California Redwood Association http://www.calredwood.org
CRI	Carpet and Rug Institute http://www.carpet-rug.com
CRRC	Cool Roof Rating System http://coolroofs.org/

CRSI	Concrete Reinforcing Steel Institute http://www.crsi.org
CSI	Cast Stone Institute http://www.caststone.org
DASMA	Door and Access Systems Manufacturers Association http://www.dasma.com/
DHI	Door and Hardware Institute http://www.dhi.org
DOE	U.S. Department of Energy http://www.energy.gov/
EEI	Edison Electric Institute http://www.eei.org
EGSA	Electrical Generating Systems Association http://www.egsa.org
EIMA	Exterior Insulation Manufacturers Association http://www.eima.com/
EPA	Environmental Protection Agency http://www.epa.gov
ETL	ETL Testing Laboratories, Inc. http://www.envirotestinglabs.com/
FCC	Federal Communications Commission http://www.fcc.gov
FHA	Federal Highway Administration http://www.fhwa.dot.gov/
FM	FM Global http://www.fmglobal.com
FPS	The Forest Products Society http://www.forestprod.org
FSC	Forest Stewardship Council http://www.fscus.org
GA	Gypsum Association http://www.gypsum.org
GANA	Glass Association of North America http://www.glasswebsite.com

GBI	Green Building Initiative http://www.thegbi.org/
GS	Green Seal http://www.greenseal.org
GSA	General Services Administration http://www.gsa.gov
HI	Hydraulic Institute http://www.pumps.org
HPVA	Hardwood Plywood & Veneer Association http://www.hpva.org
ICC	The International Code Council http://www.iccsafe.org/Pages/default.aspx
ICEA	Insulated Cable Engineers Association Inc. http://www.icea.net
IEEE	Institute of Electrical and Electronics Engineers http://www.ieee.org\
IGMA	Insulating Glass Manufacturers Alliance http://www.igmaonline.org
ITS	Intertek Training Services http://www.intertek.com/
MBMA	Metal Buildings Manufacturers Association http://www.mbma.com
MHI	Material Handling Industry of America http://www.mhi.org/
MIA	Marble Institute of America http://www.marble-institute.com/
MIC	Masonry Industry Council
MPI	Master Painters Institute http://www.mpi.net/
MSJC	Masonry Standards Joint Committee http://www.masonrysociety.org/msjc/
NAAMM	National Association of Architectural Metal Manufacturers http://www.naamm.org

NAPHCC	Plumbing-Heating-Cooling Contractors Association http://www.phccweb.org/
NBS	National Bureau of Standards See - NIST
NEC	National Electric Code See - NFPA National Fire Protection Association
NEMA	National Electrical Manufacturers Association http://www.nema.org
NFPA	National Fire Protection Association http://www.nfpa.org
NFRC	National Fenestration Rating Council http://www.nfrc.org/
NHLA	National Hardwood Lumber Association http://www.natlhardwood.org
NIH	National Institute of Health http://www.nih.gov
NIOSH	The National Institute for Occupational Safety and Health http://www.cdc.gov/niosh/
NIST	National Institute of Standards and Technology http://www.nist.gov
NLMA	Northeastern Lumber Manufacturers Association, Inc. http://www.nelma.org
NPA	National Particleboard Association 18928 Premiere Court Gaithersburg, MD 20879 (301) 670-0604
NPCA	National Precast Concrete Association http://www.precast.org
NRCA	National Roofing Contractors Association http://www.nrca.net
NSF	National Sanitation Foundation http://www.nsf.org
NSF	NSF International http://www.nsf.org/

NTMA	National Terrazzo and Mosaic Association http://ntma.com/
NWWDA	Window and Door Manufacturers Association http://www.nwwda.org
OSHA	Occupational Safety and Health Administration Department of Labor http://www.osha.gov
PCA	Portland Cement Association http://www.cement.org/
PCI	Precast Prestressed Concrete Institute http://www.pci.org
PPI	The Plastic Pipe Institute http://www.plasticpipe.org
PEI	Porcelain Enamel Institute, Inc. http://www.porcelainenamel.com
PTI	Post-Tensioning Institute http://www.post-tensioning.org
RCSC	Research Council of Structural Connections http://www.boltcouncil.org/
RFCI	The Resilient Floor Covering Institute http://www.rfci.com
RIS	Redwood Inspection Service See - CRA
RMA	Rubber Manufacturers Association, Inc. http://www.rma.org
SCAQMD	South Coast Air Quality Management District http://www.aqmd.gov
SCMA	Southern Cypress Manufacturers Association http://www.cypressinfo.org
SDI	Steel Deck Institute http://www.sdi.org
SDI	Steel Door Institute http://www.steeldoor.org

SEI Structural Engineering Institute

<http://www.asce.org/SEI/>

SJI Steel Joist Institute

<http://www.steeljoist.org>

SMACNA Sheet Metal and Air-Conditioning Contractors
National Association, Inc.

<http://www.smacna.org>

SPRI Single Ply Roofing Industry

<http://www.spri.org>

SSPC The Society for Protective Coatings

<http://www.sspc.org>

STI Steel Tank Institute

<http://www.steeltank.com>

SWI Steel Window Institute

<http://www.steelwindows.com>

SWRI Sealant Waterproofing and Restoration Institute

<http://www.swrionline.org/>

TDOT "Standard Specifications for Road and Bridge Construction", 2015.

<https://www.tn.gov/tdot/article/transportation-construction-2015-standard-specifications>

TCNA Tile Council of North America, Inc.

<http://www.tileusa.com>

TPITruss Plate Institute, Inc.

<http://www.tpinst.org/>

UL Underwriters' Laboratories Incorporated

<http://www.ul.com>

ULC Underwriters' Laboratories of Canada

<http://www.ulc.ca>

USDA U.S. Department of Agriculture

<http://www.usda.gov>

USGBC U.S. Green Building Council

<http://www.usgbc.org>

WCLIB West Coast Lumber Inspection Bureau

<http://www.wclib.org/>

WDMA Window and Door Manufacturers Association
<https://www.wdma.com/>

WH Warnock Hersey
<http://www.intertek.com/marks/wh/>

WRCLA Western Red Cedar Lumber Association
<http://www.wrcla.org/>

WWPA Western Wood Products Association
<http://www2.wwpa.org/>

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SECTION 01 45 29
TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.1 DESCRIPTION

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

1.2 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced.
Publications are referenced in text by the basic designation only. Comply with the latest edition of all referenced publications unless otherwise specified.
- B. American Association of State Highway and Transportation Officials (AASHTO):
- | | |
|------|--|
| T27 | Sieve Analysis of Fine and Coarse Aggregates |
| T96 | Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine |
| T99 | The Moisture-Density Relations of Soils Using a 2.5 Kg (5.5 lb.) Rammer and a 305 mm (12 in.) Drop |
| T104 | Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate |
| T180 | Moisture-Density Relations of Soils using a 4.54 kg (10 lb.) Rammer and a 457 mm (18 in.) Drop |
| T191 | Density of Soil In-Place by the Sand-Cone Method |
- C. ASTM International (ASTM):
- | | |
|------------|---|
| A325 | Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength |
| A370 | Definitions for Mechanical Testing of Steel Products |
| A490 | Heat Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength |
| C31/C31M | Making and Curing Concrete Test Specimens in the Field |
| C33/C33M | Concrete Aggregates |
| C39/C39M | Compressive Strength of Cylindrical Concrete Specimens |
| C109/C109M | Compressive Strength of Hydraulic Cement Mortars |

C138/C138M	Unit Weight, Yield, and Air Content (Gravimetric) of Concrete
C140	Sampling and Testing Concrete Masonry Units and Related Units
C143/C143M	Slump of Hydraulic Cement Concrete
C172/C172M	Sampling Freshly Mixed Concrete
C173/C173M	Air Content of freshly Mixed Concrete by the Volumetric Method
C330/C330M	Lightweight Aggregates for Structural Concrete
C567/C567M	Density Structural Lightweight Concrete
C780	Pre-construction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
C1019	Sampling and Testing Grout
C1064/C1064M	Freshly Mixed Hydraulic Cement Concrete
C1077	Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
C1314	Compressive Strength of Masonry Prisms
C1364	Architectural Cast Stone
D698	Laboratory Compaction Characteristics of Soil Using Standard Effort
D1143/D1143M	Deep Foundations Under Static Axial Compressive Load
D1188	Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Paraffin-Coated Specimens
D1556	Density and Unit Weight of Soil in Place by the Sand-Cone Method
D1557	Laboratory Compaction Characteristics of Soil Using Modified Effort
D2166	Unconfined Compressive Strength of Cohesive Soil
D2216	Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
D2974	Moisture, Ash, and Organic Matter of Peat and Other Organic Soils
D3666	Minimum Requirements for Agencies Testing and Inspection Bituminous Paving Materials

D3740	Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock
E94-04	Radiographic Examination
E164	Contact Ultrasonic Testing of Weldments
E329	Agencies Engaged in Construction Inspection, Testing, or Special Inspection
E543	Agencies Performing Nondestructive Testing
E709	Guide for Magnetic Particle Testing
E1155	Determining FF Floor Flatness and FL Floor Levelness Numbers

D. American Welding Society (AWS):

D1.1	Structural Welding Code-Steel
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1.4 REQUIREMENTS

A. Accreditation Requirements: Testing Laboratory retained and paid for by Contractor shall be accredited by one or more of the National Voluntary Laboratory Accreditation Program (NVLAP) programs acceptable in the geographic region for the project. Furnish to the COTR a copy of the Certificate of Accreditation and Scope of Accreditation. For testing laboratories that have not yet obtained accreditation by a NVLAP program, submit an acknowledgement letter from one of the laboratory accreditation authorities indicating that the application for accreditation has been received and the accreditation process has started, and submit to the COTR for approval, certified statements, signed by an official of the testing laboratory attesting that the proposed laboratory, meets or conforms to the ASTM standards listed below as appropriate to the testing field.

1. Laboratories engaged in testing of construction materials shall meet the requirements of ASTM E329.
2. Laboratories engaged in testing of concrete and concrete aggregates shall meet the requirements of ASTM C1077.
3. Laboratories engaged in testing of road and paving materials shall meet the requirements of ASTM D3666.
4. Laboratories engaged in testing of soil and rock, as used in engineering design and construction, shall meet the requirements of ASTM D3740.
5. Laboratories engaged in non-destructive testing (NDT) shall meet the requirements of ASTM E543.

6. Laboratories engaged in Hazardous Materials Testing shall meet the requirements of OSHA and EPA.
- B. Inspection and Testing: Testing laboratory shall inspect materials and workmanship and perform tests described herein and additional tests requested by COTR. When it appears materials furnished, or work performed by Contractor fail to meet construction contract requirements, Testing Laboratory shall direct attention of COTR to such failure.
- C. Written Reports: Testing laboratory shall submit test reports to COTR and Contractor within 24 hours after each test is completed unless other arrangements are agreed to in writing by the RE/COR. Submit reports of tests that fail to meet construction contract requirements on colored paper.
- D. Verbal Reports: Give verbal notification to RE/COR immediately of any irregularity.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EARTHWORK

- A. General: The Testing Laboratory shall provide qualified personnel, materials, equipment, and transportation as required to perform the services identified/required herein, within the agreed to schedule and/or time frame. The work to be performed is as identified herein including, but not be limited to, the following:
 1. Observe fill and subgrades during proof-rolling to evaluate suitability of surface material to receive fill or base course. Provide recommendations to the RE/COR regarding suitability or unsuitability of areas where proof-rolling was observed. Where unsuitable results are observed, witness excavation of unsuitable material and recommend to RE/COR extent of removal and replacement of unsuitable materials and observe proof-rolling of replaced areas until satisfactory results are obtained.
 2. Provide full time observation of fill placement and compaction and field density testing in building areas and provide full time observation of fill placement and compaction and field density testing in pavement areas to verify that earthwork compaction obtained is in accordance with contract documents.
 3. Provide supervised geotechnical technician to inspect excavation, subsurface preparation, and backfill for structural fill.
- B. Testing Compaction:

1. Determine maximum density and optimum moisture content for each type of fill, backfill and subgrade material used, as specified in Section 31 20 00.
2. Make field density tests in accordance with the primary testing method following ASTM D2922 wherever possible. Field density tests utilizing ASTM D1556 or AASHTO T191 shall be utilized on a case by case basis only if there are problems with the validity of the results from the primary method due to specific site field conditions. Should the testing laboratory propose these alternative methods, they shall provide satisfactory explanation to the RE/COR before the tests are conducted.
 - a. Building Slab Subgrade: At least one test of subgrade for every 2000 square feet of building slab, but in no case fewer than three tests. In each compacted fill layer, perform one test for every 2000 square feet of overlaying building slab, but in no case fewer than three tests.
 - b. Foundation Wall Backfill: One test per 100 feet of each layer of compacted fill but in no case fewer than two tests.
 - c. Pavement Subgrade: One test for each 400 square yards, but in no case fewer than two tests.
 - d. Curb, Gutter, and Sidewalk: One test for each 300 feet, but in no case fewer than two tests.
 - e. Trenches: One test at maximum 100-foot intervals per 4 feet of vertical lift and at changes in required density, but in no case fewer than two tests.
 - f. Footing Subgrade: At least one test for each layer of soil on which footings will be placed. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with related tested subgrade when acceptable to RE/COR. In each compacted fill layer below wall footings, perform one field density test for every 100 feet of wall. Verify subgrade is level, all loose or disturbed soils have been removed, and correlate actual soil conditions observed with those indicated by test borings.
- C. Testing for Footing Bearing Capacity: Evaluate if suitable bearing capacity material is encountered in footing subgrade.
- D. Testing Materials: Test suitability of on-site and off-site borrow as directed by RE/COR.

3.2 LANDSCAPING

- A. Test topsoil for organic materials, pH, phosphate, potash content, and gradation of particles.
 1. Test for organic material by using ASTM D2974.

2. Determine percent of silt, sand, clay, and foreign materials such as rock, roots, and vegetation.
- B. Submit laboratory test report of topsoil to RE/COR.
- C. Submit recommendations for soil amendments, from a regional soil conservation service or cooperative extension, to bring soil into compliance with minimum parameters in these specifications.

3.3 ASPHALT CONCRETE PAVING

- A. Aggregate Base Course:
 1. Determine maximum density and optimum moisture content for aggregate base material in accordance with AASHTO T180 or ASTM D1557, Method D.
 2. Make a minimum of three field density tests on each day's final compaction on each aggregate course in accordance with AASHTO T191 or ASTM D1556.
 3. Sample and test aggregate as necessary to insure compliance with specification requirements for gradation, wear, and soundness as specified in the applicable state highway standards and specifications.
- B. Asphalt Concrete:
 1. Aggregate: Sample and test aggregates in stockpile and hot-bins as necessary to insure compliance with specification requirements for gradation (AASHTO T27), wear (AASHTO T96), and soundness (AASHTO T104).
 2. Temperature: Check temperature of each load of asphalt concrete at mixing plant and at site of paving operation.
 3. Density: Make a minimum of two field density tests of asphalt base and surface course (in accordance with ASTM D1188 or applicable standard test methods in referenced TDOT Standard Specifications) for each day's paving operation.

3.4 SITE WORK CONCRETE

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

3.5 CONCRETE

- A. 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 50 cubic yards or less of each concrete type, and at least three cylinders for any one day's pour for each concrete type. After good concrete quality control has been established and maintained as determined by RE/COR make three cylinders for each 100 cubic yards or less of each concrete type, and at least three cylinders from any one day's pour for each concrete type. Label each cylinder with an identification number. RE/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 25 cubic yards thereafter each day. For concrete not required to be air-entrained, test every 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. Notify laboratory technician at batch plant of mix irregularities and request materials and proportioning check.
 8. Verify that specified mixing has been accomplished.
 9. 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 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 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.

10. 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.
11. Observe conveying, placement, and consolidation of concrete for conformance to specifications.
12. Observe condition of formed surfaces upon removal of formwork prior to repair of surface defects and observe repair of surface defects.
13. Observe curing procedures for conformance with specifications, record dates of concrete placement, start of preliminary curing, start of final curing, end of curing period.
14. 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.
15. Observe preparations for protection from hot weather, cold weather, sun, and rain, and preparations for curing.
16. Observe concrete mixing:
 - a. Monitor and record amount of water added at project site.
 - b. Observe minimum and maximum mixing times.
17. 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 RE/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.
18. Other inspections:
 - a. Grouting under base plates.
 - b. Grouting anchor bolts and reinforcing steel in hardened concrete.

B. 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 RE/COR. Each compressive strength test shall be the 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 to be used.
2. Furnish certified compression test reports (duplicate) to RE/COR. In each 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. Weather conditions during placing.
 - f. Temperature of concrete in each test cylinder when test cylinder was molded.
 - g. Maximum and minimum ambient temperature during placing.
 - h. Ambient temperature when concrete sample in test cylinder was taken.
 - i. Date delivered to laboratory and date tested.

3.8 ARCHITECTURAL CAST STONE

- A. Perform testing according to ASTM C1364 or verify compliance by reviewing previous test results of same product.
- B. Inspect the plant to verify that specification requirements for curing and finishes have been met.

3.9 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.
- E. Field Inspection and Materials Testing:
 - 1. Verify the following prior to grouting:
 - a. Grout space is clean.
 - b. Type, spacing, and placement of reinforcement, connectors, and anchors comply with the contract requirements.

3.10 STRUCTURAL STEEL

- A. General: Provide shop and field inspection and testing services to certify structural steel work is done in accordance with contract documents. Conform to AWS D1.1 Structural Welding Code for welding.
- B. Prefabrication Inspection:
 - 1. Review design and shop detail drawings for size, length, type and location of all welds to be made.
 - 2. Approve welding procedure qualifications by pre-qualification or by witnessing qualifications tests.
 - 3. Approve welder qualifications by certification or retesting.
 - 4. Approve procedure for control of distortion and shrinkage stresses.
 - 5. Approve procedures for welding in accordance with applicable sections of AWS D1.1.
- C. Fabrication and Erection:
 - 1. Weld Inspection:
 - a. Inspect welding equipment for capacity, maintenance and working condition.
 - b. Verify specified electrodes and handling and storage of electrodes in accordance with AWS D1.1.
 - c. Inspect preparation and assembly of materials to be welded for conformance with AWS D1.1.

- d. Inspect preheating and interpass temperatures for conformance with AWS D1.1.
 - e. Measure 25 percent of fillet welds.
 - f. Welding Magnetic Particle Testing: Test in accordance with ASTM E709 for a minimum of:
 - 1) 20 percent of all shear plate fillet welds at random, final pass only.
 - 2) 20 percent of all continuity plate and bracing gusset plate fillet welds, at random, final pass only.
 - 3) 100 percent of tension member fillet welds (i.e., hanger connection plates and other similar connections) for root and final passes.
 - 4) 20 percent of length of built-up column member partial penetration and fillet welds at random for root and final passes.
 - 5) 100 percent of length of built-up girder member partial penetration and fillet welds for root and final passes.
 - g. Welding Ultrasonic Testing: Test in accordance with ASTM E164 and AWS D1.1 for 100 percent of all full penetration welds, braced and moment frame column splices, and a minimum of 20 percent of all other partial penetration column splices, at random.
 - h. Welding Radiographic Testing: Test in accordance with ASTM E94, and AWS D1.1 for 5 percent of all full penetration welds at random.
 - i. Verify that rejected welds corrections are made in accordance with AWS D1.1.
 - j. Testing and inspection do not relieve the Contractor of the responsibility for providing materials and fabrication procedures in compliance with the specified requirements.
2. Bolt Inspection:
- a. Inspect high-strength bolted connections in accordance AISC Specifications for Structural Joints Using ASTM A325 or A490 Bolts.
 - b. Slip-Critical Connections: Inspect 10 percent of bolts, but not less than 2 bolts, selected at random in each connection in accordance with AISC Specifications for Structural Joints Using ASTM A325 or A490 Bolts. Inspect all bolts in connection when one or more are rejected.
 - c. Fully Pre-tensioned Connections: Inspect 10 percent of bolts, but not less than 2 bolts, selected at random in 25 percent of connections in accordance with AISC Specification for Structural Joints Using ASTM A325 or A490 Bolts. Inspect all bolts in connection when one or more are rejected.

- d. Bolts installed by turn-of-nut tightening may be inspected with calibrated wrench when visual inspection was not performed during tightening.
 - e. Snug Tight Connections: Inspect 10 percent of connections verifying that plies of connected elements have been brought into snug contact.
 - f. Inspect field erected assemblies; verify locations of structural steel for plumbness, level, and alignment.
- D. Submit inspection reports, record of welders and their certification, and identification, and instances of noncompliance to RE/COR.

3.11 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 RE/COR.

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SECTION 01 57 19
TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 GENERAL

1.1 DESCRIPTION

- A. This section specifies the control of environmental pollution and damage that the Contractor shall consider for air, water, and land resources. It includes management of visual aesthetics, noise, and solid waste, as well as other pollutants and resources encountered or generated by the Contractor. The Contractor is obligated to consider specified control measures with the costs included within the various contract items of work.
- B. Environmental pollution and damage is defined as the presence of chemical, physical, or biological elements or agents which:
 - 1. Adversely effect human health or welfare.
 - 2. Unfavorably alter ecological balances of importance to human life.
 - 3. Affect other species of importance to humankind.
 - 4. Degrade the utility of the environment for aesthetic, cultural, and historical purposes.

1.2 DEFINITIONS OF POLLUTANTS

- A. Chemical Waste: Petroleum products, bituminous materials, salts, acids, alkalis, herbicides, pesticides, organic chemicals, and inorganic wastes.
- B. Debris: Combustible and noncombustible wastes, such as leaves, tree trimmings, ashes, and waste materials resulting from construction or maintenance and repair work.
- C. Sediment: Soil and other debris that has been eroded and transported by runoff water.
- D. Solid Waste: Rubbish, debris, garbage, and other discarded solid materials resulting from project construction activities.
- E. 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 "waters of the United States" and require a permit to discharge water from the governing agency.
- F. Rubbish: Combustible and noncombustible wastes such as, but not limited to, paper, plastic, metal and plastic containers and cans, boxes, metal and lumber scrap.
- G. Sanitary Wastes: Domestic Sanitary Sewage.

1.3 QUALITY CONTROL

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

1.4 REFERENCES

- 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 the latest edition of all referenced publications unless otherwise specified.
- B. U.S. National Archives and Records Administration (NARA):
33 CFR 328 Definitions, Waters of the United States.
- C. Federal Environmental Regulatory Requirements: Comply with applicable regulations.
The following is for Contractor's information only:
 - 1. Storm water permits; refer to The Office of Wastewater Management, NPDES Storm Water Program: <http://www.epa.gov/npdes/stormwater>
 - 2. Dredge and fill (Section 404) permits; refer to U.S. EPA Office of Wetlands, Oceans, and Watersheds (OWOW): <http://www.epa.gov/owow/>
 - 3. RCRA hazardous and non-hazardous solid waste requirements; refer to EPA's Office of Solid Waste and Emergency Response: <http://www.epa.gov/epaoswer/osw/laws-reg.htm>
 - 4. Oil spill requirements for construction activities; refer to EPA Oil Program website: <http://www.epa.gov/oilspill/>
 - 5. Hazardous substances (Superfund Liability) requirements for construction activities; refer to EPA's Superfund website: <http://www.epa.gov/superfund/index.htm>
 - 6. Polychlorinated Biphenyl (PCB) waste requirements; refer to EPA's Polychlorinated Biphenyl (PCB) Homepage: <http://www.epa.gov/pcb/>
 - 7. Air quality requirements for construction activities; refer to EPA'S Air Program Mobile Sources Page: <http://www.epa.gov/ebtpages/airmobilesources.html>
 - 8. Asbestos requirements for construction activities; refer to EPA's Asbestos Management and Regulatory Requirements Website: <http://www.epa.gov/fedsite/cd/asbestos.html>
 - 9. National Environmental Policy Act (NEPA) requirements for construction activities
 - 10. Endangered Species Act; refer to The US Fish and Wildlife Service Endangered Species Program: <http://endangered.fws.gov/>

11. National Historic Preservation Act

C. State and Local Environmental Regulatory Requirements: Comply with applicable regulations. The following is for Contractor's information only:

1. State Office/Department of Environmental Quality.
2. Local Office/Department of Environmental Quality.
3. The Construction Industry Compliance Assistance Center:

<http://www.cicacenter.org/index.cfm>

4. The National Environmental Compliance Assistance Clearinghouse:

<http://cfpub.epa.gov/clearinghouse/>

1.5 SUBMITTALS

A. In accordance with Section, 01 33 23, the Contractor shall 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 COTR 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, prepare and submit to the COTR for approval, a written and/or graphic Environmental Protection Plan including, but not limited to, the following:
 - a. Name(s) and qualifications of person(s) within the Contractor's organization who is (are) responsible for:
 - 1) Ensuring adherence to the Environmental Protection Plan.
 - 2) Training the Contractor's environmental protection personnel.
 - b. Description of the Contractor's environmental protection personnel training program.
 - c. 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.
 - d. 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.
 - e. Procedures to provide environmental protection that complies 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.

- f. Permits, licenses, and the location of the solid waste disposal area.
 - g. Drawings showing locations of any proposed temporary excavations or embankments for haul roads, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials. Include as part of an Erosion Control Plan approved by the District Office of the U.S. Soil Conservation Service// and/or mandated state agency, and the Department of Veterans Affairs.
 - h. Environmental Monitoring Plans for the project site including land, water, air, and noise.
 - i. Work Area Plan showing the proposed activity in each portion of the area and identifying the areas of construction limits or protected areas. Plan should include measures for marking the limits of use areas. This plan may be incorporated within the Erosion Control Plan.
- B. Within 20 days after the date of its submittal, the COTR will approve the Contractor's Comprehensive Environmental Protection Plan, or respond with an explanation for its rejection and resubmittal.
- C. 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.

1.6 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 and for the required duration after the project is complete for establishment of vegetated areas as specified. Confine construction activities to areas defined by construction limits as indicated on the Drawings.
- B. Protection of Land Resources: Prior to construction, identify all land resources to be preserved within the work area. Do not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, top soil, land forms, wetlands or wetland buffers without prior approval from the RE/COR. Do not fasten or attach ropes, cables, or guys to trees for anchorage unless specifically authorized, or dictated by special emergency use.
1. Work Area Limits: Prior to any construction, mark/fence/protect the areas that require work to be performed under this Contract. Prior to construction, mark, fence or

- provide other approved techniques to protect monuments, works of art, and any other markers to remain. Convey to all personnel the purpose of marking and protecting all designated objects.
2. Protection of Specific Regulated Elements: Wetlands and wetland buffers and other landscape features shown on the Drawings shall be preserved by marking, fencing, or using any other approved protective techniques.
 - a. Protect trees and shrubs to remain on the project site to protect from damage per details shown on the Drawings.
 - b. All damage to existing trees and shrubs shall be immediately repaired 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 Erodeable Soils: Plan and conduct earthwork to minimize the duration of exposure of unprotected soils. Clear areas only as needed to use to work the area to be developed. Form earthwork to final grade as shown as quickly as possible to minimize potential erosion damage. Immediately protect side slopes and back slopes upon completion of rough grading or clearing with appropriate material as defined in the Sediment and Erosion Control Plan.
 4. Temporary Protection of Disturbed Areas: Construct diversion ditches, benches, check dams and berms to retard and divert runoff from the project site to protected drainage areas as intended 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 //____// (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, that drain from the surface of the basin.
 - b. Reuse or conserve the collected topsoil sediment as directed by the RE/COR. Topsoil use and requirements are specified in Section 31 20 10.
 - c. Institute effluent quality monitoring programs as required by Federal, State, and local environmental agencies.
 5. Erosion and Sedimentation Control Devices: Construct or install all temporary and permanent erosion and sedimentation control features shown on the Sediment and Erosion Control Plan [included as part of the Drawings] to avoid violating water quality in accordance with federal and state regulations. Maintain temporary erosion

- and sediment control measures such as berms, dikes, drains, sedimentation basins, grassing, and mulching, straw wattles, fiber rolls, until permanent drainage and erosion control facilities are completed and operative.
6. Manage and control borrow and spoil areas on and off NCA property to minimize erosion and to prevent soil and sediment from entering nearby water courses or lakes.
 7. Protect adjacent areas from despoilment by temporary excavations and embankments.
 8. 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 NCA property and dispose of waste in compliance with Federal, State, and local requirements.
 9. Store chemical waste away from the work areas in corrosion resistant containers and dispose of waste in accordance with Federal, State, and local regulations.
 10. Handle discarded materials other than those included in the solid waste category as directed by the RE/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 sediment basins prior to entering retention/detention ponds, allowing the suspended material to settle, the pollutants to separate, or the water to evaporate.
 2. Monitor water areas, wetlands and wetland buffers 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 protected 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 project site. Keep activities, equipment, processes, and work operated or performed, in strict accordance with applicable regulations of the State of Tennessee, 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 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, 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. Sprinkling, chemical treatment of an approved type, light bituminous treatment, or other methods are permitted to control particulates in the work area as approved in the Environmental Protection Plan.
 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. Noise Control: Minimize noise using every action possible. Perform noise-producing work in less sensitive hours of the day or week as directed by the Resident Engineer/COR. Maintain noise-producing work at or below the decibel levels and within the time periods specified.
1. Perform construction activities involving repetitive, high-level impact noise only between 6:00 a.m. and 6:00 p.m. unless otherwise permitted by local ordinance or the RE/COR. Repetitive impact noise on the property shall not exceed the following Decibel A-scale (dBA) limitations:

Time Duration of Impact Noise	Sound Level in dBA
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 as measured with an A-scale decibel measuring device at 50 feet:

CATEGORY OF EQUIPMENT

EARTHMOVING		MATERIALS HANDLING	
EQUIPMENT STYLE	SOUND LEVEL dBA	EQUIPMENT STYLE	SOUND LEVEL dBA
FRONT LOADERS	75	CONCRETE MIXERS	75
BACKHOES	75	CONCRETE PUMPS	75
DOZERS	75	CRANES	75
TRACTORS	75	DERRICKS, IMPACT	75
SCRAPERS	80	PILE DRIVERS	95
GRADERS	75	JACK HAMMERS	75
TRUCKS	75	ROCK DRILLS	80
PAVERS, STATIONARY	80	PNEUMATIC TOOLS	80
PUMPS	75	BLASTING	//--//
GENERATORS	75	SAWS	75
COMPRESSORS	75	VIBRATORS	75

- b. Provide soundproof housings or enclosures for noise-producing machinery.
 - c. Use efficient silencers on equipment air intakes.
 - d. Use efficient intake and exhaust mufflers on internal combustion engines that are maintained so equipment performs below noise levels specified.
 - e. Line hoppers and storage bins with sound deadening material.
 - f. 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 75 dB(A) noise level. Measure noise exposure at the property line or 50 feet from the noise source, whichever is greater. Measure the sound levels on the A weighted sound level of a General Purpose sound level meter at slow response. To minimize the effect of reflective sound waves at buildings, take measurements at three to six feet in front of any building face. Submit the recorded information to the Resident Engineer/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 NCA. 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 as approved by the RE/COR and as indicated on the Drawings. Cleaning shall include off-site 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, clearing, logging and general construction in accordance with state and local regulations and the Contract.

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SECTION 01 74 19 CONSTRUCTION WASTE MANAGEMENT

PART 1 – GENERAL

1.1 DESCRIPTION

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

1.2 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 and Demolition waste includes products of the following:
 - 1. Excess or unusable construction materials.
 - 2. Packaging used for construction products.
- B. Establish and maintain the management of non-hazardous building construction and demolition waste set forth herein. Conduct a site assessment to estimate the types of materials that will be generated by demolition and construction.
- C. Contractor shall develop and implement procedures to reuse and recycle new materials to a minimum of 50 percent.
- D. Contractor shall be responsible for implementation of any special programs involving rebates or similar incentives related to recycling. Any revenues or savings obtained from salvage or recycling shall accrue to the contractor.
- E. Contractor shall provide all demolition, removal and legal disposal of materials. Contractor shall ensure that facilities used for recycling, reuse and disposal shall be permitted for the intended use to the extent required by local, state, federal regulations. The Whole Building Design Guide website <http://www.wbdg.org/tools/cwm.php> provides a Construction Waste Management Database that contains information on companies that haul, collect, and process recyclable debris from construction projects.
- F. Contractor shall assign a specific area to facilitate separation of materials for reuse, salvage, recycling, and return. Such areas shall 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.

1.3 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 (e.g. 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.

1.4 SUBMITTALS

- A. In accordance with Section 01 33 23, furnish the following:
- B. Prepare and submit to the Resident Engineer a written Waste 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 project site waste to be generated, including:
 - 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 and methods to be used for material handling.
 - a. On site: Material separation, storage, protection where applicable.
 - b. Off site: Transportation means and destination. Include list of materials.
 - 1) Description of materials to be site-separated and self-hauled to designated facilities.
 - 2) Description of mixed materials to be collected by designated waste haulers and removed from the site.
 - c. The names and locations of mixed debris reuse and recycling facilities or sites.
 - d. The names and locations of trash disposal landfill facilities or sites.
 - e. Documentation that the facilities or sites are approved to receive the materials.
- C. Designated Manager responsible for instructing personnel, supervising, documenting and administer over meetings relevant to the Waste Management Plan.
- D. Monthly summary of construction and demolition debris diversion and disposal, quantifying all materials generated at the work site and disposed of or diverted from disposal through recycling.

1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced.

Publications are referenced by the basic designation only. Comply with the latest edition of all referenced publications unless otherwise specified.

1. U.S. Green Building Council (USGBC):
LEED Green Building Rating System for New Construction

1.6 RECORDS

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

PART 2 - PRODUCTS

2.1 MATERIALS

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

PART 3 - EXECUTION

3.1 COLLECTION

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

3.2 DISPOSAL

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

3.3 REPORT

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

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SECTION 01 81 11
SUSTAINABLE DESIGN REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section describes general requirements and procedures to comply with various federal mandates and U.S. Department of Veterans Affairs (VA) policies for sustainable design, including the Guiding Principles for Federal Leadership in High Performance and Sustainable Buildings required by Executive Orders 13423 and 13514; Energy Policy Act of 2005 (EPA 2005); and the Energy Independence and Security Act of 2007 (EISA 2007).

1.2 OBJECTIVES

- A. General:
1. Maximize resource efficiency and reduce the environmental impacts of construction and operation.
 2. Select products that minimize consumption of energy, water and non-renewable resources, while minimizing the amounts of pollution resulting from the production and employment of building technologies.
 3. Include environmental considerations as part of the normal purchasing process.
 4. Emphasize pollution prevention early in the purchasing process.
 5. Examine multiple environmental attributes throughout a product's or service's life cycle.
 6. Compare relevant environmental impacts when selecting products and services.
 7. Collect and base purchasing decisions on accurate and meaningful information about environmental performance.
 8. Control sources of potential Indoor Air Quality (IAQ) pollutants and decrease toxicity levels, by controlled selection of materials and processes used in project construction, in order to attain superior IAQ. Manage construction site and storage of materials to ensure no negative impact on the indoor environmental quality of the building.
 9. Use building practices that ensure construction debris and particulates do not contaminate or enter duct work prior to system startup and turn over.
 10. Preserve and restore the site ecosystem and biodiversity; avoid site degradation and erosion. Minimize offsite environmental impact.

11. Reduce construction waste through reuse, recycling, and supplier take-back.
 12. Optimize operational performance in order to ensure equipment operates as intended.
 13. Consider the durability, maintainability, and flexibility of building systems.
- B. Conform to the Federal Guiding Principles for Federal Leadership in High Performance and Sustainable Building as per the Memorandum of Understanding, as follows:
1. Employing integrated design: As specified and as follows:
 - a. ASTM E2348, Standard Guide for Framework for a Consensus-based Environmental Decision making Process.
 - b. ASTM E2432 Standard Guide for General Principles of Sustainability Relative to Buildings.
 2. Optimizing energy performance: As specified and as follows:
 - a. Energy Efficiency: EO 13423, EO 13514 and Energy Policy Act of 2005; 10 CFR 435 - Energy Performance Standards for New Buildings; and, FAR Part 23, 48 CFR 23 - building equipment and lighting.
 - b. ENERGY STAR.
 - c. Federal Energy Management Program (FEMP).
 3. Protecting and conserving water: As specified and as follows:
 - a. Water stewardship: EPA WaterSense, and FEMP Best Management Practices for Water Conservation.
 4. Enhancing indoor environmental quality: As specified and as follows:
 - a. Sheet Metal and Air Conditioning Contractor's National Association Indoor Air Quality Guidelines for Occupied Buildings under Construction.
 5. Reducing the environmental impact of materials: As specified and as follows:
 - a. Recycled Content Products: EPA Comprehensive Procurement guidelines.
 - b. Biobased Content Products: USDA Biopreferred.
 - c. Electronics stewardship: Federal Electronics Challenge; Electronic Product Environmental Assessment Tool (EPEAT).
 - d. Environmental Management System protocols: ISO 14001 or equivalent.

- C. The Design Professional has selected materials and utilized design processes that achieve the above objectives to the extent currently possible and practical. The Contractor is responsible to maintain and support these objectives in developing means and methods for performing the work and in proposing product substitutions and/or changes to specified processes. By submitting a change or substitution of materials or processes, the Contractor must demonstrate its diligence in performing the level of investigation and comparison encouraged under the Federal mandates and VA policies.

1.3 RELATED DOCUMENTS

- A. Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT.

1.4 DEFINITIONS

- A. Agrifiber Products: Composite panel products derived from agricultural fiber.
- B. Biobased Product: As defined in the Farm Security and Rural Investment Act, a product determined by the Secretary to be a commercial or industrial product (other than food or feed) that is composed, in whole or in significant part, of biological products or renewable domestic agricultural materials (including plant, animal, and marine materials) or forestry materials.
- C. Biobased Content: The weight of the biobased material divided by the total weight of the product and expressed as a percentage by weight.
- D. Certification(s) for Sustainable Forestry: Certificates signed by manufacturers certifying that wood used to make products has been tracked through its extraction and fabrication to ensure that it was obtained from forests certified by an approved sustainable forest certification program.
- E. Composite Wood: A product consisting of wood fiber or other plant particles bonded together by a resin or binder.
- F. Construction and Demolition (C&D) Waste: Includes solid wastes, such as building materials, packaging, rubbish, debris, and rubble resulting from construction, remodeling, repair and demolition operations. A construction waste management plan is to be provided by the Contractor as defined in Section 01 74 19.
- G. Light Pollution: Light that extends beyond its source such that the additional light is wasted in an unwanted area or in an area where it inhibits view of the night sky.

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

1.5 SUBMITTALS

- A. Sustainability Action Plan:
 - 1. Within 30 days of after Preconstruction Meeting, the General Contractor must provide a narrative plan for complying with the objectives, product requirements and construction operations' environmental controls stipulated within this section.
 - 2. The plan must make reference to the following sustainable design submittals defined by this section and either attached to report or provided within time periods allowed:

- a. Project Materials Cost Data spreadsheet.
 - b. Construction Waste Management Plan.
 - c. Construction IAQ Management Plan.
- B. Sustainable Design Submittals:
- 1. Alternative Transportation:
 - a. Provide manufacturer's cut sheets for all bike racks installed on site, including the total number of bicycle storage slots provided.
 - b. Provide manufacturer's cut sheets for any alternative-fuel refueling stations installed on site, including fueling capacity information for an 8-hour period.
 - 2. Heat Island Effect:
 - a. Site Paving: Provide manufacturer's cut sheets for all impervious paving materials, highlighting the Solar Reflectance Index (SRI) of the material; provide cut sheets for all pervious paving materials.
 - b. Roofing Materials: Submittals for roofing materials must include manufacturer's cut sheets or product data highlighting the Solar Reflectance Index (SRI) of the material.
 - 3. Exterior Lighting Fixtures: Submittals must include cut sheets with manufacturer's data on initial fixture lumens above 90° from nadir for all exterior lighting fixtures, and, for parking lot lighting, verification that the fixtures are classified by the Illuminating Engineering Society of North America (IESNA) as "full cutoff" (FCO); OR provide documentation that exterior luminaires are IDA-Approved as Dark-Sky Friendly by the International Dark Sky Association (IDA) Fixture Seal of Approval Program.
 - 4. Irrigation Systems: Provide manufacturer's cut sheets for all permanent landscape irrigation system components and for any rainwater harvesting system components, such as cisterns.
 - 5. Water Conserving Fixtures: Submittals must include manufacturer's cut sheets for all water-consuming plumbing fixtures and fittings (toilets, urinals, faucets, showerheads, etc.) highlighting maximum flow rates and/or flush rates.
 - a. Include cut sheets for any automatic faucet-control devices.
 - b. Provide copy of certification for any WaterSense-labeled products.

6. Process Water Use: Provide manufacturer's cut sheets for all water-consuming commercial equipment (clothes washers, dishwashers, ice machines, etc.), highlighting water consumption performance. Include manufacturer's cut sheets or product data for any cooling towers, highlighting water consumption estimates, water use reduction measures, and corrosion inhibitors.
7. Elimination of CFCs/HCFCs and Reduction of HFCs: Provide manufacturer's cut sheets for all cooling equipment with manufacturer's product data, highlighting refrigerants; provide manufacturer's cut sheets for all fire-suppression equipment, highlighting fire-suppression agents; provide manufacturer's cut-sheets for all polystyrene insulation (XPS) and closed-cell spray foam polyurethane insulation, highlighting the blowing agent(s).
8. Appliances and Equipment: Provide copies of manufacturer's product data for all ENERGY STAR qualified equipment and appliances, including office equipment, computers and printers, electronics, and commercial food service equipment (excluding HVAC and lighting components), verifying compliance with EPA's ENERGY STAR program.
10. Measurement and Verification Systems: Provide cut sheets and manufacturer's product data for all controls systems, highlighting electrical metering and trending capability components.
13. Recycled Content: Submittals for all materials with recycled content (excluding MEP systems equipment and components) must include the following documentation: Manufacturer's product data, product literature, or a letter from the manufacturer verifying the percentage of post-consumer and pre-consumer recycled content (by weight) of each material or product.
 - a. An electronic spreadsheet that tabulates the Project's total materials cost and combined recycled content value (defined as the sum of the post-consumer recycled content value plus one-half of the pre-consumer recycled content value) expressed as a percentage of total materials cost. Submit this spreadsheet every third month with the Contractor's Certificate and Application for Payment. Indicate, on an ongoing basis, line items for each material, including cost, pre-consumer recycled content, post-consumer recycled content, and combined recycled content value.
15. Interior Adhesives and Sealants: Submittals for all field-applied adhesives and sealants, which have a potential impact on indoor air,

- must include manufacturer's MSDSs or other Product Data highlighting VOC content.
- a. Provide additional manufacturers' documentation verifying all adhesives used to apply laminates, whether shop-applied or field-applied, contain no urea-formaldehyde.
16. Interior Paints and Coatings: Submittals for all field-applied paints and coatings, which have a potential impact on indoor air, must include manufacturer's MSDSs or other Product Data highlighting VOC content.
 17. Exterior Paints and Coatings: Submittals for all field-applied paints and coatings, which have a potential impact on ambient air quality, must include manufacturer's MSDSs or other manufacturer's Product Data highlighting VOC content.
 18. Composite Wood and Agrifiber Binders: Submittals for all composite wood and agrifiber products (including but not limited to particleboard, wheatboard, strawboard, agriboard products, engineered wood components, solid-core wood doors, OSB, MDF, and plywood products) must include manufacturer's product data verifying that these products contain no urea-formaldehyde resins.
 19. Systems Furniture and Seating: Provide manufacturer's product data verifying that all systems furniture and seating products meet the requirements of one of the following:
 - a. Greenguard certification.
 - b. SCS Indoor Advantage certification by SCS Global Services;
<http://www.scsglobalservices.com/certified-indoor-air-quality>.
 - c. SCS Indoor Advantage Gold certification by SCS Global Services.
 - d. ANSI/BIFMA Standard X7.1-2011, as tested to ANSI/BIFMA method M7.1-2011 and as verified by an independent laboratory.
 - e. Calculated indoor air concentration limits for furniture systems and seating determined by the U.S. EPA's Environmental Technology Verification Large Chamber Test Protocol for Measuring Emissions of VOCs and Aldehydes (September 1999) testing protocol as conducted in an independent air quality testing laboratory.
 20. Air Filtration: Provide manufacturer's cut sheets and product data highlighting the following:
 - a. If air handlers must be used during construction, use filtration media with a Minimum Efficiency Reporting Value (MERV) of 8 at each return air grill, as determined by ASHRAE 52.2-2007.

- b. Replace all filtration media immediately prior to occupancy.
Provide filtration media with a Minimum Efficiency Reporting Value (MERV) of 13, as determined by ASHRAE 52.2-2007 for media installed at the end of construction.
- 21. Duct Acoustical Insulation: Provide manufacturer's cut sheets or product data verifying that mechanical sound insulation materials in air distribution ducts consists of an impervious, non-porous coatings that prevent dust from accumulating in the insulating materials.
- 22. Green Housekeeping: Provide documentation that all cleaning products and janitorial paper products meet the VOC limits and content requirements of this specification section.
- 23. Refer to technical specifications for additional submittal requirements related to sustainability goals.
- D. Project Materials Cost Data: Provide a spreadsheet in an electronic file indicating the total cost for the Project and the total cost of building materials used for the Project, as follows:
 - 1. Not more than 30 days after the Preconstruction Meeting, provide preliminary schedule of materials cost to the Owner and Architect for all materials used for the Project organized by specification section. Exclude labor costs and all mechanical, electrical, and plumbing (MEP) systems materials and labor costs. Include the following:
 - a. Identify each reused or salvaged material, its cost, and its replacement value.
 - b. Identify each recycled-content material, its post-consumer and pre-consumer recycled content as a percentage the product's weight, its cost, its combined recycled content value (defined as the sum of the post-consumer recycled content value plus one-half of the pre-consumer recycled content value), and the total combined recycled content value for all materials as a percentage of total materials costs.
 - c. Identify each biobased material, its source, its cost, and the total value of biobased materials as a percentage of total materials costs. Also provide the total value of rapidly renewable materials (materials made from plants that are harvested in less than a 10-year cycle) as a percentage of total materials costs.

- e. Identify each wood-based material, its cost, the total wood-based materials cost, each FSC Certified wood material, its cost, and the total value of Certified wood as a percentage of total wood-based materials costs.
- 2. Provide final versions of the above spreadsheets to the Owner and Architect not more than 14 days after Substantial Completion.
- E. Construction Waste Management: See Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT for submittal requirements.
- F. Construction Indoor Air Quality (IAQ) Management: Submittals must include the following:
 - 1. Not more than 30 days after the Preconstruction Meeting, prepare and submit for the Architect and Owner's approval, an electronic copy of the draft Construction IAQ Management Plan (CIAQMP) in an electronic file including, but not limited to, descriptions of the following:
 - 2. Instruction procedures for meeting or exceeding the minimum requirements of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings Under Construction, 2008, including procedures for HVAC Protection, Source Control, Pathway Interruption, Housekeeping, and Scheduling.
 - a. Instruction procedures for protecting absorptive materials stored on-site or installed from moisture damage.
 - b. Schedule of submission to Architect of photographs of on-site construction IAQ management measures such as protection of ducts and on-site stored oil installed absorptive materials.
 - c. Instruction procedures if air handlers must be used during construction, including a description of filtration media to be used at each return air grille.
 - d. Instruction procedure for replacing all air-filtration media immediately prior to occupancy after completion of construction, including a description of filtration media to be used at each air handling or air supply unit.
 - 3. Not more than 30 days following receipt of the approved draft CIAQMP, submit an electronic copy of the approved CIAQMP in an electronic file, along with the following:
 - a. Manufacturer's cut sheets and product data highlighting the Minimum Efficiency Reporting Value (MERV) for all filtration

- media to be installed at return air grilles during construction if permanently installed AHUs are used during construction.
 - b. Manufacturer's cut sheets and product data highlighting the Minimum Efficiency Reporting Value (MERV) for filtration media in all air handling units (AHUs).
4. Not more than 14 days after Substantial Completion provide the following:
- a. Documentation verifying required replacement of air filtration media in all air handling units (AHUs) after the completion of construction and prior to occupancy and, if applicable, required installation of filtration during construction.
 - b. Minimum of 18 Construction photographs: Six photographs taken on three different occasions during construction of the SMACNA approaches employed, along with a brief description of each approach, documenting implementation of the IAQ management measures, such as protection of ducts and on-site stored or installed absorptive materials.
 - c. A copy of the report from testing and inspecting agency documenting the results of IAQ testing, demonstrating conformance with IAQ testing procedures and requirements defined in Section 01 81 09, TESTING FOR INDOOR AIR QUALITY.
- H. Sustainable Design Progress Reports: Concurrent with each Application for Payment, submit reports for the following:
- 1. Construction Waste Management: Waste reduction progress reports and logs complying with the requirements of Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT.
 - 2. Construction IAQ Management: Refer to Construction Indoor Air Quality Management for Construction IAQ management progress report requirements.

1.6 QUALITY ASSURANCE

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

requirements with the Contracting Officer and the Construction Quality Manager.

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

1.7 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. American Society for Testing and Materials (ASTM):
- | | |
|----------------|---|
| E2348-06(2010) | Framework for a Consensus-based Environmental Decision-making Process |
| E2432 | General Principles of Sustainability Relative to Buildings |
- C. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
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|----------------------|--|
| Standard 52.2 - 2007 | Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size |
|----------------------|--|
- D. Business Institutional Furniture Manufacturers Association (BIFMA):
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|-----------------------------|--|
| ANSI/Standard X7.1-2011 | Standard for Formaldehyde and TVOC Emissions |
| ANSI/BIFMA method M7.1-2011 | Standard Test Method for Determining VOC Emissions |
- E. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA):
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|----------------------|--|
| ANSI/SMACNA 008-2008 | The SMACNA IAQ Guidelines for Occupied Buildings Under Construction, 2nd Edition |
|----------------------|--|
- F. South Coast Air Quality Management District (SCAQMD):
- | | |
|-----------------|-----------------------------|
| SCAQMD Rule 403 | (1976; R2005) Fugitive Dust |
|-----------------|-----------------------------|

PART 2 - PRODUCTS

2.1 PRODUCT ENVIRONMENTAL REQUIREMENTS

- A. Site Clearing: Topsoil to be provided by the Contractor from on-site material which has been stockpiled for reuse. Off-site borrow should only be used when on-site sources are exhausted. Chip and/or compost on site all vegetated material identified for removal.

- B. Do not burn rubbish, organic matter, etc. or any material on the site; dispose of such material legally in accordance with Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT.
- C. Roofing Materials: Roofing systems must comply with the following requirements:
 - 1. Low-Sloped roofing less than or equal to 2:12 slope must have an SRI of at least 78.
 - 2. Steep-Sloped roofing greater than 2:12 slope must have an SRI of at least 29.
- D. Exterior Lighting Fixtures: Exterior luminaires must emit 0 percent of the total initial designed fixture lumens at an angle above 90 degrees from nadir and/or meet the requirements of the Dark Sky certification program; requirement must be confirmed by submitted products.
- E. Herbicides and Pest Control: Herbicides are not permitted; pest control measures must utilize EPA-registered biopesticides only.
- F. Water-Conserving Fixtures: Plumbing fixtures must meet or exceed requirements of the EPA WaterSense program categories.
- G. Reduction of Ozone-Depleting Compounds and Generation of Greenhouse Gases:
 - 1. Ozone Protection and Greenhouse Gas Reduction: Provide base building cooling equipment containing only the following refrigerants: HCFC-123, HFC-134a, HFC-245fa, HFC-407c, or HFC 410a.
 - 2. Fire suppression systems cannot contain ozone-depleting substances such as halon 1301 and 1211.
 - 3. Extruded polystyrene insulation (XPS) and closed-cell spray foam polyurethane insulation cannot be manufactured with hydrochlorofluorocarbon (HCFC) blowing agents.
- H. Appliances and Equipment: All materials and equipment being installed that falls under the ENERGY STAR or FEMP programs must be ENERGY STAR or FEMP-rated. Eligible equipment includes refrigerators, motors, laundry equipment, office equipment and more. Refer to each program's website for a complete list.
- I. HVAC Distribution Efficiency:
 - 1. Construct duct systems of aluminum, stainless steel or galvanized sheet metal, as deemed appropriate based on the application requirements. Fiberglass duct board is not permitted.
 - 2. Provide medium- and high-pressure ductwork systems that have been pressure-tested in accordance with the current SMACNA standards.

3. Provide externally-insulated ductwork; interior duct liner is not permitted.
 4. Provide air terminal connections hard-connected with sheet metal ductwork, where possible. If flexible ductwork is used, flexible duct extension cannot exceed 1830 mm (6 feet) in length.
 5. Isolate HVAC equipment from the ductwork system with flexible duct connectors to minimize the transmittance of vibration.
 6. Include the appropriate style of volume damper with supply and return air branch ducts. Balance air terminal devices such as grilles, registers, and diffusers at duct branch dampers - not at terminal face.
- J. Measurement and Verification: Install controls and monitoring devices as required by MEP divisions in order to comply with International Performance Measurement & Verification Protocol (IPMVP), Volume III: Concepts and Options for Determining Energy Savings in New Construction, April 2003, Option D.
- K. Recycled Content of Materials:
1. Provide building materials with recycled content such that post-consumer recycled content value plus half the pre-consumer recycled content value constitutes a minimum of 30 percent of the cost of materials used for the Project, exclusive of all MEP equipment, labor, and delivery costs. Make all attempts to maximize the procurement of materials with recycled content.
 - a. Determine the post-consumer recycled content value of a material by dividing the weight of post-consumer recycled content by the total weight of the material and multiplying by the cost of the material.
 - b. Do not include mechanical and electrical components in the calculations.
 - c. Do not include labor and delivery costs in the calculations.
 - d. Recycled content of materials is defined according to the Federal Trade Commission's "Guide for the Use of Environmental Marketing Claims," 16 CFR 260.7 (e).
 - e. Utilize all on-site existing paving materials that are scheduled for demolition as granulated fill, and include the cost of this material had it been purchased in the calculations for recycled content value.

2. Contractor is obligated by contract to satisfy Federal mandates for procurement of products and materials meeting recommendations for post-consumer content and recovered materials content; the list of designated product categories with recommendations has been compiled by the EPA - refer to <http://www.epa.gov/wastes/conserve/tools/cpg/products/>.
- a. Complying with the mandate requirements may exceed the minimum limits set by this section; otherwise, additional product and material selections with recycled content must be provided, as determined by Contractor's Sustainability Action Plan.
- b. The EPA website includes lists prepared for the Federal Comprehensive Procurement Guidelines; the website also provides tools such as a Product Supplier Directory search engine and product resource guides.
- c. EPA Categories include, but not limited to:
 - 1) Building insulation.
 - 2) Carpet (polyester).
 - 3) Carpet cushion.
 - 4) Cement and concrete.
 - 5) Consolidated and reprocessed latex paint.
 - 6) Floor tiles.
 - 7) Flowable fill.
 - 8) Laminated paperboard.
 - 9) Modular threshold ramps.
 - 10) Nonpressure pipe.
 - 11) Patio blocks.
 - 12) Railroad grade crossing surfaces.
 - 13) Roofing materials.
 - 14) Shower and restroom dividers/partitions.
 - 15) Structural fiberboard.
 - 16) Nylon carpet and nylon carpet backing.
 - 17) Compost and fertilizer made from recovered organic materials.
 - 18) Hydraulic mulch.
 - 19) Lawn and garden edging.
 - 20) Plastic lumber landscaping timbers and posts.
 - 21) Park benches and picnic tables.
 - 22) Plastic fencing.
 - 23) Playground equipment.

24) Playground surfaces.

25) Bike racks.

N. Biobased Content:

1. Subject to conformance with drawings and specifications, provide products designated by the USDA's BioPreferred program; provide other products and material made from biobased materials to the maximum extent possible without jeopardizing the intended end use or detracting from the overall quality delivered to the National Cemetery Administration. Supplies and materials must be of a type and quality that conform to applicable specifications and standards.
2. Biobased products that are designated for preferred procurement under USDA's BioPreferred program must meet the required minimum biobased content. Refer to [Http://www.biopREFERRED.gov/ProductCategories.aspx](http://www.biopREFERRED.gov/ProductCategories.aspx) for the product categories and <http://www.biopREFERRED.gov/bioPreferredCatalog/faces/jsp/catalogLanding.jsp> for the BioPreferred Catalog. Submit data for the biobased products to include biobased content and source of biobased material; indicating the name of the manufacturer, cost of each material, and the intended use of each of the materials that are to be used in carrying out the requirements of the contract.
3. Provide biobased products to the greatest extent possible.

O. Construction Operations' Environmental Aspects, Impacts and Controls: Monitor environmental aspects and impacts of Contractor's operations (including identification and pursuit of controls on and mitigation of adverse impacts) and as follows:

1. Climate Change and Air Pollution Control: Environmental aspects of and controls on Contractor operations related to climate change include Greenhouse Gas (GHG) emissions associated with construction equipment. Environmental aspects of and controls on Contractor operations related to criteria air pollutants include particulate matter (PM) and nitrogen oxides (NOx) emissions associated with construction equipment.
 - a. Documentation: Maintain the following records for review on request basis.
 - 1) For diesel powered equipment, indicate number and type of construction equipment that utilizes emission control

technologies complying with 2008 pollution requirements for new diesel engines.

- 2) GHG emissions: Document estimated GHG emissions of equipment used on the project. Calculate GHG emissions from mobile combustion in accordance with the EPA Climate Leaders protocols <http://www.epa.gov/climateleaders/resources/> Indicate quantity of fuel by type used and provide estimate for comparison to industry standard.
- 3) Air Pollution Control: Document the current emissions of the equipment. Calculate the emissions reduced with the selected option applied to the equipment in accordance with the Diesel Emissions Quantifier (www.epa.gov/cleandiesel) protocols. Indicate the change in emissions.
2. Water Stewardship: Environmental aspects of and controls on Contractor operations related to water stewardship include quantity and quality of discharges to surface water and ground water. Refer to soil and erosion control requirements within the drawings and specifications.
3. Noise Control: Perform operations to minimize noise; perform noise-producing work with heavy equipment during less sensitive hours of the day or week.
 - a. The noise source cannot exceed 60 dBA from 7:00 a.m. to 6:00 p.m.
 - b. Operations in other times must be performed under the constraints established at the need of each occurrence.
4. Air Resources:
 - a. Prevent creation of dust, air pollution, and odors.
 - b. Sequence construction to avoid disturbance to site to the greatest extent possible.
 - c. Use mulch, water sprinkling, temporary enclosures, and other appropriate methods to limit dust and dirt rising and scattering in air to lowest practical level. Do not use water when it may create hazardous or other adverse conditions such as flooding and pollution.
 - d. Store volatile liquids, including fuels and solvents, in closed containers.
 - e. Properly maintain equipment to reduce gaseous pollutant emissions.
 - f. Dust Suppressants:

- 1) Products formulated to reduce or eliminate the spread of dust associated with gravel roads, dirt parking lots, or similar sources of dust, including products used in equivalent indoor applications.
- 2) If employing these materials, products must include minimum 85 percent biobased content.

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SECTION 02 41 10
DEMOLITION AND SITE CLEARING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies all site preparation work, demolition and removal of buildings, 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: GENERAL CONDITIONS Article, ACCIDENT PREVENTION.
- C. Disconnecting utility services prior to demolition: Section 01 00 00, GENERAL REQUIREMENTS.
- D. Reserved items that are to remain the property of the Government: Section 01 00 00, GENERAL REQUIREMENTS.
- G. Environmental Protection: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.
- H. Waste Management: Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT

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 1.9 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.

SPEC WRITER NOTES:

1. Unless the building is to be demolished story by story paragraph F2 should not be used.

- F. In addition to previously listed fire and safety rules to be observed in performance of work, include following:

1. No wall or part of wall shall be permitted to fall outwardly from structures.
2. Wherever a cutting torch or other equipment that might cause a fire is used, provide and maintain fire extinguishers nearby ready for immediate use. Instruct all possible users in use of fire extinguishers.
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, survey the site and examine the drawings and specifications to determine the extent of the work. Take necessary precautions to avoid damages to existing items to remain in place, to be reused, or to remain the property of the Cemetery; any damaged items shall be repaired or replaced as approved by the Resident Engineer/Contracting Officer's Representative (RE/COR). Coordinate the work of this section with all other work and shall construct and maintain shoring, bracing, and supports as required. 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 RE/COR's approval.

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

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 SITE CLEARING

- A. General: Remove trees, shrubs, grass, and other vegetation, pavements, improvements, or obstructions, as required, to permit installation of new construction. Remove similar items elsewhere on site or premises as specifically indicated. Removal includes digging out and off-site disposal of stumps and roots.
 - 1. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
- B. Erosion Control: Provide erosion control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways. Install silt fence and inlet protection as shown and as per requirements of the SWPPP, prior to any soil disturbance activities. Provide temporary seeding as required by the SWPPP.
- C. Maintain site controls in accordance with Storm Water Pollution Prevention Plan and repair as directed by COTR to sustain compliance with SPDES permit. Maintain all records as required by the SWPPP. Perform inspections as required by the SWPPP.
- D. Topsoil - On-site: Topsoil is defined as friable clay loam surface soil found in a depth of not less than 150 mm (6 inches). Satisfactory topsoil is reasonably free and/or screened of subsoil, clay lumps, stones, and other objects over 25 mm (1 inch) in diameter, and without weeds, roots, and other objectionable material.
 - 1. Strip topsoil to whatever depths encountered in a manner to prevent intermingling with underlying subsoil or other objectionable material. Remove heavy growths of grass from areas before stripping.
 - a. Where existing trees are indicated to remain, leave existing topsoil in place within drip lines to prevent damage to root system.

2. Stockpile topsoil in storage piles in areas indicated or directed. Construct storage piles to provide free drainage of surface water. Cover storage piles to prevent wind erosion in accordance with the Storm Water Pollution Prevention Plan. Refer to Division 2 Section 32 90 00, "Planting" for soil amendments required prior to spreading topsoil.
 - a. Stockpile shall be contained with erosion and sediment controls (silt fence) and stabilized if undisturbed in accordance with the Storm Water Pollution Prevention Plan.
 3. Dispose of unsuitable or excess topsoil as specified for disposal of waste material only after approval of the Architect.
- E. Clearing and Grubbing: Clear site of trees, shrubs, and other vegetation, except for those indicated to be left standing.
1. Completely remove stumps, roots, and other debris protruding through ground surface.
 2. Use only hand methods for grubbing inside drip line of trees indicated to remain.
 3. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.
 - a. Place fill material in horizontal layers not exceeding 150 mm (6 inches) loose depth, and thoroughly compact each layer to a density equal to adjacent original ground.
- F. Removal of Improvements: Remove existing above-grade and below-grade improvements as indicated and as necessary to facilitate new construction.
- G. Abandonment or removal of certain underground pipe or conduits may be indicated on mechanical or electrical drawings and is included under work of related Division 15 and 16 Sections. Removing abandoned underground piping or conduits interfering with construction is included under this Section, except as indicated to be abandoned in-place.
- H. Continue maintenance of erosion controls in compliance with the Storm Water Pollution Prevention Plan until the work is completed and the threat of erosion is gone by either around surface stabilizer or lawn "grow-in" is at 85% complete. Temporary erosion control devices shall not be removed until the area is certified as being stabilized by the Qualified Inspector.

3.2 DEMOLITION

- A. Completely demolish and remove buildings and structures, including all appurtenances related or connected thereto, as noted below:
 - 1. As required for installation of new utility service lines.
 - 2. To full depth within an area defined by hypothetical lines located 1500 mm (5 feet) outside building lines of new structures.
- B. Debris, including brick, concrete, stone, metals and similar materials shall become property of Contractor and shall be disposed of by him daily, off the Cemetery Property to avoid accumulation at the demolition site. Materials that cannot be removed daily shall be stored in areas specified by the RE/COR. Break up concrete slabs below grade that do not require removal from present location into pieces not exceeding 600 mm (24 inches) square to permit drainage. Contractor shall dispose debris in compliance with applicable federal, state or local permits, rules and/or regulations.
- C. In removing buildings and structures of more than two stories, demolish work story by story starting at highest level and progressing down to third floor level. Demolition of first and second stories may proceed simultaneously.
- D. Remove and legally dispose of all materials, other than earth to remain as part of project work, from any trash dumps shown. Materials removed shall become property of contractor and shall be disposed of in compliance with applicable federal, state or local permits, rules and/or regulations be hauled to VA specified disposal site All materials in the indicated trash dump areas, including above surrounding grade and extending to a depth of 1500 mm (5 feet) below surrounding grade, shall be included as part of the lump sum compensation for the work of this section. Materials that are located beneath the surface of the surrounding ground more than 1500 mm (5 feet), or materials that are discovered to be hazardous, shall be handled as unforeseen. The removal of hazardous material shall be referred to Hazardous Materials specifications. Burning is not permitted on the property.
- 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 RE/COR. When Utility lines are encountered that are not indicated on the drawings, the RE/COR shall be notified prior to further work in that area.

3.2 CLEAN-UP

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

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

PART 1 - GENERAL

1.1 DESCRIPTION

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

1.2 RELATED WORK

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

1.3 TOLERANCES

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

1.4 REGULATORY REQUIREMENTS

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

1.5 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Concrete Mix Design.
- C. Shop Drawings:

1. Submit Steel Reinforcement Shop Drawings and Product Data to include all information necessary for fabrication and placement of reinforcement.
 2. Indicate grades of reinforcing steel.
 3. Clearly indicate the splice length for every size and type of bar used.
 4. Indicate the type, size and location of all accessories required for the proper assembly, placement and support of the reinforcement.
 5. Provide layout drawings of all floor slabs and formed concrete indicating construction, control, and expansion joint locations.
- D. Manufacturer's Certificates: Air-entraining admixture, chemical admixtures, curing compounds.

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 the latest edition of referenced publications unless otherwise specified
- B. American Concrete Institute (ACI):
- | | |
|-------|--|
| 117 | Specification for Tolerances for Concrete Construction and Materials and Commentary |
| 211.1 | Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete |
| 211.2 | Standard Practice for Selecting Proportions for Structural Lightweight Concrete |
| 214 | Recommended Practice for Evaluation of Strength Test Results of Concrete |
| 301 | Standard Specifications for Structural Concrete |
| 304R | Guide for Measuring, Mixing, Transporting, and Placing Concrete |
| 305.1 | Specification for Hot Weather Concreting |
| 306.1 | Standard Specification for Cold Weather Concreting |
| 308R | Standard Practice for Curing Concrete |
| 309R | Guide for Consolidation of Concrete |
| SP-66 | ACI Detailing Manual |
| 318 | Building Code Requirements for Structural Concrete and Commentary |
| 347R | Guide to Formwork for Concrete |

C. American National Standards Institute and American Hardboard Association (ANSI/AHA):

A135.4 Basic Hardboard

D. ASTM International (ASTM):

A82 Standard Specification for Steel Wire, Plain, for Concrete Reinforcement

A185 Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement

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

A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvanized) by the Hot-Dip Process

A706 Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement

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

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

C31 Standard Practice for Making and Curing Concrete Test Specimens in the Field

C33/C33M Standard Specification for Concrete Aggregates

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

C94/C94M Standard Specification for Ready Mixed Concrete

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

C150/C150M Standard Specification for Portland Cement

C171 Standard Specification for Sheet Materials for Curing Concrete

C172 Standard Specification for Sampling Freshly Mixed Concrete

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

C192/C192M	Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory
C231	Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
C260/C260M	Standard Specification for Air-Entraining Admixtures for Concrete
C309	Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
C330/C330M	Standard Specification for Lightweight Aggregates for Structural Concrete
C494/C494M	Standard Specification for Chemical Admixtures for Concrete
C496	Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens
C567	Standard Test Method for Density of Structural Lightweight Concrete
C618	Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
C666	Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing
C881	Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete
C1107	Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink)
D6	Standard Test Method for Loss on Heating of Oil and Asphaltic Compounds
D297	Standard Test Methods for Rubber Products-Chemical Analysis
D1751	Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)
D4397	Standard Specification for Polyethylene Sheeting for Construction, Industrial and Agricultural Applications

E1155 Standard Test Method for Determining F_F Floor Flatness
and F_L Floor Levelness Numbers

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

E. American Welding Society (AWS):

D1.4 Structural Welding Code Reinforcing Steel

F. Concrete Reinforcing Steel Institute (CRSI):

DA4 Manual of Standard Practice

G. Federal Specifications (Fed. Spec.):

MM-L-751H Lumber Softwood

H. U.S. Department of Commerce Product Standard (PS):

PS 1 Construction and Industrial Plywood

I. U.S. Army Corps of Engineers Handbook for Concrete and Cement:

CRD C513 Rubber Waterstops

CRD C572 Polyvinyl Chloride Waterstops

PART 2 - PRODUCTS

2.1 FORMS

- A. Wood: Fed Spec MM-L-751H, free from loose knots and suitable to facilitate finishing concrete surface specified; tongue and grooved.
- B. Plywood: PS-1 Exterior Grade B (concrete form) 5/8 inch, or 3/4 inch thick for unlined contact form. B-B High Density Concrete Form Overlay optional.
- C. Metal for Concrete Rib Type Construction: Steel (removal type) of suitable weight and form to provide required rigidity.
- D. Permanent Steel Form for Concrete Slabs: Corrugated, ASTM A653, Grade E, and Galvanized, ASTM A653, G90. Provide venting where insulating concrete fill is used.
- E. Form Lining:
 - 1. Hardboard: ANSI/AHA A135.4, Type 2, Grade 2-M-2, exterior bond not less than 3/16 inch thick.
 - 2. Plywood: Grade B-B Exterior (concrete-form) not less than 1/4 inch thick.
 - 3. Plastic, fiberglass, or elastomeric capable of reproducing the desired pattern or texture.

- F. Form Ties: Develop a minimum working strength of 3000 pounds when fully assembled. Ties shall be adjustable in length to permit tightening of forms and not have any lugs, cones, washers to act as spreader within form, nor leave a hole larger than 3/4 inch diameter, or a depression in exposed concrete surface, or leave metal closer than 1 1/2 inches to concrete surface. Wire ties not permitted. Cutting ties back from concrete face not permitted.
- G. Form releasing agents to be commercial formulations that will not bond with, stain or adversely affect concrete surfaces. Agents must not impair subsequent treatment of concrete surfaces depending upon bond or adhesion nor impede the wetting of surfaces to be cured with water or curing compounds. If special form liners are to be used, follow the recommendation of the form coating manufacturer. Submit manufacturer's recommendation on method and rate of application of form releasing agents.

2.2 MATERIALS

- A. Portland Cement: ASTM C150, Type I or II.
- B. Fly Ash: ASTM C618, Class C or F including supplementary optional requirements relating to reactive aggregates and alkalis, and loss on ignition (LOI) not to exceed 5 percent.
- C. Coarse Aggregate: ASTM C33, Size 67. Size 467 may be used for footings and walls over 12 inches thick. Provide Size 7 coarse aggregate for applied topping, encasement of steel columns and metal pan stair fill. Maximum size of coarse aggregates not more than one-fifth of narrowest dimension between sides of forms, one-third of depth of slabs, nor three-fourth of minimum clear spacing between reinforcing bars.
- D. Fine Aggregate: ASTM C33. Fine aggregate for applied concrete floor topping shall pass a No. 4 sieve, 10 percent maximum shall pass a No. 100 sieve.
- E. Lightweight Aggregate for Structural Concrete: ASTM C330, Table 1
- F. Mixing Water: Fresh, clean, and potable.
- G. Air-Entraining Admixture: ASTM C260.
- H. Chemical Admixtures: ASTM C494.
1. Water Reducing Admixture: ASTM C494, Type A and not contain more chloride ions than are present in municipal drinking water.
 2. Water Reducing, Retarding Admixture: ASTM C494, Type D and not contain more chloride ions than are present in municipal drinking water.
 3. High-Range Water-Reducing Admixture (Superplasticizer): ASTM C494, Type F or G, and not contain more chloride ions than are present in municipal drinking water.

4. Non-Corrosive, Non-Chloride Accelerator: ASTM C494, Type C or E, and not contain more chloride ions than are present in municipal drinking water. Admixture manufacturer must have long-term non-corrosive test data from an independent testing laboratory of at least one year duration using an acceptable accelerated corrosion test method such as that using electrical potential measures.
5. Calcium Nitrite corrosion inhibitor: ASTM C494 Type C.
6. Prohibited Admixtures: Calcium chloride, thiocyanate or admixtures containing more than 0.05 percent chloride ions are not permitted.
7. Certification: Written conformance to the requirements above and the chloride ion content of the admixture prior to mix design review.
- I. Vapor Barrier: ASTM E1745, 15 mil thickness.
- J. Reinforcing Steel: ASTM A615 or ASTM A996, deformed. See structural drawings for grade.
- K. Welded Wire Fabric: ASTM A1064.
- L. Reinforcing Bars to be Welded: ASTM A706.
- M. Galvanized Reinforcing Bars: ASTM A767.
- N. Reinforcement for Metal Pan Stair Fill: 2 inch wire mesh, either hexagonal mesh at 1.5 pounds per square yard, or square mesh at 1.17 pounds per square yard.
- O. Supports, Spacers, and Chairs: Types which will hold reinforcement in position shown in accordance with requirements of ACI 318 except as specified.
- P. Expansion Joint Filler: ASTM D1751.
- Q. Sheet Materials for Curing Concrete: ASTM C171.
- R. Abrasive Aggregates: Aluminum oxide grains or emery grits.
- S. Liquid Densifier/Sealer: 100 percent active colorless aqueous silicate solution.
- T. Liquid Membrane-forming Compounds for Curing Concrete: ASTM C309, Type I, with fugitive dye. Compound shall be compatible with scheduled surface treatment, such as paint and resilient tile, and shall not discolor concrete surface.
- U. Grout, Non-Shrinking: ASTM C1107, premixed ferrous or non-ferrous, mixed and applied in accordance with manufacturer's recommendations. Grout cannot show settlement or vertical drying shrinkage at 3 days or thereafter based on initial measurement made at time of placement. Grout must produce a compressive strength of minimum 2500 psi at 3 days and minimum 5000 psi at 28 days. Furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95 percent bearing under a 4 foot by 4 foot base plate. Where high fluidity or increased

placing time is required, furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95 percent under an 18 inch by 36 inch base plate.

V. Adhesive Binder: ASTM C881:

1. Bentonite Water Stop: Flexible strip of bentonite 1 inch by 3/4 inch, weighing 5.85 lbs. per foot composed of Butyl Rubber Hydrocarbon (ASTM D297), Bentonite (SS-S-210-A) and Volatile Matter (ASTM D6).
2. Porous Backfill: Crushed stone or gravel graded from 1 inch to 3/4 inch.
3. Synthetic Fibers: Monofilament or fibrillated polypropylene fibers for secondary reinforcing of concrete members. Use appropriate length and 1.5 lb. per cubic yard. Product shall have a UL rating.
4. Steel Fibers: ASTM A820, Type I cold drawn, high tensile steel wire for use as primary reinforcing in slab-on-grade. Minimum dosage rate 18 kg/m³ (30 lb. per cubic yard).
5. Epoxy Joint Filler: Two component, 100 percent solids compound, with a minimum shore D hardness of 50.
6. Bonding Admixture: Non-rewettable, polymer modified, bonding compound.
7. Architectural Concrete: For areas designated as architectural concrete on the Contract Documents, use colored cements and specially selected aggregates as necessary to produce a concrete of a color and finish which exactly matches the designated sample panel.

2.3 CONCRETE MIXES

- A. Design of concrete mixes using materials specified as set forth under Option C of ASTM C94.
- B. Compressive strength at 28 days:
 1. Foundations: Minimum 4000 psi
 2. Slabs: Minimum 3500 psi
 3. All Other: Minimum 3000 psi
- C. Establish strength of concrete by testing prior to beginning concreting operation. Test consists of average of three cylinders made and cured in accordance with ASTM C192 and tested in accordance with ASTM C39.
- D. Cement and water factor (See Table I): Maintain minimum cement factors in Table I regardless of compressive strength developed above minimums. Fly ash may be substituted for up to 20 percent of the minimum cement factor at option of Contractor, except fly ash may not be used in concrete designated as architectural concrete.

TABLE I - CEMENT AND WATER FACTORS FOR CONCRETE

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

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

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

TABLE II - MAXIMUM SLUMP, INCHES*

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

- * Slump may be increased by the use of the approved high-range water-reducing admixture (superplasticizer). Tolerances as established by ASTM C94. Concrete containing the high-range-water-reducing admixture may have a maximum slump of 9 inches. The concrete shall arrive at the job site at a slump of 2 inches to 3 inches, and 3

inches to 4 inches for lightweight concrete. This should be verified, and then the high-range-water-reducing admixture added to increase the slump to the approved level.

- F. Air-entrainment is required for all exterior concrete and as required for Section 32 05 23. Air content shall conform to ACI 318 Table 4.4.1.
- G. High early strength concrete, made with Type III cement or Type I cement plus non-corrosive accelerator, shall have a 7-day compressive strength equal to specified minimum 28 day compressive strength for concrete type specified made with standard Portland cement.
- H. Concrete slabs placed at air temperatures below 50 degrees Fahrenheit use non-corrosive, non-chloride accelerator. Concrete required to be air entrained use approved air entraining admixture. Pumped concrete, synthetic fiber concrete, architectural concrete, concrete required to be watertight, and concrete with a water/cement ratio below 0.50 use high-range water-reducing admixture (superplasticizer).
- I. Durability: Use air entrainment for exterior exposed concrete subjected to freezing and thawing and other concrete shown or specified. Air content as shown in ACI 318 Table 4.4.1.
- J. Enforcing Strength Requirements: Test as specified in Section 01 45 29, TESTING LABORATORY SERVICES, during the progress of the work. Seven day tests may be used as indicators of 28 day strength. Average of any three 28 day consecutive strength tests of laboratory cured specimens representing each type of concrete shall be equal to or greater than specified strength. No single test shall be more than 500 psi below specified strength. Interpret field test results in accordance with ACI 214. Should strengths shown by test specimens fall below required values, Resident Engineer may require any one or any combination of the following corrective actions, at no additional cost to the Government:
 - 1. Require changes in mix proportions by selecting one of the other appropriate trial mixes or changing proportions, including cement content, of approved trial mix.
 - 2. Require additional curing and protection.
 - 3. If five consecutive tests fall below 95 percent of minimum values given in Table I or if test results are so low as to raise a question as to the safety of the structure, Resident Engineer may direct Contractor to take cores from portions of the structure. Use results from cores tested by the Contractor retained testing agency to analyze structure.
 - 4. If strength of core drilled specimens falls below 85 percent of minimum value given in Table I, Resident Engineer may order load tests, made by Contractor retained testing

agency, on portions of building so affected. Load tests in accordance with ACI 318 and criteria of acceptability of concrete under test as given therein.

5. Concrete work, judged inadequate by structural analysis, by results of load test, or for any reason, shall be reinforced with additional construction or replaced, if directed by the Resident Engineer.

2.4 BATCHING AND MIXING

A. Store, batch, and mix materials as specified in ASTM C94.

1. Job-Mixed: Mix in a batch mixer in manner specified for stationary mixers in ASTM C94.

2. Ready-Mixed: Comply with ASTM C94, except use of non-agitating equipment for transporting concrete to the site will not be permitted. With each load of concrete delivered to project, ready-mixed concrete producer must furnish, in duplicate, certification as required by ASTM C94. Maximum delivery temperature of concrete is 100 degrees Fahrenheit. Minimum delivery temperature as follows:

Atmospheric Temperature	Minimum Concrete Temperature
30.1 degrees to 40 degrees F	60 degrees F.
0 degrees to 30 degrees F.	70 degrees F.

3. Services of aggregate manufacturer's representative shall be furnished during the design of trial mixes and as requested by the Resident Engineer for consultation during batching, mixing, and placing operations of lightweight structural concrete. Services will be required until field controls indicate that concrete of required quality is being furnished. Representative shall be thoroughly familiar with the structural lightweight aggregate, adjustment and control of mixes to produce concrete of required quality. Representative shall assist and advise Resident Engineer.

4. Mixing structural lightweight concrete: Charge mixer with 2/3 of total mixing water and all of the aggregate. Mix ingredients for not less than 30 seconds in a stationary mixer or not less than 10 revolutions at mixing speed in a truck mixer. Add remaining mixing water and other ingredients and continue mixing. Above procedure may be modified as recommended by aggregate producer.

PART 3 - EXECUTION

3.1 FORMWORK

- A. Installation shall conform to ACI 347. Formwork shall be sufficiently tight to hold concrete without leakage, sufficiently braced to withstand vibration of concrete, and to carry, without appreciable deflection while remaining within allowable construction tolerances, all dead and live loads to which they may be subjected. The Contractor shall retain a registered Professional Engineer to design the formwork, shores, and reshores.
 - 1. Form boards and plywood forms may be reused for contact surfaces of exposed concrete only if thoroughly cleaned, patched, and repaired and Resident Engineer approves their reuse.
 - 2. Provide forms for concrete footings unless Resident Engineer determines forms are not necessary.
 - 3. Corrugated fiberboard forms: Place forms on a smooth firm bed, set tight, with no buckled cartons to prevent horizontal displacement, and in a dry condition when concrete is placed.
- B. Treating and Wetting: Treat or wet contact forms as follows:
 - 1. Coat plywood and board forms with non-staining form sealer. In hot weather cool forms by wetting with cool water just before concrete is placed.
 - 2. Clean and coat removable metal forms with light form oil before reinforcement is placed. In hot weather, cool metal forms by thoroughly wetting with water just before placing concrete.
 - 3. Use sealer on reused plywood forms as specified for new material.
- C. Size and Spacing of Studs: Size and space studs, wales and other framing members for wall forms so as not to exceed safe working stress of kind of lumber used nor to develop deflection greater than $1/270$ of free span of member.
- D. Unlined Forms: Use plywood forms to obtain a smooth finish for concrete surfaces. Tightly butt edges of sheets to prevent leakage. Back up all vertical joints solidly and nail edges of adjacent sheets to same stud with 6d box nails spaced not over 6 inches apart.
- E. Lined Forms: May be used in lieu of unlined plywood forms. Back up form lining solidly with square edge board lumber securely nailed to studs with all edges in close contact to prevent bulging of lining. No joints in lining and backing may coincide. Nail abutted edges of sheets to same backing board. Nail lining at not over 8 inches on center along

edges and with at least one nail to each square foot of surface area; nails to be 3d blued shingle or similar nails with thin flatheads.

- F. Architectural Liner: Attach liner as recommended by the manufacturer with tight joints to prevent leakage.
- G. Wall Form Ties: Locate wall form ties in symmetrically level horizontal rows at each line of wales and in plumb vertical tiers. Space ties to maintain true, plumb surfaces. Provide one row of ties within 6 inches above each construction joint. Space through ties adjacent to horizontal and vertical construction joints not over 18 inches on center.
 - 1. Tighten row of ties at bottom of form just before placing concrete and, if necessary, during placing of concrete to prevent seepage of concrete and to obtain a clean line. Ties to be entirely removed shall be loosened 24 hours after concrete is placed and shall be pulled from least important face when removed.
 - 2. Coat surfaces of all metal that is to be removed with paraffin, cup grease or a suitable compound to facilitate removal.
- H. Inserts, sleeves, and similar items: Flashing reglets, steel strips, masonry ties, anchors, wood blocks, nailing strips, grounds, inserts, wire hangers, sleeves, drains, guard angles, forms for floor hinge boxes, inserts or bond blocks for elevator guide rails and supports, and other items specified as furnished under this and other sections of specifications and required to be in their final position at time concrete is placed shall be properly located, accurately positioned, and built into construction, and maintained securely in place.
 - 1. Locate inserts or hanger wires for furred and suspended ceilings only in bottom of concrete joists, or similar concrete member of overhead concrete joist construction.
 - 2. Install sleeves, inserts and similar items for mechanical services in accordance with drawings prepared specially for mechanical services. Contractor is responsible for accuracy and completeness of drawings and shall coordinate requirements for mechanical services and equipment.
 - 3. Do not install sleeves in beams, joists or columns except where shown or permitted by Resident Engineer. Install sleeves in beams, joists, or columns that are not shown, but are permitted by the Resident Engineer, and require no structural changes, at no additional cost to the Government.
 - 4. Minimum clear distance of embedded items such as conduit and pipe is at least three times diameter of conduit or pipe, except at stub ups and other similar locations.

5. Provide recesses and blockouts in floor slabs for door closers and other hardware as necessary in accordance with manufacturer's instructions.

I. Construction Tolerances:

1. Set and maintain concrete formwork to assure erection of completed work within tolerances specified to accommodate installation of other rough and finish materials.
2. Cast-in-place concrete installed as part of, or in the complexes surrounding, columbarian or memorial wall elements shall have concrete (on or above finished grade) constructed to dimensions indicated on the Drawings within 1/4 inch of location and elevation.
3. Engage a professional surveyor to survey the formwork for the exposed portions of the foundations for the columbarium or memorial walls, including wall segments, piers and/or columns, prior to concrete being poured. If the forms are not correct, they must be corrected and resurveyed. When correct, provide a written certification from the surveyor, to the COTR, that the forms are set according to the Drawings, within the allowable tolerances for elevation, location, orientation, and dimensions called for on the Drawings.
4. Properly brace the forms so the set concrete is correct within the allowable construction tolerances when the forms are removed.
5. Upon removal of the forms, the professional surveyor must survey the placed concrete and provide information to the COTR where the work is not in conformance with the Drawings, within the allowable construction tolerances. The work cannot progress until the exposed concrete for the foundations are brought into compliance.
6. Remedial work necessary for correcting installations that is in excess of allowable tolerances are the responsibility of the Contractor.
7. Erected work that exceeds specified tolerance limits shall be remedied or removed and replaced, at no additional cost to the NCA.
8. Any remediation work is subject to approval of the COTR in advance of the work.
9. Permissible surface irregularities for various classes of materials are defined as "finishes" in specification sections covering individual materials. They are to be distinguished from tolerances specified which are applicable to surface irregularities of structural elements.

3.2 REINFORCEMENT

- A. Details of concrete reinforcement, unless otherwise shown, shall be in accordance with ACI 318 and ACI SP-66, unless otherwise shown.

- B. Placing: Place reinforcement conforming to CRSI DA4, unless otherwise shown.
1. Place reinforcing bars accurately and tie securely at intersections and splices with 16 gauge black annealed wire. Secure reinforcing bars against displacement during the placing of concrete by spacers, chairs, or other similar supports. Portions of supports, spacers, and chairs in contact with formwork shall be made of plastic in areas that will be exposed when building is occupied. Type, number, and spacing of supports conform to ACI SP-66. Where concrete slabs are placed on ground, use concrete blocks or other non-corrodible material of proper height, for support of reinforcement. Use of brick or stone supports will not be permitted.
 2. Lap welded wire fabric at least 1 1/2 mesh panels plus end extension of wires not less than 12 inches in structural slabs. Lap welded wire fabric at least 1/2 mesh panels plus end extension of wires not less than 6 inches in slabs on grade.
 3. Splice column steel at no points other than at footings and floor levels unless otherwise shown.
- C. Spacing: Minimum clear distances between parallel bars, except in columns and multiple layers of bars in beams shall be equal to nominal diameter of bars. Minimum clear spacing is 1 inch or 1 1/3 times maximum size of coarse aggregate.
- D. Splicing: Splices of reinforcement made only as required or shown or specified. Accomplish splicing as follows:
1. Lap splices: Do not use lap splices for bars larger than Number 36 (Number 11). Minimum lengths of lap as shown.
 2. Welded splices: Splicing by butt welding of reinforcement permitted providing the weld develops in tension at least 125 percent of the yield strength (f_y) for the bars. Welding conform to the requirements of AWS D1.4. Welded reinforcing steel conform to the chemical analysis requirements of AWS D1.4.
 - a. Submit test reports indicating the chemical analysis to establish weldability of reinforcing steel.
 - b. Submit a field quality control procedure to insure proper inspection, materials and welding procedure for welded splices.
 - c. Department of Veterans Affairs retained testing agency shall test a minimum of three splices, for compliance, locations selected by Resident Engineer.
 3. Mechanical Splices: Develop in tension and compression at least 125 percent of the yield strength (f_y) of the bars. Stresses of transition splices between two reinforcing bar sizes based on area of smaller bar. Provide mechanical splices at locations indicated.

Use approved exothermic, tapered threaded coupling, or swaged and threaded sleeve.
Exposed threads and swaging in the field not permitted.

- a. Initial qualification: In the presence of Resident Engineer, make three test mechanical splices of each bar size proposed to be spliced. Department of Veterans Affairs retained testing laboratory will perform load test.
- b. During installation: Furnish, at no additional cost to the Government, one companion (sister) splice for every 50 splices for load testing. Department of Veterans Affairs retained testing laboratory will perform the load test.
- E. Bending: Bend bars cold, unless otherwise approved. Do not field bend bars partially embedded in concrete, except when approved by Resident Engineer.
- F. Cleaning: Metal reinforcement, at time concrete is placed, shall be free from loose flaky rust, mud, oil, or similar coatings that will reduce bond.
- G. Future Bonding: Protect exposed reinforcement bars intended for bonding with future work by wrapping with felt and coating felt with a bituminous compound unless otherwise shown.

3.3 VAPOR BARRIER

- A. Except where membrane waterproofing is required, place interior concrete slabs on a continuous vapor barrier.
- B. Place 4 inches of fine granular fill over the vapor barrier to act as a blotter for concrete slab.
- C. Lap joints 6 inches and seal with a compatible waterproof pressure-sensitive tape.
- D. Patch punctures and tears.

3.4 CONSTRUCTION JOINTS

- A. Unless otherwise shown, location of construction joints to limit individual placement shall not exceed 80 feet in any horizontal direction, except slabs on grade which shall have construction joints shown. Allow 48 hours to elapse between pouring adjacent sections unless this requirement is waived by Resident Engineer.
- B. Locate construction joints in suspended floors near the quarter-point of spans for slabs, beams or girders, unless a beam intersects a girder at center, in which case joint in girder shall be offset a distance equal to twice width of beam. Provide keys and inclined dowels as shown. Provide longitudinal keys as shown.
- C. Place concrete for columns slowly and in one operation between joints. Install joints in concrete columns at underside of deepest beam or girder framing into column.

- D. Allow 2 hours to elapse after column is cast before concrete of supported beam, girder or slab is placed. Place girders, beams, grade beams, column capitals, brackets, and haunches at the same time as slab unless otherwise shown.

3.5 CONTROL JOINTS

- A. Control joints to be a maximum 1-1/2 inch deep sawn or tooled joints within concrete paving as depicted on Drawings. Control joints are not to break or disrupt concrete paving reinforcement.
- B. Control joints to be used to define individual concrete paving areas with nominal 2:1 ratio of length to width maximum.

3.6 EXPANSION JOINTS

- A. Clean expansion joint surfaces before installing premolded filler and placing adjacent concrete.

3.7 PLACING CONCRETE

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

paint. Apply to a damp base slab by scrubbing with a stiff fiber brush. New concrete shall be placed while the bonding grout is still tacky.

- C. Conveying Concrete: Convey concrete from mixer to final place of deposit by a method which will prevent segregation. Method of conveying concrete subject to approval of Resident Engineer.
- D. Placing: For special requirements see Paragraphs, HOT WEATHER and COLD WEATHER.
1. Do not place concrete when weather conditions prevent proper placement and consolidation, or when concrete has attained its initial set, or has contained its water or cement content more than 1 1/2 hours.
 2. Deposit concrete in forms as near as practicable in its final position. Prevent splashing of forms or reinforcement with concrete in advance of placing concrete.
 3. Do not drop concrete freely more than 10 feet for concrete containing the high-range water-reducing admixture (superplasticizer) or 5 feet for conventional concrete. Where greater drops are required, use a tremie or flexible spout (canvas elephant trunk), attached to a suitable hopper.
 4. Discharge contents of tremies or flexible spouts in horizontal layers not exceeding 20 inches in thickness, and space tremies such as to provide a minimum of lateral movement of concrete.
 5. Continuously place concrete until an entire unit between construction joints is placed. Rate and method of placing concrete shall be such that no concrete between construction joints will be deposited upon or against partly set concrete, after its initial set has taken place, or after 45 minutes of elapsed time during concrete placement.
 6. On bottom of members with severe congestion of reinforcement, deposit 1 inch layer of flowing concrete containing the specified high-range water-reducing admixture (superplasticizer). Successive concrete lifts may be a continuation of this concrete or concrete with a conventional slump.
 7. Concrete on metal deck:
 - a. Concrete on metal deck shall be minimum thickness shown. Allow for deflection of steel beams and metal deck under the weight of wet concrete in calculating concrete quantities for slab.

- 1) The Contractor shall become familiar with deflection characteristics of structural frame to include proper amount of additional concrete due to beam/deck deflection.
- E. Consolidation: Conform to ACI 309. Immediately after depositing, spade concrete next to forms, work around reinforcement and into angles of forms, tamp lightly by hand, and compact with mechanical vibrator applied directly into concrete at approximately 18 inch intervals. Mechanical vibrator shall be power driven, hand operated type with minimum frequency of 5000 cycles per minute having an intensity sufficient to cause flow or settlement of concrete into place. Vibrate concrete to produce thorough compaction, complete embedment of reinforcement and concrete of uniform and maximum density without segregation of mix. Do not transport concrete in forms by vibration.
1. Use of form vibration shall be approved only when concrete sections are too thin or too inaccessible for use of internal vibration.
 2. Carry on vibration continuously with placing of concrete. Do not insert vibrator into concrete that has begun to set.

3.8 HOT WEATHER

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

3.9 COLD WEATHER

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

3.10 PROTECTION AND CURING

- A. Conform to ACI 308: Initial curing shall immediately follow the finishing operation. Protect exposed surfaces of concrete from premature drying, wash by rain and running water, wind, mechanical injury, and excessively hot or cold temperatures. Keep concrete not covered with membrane or other curing material continuously wet for at least 7 days

after placing, except wet curing period for high-early-strength concrete shall be not less than 3 days. Keep wood forms continuously wet to prevent moisture loss until forms are removed. Cure exposed concrete surfaces as described below. Other curing methods may be used if approved by Resident Engineer.

1. Liquid curing and sealing compounds: Apply by power-driven spray or roller in accordance with the manufacturer's instructions. Apply immediately after finishing. Maximum coverage 400 square feet per gallon on steel troweled surfaces and 300 square feet per gallon on floated or broomed surfaces for the curing/sealing compound.
2. Plastic sheets: Apply as soon as concrete has hardened sufficiently to prevent surface damage. Utilize widest practical width sheet and overlap adjacent sheets 2 inches. Tightly seal joints with tape.
3. Paper: Utilize widest practical width paper and overlap adjacent sheets 2 inches. Tightly seal joints with sand, wood planks, pressure-sensitive tape, mastic or glue.

3.11 REMOVAL OF FORMS

- A. Remove in a manner to assure complete safety of structure after the following conditions have been met.
 1. Where structure as a whole is supported on shores, forms for beams and girder sides, columns, and similar vertical structural members may be removed after 24 hours, provided concrete has hardened sufficiently to prevent surface damage and curing is continued without any lapse in time as specified for exposed surfaces.
 2. Take particular care in removing forms of architectural exposed concrete to insure surfaces are not marred or gouged, and that corners and arises are true, sharp and unbroken.
- B. Reshoring: Reshoring is required if superimposed load plus dead load of the floor exceeds the capacity of the floor at the time of loading. Reshoring accomplished in accordance with ACI 347 at no additional cost to the Government.

3.12 CONCRETE SURFACE PREPARATION

- A. Metal Removal: Unnecessary metal items cut back flush with face of concrete members.
- B. Patching: Maintain curing and start patching as soon as forms are removed. Do not apply curing compounds to concrete surfaces requiring patching until patching is completed. Use cement mortar for patching of same composition as that used in concrete. Use white or gray Portland cement as necessary to obtain finish color

matching surrounding concrete. Thoroughly clean areas to be patched. Cut out honeycombed or otherwise defective areas to solid concrete to a depth of not less than 1 inch. Cut edge perpendicular to surface of concrete. Saturate with water area to be patched, and at least 6 inches surrounding before placing patching mortar. Give area to be patched a brush coat of cement grout followed immediately by patching mortar. Cement grout composed of one part Portland cement, 1.5 parts fine sand, bonding admixture, and water at a 50:50 ratio, mix to achieve consistency of thick paint. Mix patching mortar approximately 1 hour before placing and remix occasionally during this period without addition of water. Compact mortar into place and screed slightly higher than surrounding surface. After initial shrinkage has occurred, finish to match color and texture of adjoining surfaces. Cure patches as specified for other concrete. Fill form tie holes which extend entirely through walls from unexposed face by means of a pressure gun or other suitable device to force mortar through wall. Wipe excess mortar off exposed face with a cloth.

- C. Upon removal of forms, clean vertical concrete surface that is to receive bonded applied cementitious application with wire brushes or by sand blasting to remove unset material, laitance, and loose particles to expose aggregates to provide a clean, firm, granular surface for bond of applied finish.
- D. For exposed surfaces of concrete for the columbarium and memorial walls and walls in their complexes, follow the procedures identified in Paragraph 3.12.A.3.
- E. For columbarium and memorial walls and their complexes, immediately after forms are removed, take steps to prepare and smooth the exposed portions of the concrete. Remove the form marks, including joint marks, fins, burrs and similar projections to produce a smooth surface. Complete the surface finish to result in a uniform textured surface with homogeneous color, unless surface is to be otherwise treated. Work must be as approved during the review of the mock-up.

3.13 CONCRETE FINISHES

- A. Vertical and Overhead Surface Finishes:
 - 1. Unfinished areas: Vertical and overhead concrete surfaces exposed in pipe basements, elevator and dumbwaiter shafts, pipe spaces, pipe trenches, above suspended ceilings, manholes, and other unfinished areas will not require additional finishing.
 - 2. Interior and exterior exposed areas to be painted: Remove fins, burrs and similar projections on surfaces flush, and smooth by mechanical means approved by

Resident Engineer, and by rubbing lightly with a fine abrasive stone or hone. Use ample water during rubbing without working up a lather of mortar or changing texture of concrete.

3. Interior and exterior exposed areas finished: Give a grout finish of uniform color and smooth finish treated as follows:
 - a. After concrete has hardened and laitance, fins and burrs removed, scrub concrete with wire brushes. Clean stained concrete surfaces by use of a hone stone.
 - b. Apply grout composed of one part of Portland cement, one part fine sand, smaller than a 600 μm (No. 30) sieve. Work grout into surface of concrete with cork floats or fiber brushes until all pits, and honeycombs are filled.
 - c. After grout has hardened slightly, but while still plastic, scrape grout off with a sponge rubber float and, about 1 hour later, rub concrete vigorously with burlap to remove any excess grout remaining on surfaces.
 - d. In hot, dry weather use a fog spray to keep grout wet during setting period. Complete finish of area in same day. Make limits of finished areas at natural breaks in wall surface. Leave no grout on concrete surface overnight.
4. Textured: Finish as specified. Maximum quantity of patched area 2 square feet in each 1000 square feet of textured surface.

B. Slab Finishes:

1. Monitoring and Adjustment: Provide continuous cycle of placement, measurement, evaluation and adjustment of procedures to produce slabs within specified tolerances. Provide information to Resident Engineer and floor consultant for evaluation and recommendations for subsequent placements.
2. Set perimeter forms to serve as screed using either optical or laser instruments. For slabs on grade, wet screeds may be used to establish initial grade during strike-off, unless Resident Engineer determines that the method is proving insufficient to meet required finish tolerances and directs use of rigid screed guides. Where wet screeds are allowed, they shall be placed using grade stakes set by optical or laser instruments. Use rigid screed guides, as opposed to wet screeds, to control strike-off elevation for all types of elevated (non slab-on-grade) slabs. Divide bays into halves or thirds by hard screeds. Adjust as necessary where monitoring of previous placements indicates unshored structural steel deflections to other than a level profile.

3. Place slabs monolithically. Once slab placement commences, complete finishing operations within same day. Slope finished slab to floor drains where they occur, whether shown or not.
4. Use straightedges specifically made for screeding, such as hollow magnesium straightedges or power strike-offs. Do not use pieces of dimensioned lumber. Strike off and screed slab to a true surface at required elevations. Use optical or laser instruments to check concrete finished surface grade after strike-off. Repeat strike-off as necessary. Complete screeding before any excess moisture or bleeding water is present on surface. Do not sprinkle dry cement on the surface.
5. Immediately following screeding, and before any bleed water appears, use a 10 foot wide highway straightedge in a cutting and filling operation to achieve surface flatness. Do not use bull floats or darbys, except that darbying may be allowed for narrow slabs and restricted spaces.
6. Wait until water sheen disappears and surface stiffens before proceeding further. Do not perform subsequent operations until concrete will sustain foot pressure with maximum of 1/4 inch indentation.
7. Scratch Finish: Finish base slab to receive a bonded applied cementitious application as indicated above, except that bull floats and darbys may be used. Thoroughly coarse wire broom within two hours after placing to roughen slab surface to insure a permanent bond between base slab and applied materials.
8. Float Finish: Slabs to receive unbonded toppings, steel trowel finish, fill, mortar setting beds, or a built-up roof, and ramps, stair treads, platforms (interior and exterior), and equipment pads shall be floated to a smooth, dense uniform, sandy textured finish. During floating, while surface is still soft, check surface for flatness using a 10 foot highway straightedge. Correct high spots by cutting down and correct low spots by filling in with material of same composition as floor finish. Remove any surface projections and re-float to a uniform texture.
9. Steel Trowel Finish: Concrete surfaces to receive resilient floor covering or carpet, monolithic floor slabs to be exposed to view in finished work, future floor roof slabs, applied toppings, and other interior surfaces for which no other finish is indicated. Steel trowel immediately following floating. During final troweling, tilt steel trowel at a slight angle and exert heavy pressure to compact cement paste and form a dense, smooth surface. Finished surface shall be smooth, free of trowel marks, and uniform in texture and appearance.

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

Slab on Grade:

Specified overall value	$F_F 25/F_L 20$
Minimum local value	$F_F 17/F_L 15$
Specified overall value	FF 25
Minimum local value	FF 17

Level tolerance such that 80 percent of all points fall within a 3/4 inch envelope +3/8 inch, -3/8 inch from the design elevation.
 - b. Areas that will be exposed, receive thin-set tile or resilient flooring, or roof areas designed as future floors:

Slab on grade:

Specified overall value	FF 36/FL 20
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Level tolerance such that 80 percent of all points fall within a 3/4 inch envelope +3/8 inch, -3/8 inch from the design elevation.
 - c. "Specified overall value" is based on the composite of all measured values in a placement derived in accordance with ASTM E1155.
 - d. "Minimum local value" (MLV) describes the flatness or levelness below which repair or replacement is required. MLV is based on the results of an individual placement and applies to a minimum local area. Minimum local area boundaries may not cross a construction joint or expansion joint. A minimum local area will be bounded by construction and/or control joints, or by column lines and/or half-column lines, whichever is smaller.
12. Measurements
 - a. Department of Veterans Affairs retained testing laboratory will take measurements as directed by Resident Engineer, to verify compliance with F_F , F_L , and other finish requirements. Measurements will occur within 72 hours after completion of concrete placement (weekends and holidays excluded). Make measurements before shores or forms are removed to insure the "as-built"

levelness is accurately assessed. Profile data for above characteristics may be collected using a laser level or any Type II apparatus (ASTM E1155, "profileograph" or "dipstick"). Contractor's surveyor shall establish reference elevations to be used by Department of Veterans Affairs retained testing laboratory.

- b. Contractor not experienced in using F_F and F_L criteria is encouraged to retain the services of a floor consultant to assist with recommendations concerning adjustments to slab thicknesses, finishing techniques, and procedures on measurements of the finish as it progresses in order to achieve the specific flatness and levelness numbers.

13. Acceptance/ Rejection:

- a. If individual slab section measures less than either of specified minimum local F_F/F_L numbers, that section shall be rejected and remedial measures shall be required. Sectional boundaries may be set at construction and contraction (control) joints, and not smaller than one-half bay.
- b. If composite value of entire slab installation, combination of all local results, measures less than either of specified overall F_F/F_L numbers, then whole slab shall be rejected and remedial measures shall be required.

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

3.14 SURFACE TREATMENTS

- A. Mix and apply surface treatments in accordance with manufacturer's printed instructions.
- B. Liquid Densifier/Sealer: Use on all exposed concrete floors and concrete floors to receive carpeting, except those specified to receive non-slip finish.
- C. Non-Slip Finish: Except where safety nosing and tread coverings are shown, apply non-slip abrasive aggregate to treads and platforms of all concrete steps and stairs, and to surfaces of exterior concrete ramps and platforms. Broadcast aggregate uniformly over concrete surface. Trowel concrete surface to smooth dense finish. After curing, rub the treated surface with abrasive brick and water sufficiently to slightly expose abrasive aggregate.

3.15 APPLIED TOPPING

- A. Separate concrete topping on floor base slab of thickness and strength shown. Topping mix shall have a maximum slump of 8 inches for concrete containing a high-range water-reducing admixture (superplasticizer) and 4 inches for conventional mix. Neatly bevel or slope at door openings and at slabs adjoining spaces not receiving an applied finish.
- B. Placing: Place continuously until entire section is complete, struck off with straightedge, leveled with a highway straightedge or highway bull float, floated and troweled by machine to a hard dense finish. Slope to floor drains as required. Do not start floating until free water has disappeared and no water sheen is visible. Allow drying of surface moisture naturally. Do not hasten by "dusting" with cement or sand.

3.16 PRECAST CONCRETE ITEMS

- A. Cast precast concrete items, not specified elsewhere, using 4000 psi air-entrained concrete to shapes and dimensions shown. Finish surfaces to match corresponding adjacent concrete surfaces. Reinforce with steel as necessary for safe handling and erection.

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SECTION 05 12 00 STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 DESCRIPTION

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

1.2 RELATED WORK

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

1.3 QUALITY ASSURANCE

- A. Fabricator and erector must maintain a program of quality assurance in conformance with Section 8, Code of Standard Practice for Steel Buildings and Bridges. Fabricate work in an AISC certified Category Conventional Steel Structures fabrication plant.
- B. The controlling contractor must ensure that the steel erector is provided written notification required by 29 CFR 1926.752, before authorizing the commencement of steel erection; provide copy of this notification to the COTR.
- C. Pre-Installation Conference: Convene a meeting on site, after submittals are received and approved but before any work, to review drawings and specifications, submittals, schedule, manufacturer instructions, site logistics and pertinent matters of coordination, temporary protection, governing regulations, tests and inspections; participants to include COTR and all parties whose work is effected or related to the work of this section.

1.4 TOLERANCES

- A. Hold fabrication tolerances for structural steel within limits established by ASTM A6, by Section 7, Code of Standard Practice for Buildings and Bridges, and by Standard Mill Practice - General Information (AISC ASD Manual, Ninth Edition, Page 1-145), except as follows:
 - 1. Elevation tolerance for column splice points at time member is erected is 10 mm (3/8 inch).

2. Elevation tolerance for top surface of steel beams and girders at connections to columns at time floor is erected is 13 mm (1/2 inch).
3. Elevation tolerance for closure plates at the building perimeter and at slab openings prior to concrete placement is 6 mm (1/4 inch).

1.5 REGULATORY REQUIREMENTS

- A. AISC: Specification for Structural Steel Buildings - Load and Resistance Factor Design (LRFD) or Allowable Strength Design (ASD).
- B. AISC: Code of Standard Practice for Steel Buildings and Bridges.

1.6 SUSTAINABILITY REQUIREMENTS

- A. Materials in this section may contribute towards contract compliance with sustainability requirements. See Section 01 81 11, SUSTAINABLE DESIGN REQUIREMENTS, for project local/regional materials, recycled content, requirements.

1.7 SUBMITTALS

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

1.8 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by the basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
- B. American Institute of Steel Construction (AISC):
AISC 303-10 Steel Buildings and Bridges

AISC 360-10 Structural Steel Buildings

C. American National Standards Institute (ANSI):

B18.22.1-03 Plain Washers

B18.22M-05 Metric Plain Washers

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

A6/A6M-13 General Requirements for Rolled Structural Steel Bars,
Plates, Shapes, and Sheet Piling

A36/A36M-12 Carbon Structural Steel

A53/A53M-12 Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded
and Seamless

A123/A123M-12 Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel
Products

A242/A242M-04(2009) High-Strength Low-Alloy Structural Steel

A283/A283M-12a Low and Intermediate Tensile Strength Carbon Steel
Plates

A307-12 Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength

A325-10 Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum
Tensile Strength

A490/A490M-12 Heat-Treated Steel Structural Bolts 150 ksi Minimum
Tensile Strength

A500/A500M-10a Cold Formed Welded and Seamless Carbon Steel
Structural Tubing in Rounds and Shapes

A501-07 Hot-Formed Welded and Seamless Carbon Steel
Structural Tubing

A572/A572M-12a High-Strength Low-Alloy Columbium-Vanadium Structural
Steel

A992/A992M-11 Structural Steel Shapes

E. American Welding Society (AWS):

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

F. Research Council on Structural Connections (RCSC) of The Engineering Foundation:
Specification for Structural Joints Using ASTM A325 or A490 Bolts (2000)

G. Military Specifications (Mil. Spec.):

MIL-P-21035 Paint, High Zinc Dust Content, Galvanizing, Repair (2003)

H. Occupational Safety and Health Administration (OSHA):

29 CFR Part 1926

Safety Standards for Construction

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Structural Steel: ASTM Grade 50.
- B. Structural Tubing: ASTM A500, Grade B.
- C. Structural Tubing: ASTM A501.
- D. Steel Pipe: ASTM A53, Grade B.
- E. Bolts, Nuts and Washers:
 - 1. High-strength bolts, including nuts and washers: ASTM A325.
 - 2. Bolts and nuts, other than high-strength: ASTM A307, Grade A.
 - 3. Plain washers, other than those in contact with high-strength bolt heads and nuts:
ANSI Standard B18.22.1.
- F. Zinc Coating: ASTM A123.
- G. Galvanizing Repair Paint: Mil. Spec. MIL-P-21035.

PART 3 - EXECUTION

3.1 CONNECTIONS (SHOP AND FIELD)

- A. Welding: Welding in accordance with AWS D1.1. Make welds only by welders and welding operators who have been previously qualified by tests as prescribed in AWS D1.1 to perform type of work required.
- B. High-Strength Bolts: High-strength bolts tightened to a bolt tension not less than proof load given in Specification for Structural Joints Using ASTM A325 or A490 Bolts. Perform tightening with properly calibrated wrenches, by turn-of-nut method or by use of direct tension indicators (bolts or washers). Tighten bolts in connections identified as slip-critical using Direct Tension Indicators or the turn-of-the-nut method. Twist-off torque bolts are not an acceptable alternate fastener for slip critical connections.

3.2 FABRICATION

- A. Execute fabrication in accordance with Chapter M, Specification for Steel Buildings - Load and Resistance Factor Design (LRFD) or Allowable Strength Design (ASD).

3.3 SHOP PAINTING

- A. General: Shop paint steel with primer in accordance with Section 6, Code of Standard Practice for Steel Buildings and Bridges.
- B. Shop paint for steel surfaces is specified in Section 09 91 00, PAINTING.

- C. Do not apply paint to following:
 - 1. Surfaces within 2 inches of joints to be welded in field.
 - 2. Surfaces which will be encased in concrete.
 - 3. Surfaces which will receive sprayed on fireproofing.
 - 4. Top flange of members which will have shear connector studs applied.
- D. Structural steel in the interstitial space that does not receive sprayed on fireproofing shall be painted with primer in accordance with general requirement of shop painting.
- E. Zinc Coated Finish (Hot Dip Galvanized): Provide per ASTM A123 (after fabrication).
- F. Touch-up (after erection): Clean and wire brush any abraded and other spots worn through zinc coating, including threaded portions of bolts and welds and touch-up with galvanizing repair paint.

3.4 ERECTION

- A. General: Erect structural steel framing in accordance with Section 7, Code of Standard Practice for Steel Buildings and Bridges.
- B. Temporary Supports: Provide temporary support of structural steel frames during erection in accordance with Section 7, Code of Standard Practice for Steel Buildings and Bridges.

3.5 FIELD PAINTING

- A. After erection, touch-up steel surfaces specified to be shop painted. After welding is completed, clean and prime areas not painted due to field welding.
- B. Finish painting of steel surfaces is specified in Section 09 91 00, PAINTING.

3.6 SURVEY

- A. Upon completion of finish bolting or welding on any part of the work, and prior to start of work by other trades that may be supported, attached, or applied to the structural steel work, submit a certified report of survey to COTR for approval. Prepare reports by Registered Land Surveyor or Registered Civil Engineer as specified in Section 01 00 00, GENERAL REQUIREMENTS; specify that location of structural steel is acceptable for plumbness, level and alignment within specified tolerances specified in the AISC Manual.

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SECTION 05 31 00 STEEL DECKING

PART 1 - GENERAL

1.1 DESCRIPTION

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

1.2 RELATED WORK

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

1.3 DESIGN REQUIREMENTS

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

1.4 SUBMITTALS

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

1.5 QUALITY ASSURANCE

- A. 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. Pre-Installation Conference: Convene a meeting on site, after submittals are received and approved but before any work, to review drawings and specifications, submittals, schedule, manufacturer instructions, site logistics and pertinent matters of coordination, temporary protection, governing regulations, tests and inspections; participants to include COTR and all parties whose work is effected or related to the work of this section.

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. American Society for Testing and Materials (ASTM):
 - A36/A36M-12 Carbon Structural Steel
 - A653/A653M-11 Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanized) by the Hot-Dip Process
 - A1008/A1008M-12a Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
- C. American Institute of Steel Construction (AISC):
 - AISC 360-10 Specification for Structural Steel Buildings – Load and Resistance Factor Design (LRFD) or Allowable Strength Design (ASD)
- D. American Iron and Steel Institute (AISI):
 - AISI S100-07 North American Specification for the Design of Cold-Formed Steel Structural Members, Specification and Commentary for the Design of Cold-Formed Steel Structural Members
- E. American Welding Society (AWS):
 - D1.3D1.3M-08 Structural Welding Code - Sheet Steel

F. Factory Mutual (FM Global):

1. Loss Prevention Data Sheet 1-28: Design Wind Loads (2012)
2. Factory Mutual Research Approval Guide (2005)

F. Military Specifications (Mil. Spec.):

MIL-P-21035B Paint, High Zinc Dust Content, Galvanizing Repair (2003)

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Steel Decking: ASTM A653, Structural Quality.
- B. Galvanizing: ASTM A653, G60.
- C. Galvanizing Repair Paint: Mil. Spec. MIL-P-21035B.
- D. 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 must be compatible with specified finish painting.
- E. Miscellaneous Steel Shapes: ASTM A36.
- F. Welding Electrode: E60XX minimum.
- G. Sheet Metal Accessories: ASTM A653, galvanized, unless noted otherwise. Provide accessories of every kind required to complete the installation of metal decking in the system shown. Finish sheet metal items to match deck including, but not limited to, the following items:
 1. Metal Cover Plates: Provide for end-abutting deck units, to close gaps at changes in deck direction, columns, walls and openings; same quality as deck units but not less than 18 gauge sheet steel.
 2. Continuous Sheet Metal Edging: Provide at openings, concrete slab edges and roof deck edges; same quality as deck units but not less than 18 gauge steel.
Manufacture to design side and end closures supporting concrete and their attachment to supporting steel, to safely support the wet weight of concrete and construction loads. Limit deflection of cantilever closures to 1/8 inch maximum.
 3. Metal Closure Strips: Provide for openings between decking and other construction, of not less than 18 gauge sheet steel of the same quality as the deck units. Form to the configuration required to provide tight-fitting closures at open ends of flutes and sides of decking.
 4. Ridge and Valley Plates: Provide 18 gauge, 4 inch wide ridge and valley plates where roof slope exceeds 1/2 inch per foot.

5. Cant Strips: Provide bent metal 45 degree leg cant strips where indicated on the Drawings. Fabricate cant strips from 20 gauge metal with a minimum 5 inch face width.
6. Seat Angles for Deck: Provide where a beam does not frame into a column.
7. Sump Pans for Roof Drains: Fabricate from single piece of minimum 14 gauge galvanized sheet steel with level bottoms and sloping sides to direct water flow to drain, unless otherwise shown. Provide sump pans of adequate size to receive roof drains and with bearing flanges not less than 3 inches wide. Recess pans not less than 1 1/2 inches below roof deck surface, unless otherwise shown or required by deck configuration. Holes for drains will be cut in the field.

2.2 REQUIREMENTS

- A. Provide steel decking of the type, depth, gauge, and section properties as shown.
- B. Metal Form Deck – Type 2: Corrugated deck units used as a permanent form for reinforced concrete slabs. Comply with the depth and minimum gauge requirements as shown on the Contract Documents.
 1. Finish: Galvanized.
- C. Metal Roof Deck: Single pan fluted units with flat horizontal top surfaces utilized to act as a permanent support for all superimposed loads. Comply with the depth and minimum gauge requirements as shown on the Contract Documents.
 1. Wide Rib (Type B) deck
 2. Finish: Galvanized G-60.
- D. Do not use steel deck for hanging supports for any type or kind of building components including suspended ceilings, electrical light fixtures, plumbing, heating, or air conditioning pipes or ducts or electrical conduits.
- E. Steel decking units used for interstitial levels shall include an integral system.
 1. System to provide a simple point of attachment for light duty hanger devices.
 2. System to allow for flexibility for attaching hangers for support of suspended ceilings, electrical, plumbing, heating, or air conditioning items, weight not to exceed 10 psf.
 3. System shall provide for a minimum spacing pattern of 12 inches on centers longitudinally and 24 inches on centers transversely.
 4. Maximum load suspended from any hanger is 50 pounds.
 5. System consisting of fold-down type hanger tabs or lip hanger is acceptable.

PART 3 - EXECUTION

3.1 ERECTION

- A. Do not start installation of metal decking until corresponding steel framework has been plumbed, aligned and completed and until temporary shoring, where required, has been installed. Remove any oil, dirt, paint, ice, water and rust from steel surfaces to which metal decking will be welded.
- B. Coordinate and cooperate with structural steel erector in locating decking bundles to prevent overloading of structural members.
- C. Do not use floor deck units for storage or working platforms until permanently secured. Do not overload deck units once placed. Replace any deck units that become damaged after erection and prior to casting concrete at no cost to the Government.
- D. Provide steel decking in sufficient lengths to extend over 3 or more spans, except for interstitial levels.
- E. Place steel decking units at right angles to supporting members. End lap sheets of roof deck a minimum of 2 inches and over supports.
- F. Fastening Deck Units:
 - 1. Fasten floor deck units to steel supporting members by not less than 5/8 inch diameter puddle welds or elongated welds of equal strength, spaced not more than 12 inches o.c. with a minimum of two welds per unit at each support. Where two units abut, fasten each unit individually to the supporting steel framework.
 - 2. Tack weld or use self-tapping No. 8 or larger machine screws at 3 feet o.c. for fastening end closures. Only use welds to attach longitudinal end closures.
 - 3. Weld side laps of adjacent floor deck units that span more than 5 feet. Fasten at midspan or 3 feet o.c., whichever is smaller.
 - 4. Fasten roof deck units to steel supporting members by not less than 5/8 inch diameter puddle welds or elongated welds of equal strength, spaced not more than 12 inches o.c. at every support, and at closer spacing where required for lateral force resistance by diaphragm action. Attach split or partial panels to the structure in every valley. In addition, secure deck to each supporting member in ribs where side laps occur. Power driven fasteners may be used in lieu of welding for roof deck if strength equivalent to the welding specified above is provided. Submit test data and design calculations verifying equivalent design strength.

5. Mechanically fasten side laps of adjacent roof deck units with spans greater than 5 feet between supports, at intervals not exceeding 3 feet o.c., or midspan, whichever is closer, using self-tapping No. 8 or larger machine screws.
6. Provide any additional fastening necessary to comply with the requirements of Underwriters Laboratories and/or Factory Mutual to achieve the required ratings.
7. Uplift Loading: Install and anchor roof deck units to resist gross uplift loading of 45 psf at eave overhang and 30 psf for other roof areas.
8. Weld end laps of corrugated form deck units in valley of side lap and at middle of sheet (maximum spacing of welds is 15 inches).
9. Weld corrugated deck to intermediate supports in an X pattern. Weld in valley of side laps on every other support and in the valley of the center corrugation on the remaining supports (maximum spacing of welds is 30 inches).

G. Cutting and Fitting:

1. Cut all metal deck units to proper length in the shop prior to shipping.
2. Field cutting by the metal deck erector is restricted to bevel cuts, notching to fit around columns and similar items, and cutting openings that are located and dimensioned on the Structural Drawings.
3. Other penetrations shown on the approved metal deck shop drawings but not shown on the Structural Drawings are to be located, cut and reinforced by the trade requiring the opening.
4. Make all cuts neat and trim using a metal saw, drill or punchout device; cutting with torches is expressly prohibited.
5. Do not make any cuts in the metal deck that are not shown on the approved metal deck drawings. If an additional opening not shown on the approved shop drawings is required, submit a sketch, to scale, locating the required new opening and any other openings and supports in the immediate area. Do not cut the opening until the sketch has been reviewed and accepted by the RE/COTR. Provide any additional reinforcing or framing required for the opening at no cost to the NCA. Failure to comply with these requirements is cause for rejection of the work and removal and replacement of the affected metal deck.
6. Reinforcement at Openings: Provide additional metal reinforcement and closure pieces as required for strength, continuity of decking, and support of other work shown.

3.2 WELDING

- A. Make welds only by welders and welding operators who have been previously qualified by tests as prescribed in AWS D1.3.

3.3 FIELD REPAIR

- A. Areas scarred during erection.
- B. Welds to be thoroughly cleaned and touched-up. Touch-up paint for zinc-coated units must be zinc rich galvanizing repair paint.

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SECTION 05 36 00 COMPOSITE METAL DECKING

PART 1 – GENERAL

1.1 DESCRIPTION

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

1.2 RELATED WORK

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

1.3 DESIGN REQUIREMENTS

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

1.4 SUSTAINABILITY REQUIREMENTS

- A. Materials in this section may contribute towards contract compliance with sustainability requirements. See Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT, for project local/regional materials, recycled content, requirements.

1.5 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: Prepare shop and erection drawings showing decking unit layout, connections to supporting members, and information necessary to complete the installation as shown and specified, including supplementary framing, cant strips, cut openings, special jointing or other accessories. Show welding, side lap, closure, deck reinforcing and closure reinforcing details. Show openings required for work of other trades, including openings not shown on structural drawings. Indicate where temporary shoring is required to satisfy design criteria.
- C. Manufacturer's Literature and Data: Indicate steel decking section properties and specifying structural characteristics as specified herein.
- D. Manufacturer's written recommendations for:

1. Shape of decking section to be used.
 2. Cleaning of steel decking prior to concrete placement.
- E. Test Report: Verify structural characteristics of composite concrete and steel decking system.
- F. Test Report: Verify stud base qualification.
- G. Submit welding power setting recommendation by shear stud manufacturer.
- H. Shear Stud Layouts: Submit drawings showing the number, pattern, spacing and configuration of the shear studs for each beam and girder.

1.6 QUALITY ASSURANCE

- A. Pre-Installation Conference: Convene a meeting on site, after submittals are received and approved but before any work, to review drawings and specifications, submittals, schedule, manufacturer instructions, site logistics and pertinent matters of coordination, temporary protection, governing regulations, tests and inspections; participants to include COTR and all parties whose work is effected or related to the work of this section.

1.7 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. American Iron and Steel Institute (AISI):
Specification and Commentary for the Design of Cold-Formed Steel Structural Members (Latest Edition)
- C. American Society of Testing and Materials (ASTM):
- | | |
|---------------|---|
| A36/A36M-12 | Carbon Structural Steel |
| A108-07 | Steel Bars, Carbon, Cold Finished, Standard Quality |
| A653/A653M-11 | Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanized) by the Hot-Dip Process |
| A780/A780M-09 | Repair of Damaged and Uncoated Areas of Hot Dip Galvanized Coatings |
- D. American Institute of Steel Construction (AISC):

Specification for Structural Steel Buildings – Allowable Stress Design and Plastic Design
(Latest Edition)

Load and Resistance Factor Design Specification for Structural Steel Buildings (Latest
Edition)

E. American Welding Society (AWS):

D1.1 Structural Welding Code - Steel

D1.3 Structural Welding Code - Sheet Steel

F. Military Specifications (Mil. Spec.):

MIL-P-21035B Paint, High Zinc Dust Content, Galvanizing Repair

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel Decking and all Flashings: ASTM A653.

B. Galvanizing: ASTM A653, G60, Grade 33.

C. Shear connector studs: ASTM A108, Grades 1015-1020.

1. Yield: Minimum 350 Mpa (50,000 psi).

2. Tensile strength: Minimum 400 Mpa (60,000 psi)

3. Reduction of area: 50 percent minimum

4. Studs of uniform diameter; heads concentric and normal to shaft; stud after welding
free from any substance or defect which would interfere with its function as a shear
connector.

5. Do not paint or galvanize studs.

6. Provide stud size(s) as shown on drawings.

7. Studs must be manufactured by a company normally engaged in the manufacture of
shear studs and installation equipment.

D. Galvanizing Repair Paint: Mil. Spec. MIL-P-21035B.

E. Miscellaneous Steel Shapes: ASTM A36.

F. Welding Electrode: E60XX minimum.

G. Sheet Metal Accessories: ASTM A653, galvanized, unless noted otherwise. Provide
accessories of every kind required to complete the installation of metal decking in the
system shown. Finish sheet metal items to match deck including, but not limited to, the
following items:

1. Metal Cover Plates: Provide for end-abutting deck units, to close gaps at changes in deck direction, columns, walls and openings; same quality as deck units but not less than 1.3 mm (18 gauge) sheet steel.
2. Continuous Sheet Metal Edging: Provide at openings; same quality as deck units but not less than 1.3 mm (18 gauge) steel.
3. Metal Closure Strips: Provide for openings between decking and other construction, of not less than 1.3 mm (18 gauge) sheet steel of the same quality as the deck units. Form to the configuration required to provide tight-fitting closures at open ends of flutes and sides of decking.
4. Seat Angles for Deck: Provide where a beam does not frame into a column.

2.2 REQUIREMENTS

- A. Steel decking depth, gage, and section properties to be as shown. Provide edges of deck with vertical interlocking male and female lip providing for a positive mechanical connection.
- B. Steel decking units to include an integral system which provides a simple point of attachment for light duty hanger devices for flexibility for attaching hangers for support of acoustical, lathing, plumbing, heating, air conditioning and electrical items.

PART 3 - EXECUTION

3.1 ERECTION

- A. Do not start installation of metal decking until corresponding steel framework has been plumbed, aligned and completed and until temporary shoring, where required, has been installed. Remove any oil, dirt, paint, ice, water and rust from steel surfaces to which metal decking will be welded.
- B. Coordinate and cooperate with structural steel erector in locating decking bundles to prevent overloading of structural members.
- C. Erect steel deck in accordance with manufacturer's printed instructions.
- D. Ship steel deck units to project in standard widths and cut to proper length.
- E. Provide steel decking in sufficient lengths to extend over 3 or more spans, except where structural steel layout does not permit.
- F. Place steel decking units on supporting steel framework and adjust to final position before being permanently fastening. Bring each unit to proper bearing on supporting beams. Place deck units in straight alignment for entire length of run of flutes and with close registration of flutes of one unit with those of abutting unit. Maximum space

between ends of abutting units is 13 mm (1/2 inch). If space exceeds 13 mm (1/2 inch), install closure plates at no additional cost to NCA.

G. Ceiling hanger loops, if used, must be flattened or removed to obtain bearing of units on structural steel.

H. Fastening Deck Units:

1. Fasten floor deck units to steel supporting members by not less than 16 mm (5/8 inch) diameter puddle welds.
2. Tack weld or use self-tapping No. 8 or larger machine screws located as indicated for fastening end closures. Only use welds to attach longitudinal end closures.
3. Weld side laps and perimeter edge as indicated.

I. Welding to conform to AWS D1.3 and done by competent experienced welding mechanics.

J. Areas Scarred during Erection – Galvanizing Repairs: Comply with ASTM A780.

K. Cutting and Fitting:

1. Cut all metal deck units to proper length in the shop prior to shipping.
2. Field cutting by the metal deck erector is restricted to bevel cuts, notching to fit around columns and similar items, and cutting openings that are located and dimensioned on the structural drawings.
3. Other penetrations shown on the approved metal deck shop drawings but not shown on the structural drawings are to be located, cut and reinforced by the trade requiring the opening.
4. Make all cuts neat and trim using a metal saw, drill or punchout device; cutting with torches is expressly prohibited.
5. Do not make any cuts in the metal deck that are not shown on the approved metal deck drawings. If an additional opening not shown on the approved shop drawings is required, submit a sketch, to scale, locating the required new opening and any other openings and supports in the immediate area. Do not cut the opening until the sketch has been reviewed and accepted by the COTR. Provide any additional reinforcing or framing required for the opening at no cost to the NCA. Failure to comply with these requirements is cause for rejection of the work and removal and replacement of the affected metal deck.
6. Reinforcement at Openings: Provide additional metal reinforcement and closure pieces as required for strength, continuity of decking and support of other work shown.

- L. Installation of shear connector studs through previously installed metal deck to conform to AWS D1.1, Section 7, except all studs will be installed with automatically timed welding equipment and as specified below:
1. Do not place reinforcing steel temperature mesh or other materials and equipment which will interfere with stud installation on steel deck until shear connector studs are installed.
 2. Steel deck sheets must be free of oil, rust, dirt, and paint. Release water in deck's valley so that it does not become entrapped between deck and beam. Surface to which stud is to be welded must be clean and dry.
 3. Rest metal deck tightly upon top flange of structural member with bottom of deck rib in full contact with top of beam flange.
 4. Weld studs only through a single thickness of deck. Place decking so that a butt joint is obtained. Place studs directly over beam web, where one row of studs are required.
 5. Ferrules specially developed for the weld-through technique must be used; provide ferrules appropriate for size of studs used; remove ferrules after welding.
 6. Submit report of successful test program for stud base qualification as required by AWS D1.1, Appendix K.

3.2 CLEANING

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

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SECTION 05 40 00 COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies materials and delegated design services required for installation of cold-formed steel, including tracks and required accessories as shown and specified.

This Section includes the following:

1. Pre-fabricated metal roof trusses.
2. Interior load-bearing steel stud walls.
3. Exterior envelope non-load-bearing steel stud wall framing.
4. Steel joists.

1.2 RELATED WORK

- A. Structural steel framing: Section 05 12 00, STRUCTURAL STEEL FRAMING.
- B. Non-load-bearing metal stud framing assemblies: Section 09 22 16, NON-STRUCTURAL METAL FRAMING.
- C. Gypsum board assemblies: Section 09 29 00, GYPSUM BOARD.

1.3 DESIGN REQUIREMENTS

- A. Design steel in accordance with American Iron and Steel Institute Publication "Specification for the Design of Cold-Formed Steel Structural Members", except as otherwise shown or specified.
- B. Structural Performance: Engineer, fabricate and erect cold-formed metal framing with the minimum physical and structural properties indicated.
- C. Structural Performance: Engineer, fabricate and erect cold-formed metal framing to withstand design loads within limits and under conditions required.
1. Design Loads: As indicated.
 2. Design framing systems to withstand design loads without deflections greater than the following:
 - a. Prefabricated Metal Roof Trusses: Vertical deflection of 1/360 of the span.
 - b. Interior Load-Bearing Walls: Lateral deflection 1/360 of the wall height.
 - c. Exterior Envelope Non-Load-Bearing Wall Framing: Lateral deflection of 1/600 of the wall height.
 - d. Steel Joists: Vertical deflection of 1/360 of the span.

3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change (range) of 67 degrees C (120 degrees F).
 4. Design framing system to accommodate deflection of primary building structure and construction tolerances, and to maintain clearances at openings.
 5. Design exterior envelope non-load-bearing wall framing to accommodate lateral deflection without regard to contribution of sheathing materials.
 6. Seismic Loads: Design and size components to withstand seismic loads and sway displacement as in accordance with code.
 7. Engineering Responsibility: Engage a qualified professional engineer who assumes undivided responsibility for engineering cold-formed metal framing, prepares design calculations, shop drawings, and other structural data.
- D. Welding in accordance with AWS D1.3.
- E. Furnish members and accessories by one manufacturer only.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings:
 1. Shop and erection drawings showing layout, spacing, sizes, thicknesses, and types of cold-formed metal framing; fabrication, fastening and anchorage details, including mechanical fasteners. Include information necessary to complete installation as shown and specified.
 2. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
 3. Include seal of the qualified professional engineer responsible for their preparation.
- C. Manufacturer's Literature and Data: Showing steel component sections and specifying structural characteristics.
- D. Delegated-Design Submittal: For cold-formed metal framing indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- E. Qualification Data: For professional engineer demonstrating license to practice in location of their practice.

1.5 PRE-INSTALLATION CONFERENCE

- A. Convene a meeting on site, after submittals are received and approved but before any work, to review drawings and specifications, submittals, schedule, manufacturer instructions, site logistics and pertinent matters of coordination, temporary protection, governing regulations, tests and inspections; participants to include COTR and all parties whose work is effected or related to the work of this section.

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. American Iron and Steel Institute (AISI):
Design of Cold-Formed Steel Structural Members (2010)
- C. American Society of Testing and Materials (ASTM):
- | | |
|------------------|---|
| A36/A36M-12 | Carbon Structural Steel |
| A123/A123M-12 | Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products |
| A153/A153M-09 | Zinc Coating (Hot-Dip) on Iron and Steel Hardware |
| A307-12 | Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength |
| A653/A653M-11 | Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process |
| A780/A780M-09 | Repair of Damaged and Uncoated Areas of Hot Dipped Galvanized Coatings |
| A1003/A1003M-13a | Steel Sheet, Carbon, Metallic- and Non-metallic coated for Cold Form Metal Framing Members |
| C955-11c | Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases |
| C1107/C1107M-13 | Packaged Dry, Hydraulic-Cement Grout (Non-shrink) |
| C1513-12 | Steel Tapping Screws for Cold-Formed Steel Framing Connections |
| E119-12 | Test Methods for Fire Tests of Building Construction and Materials |

E488/E488M-10	Test Methods for Strength of Anchors in Concrete Elements
E1190-11	Test Methods for Strength of Power-Actuated Fasteners Installed in Structural Members
F1941-10	Electrodeposited Coatings on Threaded Fasteners (Unified Inch Screw Threads (UN/UNR))

D. American Welding Society (AWS):

D1.3/D1.3M:2008 Structural Welding Code-Sheet Steel

E. Military Specifications (Mil. Spec.):

MIL-P-21035B

(Reinst. Notice 2) Paint, High Zinc Dust Content, Galvanizing Repair

F. Society for Protective Coatings (SSPC):

SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic,"
and Type II, "Organic")

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Sheet Steel for joists, studs and other structural elements 16 gage and heavier: ASTM A1003, structural grade, zinc coated Z180 (G60), with a yield of 50 ksi minimum.
- B. Sheet Steel for joists, studs, and accessories 18 gage and lighter: ASTM A653 or ASTM A1003, zinc coated G90, with a yield of 33 ksi minimum.
- C. Galvanizing Repair Paint: MIL-P-21035B or SSPC - Paint 20.

2.2 WALL FRAMING

- A. Framing components must comply with ASTM C955 and the following.
- B. Steel Studs: Manufacturer's standard C-shaped steel studs of web depth indicated, with lipped flanges, and complying with the following:
 - 1. Design Uncoated-Steel Thickness:
16 gage
 - 2. Flange Width:
1-5/8 inches
 - 3. Web: Punched.
- C. Steel Track: Manufacturer's standard U-shaped steel track, unpunched, of web depths indicated, with straight flanges, and complying with the following:
 - 1. Design Uncoated-Steel Thickness: Matching steel studs.

2. Flange Width: Manufacturer's standard deep flange where indicated, standard flange elsewhere.

2.3 JOIST FRAMING:

- A. Steel Joists: Manufacturer's standard C-shaped steel joists, unpunched, of web depths indicated, with lipped flanges, and complying with the following:
 1. Design Uncoated-Steel Thickness: 16 gage (min).
 2. Flange Width: 1 5/8 inches minimum.
- B. Steel Joist Track: Manufacturer's standard U-shaped steel joist track, unpunched, of web depths indicated, with straight flanges, and complying with the following:
 1. Design Uncoated-Steel Thickness: Matching steel joists.
 2. Flange Width: 2 inches.

2.4 FRAMING ACCESSORIES

- A. Fabricate steel framing accessories of the same material and finish used for framing members, with a minimum yield strength of 33 ksi.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
 1. Supplementary framing.
 2. Bracing, bridging, and solid blocking.
 3. Web stiffeners.
 4. Gusset plates.
 5. Deflection track and vertical slide clips.
 6. Stud kickers and girts.
 7. Joist hangers and end closures.
 8. Reinforcement plates.

2.5 CONNECTIONS

- A. Provide screws for steel-to-steel connections as self-drilling or tapping screws in compliance with ASTM C1513 of the type, size and location shown on the shop drawings.
- B. Electroplated screws to have a minimum 5 micron zinc coating in accordance with ASTM F1941.
- C. Screws, bolts, and anchors to be hot-dipped galvanized in accordance with ASTM A123 or ASTM A153 as appropriate.
- D. Screws, bolts, and anchors to be hot dipped galvanized in accordance with ASTM A123 or ASTM A153 as appropriate.

2.6 PLASTIC GROMMETS

- A. Supply plastic grommets, recommended by stud manufacturer, to protect electrical wires.
- B. Prevent metal to metal contact for plumbing pipes.

2.7 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A36, zinc coated by the hot-dip process according to ASTM A123.
- B. Cast-in-Place Anchor Bolts and Studs: ASTM A307, Grade A, zinc coated by the hot-dip process according to ASTM A153.
- C. Expansion Anchors: Provide products fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times the design load, as determined by testing per ASTM E488 conducted by a qualified independent testing agency.
- D. Power-Actuated Anchors: Provide fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times the design load, as determined by testing per ASTM E1190 conducted by a qualified independent testing agency.
- E. Mechanical Fasteners: Corrosion-resistant coated, self-drilling, self-threading steel drill screws; low-profile head beneath sheathing, manufacturer's standard elsewhere.
- F. Welding Electrodes: Comply with AWS Standards.

2.8 REQUIREMENTS:

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

PART 3 - EXECUTION

3.1 FABRICATION

- A. Framing components may be preassembled into panels; fabricate panels square with components attached.
- B. Cut framing components squarely or as required for attachment. Cut framing members by sawing or shearing; do not torch cut.
- C. Hold members in place until fastened.
- D. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator; wire tying of framing members is not permitted.
 - 1. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

2. Locate mechanical fasteners and install according to cold-formed metal framing manufacturer's instructions with screw penetrating joined members by not less than 3 exposed screw threads.
- E. Where required, provide specified insulation in double header members and double jamb studs which will not be accessible after erection.

3.2 INSTALLATION

- A. General:
1. Install cold-formed framing in accordance with ASTM C1107 and AISI S200.
 2. Install cold-formed steel framing according to AISI S202 and to manufacturer's written instructions unless more stringent requirements are indicated.
- B. Handle and lift prefabricated panels in a manner as to not distort any member.
- C. Securely anchor tracks to supports as shown.
- D. At butt joints, securely anchor two pieces of track to same supporting member or butt-weld or splice together.
- E. Plumb, align, and securely attach studs to flanges or webs of both upper and lower tracks.
- F. Align all axially loaded members vertically to allow for full transfer of the loads down to the foundation; maintain vertical alignment at floor/wall intersections.
- G. Provide at least two studs at jambs of doors and other openings 2 feet wide or larger.
- H. Install jack studs above and below openings and as required to furnish support. Securely attach jack studs to supporting members.
- I. Install headers in all openings that are larger than the stud spacing in that wall.
- J. Building Envelope Construction:
1. Provide for vertical movement where studs connect to the structural frame.
 2. Provide horizontal bracing in accordance with the design calculations and AISI SG03-3, consisting of, as a minimum, runner channel cut to fit between and welded to the studs or hot- or cold-rolled steel channels inserted through cutouts in web of each stud and secured to studs with welded clip angles.
3. Minimum Bracing:

LOAD	HEIGHT	BRACING
Wind load only	Up to 10 feet	One row at mid-height
	Over 10 feet	Rows 5'-0" o.c. maximum
Axial load	Up to 10 feet	Two rows at 1/3 points
	Over 10 feet	Rows 3'-4" o.c. maximum

- K. Attach bridging for studs in a manner to prevent stud rotation.
- L. Provide studs in one piece for their entire length; splices will not be permitted.
- M. Provide a load distribution member at top track where joist is not located directly over bearing stud.
- N. Provide joist bridging and web stiffeners at reaction points where shown.
- O. Provide end blocking where joist ends are not restrained from rotation.
- P. Provide an additional joist under parallel partitions, unless otherwise shown, when partition length exceeds one-half joist span and when floor and roof openings interrupt one or more spanning members.
- Q. Provide temporary bracing and leave in place until framing is permanently stabilized.
- R. Do not bridge building expansion joints with cold-formed metal framing. Independently frame both sides of joints.
- S. Fasten reinforcement plate over web penetrations that exceed size of manufacturer's standard punched openings.

3.3 TOLERANCES

- A. Vertical Alignment (plumbness) of Studs: Within 1/960th of the span.
- B. Horizontal Alignment (levelness) of Walls: Within 1/960th of their respective lengths.
- C. Spacing of Studs: Not be more than 1/8 inch +/- from the designed spacing providing that the cumulative error does not exceed the requirements of the finishing materials.
- D. Prefabricated panels shall not be more than 1/8 inch +/- out of square within the length of that panel.

3.4 FIELD QUALITY CONTROL

- A. Testing: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
 - 1. Test and inspect field and shop welds.
 - 2. Perform inspections in order to assure strict conformance to the shop drawings at all phases of construction.
 - 3. Check members for proper alignment, bearing, completeness of attachments, proper alignment, reinforcement, etc.
- B. Testing agency must report test results promptly and in writing.
- C. Remove and replace work where test results indicate that it does not comply with specified requirements.

- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.5 FIELD REPAIR

- A. Touch-up damaged galvanizing with galvanizing repair paint complying with ASTM A780.

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SECTION 05 50 00 METAL FABRICATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies items and assemblies fabricated from structural steel shapes and other materials as shown and specified.
- B. Items specified:
 - 1. Support for wall and ceiling mounted items.
 - 2. Loose Lintels.
 - 3. Shelf Angles.
 - 4. Railings.
 - 5. Ladders.
 - 6. Access Platforms.
 - 7. Frames.
 - 8. Guards.
 - 9. Covers and Frames for Pits and Trenches.
 - 10. Gratings.
 - 11. Plate Door Sill.
 - 12. Safety Nosings.
 - 13. Sidewalk Access Doors.

1.2 RELATED WORK

- A. Railings attached to steel stairs: Section 05 51 00, METAL STAIRS.
- B. Prime and finish painting: Section 09 91 00, PAINTING.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS AND PRODUCT DATA.
- B. Manufacturer's Literature and Data:
 - Grating, each type.
- C. Shop Drawings:
 - 1. Indicate 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:
1. Anodized finish as specified.
 2. Live load designs as specified.
- E. Submit Design Calculations for specified live loads including dead loads prepared by professional engineer licensed in the location of their practice.
- 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 must meet or exceed the requirements specified, and be a standard commercial product of a manufacturer regularly presently manufacturing items of type specified.
- B. Each product type to 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. 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. American Society of Mechanical Engineers (ASME):
- | | |
|-------------------|-------------------------------|
| B18.6.1-81(R2008) | Wood Screws |
| B18.2.2-10 | Nuts for General Applications |
- C. American Society for Testing and Materials (ASTM):
- | | |
|-------------|---|
| A36/A36M-12 | Carbon Structural Steel |
| A47-14 | Ferritic Malleable Iron Castings |
| A48-12 | Gray Iron Castings |
| A53-12 | Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless |

A123/A123M-12	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
A269-14	Seamless and Welded Austenitic Stainless Steel Tubing for General Service
A307-12	Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength
A312/A312M-15	Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
A391/A391M-12	Grade 80 Alloy Steel Chain
A500/A500M-10a	Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
A653/A653M-11	Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process
A786/A786M-09	Hot-Rolled Carbon, Low-Alloy, High-Strength, Low-Alloy, and Alloy Steel Floor Plates
B221-14	Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
B456-11	Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium
B632/B632M-08	Aluminum-Alloy Rolled Tread Plate
C1107/C1107M-13	Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
E488-10	Strength of Anchors in Concrete Elements
F436-11	Hardened Steel Washers
F468-13	Nonferrous Bolts, Hex Cap Screws, Socket Head Cap Screws, and Studs for General Use
F593-13a	Stainless Steel Bolts, Hex Cap Screws, and Studs
F1667-13	Driven Fasteners: Nails, Spikes, and Staples
D. American Welding Society (AWS):	
D1.1/D1.1M:2010	Structural Welding Code Steel
D1.2/D1.2M:2008	Structural Welding Code Aluminum
D1.3/D1.3M:2008	Structural Welding Code Sheet Steel
E. National Association of Architectural Metal Manufacturers (NAAMM):	
AMP 500-06-2006	Metal Finishes Manual
AMP 521-01-12	Pipe Railing Manual

MBG531-09 Metal Bar Grating Manual

MBG532-09 Heavy Duty Metal Bar Grating Manual

F. Structural Steel Painting Council (SSPC):

SSPC-SP 1 Solvent Cleaning

SSPC-SP 2 Hand Tool Cleaning

SSPC-SP 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: 250 pounds at any point.
- C. Railings and Handrails: 200 pounds in any direction at any point.
- D. Manhole Covers: 250 pounds per square foot.

2.2 MATERIALS

- A. Structural Steel: ASTM A36.
- B. Structural Tubing: ASTM A500.
- C. Stainless Steel: ASTM A167, Type 302 or 304.
- D. Aluminum, Extruded: ASTM B221, Alloy 6063-T5 unless otherwise specified. For structural shapes use alloy 6061-T6 and alloy 6061-T4511.
- E. Floor Plate:
 - 1. Steel ASTM A768.
 - 2. Aluminum: ASTM B632.
- F. Steel Pipe: ASTM A53.
 - 1. Galvanized for exterior locations.
 - 2. Type S, Grade A unless specified otherwise.
 - 3. NPS (inside diameter) as shown.
- G. Cast-Iron: ASTM A48, Class 30, commercial pattern.
- H. Malleable Iron Casting: A47.
- I. Primer Paint: As specified in Section 09 91 00, PAINTING.
- J. Stainless Steel Tubing: ASTM A269, type 302 or 304.
- K. Modular Channel Units:

1. Factory fabricated, channel shaped, cold formed sheet steel shapes, complete with fittings bolts and nuts required for assembly.
2. Form channel with in-turned pyramid shaped clamping ridges on each side.
3. Provide case hardened steel nuts with serrated grooves in the top edges designed to be inserted in the channel at any point and be given a quarter turn so as to engage the channel clamping ridges. Provide each nut with a spring designed to hold the nut in place.
4. Factory finish channels and parts with oven baked primer when exposed to view. Channels fabricated of ASTM A653, G90 galvanized steel may have primer omitted in concealed locations. Finish screws and nuts with zinc coating.
5. Fabricate snap-in closure plates to fit and close exposed channel openings of not more than 0.0125 inch thick stainless steel.

L. Grout: ASTM C1107, pourable type.

M. 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 is used.

B. Bolts with nuts: same material, color, and finish as the metal to which applied when exposed.

1. ASME B18.2.2.
2. ASTM A307 for 60,000 psi tensile strength bolts.
3. ASTM F468 for nonferrous bolts.
4. ASTM F593 for stainless steel.

C. Expansion and Adhesive Anchors: Design values listed must be as tested according to ASTM E488.

D. Lag Screws and Bolts: ASME B18.2.1, type and grade best suited for the purpose.

E. Toggle Bolts: ASME B18.2.1.

F. Bolts, Nuts, Studs and Rivets: ASME B18.2.2 or ASTM A307.

G. Washers: ASTM F436, type to suit material and anchorage.

H. Nails: ASTM F1667, Type I, style 6 or 14 for finish work.

2.4 FABRICATION

A. General:

1. Provide for items that do not form a part of the structural steel framework, such as lintels, sill angles, support framing for ceiling-mounted toilet partitions, miscellaneous mountings and frames.
2. Provide lintels fabricated from structural steel shapes over openings in masonry walls and partitions as required to support wall loads over openings. Provide with connections.
3. Construct to have at least 8 inches bearing on masonry at each end.
4. Provide angles and plates, ASTM A36, for embedment as indicated.
5. Galvanize embedded items exposed to the elements according to ASTM A123.

B. 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.

C. 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.

D. 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 punch or drill; 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 member's machine screws or bolts.

E. 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.

F. 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 standards as listed in article Applicable Publications.

- b. Welds shall show good fusion, be free from cracks and porosity and accomplish secure and rigid joints in proper alignment.
 - c. Where exposed in the finished work, continuous weld for the full length of the members joined and have depressed areas filled and protruding welds finished smooth and flush with adjacent surfaces.
 - d. Finish welded joints to match finish of adjacent surface.
3. Joining:
- a. Miter or butt members at corners.
 - b. Where frames members are butted at corners, cut leg of frame member perpendicular to surface, as required for clearance.
4. Anchors:
- a. Provide as indicated.
 - b. Where metal fabrications are shown to be preset in concrete, weld 1-1/4 by 1/8 inch steel strap anchors, 6 inches long with one inch hooked end, to back of member at 2 feet on center, unless otherwise shown.
 - c. Where metal fabrications are shown to be built into masonry use 1-1/4 by 1/8 inch steel strap anchors, 10 inches long with 2 inch hooked end, welded to back of member at 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. Fabricate fit of components and the alignment of holes to 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.

G. Finish:

- 1. Finish exposed surfaces in accordance with NAAMM Metal Finishes Manual.

2. Aluminum: NAAMM AMP 501.
 - a. Mill finish, AA-M10, as fabricated, use unless specified otherwise.
 - b. Clear anodic coating, AA-C22A41, chemically etched medium matte, with Architectural Class 1, 0.7 mils or thicker.
 - c. Colored anodic coating, AA-C22A42, chemically etched medium matte with Architectural Class 1, 0.7 mils or thicker.
 - d. Painted: AA-C22R10.
3. Steel and Iron: NAAMM AMP 504.
 - a. Zinc coated (Galvanized): ASTM A123, G90 unless noted otherwise.
 - b. Surfaces exposed in the finished work:
 - 1) Finish smooth rough surfaces and remove projections.
 - 2) Fill holes, dents and similar voids and depressions with epoxy type patching compound.
 - c. Shop Prime Painting:
 - 1) Surfaces of Ferrous metal:
 - a) Items not specified to have other coatings.
 - b) Galvanized surfaces specified to have prime paint.
 - c) Remove all loose mill scale, rust, and paint, by hand or power tool cleaning as defined in SSPC-SP2 and SP3.
 - d) Clean of oil, grease, soil and other detrimental matter by use of solvents or cleaning compounds as defined in SSPC-SP1.
 - e) After cleaning and finishing apply one coat of primer as specified in Section PAINTING.
 - 2) Non ferrous metals: Comply with MAAMM-500 series.
4. Stainless Steel: NAAMM AMP-504 Finish No. 4.

H. Protection:

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

2.5 SUPPORTS

A. General:

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

B. For Ceiling Hung Toilet Stall:

1. Use a continuous steel channel above pilasters with hangers centered over pilasters.
2. Make provision for installation of stud bolts in lower flange of channel.
3. Provide a continuous steel angle at wall and channel braces spaced as shown.
4. Use threaded rod hangers.
5. Provide diagonal angle brace where the suspended ceiling over toilet stalls does not extend to side wall of room.

C. For Wall Mounted Items:

1. For items supported by metal stud partitions.
2. Steel strip or hat channel minimum of 0.0598 inch thick.
3. Steel strip minimum of 6 inches wide, length extending one stud space beyond end of item supported.
4. Steel hat channels where shown. Flange cut and flattened for anchorage to stud.
5. Structural steel tube or channel for grab bar at water closets floor to structure above with clip angles or end plates formed for anchors.
6. Use steel angles for thru wall counters. Drill angle for fasteners at ends and not over 4 inches on center between ends.

D. For Trapeze Bars:

1. Construct assembly above ceilings as shown and design to support not less than a 750 pound working load at any point.
2. Fabricate trapeze supports as shown, with all exposed members, including screws, nuts, bolts and washers, fabricated of stainless steel.
3. Fabricate concealed components of structural steel shapes unless shown otherwise.
4. Stainless steel ceiling plate drilled for eye bolt.
5. Continuously weld connections where welds shown.
6. Use modular channel where shown with manufacturers bolts and fittings.
 - a. Weld ends of steel angle braces to steel plates and secure to modular channel units as shown. Drill plates for anchor bolts.

- b. Fabricate eye bolt, special clamp bolt, and plate closure full length of modular channel at ceiling line and secure to modular channel unit with manufacturers standard fittings.

2.6 LOOSE LINTELS

- A. Furnish lintels of sizes shown. Where size of lintels is not shown, provide the sizes specified.
- B. Fabricate lintels with not less than 6 inch bearing at each end for nonbearing masonry walls, and 8 inch bearing at each end for bearing walls.
- C. Provide one angle lintel for each 4 inches of masonry thickness as follows except as otherwise specified or shown.
 - 1. Openings 2-1/2 feet to 6 feet - 4 x 3-1/2 x 5/16 inch.
 - 2. Openings 6 feet to 10 feet - 6 x 3-1/2 x 3/8 inch.
- D. For 6 inch thick masonry openings 2-1/2 feet to 10 feet use one angle 6 x 3-1/2 x 3/8 inch.
- E. Provide bearing plates for lintels where shown.
- F. Weld or bolt upstanding legs of double angle lintels together with 3/4 inch bolts spaced at 12 inches on centers.
- G. Insert spreaders at bolt points to separate the angles for insertion of metal windows, louver, and other anchorage.
- H. Where shown or specified, punch upstanding legs of single lintels to suit size and spacing of anchor bolts.
- I. Elevator Entrance:
 - 1. Fabricate lintel from plate bent to channel shape, and provide a minimum of 4 inch bearing each end.
 - 2. Cut away the front leg of the channel at each end to allow for concealment behind elevator hoistway entrance frame.

2.7 SHELF ANGLES

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

2.8 RAILINGS

- A. Design Criteria: 200 pounds in any direction at any point.
- B. Fabrication General:

1. Provide continuous welded joints, dressed smooth and flush.
 2. Standard flush fittings, designed to be welded, may be used.
 3. Exposed threads will not be approved.
 4. Form handrail brackets to size and design shown.
 5. Exterior Post Anchors.
 - a. Fabricate tube or pipe sleeves with closed ends or plates as shown.
 - b. Where inserts interfere with reinforcing bars, provide flanged fittings welded or threaded to posts for securing to concrete with expansion bolts.
 - c. Provide heavy pattern sliding flange base plate with set screws at base of pipe or tube posts.
 6. Interior Post Anchors:
 - a. Provide flanged fittings for securing fixed posts to floor with expansion bolts, unless shown otherwise.
 - b. Weld or thread flanged fitting to posts at base.
 - c. For securing removable posts to floor, provide close fitting sleeve insert or inverted flange base plate with stud bolts or rivets concrete anchor welded to the base plate.
 - d. Provide sliding flange base plate on posts secured with set screws.
 - e. Weld flange base plate to removable posts set in sleeves.
- C. Handrails:
1. Close free ends of rail with flush metal caps welded in place except where flanges for securing to walls with bolts are shown.
 2. Make provisions for attaching handrail brackets to wall, posts, and handrail as shown.
- D. Steel Pipe Railings:
1. Fabricate of steel pipe with welded joints.
 2. Number and space of rails as shown.
 3. Space posts for railings not over 6 feet on centers between end posts.
 4. Form handrail brackets from malleable iron.
 5. Fabricate removable sections with posts at end of section.
 6. Removable Rails:
 - a. Provide "U" shape brackets at each end to hold removable rail as shown. Use for top and bottom horizontal rail when rails are joined together with vertical members.

- b. Secure rail to brackets with 3/8 inch stainless steel through bolts and nuts at top rail only when rails joined with vertical members.
 - c. Continuously weld brackets to post.
 - d. Provide slotted bolt holes in rail bracket.
 - e. Weld bolt heads flush with top of rail.
 - f. Weld flanged fitting to post where posts are installed in sleeves.
7. Opening Guard Rails:
- a. Fabricate rails with flanged fitting at each end to fit between wall opening jambs.
 - b. Design flange fittings for fastening with machine screws to steel plate anchored to jambs.
 - c. Fabricate rails for floor openings for anchorage in sleeves.
8. Gates:
- a. Fabricate from steel pipe as specified for railings.
 - b. Fabricate gate fittings from either malleable iron or wrought steel.
 - c. Hang each gate on suitable spring hinges of clamp on or through bolted type. Use bronze hinges for exterior gates.
 - d. Provide suitable stops, so that gate will swing as shown.
 - e. Provide padlock eyes where shown.
9. Chains:
- a. Chains: ASTM A391, Grade 63, straight link style, normal size chain bar 5/16 inch diameter, eight links per foot and with boat type snap hook on one end, and through type eye bolt on other end.
 - b. Fabricate eye bolt for attaching chain to pipe posts, size not less than 3/8 inch diameter.
 - c. Fabricate anchor at walls, for engagement of snap hook of either a 3/8 inch diameter eye bolt or punched angle.
 - d. Galvanize chain and bolts after fabrication.

2.9 LADDERS

A. Steel Ladders:

- 1. Fixed-rail type with steel rungs shouldered and headed into and welded to rails.
- 2. Fabricate angle brackets of 2 inch wide by 1/2 inch thick steel; brackets spaced maximum of 4 feet apart and of length to hold ladder 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.

SPEC WRITER NOTE: Verify details, show size
and dimensions of components, or specify.

B. Aluminum Ladders:

1. Fixed-rail type, constructed of structural aluminum, with mill finish.
2. Fabricate side rails and rungs of size and design shown, with the rungs shouldered and headed into and welded to the rails.
3. Where shown fabrication side rails curved, twisted and formed into gooseneck.
4. Fabricate angle brackets at top and bottom and intermediate brackets where shown.
Drill for bolting.

C. Ladder Rungs:

1. Fabricate from one inch diameter steel bars.
2. Fabricate so that rungs will extend at least 4 inches into wall with ends turned 2 inches, project out from wall 7 inches, be 16 inches wide and be designed so that foot cannot slide off end.
3. Galvanized after fabrication, ASTM A123, G-90 rungs for exterior use and for access to pits.

2.10 ACCESS PLATFORMS

- A. Fabricate platforms, railings, ladders, supports and hangers, and arrangement of members as shown on drawings.
- B. Fabricate stairs as specified in Section 05 51 00, METAL STAIRS.
- C. Fabricate steel ladders as specified under paragraph LADDERS unless shown otherwise.
- D. Fabricate steel pipe railings as specified under paragraph RAILINGS.
- E. Platforms floor surfaces as shown.
 1. Steel gratings as specified under paragraph gratings, either bar or plank type.
 2. Steel floor plate.
 3. Aluminum floor plate.
- F. Prime paint platform system.

2.11 FRAMES

- A. Channel Door Frames:
 1. Fabricate of structural steel channels of size shown.
 2. Miter and weld frames at corners.

3. Where anchored to masonry or embedded in concrete, weld to back of frame at each jamb, 3/16 inch thick by 1-3/4 inch wide steel strap anchors with ends turned 2 inches, and of sufficient length to extend at least 12 inches into wall. Space anchors 24 inches above bottom of frame and 24 inches o.c. to top of jamb. Weld clip angles to bottom of jambs and provide holes for expansion bolts.
4. Where anchored to concrete or masonry in prepared openings, drill holes at jambs for anchoring with expansion bolts. Weld clip angles to bottom of frame and provide holes for expansion bolt anchors as shown. Drill holes starting 24 inches above bottom of frame and 24 inches o.c. to top of jamb and at top of jamb. Provide pipe spacers at holes welded to channel.
5. Where closure plates are shown, continuously weld them to the channel flanges.
6. Weld continuous 3/4 x 3/4 x 1/8 inch thick steel angles to the interior side of each channel leg at the head and jambs to form a caulking groove.
7. Prepare frame for installation of hardware specified in Section, BUILDER'S HARDWARE.
 - a. Cut a slot in the lock jamb to receive the lock bolt.
 - b. Where shown use continuous solid steel bar stops at perimeter of frame, weld or secure with countersunk machine screws at not more than 18 inches on center.

2.12 GUARDS

- A. Wall Corner Guards:
 1. Fabricate from steel angles and furnish with anchors as shown.
 2. Continuously weld anchor to angle.
- B. Guard Angles for Overhead Doors:
 1. Cut away top portion of outstanding leg of angle and extend remaining portion of angle up wall.
 2. Weld filler piece across head of opening to jamb angles.
 3. Make provisions for fasteners and anchorage.
- C. Channel Guard at Loading Platform:
 1. Fabricate from steel channel of size shown.
 2. Weld anchors to channels as shown.
 3. Drill channel for bumper anchor bolts.
- D. Edge Guard Angles for Openings in slabs.
 1. Fabricate from steel angles of sizes and with anchorage shown.

2. Where size of angle is not shown, provide 2 x 2 x 1/4 inch steel angle with 1-1/4 x 3/16 inch strap anchors, welded to back.
3. Miter or butt angles at corners and weld.
4. Use one anchor near end and three feet on centers between end anchors.

E. Wheel Guards:

1. Construct wheel guards of not less than 5/8 inch thick cast iron.
2. Provide corner type, with flanges for bolting to walls.

2.13 COVERS AND FRAMES FOR PITS AND TRENCHES

A. Fabricate covers to support live loads specified.

B. Galvanized steel members after fabrication in accordance with ASTM A123, G-90 coating.

C. Steel Covers:

1. Use 1/4 inch thick floor plate for covers unless otherwise shown. Use gratings where shown as specified in paragraph GRATINGS. Use smooth floor plate unless noted otherwise.
2. Provide clearance at all sides to permit easy removal of covers.
3. Make cutouts within 1/4 inch of penetration for passage of pipes and ducts.
4. Drill covers for flat head countersunk screws.
5. Make cover sections not to exceed 25 square feet in area and 200 pounds in weight.
6. Fabricate trench cover sections not be over 3 feet long and if width of trench is more than 3 feet or over, equip one end of each section with an angle or "T" bar stiffener to support adjoining plate.
7. Use two, 1/2 inch diameter steel bar flush drop handles for each cover section.

D. Steel Frames:

1. Form frame from structural steel angles as shown. Where not shown use 2-1/2 x 2-1/2 x 1/4 inch angles for frame openings over 4 feet long and 2 x 2 x 1/4 inch for frame openings less than 4 feet.
2. Fabricate intermediate supporting members from steel "T's" or angles; located to support cover section edges.
3. Where covers are required use steel border bars at frames so that top of cover will be flush with frame and finish floor.
4. Weld steel strap anchors to frame. Space straps not over 24 inches o.c., not shown otherwise between end anchors. Use 1/4 x 1 x 8 inches with 2 inch bent ends strap anchors unless shown otherwise.

5. Drill and tap frames for screw anchors where plate covers occur.

2.14 GRATINGS

A. Cast Iron Gratings:

1. Fabricate gratings to support a live load of 500 pounds per square foot.
2. Fabricate gratings and frames for gutter type drains from cast-iron conforming to ASTM A48.
3. Fabricate gratings in section not longer than 4 feet or over 200 pounds and fit so as to be readily removable.

2.15 PLATE DOOR SILL

A. Fabricate of checkered plate as detailed.

1. Aluminum Plate: ASTM B632, 0.125 inch thick.
2. Steel Plate: ASTM A786, 0.125 inch thick, galvanized G90.

B. Fabricate for anchorage with flat head countersunk bolts at each end and not over 12 inches, o.c.

2.16 SAFETY NOSINGS

A. Fed. Spec. RR-T-650, Type C.

1. Aluminum: Class 2, Style 2.
2. Cast iron: Class 4.

B. Fabricate nosings for exterior use from cast aluminum, and nosings for interior use from either cast aluminum or cast iron. Use one Class throughout.

C. Fabricate nosings approximately 4 inches wide with not more than 3/8 inch nose.

D. Provide nosings with integral type anchors spaced not more than 4 inches from each end and intermediate anchors spaced approximately 15 inches on center.

E. Fabricate nosings to extend within 4 inches of ends of concrete stair treads except where shown to extend full width.

F. Fabricate nosings to extend full width between stringers of metal stairs and full width of door openings.

G. On curved steps fabricate to terminate at point of curvature of steps having short radius curved ends.

2.17 SIDEWALK ACCESS DOOR

A. Use flush, watertight, gutter type design.

B. Cover fabricate of 1/4 inch thick, diamond pattern floor plate.

C. Use automatic lock hold open feature and be hung on two flush type heavy bronze hinges capable of 90 degree swing on each door leaf.

- D. Equip with locking and latching device and lifting devices; operable and accessible from both sides of doors.
- E. Doors removable without disturbing frame.
- F. Provide gutters at all joints for drainage of water.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

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

3.2 INSTALLATION OF SUPPORTS

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

B. Ceiling Hung Toilet Stalls:

1. Securely anchor hangers of continuous steel channel above pilasters to structure above.
2. Bolt continuous steel angle at wall to masonry or weld to face of each metal stud.
3. Secure brace for steel channels over toilet stall pilasters to wall angle supports with bolts at each end spaced as shown.
4. Install diagonal angle brace where the suspended ceiling over toilet stalls does not extend to side wall of room.
5. Install stud bolts in lower flange of channel before installing furred down ceiling over toilet stalls.
6. Install support for ceiling hung pilasters at entrance screen to toilet room similar to toilet stall pilasters.

C. Supports for Wall Mounted items:

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

D. Supports for Trapeze Bars:

1. Secure plates to overhead construction with fasteners as shown.
2. Secure angle brace assembly to overhead construction with fasteners as shown and bolt plate to braces.
3. Fit modular channel unit flush with finish ceiling, and secure to plate with modular channel unit manufacturer's standard fittings through steel shims or spreaders as shown.
 - a. Install closure plates in channel between eye bolts.
 - b. Install eyebolts in channel.

3.3 STEEL LINTELS

- A. Use lintel sizes and combinations shown or specified.
- B. Install lintels with longest leg upstanding, except for openings in 6 inch masonry walls install lintels with longest leg horizontal.
- C. Install lintels to have not less than 6 inch bearing at each end for nonbearing walls, and 8 inch bearing at each end for bearing walls.

3.4 SHELF ANGLES

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

3.5 RAILINGS

- A. Steel Posts:
 - 1. Secure fixed posts to concrete with expansion bolts through flanged fittings except where sleeves are shown with pourable grout.
 - 2. Install sleeves in concrete formwork.
 - 3. Set post in sleeve and pour grout to surface. Apply beveled bead of urethane sealant at perimeter of post or under flange fitting as specified in Section 07 92 00, JOINT SEALANTS-on exterior posts.
 - 4. Secure removable posts to concrete with either machine screws through flanged fittings which are secured to inverted flanges embedded in and set flush with finished floor, or set posts in close fitting pipe sleeves without grout.
 - 5. Secure sliding flanged fittings to posts at base with set screws.
 - 6. Secure fixed flanged fittings to concrete with expansion bolts.
 - 7. Secure posts to steel with welds.
- B. Anchor to Walls:
 - 1. Anchor rails to concrete or solid masonry with machine screws through flanged fitting to steel plate.
 - a. Anchor steel plate to concrete or solid masonry with expansion bolts.
 - b. Anchor steel plate to hollow masonry with toggle bolts.
 - 2. Anchor flanged fitting with toggle bolt to steel support in frame walls.
- C. Removable Rails:
 - 1. Rest rails in brackets at each end and secure to bracket with stainless steel bolts and nuts where part of a continuous railing.
 - 2. Rest rail posts in sleeves where not part of a continuous railing. Do not grout posts.
- D. Gates:
 - 1. Hang gate to swing as shown.
 - 2. Bolt gate hinges to jamb post with clamp on or through bolts.
- E. Chains:
 - 1. Eye bolt chains to pipe posts.
 - 2. Eye bolt anchoring at walls.

- a. Expansion bolt to concrete or solid masonry.
- b. Toggle bolt to hollow masonry of frame wall installed support.

F. Handrails:

- 1. Anchor brackets for metal handrails as detailed.
- 2. Install brackets within 12 inches of return of walls, and at evenly spaced intermediate points not exceeding 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.

3.6 LADDERS

- A. Anchor ladders to walls and floors with expansion bolts through turned lugs or angle clips or brackets.
- B. In elevator pits, set ladders to clear all elevator equipment where shown on the drawings.
 - 1. Where ladders are interrupted by division beams, anchor ladders to beams by welding, and to floors with expansion bolts.
 - 2. Where ladders are adjacent to division beams, anchor ladders to beams with bent steel plates, and to floor with expansion bolts.
- C. Ladder Rungs:
 - 1. Set ladder rungs into formwork before concrete is placed. Build ladder rungs into masonry as the work progresses.
 - 2. Set step portion of rung 6 inches from wall.
 - 3. Space rungs approximately 12 inches on centers.
 - 4. Where only one rung is required, locate it 16 inches above the floor.

3.7 ACCESS PLATFORMS

- A. Expansion bolt members to concrete unless shown otherwise.
- B. Bolt or weld structural components together including ladders and stairs to support system.
- C. Weld railings to structural framing.
- D. Bolt or weld walk surface to structural framing.
- E. Smooth field welds and spot prime damaged prime paint surface.
- F. Fasten removable members with stainless steel fasteners.

3.8 DOOR FRAMES

- A. Secure clip angles at bottom of frames to concrete slab with expansion bolts as shown.

- B. Level and plumb frame; brace in position required.
- C. At masonry, set frames in walls so anchors are built-in as the work progresses unless shown otherwise.
- D. Set frames in formwork for frames cast into concrete.
- E. Where frames are set in prepared openings, bolt to wall with spacers and expansion bolts.

3.9 OTHER FRAMES

- A. Set frame flush with surface unless shown otherwise.
- B. Anchor frames at ends and not over 18 inches on centers unless shown otherwise.
- C. Set in formwork before concrete is placed.

3.10 GUARDS

- A. Steel Angle Corner Guards:
 - 1. Build into masonry as the work progress.
 - 2. Set into formwork before concrete is placed.
 - 3. Set angles flush with edge of opening and finish floor or wall or as shown.
 - 4. At existing construction fasten angle and filler piece to adjoining construction with 5/8 inch diameter by 3 inch long expansion bolts 18 inches on center.
 - 5. Install Guard Angles at Edges of Trench, Openings in Slab and Overhead Doors where shown.
- B. Channel Guard at Top Edge of Concrete Platforms:
 - 1. Install in formwork before concrete is placed.
 - 2. Set channel flush with top of the platform.
- C. Wheel Guards:
 - 1. Set flanges of wheel guard at least 2 inches into pavement.
 - 2. Anchor to walls as shown, expansion bolt if not shown.

3.11 COVERS AND FRAMES FOR PITS AND TRENCHES

- A. Set frame and cover flush with finish floor.
- B. Secure plates to frame with flat head countersunk screws.
- C. Set gratings loose in drainage trenches or over pits unless shown anchored.

3.12 GRATINGS

- A. Set grating flush with finish floor; top of curb, or areaway wall. Set frame so that horizontal leg of angle frame is flush with face of wall except when frame is installed on face of wall.
- B. Set frame in formwork before concrete is placed.

- C. Where grating terminates at a wall bolt frame to concrete or masonry with expansion bolts unless shown otherwise.
- D. Secure removable supporting members in place with stainless steel bolts.
- E. Bolt gratings to supports.

3.13 PLATE DOOR SILL

- A. Install after roofing base flashing and counter flashing work is completed.
- B. Set in sealant and bolt to curb.
- C. Install nosing to within 4 inches of ends of concrete stair treads, except where shown to extend full width.
- D. Extend nosings full width of door openings.
- E. Extend nosings, full width between stringers of metal stairs, and terminate at point of curvature of steps having short radius curved ends.

3.14 SAFETY NOSINGS

- A. Except as specified and where preformed rubber treads are shown or specified install safety nosings at the following:
 - 1. Exterior concrete steps.
 - 2. Door sills of areaway entrances curbs.
 - 3. Exposed edges of curbs of door sills at transformer and service rooms.
 - 4. Interior concrete steps, including concrete filled treads of metal stairs of service stairs.
- B. Install flush with horizontal and vertical surfaces.
- C. Install nosing to within 4 inches of ends of concrete stair treads, except where shown to extend full width.
- D. Extend nosings full width of door openings.
- E. Extend nosings, full width between stringers of metal stairs, and terminate at point of curvature of steps having short radius curved ends.

3.15 SIDEWALK ACCESS DOOR

- A. Set frame flush with finished concrete slab or curb.
- B. Secure well linings to structure with expansion bolts unless shown otherwise.
- C. Bolt ceiling hatch to well lining angle brace and to angle iron frames near corners and 12 inches on centers with not less than 3/8 inch roundhead machine screws.
- D. Coordinate sidewalk door drain connections with plumbing work.

3.16 STEEL COMPONENTS FOR MILLWORK ITEMS

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

3.17 CLEAN AND ADJUSTING

- A. Adjust movable parts including hardware to operate as designed without binding or deformation of the members centered in the opening or frame and, where applicable, contact surfaces fit tight and even without forcing or warping the components.
- B. Clean after installation exposed prefinished and plated items and items fabricated from aluminum and copper alloys, as recommended by the metal manufacture and protected from damage until completion of the project.

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SECTION 05 51 00 METAL STAIRS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Section specifies steel stairs with railings.
- B. Closed riser stairs with concrete filled treads and platforms.

1.2 RELATED WORK

- A. Concrete fill for treads and platforms: Section 03 30 53, SHORT FORM CAST-IN-PLACE CONCRETE.
- B. Wall handrails and railings for other than steel stairs: Section 05 50 00, METAL FABRICATIONS.
- C. Requirements for shop painting: Section 09 91 00, PAINTING.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: Show design, fabrication details, installation, connections, material, and size of members.

1.4 APPLICABLE PUBLICATIONS

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

A36/A36M-08	Structural Steel
A47-99(2009)	Ferritic Malleable Iron Castings
A48-08	Gray Iron Castings
A53-12	Pipe, Steel, Black and Hot-Dipped Zinc-Coated Welded and Seamless
A307-14	Carbon Steel Bolts, Studs, and Threaded Rod 60000 PSI Tensile Strength
A563-14	Carbon and Alloy Steel Nuts
A653/A653-11	Steel Sheet, Zinc Coated (Galvanized) or Zinc Alloy Coated (Galvannealed) by the Hot-Dip Process
A786/A786M-09	Hot-Rolled Carbons, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates

- | | |
|----------|--|
| A1008-10 | Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength, Low-Alloy |
| A1011-10 | Steel, Sheet and Strip, Strip, Hot-Rolled Carbon, Structural, High-Strength, Low-Alloy |
- C. American Welding Society (AWS):
- | | |
|---------|-------------------------------------|
| D1.1-10 | Structural Welding Code-Steel |
| D1.3-08 | Structural Welding Code-Sheet Steel |
- D. American Iron and Steel Institute (AISI):
- | | |
|------|--|
| 2008 | Design of Cold-Formed Steel Structural Members |
|------|--|
- E. The National Association of Architectural Metal Manufacturers (NAAMM) Manuals:
- | | |
|---------------|--------------------------|
| MBG 531-09 | Metal Bar Grating Manual |
| AMP 521-01-12 | Pipe Railing Manual |

PART 2 - PRODUCTS

2.1 DESIGN CRITERIA

- A. Design stairs to support a live load of 100 pounds per square foot.
- B. Structural design, fabrication and assembly in accordance with requirements of NAAMM Metal Stairs Manual, except as otherwise specified or shown.
- C. Design pipe railings in accordance with NAAMM Pipe Railing Manual for 200 pounds in any direction at any point.

2.2 MATERIALS

- A. Steel Pipe: ASTM A53, Standard Weight, zinc coated.
- B. Sheet Steel: ASTM A1008.
- C. Structural Steel: ASTM A36.
- D. Steel Floor Plate: ASTM 786.
- E. Steel Decking: Form from zinc coated steel conforming to ASTM A653, with properties conforming to AISI Specification for the Design of Cold-Formed Steel Structural Members.
- F. Steel Plate: ASTM A1011.
- G. Iron Castings: ASTM A48, Class 30.
- H. Malleable Iron Castings: ASTM A47.

2.3 FABRICATION GENERAL

- A. Fasteners:
 - 1. Conceal bolts and screws wherever possible.

2. Use countersunk heads on exposed bolts and screws with ends of bolts and screws dressed flush after nuts are set.
- B. Welding:
1. Structural steel, AWS D1.1 and sheet steel, AWS D1.3.
 2. Where possible, locate welds on unexposed side.
 3. Grind exposed welds smooth and true to contour of welded member.
 4. Remove welding splatter.
- C. Remove sharp edges and burrs.
- D. Fit stringers to head channel and close ends with steel plates welded in place where shown.
- E. Fit face stringer to newel post by tenoning into newel post, or by notching and fitting face stringer to side of newel where shown.
- F. Shop Prime Painting: Prepare surface and apply primer as specified for ferrous metals in Section 09 91 00, PAINTING.

2.4 RAILINGS

- A. Fabricate railings, including handrails, from steel pipe with flush.
1. Connections may be standard fittings designed for welding, or coped or mitered pipe with full welds.
 2. Wall handrails are provided under Section 05 50 00, METAL FABRICATIONS.
- B. Return ends of handrail to wall and close free end.
- C. Provide standard terminal castings where fastened to newel.
- D. Space intermediate posts not over six feet on center between end post or newel post.
- E. Fabricate handrail brackets from cast malleable iron.
- F. Provide standard terminal fittings at ends of post and rails.

2.5 CLOSED STAIR RISERS

- A. Provide treads, risers, platforms, railings, stringers, headers and other supporting members.
- B. Fabricate pans for treads and platforms, and risers from sheet steel.
- C. Form risers with sanitary cove.
- D. Fabricate stringers, headers, and other supporting members from structural steel.
- E. Construct newel posts of steel tubing having wall thickness not less than 3/16-inch, with forged steel caps and drops.

PART 3 - EXECUTION

3.1 STAIR INSTALLATION

- A. Provide hangers and struts required to support the loads imposed.
- B. Perform job site welding and bolting as specified for shop fabrication.
- C. Set stairs and other members in position and secure to structure as shown.
- D. Install stairs plumb, level and true to line.
- E. Provide steel closure plate to fill any gap between the stringer and surrounding shaft wall. Weld and finish with prime and paint finish of adjoining steel.

3.2 RAILING INSTALLATION

- A. Install standard terminal fittings at ends of posts and rails.
- B. Secure brackets, posts and rails to steel by welds, and to masonry or concrete with expansion sleeves and bolts, except secure posts at concrete by setting in sleeves filled with commercial non-shrink grout.
- C. Set rails horizontal or parallel to rake of stairs to within 1/8-inch in 12 feet.
- D. Set posts plumb and aligned to within 1/8-inch in 12 feet.

3.3 FIELD PRIME PAINTING

- A. When installation is complete, clean field welds and surrounding areas to bright metal, and coat with same primer paint used for shop priming.
- B. Touch-up abraded areas with same primer paint used for shop priming.
- C. Touch up abraded galvanized areas with zinc rich paint as specified in section 09 91 00, PAINTING.

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SECTION 06 10 00 ROUGH CARPENTRY

PART 1 - GENERAL

1.1 DESCRIPTION

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

1.2 RELATED WORK

- A. Milled Woodwork: Section 06 20 00, FINISH CARPENTRY.

1.3 PERFORMANCE REQUIREMENTS

- A. Sustainably Harvested Wood: Comply with requirements of Section 01 81 11, SUSTAINABLE DESIGN REQUIREMENTS.
- B. Engineered Wood Products:
 - 1. Provide products with no added urea formaldehyde; determine formaldehyde concentrations in air from wood products under test conditions of temperature and relative humidity in accordance with ASTM D6007 or E1333.
 - 2. Bio-based Content:
 - a. Interior Panels: Engineered products designed specifically for interior applications and providing a surface that is impact-, scratch-, and wear-resistant and that does not absorb or retain moisture; provide minimum 55 percent bio-based content.
 - b. Structural Interior Panels: Engineered products designed for use in structural construction applications; provide minimum 89 percent bio-based content.
 - c. Structural Wall Panels: Engineered products designed for use in structural walls, curtain walls, floors and roofs; provide minimum 94 percent bio-based content.
 - 3. VOC Emissions:
 - a. Provide low VOC products with Green Seal Certification to GS-36 and description of the basis for certification.

1.4 SUSTAINABILITY REQUIREMENTS

- A. Materials in this section may contribute towards contract compliance with sustainability requirements. See Section 01 81 11, SUSTAINABLE DESIGN REQUIREMENTS, for project local/regional materials, recycled content, certified wood requirements.
- B. Biobased Material: For products designated by the USDA's BioPreferred® program, provide products that meet or exceed USDA recommendations for biobased content, subject to the products compliance with performance requirements in this Section. For

more information regarding the product categories covered by the BioPreferred® program, visit <http://www.biopreferred.gov>.

1.5 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Provide documentation of conformance with performance requirements of this section.
- C. Prepare shop drawings showing framing connection details, fasteners, connections and dimensions.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

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

1.7 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. American Forest and Paper Association (AF&PA):
Wood Structural Design Data
- C. American Lumber Standard Committee, Incorporated (ALSC):
ALSC Board of Review
- D. American National Standards Institute (ANSI):
ANSI A190.1-2012 Structural Glued Laminated Timber
- E. American Plywood Association (APA):
E30-2011 Engineered Wood Construction Guide
- F. American Society of Mechanical Engineers (ASME):
B18.2.1-2012 Square, Hex, Heavy Hex and Askew Head Bolts and Hex,
Heavy Hex, Hex Flange, Lobed Head, and Lag Screws
B18.2.2-2010 Hex Nuts for General Applications
B18.6.1-81 (R2008) Wood Screws

B18.6.4-98(R2005) Thread Forming and Thread Cutting Tapping Screws and
Metallic Drive Screws

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

A307-10 Carbon Steel Bolts and Studs, 60,000 PSI Tensile
Strength

C954-11 Steel Drill Screws for the Application of Gypsum Panel
Products or Metal Plaster Bases to Steel Studs from 0.033
in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness

C1002-07 Steel Self-Piercing Tapping Screws for the Application of
Gypsum Panel Products or Metal Plaster Bases to Wood
Studs or Steel Studs

D6007-02 Determining Formaldehyde Concentration in Air from
Wood Products Using a Small Scale Chamber

E1333-10 Determining Formaldehyde Concentrations in Air and
Emission Rates from Wood Products Using a Large
Chamber

F844-07a Washers, Steel, Plan (Flat) Unhardened for General Use

F1667-11ae1 Nails, Spikes, and Staples

H. American Wood Protection Association (AWPA)

I. FM Global Group (FM):

FM 4435 Approval Standard for Edge Systems Used with Low Slope
Roofing Systems

J. Green Seal (GS):

GS-36 (2013) Commercial Adhesives

K. South Coast Air Quality Management District (SCAQMD):

SCAQMD Rule 1168 (1989; R2005) Adhesive and Sealant Applications

L. U.S. Department of Commerce/National Institute of Science and Technology:

PS 1-09 Structural Plywood

PS 20-10 American Softwood Lumber Standard

PART 2 - PRODUCTS

2.1 LUMBER

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

1. Identifying marks in accordance with rule or standard under which material is produced, including requirements for qualifications and authority of the inspection organization, usage of authorized identification, and information included in the identification.
 2. Inspection agency for lumber approved by the Board of Review, American Lumber Standards Committee, to grade species used.
- B. Structural Members: Species and grade as listed in the AF&PA, National Design Specification for Wood Construction having design stresses as shown.
- C. Lumber Other Than Structural:
1. Unless otherwise specified, species graded under the grading rules of an inspection agency approved by Board of Review, American Lumber Standards Committee.
 2. Framing lumber: Minimum extreme fiber stress in bending of 1100.
 3. Furring, blocking, nailers and similar items 100 mm (4 inches) and narrower Standard Grade; and, members 150 mm (6 inches) and wider, Number 2 Grade.
- D. Sizes:
1. Conforming to Prod. Std. PS20.
 2. Size references are nominal sizes, unless otherwise specified, actual sizes within manufacturing tolerances allowed by standard under which produced.
- E. Moisture Content:
1. At time of delivery and maintained at the site.
 2. Boards and lumber 50 mm (2 inches) and less in thickness: 19 percent or less.
 3. Lumber over 50 mm (2 inches) thick: 25 percent or less.
- F. Preservative Treatment:
1. Do not treat Heart Redwood and Western Red Cedar.
 2. Products containing chromium or arsenic will not be permitted.
 3. Provide products with waterborne or boron-based preservatives.
- G. Waterborne Wood Preservatives:
1. Treat wood products with waterborne wood preservatives listed in Section 4 of AWWA Standards U1, excluding those which contain arsenic and/or chromium.
 2. Pressure treatment of wood products must conform to the requirements of AWWA Standards U1 and T1.
 3. Retention of preservatives as prescribed in AWWA Standard U1 for the following Use Categories (material conforming to a higher AWWA Use Category may be specified):
 - a. UC1: Interior construction - above ground, dry conditions.

- b. UC2: Interior construction - above ground, damp conditions.
- c. UC3A: Exterior construction - above ground, coated and with rapid water runoff.
- d. UC3B: Exterior construction - above ground, uncoated or poor water runoff.
- e. UC4A: General purpose soil or fresh water contact - heavy duty above ground.
- f. UC4B: Heavy duty soil or fresh water contact - critical or difficult to replace components.
- g. UC4C: Extreme duty soil or fresh water contact - critical structural components.
- H. Boron-based Preservatives: Impregnate lumber with preservative treatment conforming to AWWPA Standard U1.
- I. Fire-retardant Treatment:
 - 1. Fire-retardant-treated wood products to be free of halogens, sulfates, ammonium phosphate and formaldehyde.
 - 2. Fire retardant treatment of wood products to conform to the requirements of AWWPA Standard U1, Commodity Specification H and AWWPA Standard T1, Section H.

2.2 PLYWOOD

- A. Comply with Prod. Std. PS 1 and APA E30.
- B. Bear the mark of a recognized association or independent inspection agency that maintains continuing control over quality of plywood which identifies compliance by veneer grade, group number, span rating where applicable, and glue type.
- C. Sheathing:
 - 1. APA rated Exposure 1 or Exterior; panel grade CD or better.
 - 2. Wall Sheathing:
 - a. Minimum 9 mm (11/32 inch) thick with supports 400 mm (16 inches) on center and 12 mm (15/32 inch) thick with supports 600 mm (24 inches) on center unless specified otherwise.
 - b. Minimum 1200 mm (48 inches) wide at corners without corner bracing of framing.
 - 3. Roof Sheathing:
 - a. Minimum 9 mm (11/32 inch) thick with span rating 24/0 or 12 mm (15/32 inch) thick with span rating for supports 400 mm (16 inches) on center unless specified otherwise.
 - b. Minimum 15 mm (19/32 inch) thick or span rating of 40/20 or 18 mm (23/32 inch) thick or span rating of 48/24 for supports 600 mm (24 inches) on center.

2.3 ROUGH HARDWARE

- A. Anchor Bolts: ASTM A307, size as indicated, complete with nuts and washers.
- B. Washers:
 - 1. ASTM F844.
 - 2. Use zinc or cadmium coated steel or cast iron for washers exposed to weather.
- C. Screws:
 - 1. Wood to Wood: ANSI B18.6.1 or ASTM C1002.
 - 2. Wood to Steel: ASTM C954, or ASTM C1002.
- D. Nails:
 - 1. 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.

2.4 BLOCKING

- A. General: Provide miscellaneous lumber as indicated and lumber support or attachment for other construction, including the following:
 - 1. Blocking.
 - 2. Nailers.
 - 3. Furring.
- B. Provide Standard or No. 2 Grade lumber.

PART 3 - EXECUTION

3.1 INSTALLATION OF FRAMING AND MISCELLANEOUS WOOD MEMBERS

- A. Conform to applicable requirements of the following:
 - 1. Comply with APA standards for installation of plywood.
- B. Anchors in Masonry: Except where indicated otherwise, embed anchor bolts not less than 400 mm (15 inches) in masonry unit walls and provide each with a nut and a 50 mm (2 inch) diameter washer at bottom end. Fully grout bolts with mortar.
- C. Anchors in Concrete:
 - 1. Except where indicated otherwise, embed anchor bolts not less than 200 mm (8 inches) in poured concrete walls and provide each with a nut and a 50 mm (2 inch) diameter washer at bottom end.

2. A bent end may be substituted for the nut and washer; bend to be not less than 90 degrees.
 3. Powder-actuated fasteners spaced 900 mm (3 feet) o.c. may be provided instead of bolts for single thickness plates on concrete.
- D. Sheathing:
1. Lay panels with joints staggered, with edge and ends 3 mm (1/8 inch) apart and nailed over bearings as specified.
 2. Set nails not less than 9 mm (3/8 inch) from edges.
 3. Install 50 mm by 100 mm (2 inch by 4 inch) blocking spiked between studs to support edge or end joints of panels.
- E. Wood Roof Nailers, Edge Strips, Crickets, Curbs, and Cants: Provide sizes and configurations indicated or specified and anchored securely to continuous construction.
1. Roof Edge Strips and Nailers: Provide at perimeter of roof, around openings through roof, and where roofs abut walls, curbs, and other vertical surfaces.
 2. Except where indicated otherwise, nailers to be 150 mm (6 inches) wide and the same thickness as the insulation. Anchor nailers securely to underlying construction.
 3. Anchor perimeter nailers in accordance with FM 4435.
 4. Crickets, Cants, and Curbs: Provide wood saddles or crickets, cant strips, curbs for scuttles and ventilators, and at expansion joints, as indicated, specified, or necessary.
- F. Wood Blocking: Provide proper sizes and shapes at proper locations for the installation and attachment of wood and other finish materials, fixtures, equipment, and items indicated or specified.
- G. Wood Grounds: Provide for fastening wood trim, finish materials, and other items to plastered walls and ceilings. Install grounds in proper alignment and true with a 2400 mm (8 foot) straightedge.
- H. Wood Furring:
1. Provide where shown and as necessary for facing materials specified.
 2. Except as shown otherwise, furring strips to be nominal one by 3, continuous, and spaced 400 mm (16 inches) o.c. Erect furring vertically or horizontally as necessary.
 3. Nail furring strips to masonry.
 4. Do not use wood plugs.
 5. Provide furring strips around openings, behind bases, and at angles and corners.

6. Furring to be plumb, rigid, and level and shimmed as necessary to provide a true, even plane with surfaces suitable to receive the finish required.

3.2 PROTECTION

- A. Protect rough carpentry from weather.
- B. If rough carpentry becomes wet, apply EPA-registered borate treatment complying with EPA registered label.

- - - E N D - - -

SECTION 06 20 00 FINISH CARPENTRY

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies exterior and interior millwork.

1.2 RELATED WORK

- A. Fabricated Metal brackets, bench supports and countertop legs: Section 05 50 00, METAL FABRICATIONS.
- B. Framing, furring and blocking: Section 06 10 00, ROUGH CARPENTRY.
- C. .Stock Casework: Section 12 32 00, MANUFACTURED WOOD CASEWORK.
- D. Electrical light fixtures and duplex outlets: Division 26, ELECTRICAL.

1.3 PERFORMANCE REQUIREMENTS

- A. Sustainably Harvested Wood: Comply with requirements of Section 01 81 11, SUSTAINABLE DESIGN REQUIREMENTS.
- B. Engineered Wood Products:
 - 1. Provide products with no added urea formaldehyde; determine formaldehyde concentrations in air from wood products under test conditions of temperature and relative humidity in accordance with ASTM D6007 or E1333.
 - 2. Bio-based Content:
 - a. Interior Panels: Engineered products designed specifically for interior applications and providing a surface that is impact-, scratch-, and wear-resistant and that does not absorb or retain moisture; provide minimum 55 percent bio-based content.
 - b. Structural Interior Panels: Engineered products designed for use in structural construction applications; provide minimum 89 percent bio-based content.
 - c. Structural Wall Panels: Engineered products designed for use in structural walls, curtain walls, floors and roofs; provide minimum 94 percent bio-based content.
 - 3. VOC Emissions:
 - a. Provide low VOC products with Green Seal Certification to GS-36 and description of the basis for certification.

1.4 SUSTAINABILITY REQUIREMENTS

- A. Materials in this section may contribute towards contract compliance with sustainability requirements. See Section 01 81 11, SUSTAINABLE DESIGN REQUIRMENTS, for

project local/regional materials, low-emitting materials, recycled content, certified wood requirements.

- B. Biobased Material: For products designated by the USDA's BioPreferred® program, provide products that meet or exceed USDA recommendations for biobased content, subject to the products compliance with performance requirements in this Section. For more information regarding the product categories covered by the BioPreferred® program, visit <http://www.biopreferred.gov>.

1.5 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Provide documentation of conformance with performance requirements of this section.
- C. Shop Drawings:
1. Millwork: Half size scale for sections and details; 1:50 (1/4-inch) for elevations and plans.
 2. Indicate materials and details of construction, methods of fastening, erection, and installation.
- D. Samples:
1. Plastic laminate, finished plywood or particleboard, 150 mm by 300 mm (6 by 12 inches).
- E. Certificates:
1. Indicate preservative treatment of materials meet the requirements specified.
 2. Indicating moisture content of materials meet the requirements specified.
- F. List of acceptable sealers for fire retardant and preservative treated materials.
- G. Manufacturer's literature and data:
1. Finish hardware.
 2. Sinks with fittings.
 3. Electrical components.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Protect lumber and millwork from dampness, maintaining moisture content specified both during and after delivery at site.
- B. Store finishing lumber and millwork in weathertight well ventilated structures or in space in existing buildings designated by COTR. Store at a minimum temperature of 21°C (70°F) for not less than 10 days before installation.

- C. Pile lumber in stacks in such manner as to provide air circulation around surfaces of each piece.

1.7 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. American Society of Testing and Materials (ASTM):
- | | |
|---------------|--|
| A167-99(2009) | Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip |
| B26/B26M-12 | Aluminum-Alloy Sand Castings |
| B221-13 | Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes |
| D6007-02 | Determining Formaldehyde Concentration in Air from Wood Products Using a Small Scale Chamber |
| E1333-10 | Determining Formaldehyde Concentrations in Air and Emission Rates from Wood Products Using a Large Chamber |
- C. American Hardboard Association (AHA):
- | | |
|-----------|-----------------|
| A135.4-12 | Basic Hardboard |
|-----------|-----------------|
- D. American Lumber Standard Committee, Incorporated (ALSC):
ALSC Board of Review
- E. American National Standards Institute (ANSI):
- | | |
|-----------------|---|
| NPA A208.1-2009 | Particleboard (published by National Particleboard Association/Composite Panel Association) |
| Z124.3-05 | Plastic Lavatories |
- F. American Society of Mechanical Engineers (ASME):
- | | |
|--------------|---|
| B18.2.1-2012 | Square, Hex, Heavy Hex and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws |
| B18.2.2-2010 | Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series) |
- G. American Wood-Preservers' Association (AWPA)
- H. Architectural Woodwork Institute (AWI):
Architectural Woodwork Standards and Quality Certification Program (2009)

- I. Builders Hardware Manufacturers Association (BHMA):
 - A156.9-10 Concealed Cabinet Hardware
 - A156.11-10 Cabinet Locks
 - A156.16-02 Auxiliary Hardware
 - A156.18-12 Exposed Cabinet Hardware
- J. Green Seal (GS):
 - GS-36 (2013) Commercial Adhesives
- K. Hardwood Plywood and Veneer Association (HPVA):
 - HP-1-2011 Hardwood Plywood Handbook
- L. National Electrical Manufacturers Association (NEMA):
 - LD 3-05 High-Pressure Decorative Laminates
- M. National Hardwood Lumber Association (NHLA)
- N. South Coast Air Quality Management District (SCAQMD):
 - SCAQMD Rule 1168 (1989; R2005) Adhesive and Sealant Applications
- O. U.S. Department of Commerce/National Institute of Science and Technology:
 - PS1-09 Construction and Industrial Plywood
 - PS20-10 American Softwood Lumber Standard

PART 2 - PRODUCTS

2.1 LUMBER

- A. Grading and Marking:
 - 1. Lumber to bear the grade mark, stamp, or other identifying marks indicating grades of material.
 - 2. Such identifying marks on a material to be in accordance with the rule or standard under which the material is produced, including requirements for qualifications and authority of the inspection organization, usage of authorized identification, and information included in the identification.
 - 3. The inspection agency for lumber to be approved by the Board of Review, American Lumber Standards Committee, to grade species used.

B. Sizes:

1. Lumber size references, unless otherwise specified, are nominal sizes; actual sizes to be within manufacturing tolerances allowed by the standard under which product is produced.
2. Millwork, standing and running trim, and rails: Actual size as shown or specified.

C. Hardwood: FAS Grade of NHLA, species as specified for each item.

D. Softwood: PS-20, exposed to view appearance grades:

1. Use C select or D select, vertical grain for transparent finish including stain transparent finish.
2. Use Prime for painted or opaque finish.

E. Use edge grain wood members exposed to weather.

2.2 PLYWOOD

A. Softwood Plywood:

1. Prod. Std.
2. Grading and Marking:
 - a. Each sheet of plywood must bear the mark of a recognized association or independent inspection agency that maintains continuing control over the quality of the plywood.
 - b. The mark must identify the plywood by species group or identification index, and show glue type, grade, and compliance with PS1.
3. Plywood, 13 mm (1/2 inch) and thicker; not less than five ply construction, except 32 mm (1-1/4 inch) thick plywood not less than seven ply.
4. Plastic Laminate Plywood Cores:
 - a. Exterior Type, any species group.
 - b. Veneer Grade: A-C.
5. Shelving Plywood:
 - a. Interior Type, any species group.
 - b. Veneer Grade: A-B or B-C.
6. Other: As specified for item.

B. Hardwood Plywood:

1. HPVA: HP-1.
2. Species of Face Veneer: As shown or as specified in connection with each particular item.
3. Inside of Building:

- a. Use Type II (interior) A grade veneer for transparent finish.
- b. Use Type II (interior) Sound Grade veneer for paint finish.
- 4. On Outside of Building:
 - a. Use Type I, (exterior) A Grade veneer for natural or stained and varnish finish.
 - b. Use Type I, (exterior) Sound Grade veneer for paint finish.
- 5. Use plain sliced red oak or rotary cut white birch unless specified otherwise.

2.3 PARTICLEBOARD

- A. ANSI NPA A208.1
- B. Plastic Laminate Particleboard Cores:
 - 1. Use Type 1, Grade 1-M-3, or Type 2, Grade 2-M-2, unless otherwise specified.
 - 2. Use Type 2, Grade 2-M-2, exterior bond, for tops with sinks.
- C. General Use: Type 1, Grade 1-M-3 or Type 2, Grade 2-M-2.
- D. Do not use product with urea formaldehyde.

2.4 PLASTIC LAMINATE

- A. NEMA LD-3.
- B. Exposed decorative surfaces including countertops, both sides of cabinet doors, and for items having plastic laminate finish; General Purpose, Type HGL.
- C. Cabinet Interiors including Shelving: Both of following options to comply with NEMA CLS Grade, as a minimum.
 - 1. Plastic laminate clad plywood or particle board.
 - 2. Resin impregnated decorative paper thermally fused to particle board.
- D. Backing sheet on bottom of plastic laminate covered wood tops: Backer, Type HGP.
- E. Plastic Laminate Work:
 - 1. Factory glued to a plywood or particle board core, thickness as shown or specified.
 - 2. Cover exposed edges with plastic laminate, except where aluminum, stainless steel, or plastic molded edge strips are shown or specified. Use plastic molded edge strips on 19 mm (3/4-inch) molded thick or thinner core material.
 - 3. Provide plastic backing sheet on underside of countertops, vanity tops, thru-wall counter and sills including back splashes and end splashes of countertops.
 - 4. Use backing sheet on concealed large panel surface when decorative face does not occur.
- F. Counter or Work Tops:
 - 1. Fabrication with plastic laminate over 32 mm (1-1/4 inch) thick core unless shown otherwise.

- a. Use decorative laminate for exposed edges of tops 38 mm (1-1/2 inches) wide and on back splash and end splash. Use plastic or metal edges for top edges less than 38 mm (1-1/2 inches) wide.
- b. Assemble back splash and end splash to counter top.
- c. Use one piece counters for straight runs.
- d. Miter corners for field joints with overlapping blocking on underside of joint.

2.5 SOLID SURFACE COUNTERTOPS

- A. Comply with AWI Section 400 and ANSI Z124.3 requirements for countertops.

2.6 BUILDING BOARD (HARDBOARD)

- A. ANSI/AHA A135.4.

2.7 ADHESIVE

- A. Product compliant with performance requirements.

2.8 STAINLESS STEEL

- A. ASTM A167, Type 302 or 304.

2.9 ALUMINUM CAST

- A. ASTM B26.

2.10 ALUMINUM EXTRUDED

- A. ASTM B221.

2.11 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 electric-galvanizing process. Provide galvanized where indicated.
 2. Use galvanized coating on ferrous metal for exterior work unless non-ferrous metals or stainless is used.
 3. Fasteners:
 - a. Bolts with Nuts: ASME B18.2.1 and ASME B18.2.2.
 - b. Screws: ASMC B18.6.1.
- B. Finish Hardware:
 1. Cabinet Hardware: ANSI A156.9.
 - a. Door/Drawer Pulls: B02011. Door in seismic zones: B03182.
 - b. Drawer Slides: B05051 for drawers over 150 mm (6 inches) deep, B05052 for drawers 75 mm to 150 mm 3 to 6 inches) deep, and B05053 for drawers less than 75 mm (3 inches) deep.

- c. Sliding Door Tracks: B07063.
 - d. Adjustable Shelf Standards: B4061 with shelf rest B04083.
 - e. Concealed Hinges: B1601, minimum 110 degree opening.
 - f. Butt Hinges: B01361, for flush doors, B01381 for inset lipped doors, and B01521 for overlay doors.
 - g. Cabinet Door Catch: B0371 or B03172.
 - h. Vertical Slotted Shelf Standard: B04103 with shelf brackets B04113, sized for shelf depth.
2. Cabinet Locks: ANSI A156.11.
- a. Drawers and Hinged Door: E07262.
 - b. Sliding Door: E07162.
3. Primers: Manufacturer's standard primer for steel providing baked enamel finish.

2.12 MOISTURE CONTENT

- A. Moisture content of lumber and millwork at time of delivery to site.
- 1. Moisture content of other materials to be in accordance with the standards under which the products are produced.

2.14 FABRICATION

- A. General:
- 1. Provide interior woodwork complying with referenced quality standard.
 - 2. Use AWI Custom Grade for architectural woodwork and interior millwork, except as otherwise indicated.
 - 3. Finish woodwork must be free from pitch pockets.
 - 4. Provide trim as standard stock molding and members of the same species, except where special profiles are shown.
 - 5. Plywood cannot be less than 13 mm (1/2 inch), unless otherwise shown or specified.
 - 6. Edges of members in contact with concrete or masonry to have a square corner caulking rebate.
 - 7. Fabricate members less than 4 m (14 feet) in length from one piece of lumber, back channeled and molded as shown.
 - 8. Plastic Laminate Work:
 - a. Factory glued to plywood or particle board core, thickness as shown or specified.
 - b. Cover exposed edges with plastic laminate, except where aluminum, stainless steel, or plastic molded edge strips are shown or specified. Use plastic molded edge strips on 19 mm (3/4-inch) molded thick or thinner core material.

- c. Provide plastic backing sheet on underside of countertops, vanity tops, thru-wall counter and sills including back splashes and end splashes of countertops.
- d. Use backing sheet on concealed large panel surface when decorative face does not occur.

PART 3 - EXECUTION

3.1 ENVIRONMENTAL REQUIREMENTS

- A. Maintain work areas and storage areas to a minimum temperature of 21°C (70°F) for not less than 10 days before and during installation of interior millwork.
- B. Do not install finish lumber or millwork in any room or space where wet process systems such as concrete, masonry, or plaster work are not complete and dry.

3.2 INSTALLATION

- A. General:
 - 1. Install to comply with AWI 1700.
 - 2. Millwork receiving transparent finish to be primed and back-painted on concealed surfaces; do not set millwork until primed and back-painted.
 - 3. Secure trim with fine finishing nails, screws, or glue as required.
 - 4. Set nails for putty stopping. Use washers under bolt heads where no other bearing plate occurs.
 - 5. Seal cut edges of preservative and fire retardant treated wood materials with a certified acceptable sealer.
 - 6. Coordinate with plumbing and electrical work for installation of fixtures and service connections in millwork items.
 - 7. Plumb and level items unless shown otherwise.
 - 8. Nail finish at each blocking, lookout, or other nailer and intermediate points; toggle or expansion bolt in place where nails are not suitable.
 - 9. Exterior Work: Provide joints that are close fitted, mitered, tongue and grooved, rebated, or lapped to exclude water filled and sealed.
 - 10. Install woodwork plumb and level to a tolerance of 3 mm in 2400 mm (1/8 inch in 96 inches).
- B. Install with butt joints in straight runs and miter joints at corners.

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SECTION 07 11 13 BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies materials and workmanship for bituminous dampproofing on concrete and masonry surfaces.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Product description.
 - 2. Application instructions.

1.3 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 for Testing and Materials (ASTM):
 - D226-09 Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
 - D449-03(R2008)..... Asphalt Used in Dampproofing and Waterproofing
 - D1227-95(R2007)..... Emulsified Asphalt Used as a Protective Coating for Roofing

PART 2 - PRODUCTS

2.1 ASPHALT (HOT APPLIED)

- A. ASTM D449, Type I.

2.2 ASPHALT SATURATED FELT

- A. ASTM D226, Type I, 7 kg (# 15).

2.3 ASPHALT EMULSION (COLD APPLIED)

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

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

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

3.2 APPLICATION

- A. Comply with Manufacturer's written instructions for methods and rates of dampproofing application, cleaning and installation of any protection course.
- B. Apply each coat at the rate of not less than 1 L/m² (2-1/2 gallons per 100 square feet) and allow not less than 24 hours drying time after application.

3.3 LOCATION

- A. Apply to surfaces where shown.
- B. Apply to exterior surface of inner wythe of masonry cavity walls where shown.
Coordinate application with masonry work.

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SECTION 07 21 13 THERMAL INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies thermal and acoustical insulation for buildings.
- B. Acoustical insulation is identified by thickness and words "Acoustical Insulation".

1.2 RELATED WORK

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

1.3 SUSTAINABILITY REQUIREMENTS

- A. Materials in this section may contribute towards contract compliance with sustainability requirements. See Section 01 81 11, SUSTAINABLE DESIGN REQUIREMENTS, for project local/regional materials, low-emitting materials, recycled content, requirements.
- B. Biobased Material: For products designated by the USDA's BioPreferred® program, provide products that meet or exceed USDA recommendations for biobased content, subject to the products compliance with performance requirements in this Section. For more information regarding the product categories covered by the BioPreferred® program, visit <http://www.biopreferred.gov>.

1.4 REGULATORY REQUIREMENTS FOR RECYCLED CONTENT

- A. Products and Materials with Post-Consumer Content and Recovered Materials Content:
 - 1. Contractor is obligated by contract to satisfy Federal mandates for procurement of products and materials meeting recommendations for post-consumer content and recovered materials content; the list of designated product categories with recommendations has been compiled by the EPA - refer to <http://www.epa.gov/wastes/conserve/tools/cpg/products/>.
 - 2. Materials or products specified by this section may be obligated to satisfy this Federal mandate and Comprehensive Procurement Guidelines program.
 - 3. The EPA website also provides tools such as a Product Supplier Directory search engine and product resource guides.
- B. Fulfillment of regulatory requirements does not relieve the Contractor of satisfying sustainability requirements stipulated by Section 01 81 11, SUSTAINABLE DESIGN

REQUIREMENTS, as it relates to recycled content; additional product and material selections with recycled content may be required, as determined by Contractor's Sustainability Action Plan.

1.5 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Insulation, each type used.
 - 2. Adhesive, each type used.
 - 3. Tape.
- C. Certificates: Stating the type, thickness and "R" value (thermal resistance) of the insulation to be installed.

1.6 SUSTAINABLE DESIGN CERTIFICATION

- A. Provide third party certified product in accordance with ULE GREENGUARD, SCS Global Indoor Advantage Certification or equal; certification must be current and performed annually.
- B. Provide documentation to demonstrate fiberglass insulation does not contain urea-formaldehyde.

1.7 STORAGE AND HANDLING

- A. Store insulation materials in weathertight enclosure.
- B. Protect insulation from damage from handling, weather and construction operations before, during, and after installation.

1.8 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. American Society for Testing and Materials (ASTM):
 - C270 Mortar for Unit Masonry
 - C553-11 Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
 - C578-12b Rigid, Cellular Polystyrene Thermal Insulation

C591-12b Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation

C665-12 Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing

D312-00(R2006) Asphalt Used in Roofing

F1667-11ae1 Driven Fasteners: Nails, Spikes and Staples

C. Scientific Certification Systems (SCS Global): SCS Indoor Advantage certification.

D. UL Environment, GREENGUARD (ULE GREENGUARD): The GREENGUARD Product Guide (online)

PART 2 - PRODUCTS

2.1 INSULATION – GENERAL

- A. Where thermal resistance ("R" value) is specified or shown for insulation, the thickness shown on the drawings is nominal. Use only insulation with actual thickness that is not less than that required to provide the thermal resistance specified.
- B. Where "R" value is not specified for insulation, use the thickness shown on the drawings.
- C. Comply with following minimum content standards for recovered materials:

Material Type	Percent by Weight
Polyisocyanurate/polyurethane/polystyrene	9 percent recovered material
Glass fiber reinforced	6 percent recovered material

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

2.2 POLYISOCYANURATE BOARD INSULATION

- A. ASTM C591, Type I, faced with a vapor retarder having a perm rating of not more than 0.5.

2.3 POLYSTYRENE BOARD

- A. ASTM C578, Type X for cavity walls.
- B. ASTM C578, Type IV, V, VI, VII, or IX where covered by soil or concrete.

2.4 GLASS FIBER AND STONE WOOL INSULATION

- A. Unfaced Insulation: ASTM C665, Type I or ASTM C533.
- B. Faced Insulation: ASTM C665, Type III, Faced.

- C. Acoustical Insulation: Preformed, friction-fit type, unfaced; insulation type conforming to ASTM C665 or C553.

2.5 FASTENERS

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

2.6 ADHESIVE

- A. As recommended by the manufacturer of the insulation.
- B. Asphalt: ASTM D312, Type III or IV.
- C. Mortar: ASTM C270, Type 0.

2.7 TAPE

- A. Pressure sensitive adhesive on one face.
- B. Perm rating of not more than 0.50.

2.8 BLOCKING AROUND HEAT PRODUCING DEVICES

- A. Provide non-combustible blocking around heat producing devices to provide the following clearances:
 - 1. Recessed lighting fixtures, including wiring compartments, ballasts, and other heat producing devices, unless certified for installation surrounded by insulation: 75 mm 3 inches from outside face of fixtures and devices or as required by NFPA 70 and, if insulation is to be placed above fixture or device, 600 mm 24 inches above fixture.
 - 2. Vents and vent connectors used for venting products of combustion, flues, and chimneys: minimum clearances as required by NFPA 211.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

- A. Install insulation with the vapor barrier facing the heated side, unless specified otherwise.
- B. Install rigid insulating units with joints close and flush, in regular courses and with cross joints broken.
- C. Install batt insulation with tight joints and filling framing void completely. Seal cuts, tears, and unlapped joints with tape.
- D. Fit insulation tight against adjoining construction and penetrations, unless specified otherwise.
- E. Do not install insulation in a manner that would sandwich electrical wiring between two layers of insulation.

- F. Place insulation to the outside of pipes.
- G. Butt tightly against adjoining boards, studs, rafters, joists, sill plates, headers and obstructions. Provide continuity and integrity of insulation at corners, wall to ceiling joint, roof, and floor. Avoid creating any thermal bridges or voids.

3.2 POLYISO BOARD

- A. Bond polyisocyanurate board, to surfaces with adhesive as recommended by insulation manufacturer.

3.3 POLYSTYRENE BOARD

- A. Vertical Insulation:
 - 1. Fill joints of insulation with same material used for bonding.
 - 2. Bond polystyrene board to surfaces with adhesive and applied in accordance with recommendations of insulation manufacturer.

3.4 GLASS FIBER BATT

- A. Pack insulation around door frames and windows and in building expansion joints, door soffits and other voids. Pack behind outlets around pipes, ducts, and services encased in walls. Open voids are not permitted. Hold insulation in place with pressure sensitive tape.
- B. Lap vapor retarder flanges together over face of framing for continuous surface. Seal all penetrations through the insulation.
- C. Fasten blanket insulation between metal studs or framing and exterior wall furring by continuous pressure sensitive tape along flanged edges.
- D. Roof Rafter Insulation or Floor Joist Insulation: Place mineral fiber blankets between framing to provide not less than a 50 mm (two inch) air space between insulation and roof sheathing or subfloor.
- E. Ceiling Insulation and Soffit Insulation:
 - 1. Fasten blanket insulation between wood framing and joists with nails or staples through flanged edges of insulation.
 - 2. At metal framing or ceilings suspension systems, install blanket insulation above suspended ceilings or metal framing at right angles to the main runners or framing. Tape insulation tightly together so no gaps occur and metal framing members are covered by insulation.
 - 3. In areas where suspended ceilings adjoin areas without suspended ceilings, install blanket, batt, or mineral fiberboard extending from the suspended ceiling to

underside of deck or slab above. Secure in place to prevent collapse or separation of hung blanket, batt, or board insulation and maintain in vertical position. Secure blanket or batt with continuous cleats to structure above.

3.5 ACOUSTICAL INSULATION

- A. Fasten blanket insulation between metal studs and wall furring with continuous pressure sensitive tape along edges or adhesive.
- B. Pack insulation around door frames and windows and in cracks, expansion joints, control joints, door soffits and other voids. Pack behind outlets, around pipes, ducts, and services encased in wall or partition. Hold insulation in place with pressure sensitive tape or adhesive.
- C. Do not compress insulation below required thickness except where embedded items prevent required thickness.
- D. Where acoustical insulation is installed above suspended ceilings install blanket at right angles to the main runners or framing. Extend insulation over wall insulation systems not extending to structure above.

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SECTION 07 21 29 SPRAY FOAM INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies spray foam thermal insulation for buildings.

1.2 RELATED WORK

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

1.3 SUSTAINABILITY REQUIREMENTS

- A. Materials in this section may contribute towards contract compliance with sustainability requirements. See Section 01 81 11, SUSTAINABLE DESIGN REQUIREMENTS, for project local/regional materials, low-emitting materials, recycled content, requirements.
- B. Biobased Material: For products designated by the USDA's BioPreferred® program, provide products that meet or exceed USDA recommendations for biobased content, subject to the products compliance with performance requirements in this Section. For more information regarding the product categories covered by the BioPreferred® program, visit <http://www.biopreferred.gov>.

1.4 REGULATORY REQUIREMENTS FOR RECYCLED CONTENT

- A. Products and Materials with Post-Consumer Content and Recovered Materials Content:
 - 1. Contractor is obligated by contract to satisfy Federal mandates for procurement of products and materials meeting recommendations for post-consumer content and recovered materials content; the list of designated product categories with recommendations has been compiled by the EPA - refer to <http://www.epa.gov/wastes/conservation/tools/cpg/products/>.
 - 2. Materials or products specified by this section may be obligated to satisfy this Federal mandate and Comprehensive Procurement Guidelines program.
 - 3. The EPA website also provides tools such as a Product Supplier Directory search engine and product resource guides.
- B. Fulfillment of regulatory requirements does not relieve the Contractor of satisfying sustainability requirements stipulated by Section 01 81 11, SUSTAINABLE DESIGN REQUIREMENTS, as it relates to recycled content; additional product and material

selections with recycled content may be required, as determined by Contractor's Sustainability Action Plan.

1.5 PERFORMANCE REQUIREMENTS

- A. Conform to applicable code for flame and smoke, concealment, and over coat requirements.

1.6 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data: For each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- C. Certificates: Stating the type, thickness and "R" value (thermal resistance) of the insulation to be installed and meet or exceed specified requirements.

1.7 SUSTAINABLE DESIGN CERTIFICATION

- A. Provide third party certified product in accordance with ULE GREENGUARD, SCS Global Indoor Advantage Certification or equal; certification must be current and performed annually.
- B. Provide documentation to demonstrate fiberglass insulation does not contain urea-formaldehyde.

1.8 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Manufacturer with a minimum of ten years of experience manufacturing products in this section shall provide all products listed.
- B. Installer Qualifications: Products listed in this section shall be installed by a single organization with at least five years of experience successfully installing insulation on projects of similar type and scope as specified in this section.
- C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
 - 1. Finish area designated for mock-up.
 - 2. Do not proceed with remaining work until workmanship is approved.
 - 3. Refinish mock-up area as required to produce acceptable work.
 - 4. Approved mock-up may remain as part of completed work.

1.9 DELIVERY, STORAGE AND HANDLING

- A. Deliver and store products in manufacturer's unopened packaging clearly labeled with manufacturer's product information.
- B. Storage: Store materials in dry locations with adequate ventilation, protected from freezing rain, direct sunlight and excess heat and in such a manner to permit easy access for inspection and handling. Store at temperature between 55 and 80 degrees F (12.7 to 26.6 degrees C).
- C. Handling: Handle Materials to avoid damage of packaging and contents.

1.10 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. American Society for Testing and Materials (ASTM):
 - C117 Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus
 - C270 Mortar for Unit Masonry
 - C518 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
 - C553-11 Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
 - C578-12b Rigid, Cellular Polystyrene Thermal Insulation
 - C591-12b Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
 - C665-12 Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
 - C1338 Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings
 - D312-00(R2006) Asphalt Used in Roofing
- C. Scientific Certification Systems (SCS Global): SCS Indoor Advantage certification.

- D. UL Environment, GREENGUARD (ULE GREENGUARD): The GREENGUARD Product Guide (online)

PART 2 - PRODUCTS

2.1 BASIS OF DESIGN

- A. Basis of Design: CertainTeed Corp., Insulation Group, 750 E. Swedesford Road, Valley Forge, PA. 19482; phone 800-233-8990; www.certainteed.com/products/insulation.

2.2 SPRAY FOAM INSULATION

- A. Basis of Design Insulation: HFC-blown type Closed Cell Foam: CertainTeed CertaSpray Closed Cell Foam of medium density, MDI-based polyurethane thermoset rigid foam with an in-place core density of 1.9 – 2.2 pcf.
- B. Physical and Mechanical Properties:
1. Core Density: 1.9-2.4 pcf when tested in accordance with ASTM D 1622.
 2. Thermal Resistance (aged): 5.8 less than or equal to 2-1/2 inches / 6.4 when greater than 2-1/2 inches when tested in accordance with ASTM C 518 at 75 degrees F, (h-ft²- degrees F)/Btu.
 3. Thermal Resistance (initial): 6.4 when tested in accordance with ASTM C 518 at 75 degrees F, (h-ft²- degrees F)/Btu.
 4. Closed Cell Content: 88-95 percent when tested in accordance with ASTM D 2842.
 5. Compressive Strength: Greater than 25 psi when tested in accordance with ASTM D 1621.
 6. Tensile Strength: 23 psi when tested in accordance with ASTM D 1623.
 7. Water Absorption: Less than 2 percent by volume when tested in accordance with ASTM D 2842.
 8. Dimensional Stability: Less than 9 percent by volume when tested in accordance with ASTM D 1626 at 75 degrees F/95 percent RH, 28 Day.
 9. Water Vapor Transmission: 1.3 perm/inch when tested in accordance with ASTM E 96.
 10. Air Permeability: 0.013 when tested in accordance with ASTM E 283 at 1 inch thickness, L/s/m².
 11. Fungi Resistance: Pass, with no growth when tested in accordance with ASTM C 1338.

C. Fire Performance:

1. Flame Spread: Less than 25 when tested in accordance with ASTM E 84.
2. Smoke: Less than 450 when tested in accordance with ASTM E 84.

D. Thermal Performance (aged): Tested in accordance with ASTM C 518 and/or ASTM C 177 at 75 degrees F (24 degrees C) mean temperature.

1. Thickness 2 inches (51 mm) minimum, R-Value 11.6 (h-ft²-degreesF)/Btu (2.0(m²-degreesC)/W).

2.8 BLOCKING AROUND HEAT PRODUCING DEVICES

- A. Provide non-combustible blocking around heat producing devices to provide the clearances as recommended by spray foam material manufacturer or as listed below.
1. Recessed lighting fixtures, including wiring compartments, ballasts, and other heat producing devices, unless certified for installation surrounded by insulation: 75 mm 3 inches from outside face of fixtures and devices or as required by NFPA 70 and, if insulation is to be placed above fixture or device, 600 mm 24 inches above fixture.
 2. Vents and vent connectors used for venting products of combustion, flues, and chimneys: minimum clearances as required by NFPA 211.

PART 3 - EXECUTION

3.1 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
- B. Do not apply insulations when substrate temperatures are under 40 degrees F (4.4 degrees C) prior to installation.
- C. Surfaces must be dry prior to application of spray foam insulation. Excess humidity may cause poor adhesion, and result in product failure.
- D. to avoid overspray, product should not be applied when conditions are windy.

3.2 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. Verify that all exterior and interior wall, partition, and floor/ceiling assembly construction has been completed to the point where the insulation may correctly be installed.
- C. Verify that substrate and cavities are dry and free of any foreign material that will impede application.

- D. Verify that mechanical and electrical services in ceilings, walls and floors have been installed and tested and, if appropriate, verify that adjacent materials are dry and ready to receive insulations.
- E. If substrate preparation is the responsibility of another installer, notify COR of unsatisfactory preparation before proceeding.

3.3 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Mask and protect adjacent surfaces from overspray or dusting.

3.4 INSTALLATION

- A. Install spray foam insulation in accordance with manufacturer's printed instructions. Product must be installed according to local code, and must be applied by a qualified applicator.
- B. Apply spray foam insulation by spray method, to uniform monolithic density without voids.
- C. Apply to minimum cured thickness as indicated on the Drawings or as scheduled in this section.
- D. Apply to a minimum cured thickness of 2 inches.
- E. Apply spray foam insulation to seal voids at truss ends to prevent wind scouring of ceiling insulation where applicable.
- F. Apply to seal voids around plumbing stacks, electrical wiring and other penetrations to control air leakage.
- G. Apply to seal voids around doors and windows. Apply to fill voids around accessible service and equipment penetrations.
- H. Do not install spray foam insulation in areas where it will be in contact with equipment or materials with operating temperatures of 180 degrees F (82 degrees C) or greater.
- I. Where building is designed to meet the specific air tightness standards of the Energy Star Program, apply spray foam insulation as recommended by manufacturer to provide airtight construction. Apply sealant to joints between structural assemblies as specified in Division 7.
- J. Patch damaged areas as required.

3.5 FIELD QUALITY CONTROL

- A. Inspection will include verification of insulation and density.

3.6 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion at no additional expense to Owner.

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SECTION 07 22 00 ROOF AND DECK INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Installation of roof and deck insulation, and vapor retarder on new construction ready to receive roofing or waterproof membrane.
- B. Repairs and alteration work to existing roof insulation.

1.2 RELATED WORK

- A. Wood blocking and edge strips: Section 06 10 00, ROUGH CARPENTRY.
- B. Perimeter, rigid, and batt or blanket insulation: Section 07 21 13, THERMAL INSULATION.
- C. Sheet metal components: Section 07 60 00, FLASHING AND SHEET METAL.

1.3 QUALITY CONTROL

- A. Supervision of work by persons that are knowledgeable and experienced in roofing. See submittals for documentation of supervisor's qualification.
- B. Unless specified otherwise, comply with the recommendations of the NRCA "Roofing and Waterproofing Manual" applicable to insulation for storage, handling, and application.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Asphalt materials, each type
 - 2. Roofing cement, each type
 - 3. Roof insulation, each type
 - 4. Fastening requirements
 - 5. Insulation span data for flutes of metal decks
- C. Samples:
 - 1. Roof insulation, each type
 - 2. Nails and fasteners, each type
- D. Certificates:
 - 1. Indicating type, thickness and thermal conductance of insulation. (Average thickness for tapered insulation).

2. Indicating materials and method of application of insulation system on metal decks meet the requirements of Factory Mutual Research Corporation for Class 1 Insulated Steel Deck Roofs.

- E. Laboratory Test Reports: Thermal values of insulation products.
- F. Layout of tapered roof system showing units required.
- G. Documentation of supervisors training and experience showing knowledge of roofing procedures.

1.5 DELIVERY, STORAGE AND MARKING

- A. Deliver materials to the site in original sealed packages or containers marked with the name and brand, or trademark of the manufacturer or seller.
- B. Keep materials dry, and store in dry, weather tight facilities or under canvas tarps. Use of polyethylene or plastic tarps to cover materials is not permitted. Store above ground or deck level on wood pallets. Cover ground under stored materials with plastic tarp.
 1. Store rolled materials (felts, base sheets, paper) on end. Do not store materials on top of rolled material.
 2. Store foam insulation away from areas where welding is being performed and where contact with open flames is possible.
- C. Protect from damage from handling, weather and construction operations before, during, and after installation.

1.6 APPLICABLE PUBLICATIONS

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

C1289-10	Faced Rigid Cellular Polyisocynurate Thermal Insulation Board
D41-11	Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
D312-00(R2006).....	Asphalt Used in Roofing
D2178-04	Asphalt Glass Felt Used in Roofing and Waterproofing
D2822-05(R2011).....	Asphalt Roof Cement
D4897-01(2009)	Asphalt Coated Glass Fiber Venting Base Sheet
- C. Factory Mutual Global (FM):

4450-89	Approved Standard for Class 1 Insulated Steel Deck Roofs
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D. National Roofing Contractors Association (NRCA):

The NRCA Roofing and Waterproofing Manual - Fifth Edition (2009).

E. Underwriters Laboratories, Inc. (UL):

Fire Resistance Directory (2009)

1.7 QUALITY ASSURANCE:

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

PART 2 - PRODUCTS

2.1 ASPHALT MATERIALS

- A. Primer: ASTM D41.
- B. Asphalt: ASTM D312, Type III or IV for vapor retarders and insulation.
- C. Glass (Felt): ASTM D2178, Type IV, heavy duty ply sheet.
- D. Venting Asphalt Base Sheet: ASTM D4897, Type I or Type II.
- E. Roof Cement: ASTM D2822, Type I or Type II, asbestos free; or, D4586, Type I or Type II.

2.2 INSULATION

- A. Isocyanurate Board: ASTM C1289, Type I, Class 2 or Type III.
- B. Tapered Roof Insulation System Segments:
 - 1. Fabricate of mineral fiberboard, isocyanurate, perlite board, or cellular glass. Use only one insulation material for tapered sections.

2. Cut to provide high and low points with crickets and slopes as shown.
3. Minimum thickness of tapered sections; 13 mm (1/2 inch), unless manufacturers allow taper to zero mm (inch).

2.3 FASTENERS

- A. Fasteners for securing insulation to steel decks:
1. Conform to requirements of Factory Mutual Research Corporation for wind uplift.
 2. Self-drilling galvanized screws with 50 mm (two inch) diameter disk.
 3. Antibackout thread design.
 4. Have a pullout resistance of 14 kg (30 pounds) minimum.

2.4 RECOVERED MATERIALS

- A. Comply with following minimum content standards for recovered materials:

Material Type	Percent by Weight
Plastic rigid foams: Polyisocyanurate/polyurethane	
Rigid foam	9 percent recovered material
Foam-in-place	5 percent recovered material
Glass fiber reinforced	6 percent recovered material
Rock wool material	75 percent recovered material

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

PART 3 - EXECUTION

3.1 GENERAL

- A. Do not apply roof insulation if deck will be used for subsequent work platform, storage of materials, or staging or scaffolding will be erected thereon.
- B. Entire roof deck construction of any section of the building shall be completed before insulation system work is begun. Curbs, blocking, edge strips, and other components which insulation, roofing and base flashing is attached to shall be in place ready to receive insulation and roofing. Coordinate roof insulation operations with roofing and sheet metal work so that insulation is installed to permit continuous roofing operations.
- C. Insulation system materials shall be dry and damage free when applied. Do not use broken insulation or insulation with damaged facings. Remove damaged insulation from the site immediately.

- D. Dry out surfaces, including the flutes of metal deck, that become wet from any cause during progress of the work before roofing work is resumed. Apply materials only to dry substrates.
- E. Do not apply materials during damp or rainy weather, during excessive wind conditions, nor while moisture (dew, fog, snow, ice) or frost is present in any amount in or on the materials when temperature is below 10 °C (50 °F). Do not apply materials to substrate having temperature of 10 °C (50 °F) or less.
- F. Phased construction is not permitted. The complete installation of all flashing, insulation, and roofing shall be completed in the same day except for the area where temporary protection is required when work is stopped.

3.2 SURFACE PREPARATION

- A. Sweep decks to broom clean condition. Remove all dust, dirt or debris.
- B. Remove projections that might damage materials.

3.3 INSULATION THICKNESS

- 1. Thickness of roof insulation shown on drawings is nominal. Actual thickness shall provide the thermal resistance "R" value of not less than specified.
- 2. The minimum thickness of insulation for metal decks shall not be less than recommended by the insulation manufacturer to span the rib opening (flute size) of the metal deck used.
- 3. When thickness of insulation to be used is more or less than that shown on the drawings, make adjustments in the alignment and location of roof drains, flashing, gravel stops, fascias and similar items at no additional cost to the NCA.
- 4. Tapered insulation shall be preformed and fabricated to the slopes indicated.
- 5. Use not less than two layers of insulation when insulation is 25 mm (one inch) or more in thickness unless specified otherwise.

3.5 INSTALLATION OF INSULATION

- A. Lay insulating units with close joints, in regular courses and with cross joints broken. When laid in more than one layer, break joints of succeeding layers of roof insulation with those in preceding layer. Bed insulation layers in Type III or IV asphalt firmly pressed into the hot bitumen. Keep bitumen below surface of insulation to receive single ply rubber roofing.
- B. Lay units with long dimension perpendicular to the rolled (longitudinal) direction of the roofing felt.
- C. Cover all insulation installed on the same day by either:

1. The roofing membrane as specified.
 2. Temporary protection as specified.
- D. Seal all cut edges at penetrations and at edges against blocking with bitumen or roof cement.
- E. Cut to fit tight against blocking or penetrations.
- F. Over Vapor Retarder: Lay insulation in hot bitumen as specified.
- G. Steel Deck:
1. Material and method of application of insulation systems used on metal decks shall meet the requirements of Underwriters laboratories for Class A or Factory Mutual Research Corporation for Class I Insulated Steel Roof Deck.
 2. Mechanically anchor first layer of insulation to steel deck to conform to FM Class 1-60, Insulated Steel Roof Deck.
 3. Locate the long dimension edge joints to have solid bearing on top of deck ribs; do not cantilever over deck rib openings or flutes.

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SECTION 07 41 13 STANDING SEAM METAL ROOFING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the installation of pre-formed standing seam roofing panels with double roll formed field seam.

1.2 RELATED WORK

- A. Sealant: Section 07 92 00, JOINT SEALANTS.
- B. Fascia and Trim: 07 60 00, FLASHING AND SHEET METAL.

1.3 DESIGN REQUIREMENTS

- A. Provide panels in continuous lengths up to manufacturer's standard longest lengths, with no joints or seams, except where indicated or specified. Ribs of adjoining sheets must be in continuous contact from eave to ridge.
- B. There cannot be exposed or penetrating fasteners except where shown on approved shop drawings. Fasteners into steel must be stainless steel, zinc cast head, or cadmium plated steel screws inserted into predrilled holes.
- C. Field-formed seam type system must be mechanically locked closed by the manufacturer's locking tool.
- D. Roof panel anchor clips must be concealed and designed to allow for longitudinal thermal movement of the panels, except where specific fixed points are indicated. Provide for lateral thermal movement in panel configuration or with clips designed for lateral and longitudinal movement.
- E. Design metal roof panel assembly, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
 - 1. Structural Performance: Provide metal roof panel assemblies capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E1592.
 - 2. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class; design and size components to withstand positive and negative wind loads, including increased loads at building corners as calculated according to local jurisdiction and ASCE 7.

3. Deflection: Provide panels capable of supporting design loads between unsupported spans with deflection of not greater than $L/180$ of the span.
- F. Single Source: Roofing panels, clips, closures, and other accessories must be standard products of the same manufacturer; be the latest design by the manufacturer; and have been designed by the manufacturer to operate as a complete system for the intended use.
- G. Energy Performance, Energy Star: Provide roofing finish system that is listed on DOE's ENERGY STAR "Roof Products Qualified Product List" or listed on Cool Roof Rating Council (CRRC) product list.

1.4 INSTALLATION REQUIREMENTS

- A. Pre-Installation Conference: Convene a meeting on site, after submittals are received and approved but before any work, to review drawings and specifications, submittals, schedule, manufacturer instructions, site logistics and pertinent matters of coordination, temporary protection, governing regulations, tests and inspections; participants to include COTR and all parties whose work is effected or related to the work of this section.
- B. Install in accordance with SMACNA Architectural Sheet Metal Manual except as otherwise shown or specified.

1.5 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: Show design, details of construction, flashing, and fastenings.
- C. Provide design calculations prepared by a professional engineer specializing in structural engineering verifying that system supplied and any additional framing meets design load criteria indicated. Coordinate calculations with manufacturer's test results. Include calculations for:
 1. Wind load uplift design pressure at roof locations.
 2. Clip spacing and allowable load per clip.
 3. Fastening of clips to structure or intermediate supports.
 4. Intermediate support spacing and framing and fastening to structure when required.
 5. Allowable panel span at anchorage spacing indicated.
 6. Safety factor used in design loading.
 7. Governing code requirements or criteria.

8. Edge and termination details.

- D. Installer Qualifications: Document installer is factory-trained, approved by the metal roofing system manufacturer to install the system, and has a minimum of three years' experience as an approved applicator with that manufacturer. The applicator must have applied five installations of similar size and scope as this project within the previous 3 years.

1.6 SUSTAINABILITY REQUIREMENTS

- A. Materials in this section may contribute towards contract compliance with sustainability requirements. See Section 01 81 11, SUSTAINABLE DESIGN REQUIREMENTS, for project local/regional materials, recycled content requirements.

1.7 REGULATORY REQUIREMENTS FOR RECYCLED CONTENT

- A. Products and Materials with Post-Consumer Content and Recovered Materials Content:
1. Contractor is obligated by contract to satisfy Federal mandates for procurement of products and materials meeting recommendations for post-consumer content and recovered materials content; the list of designated product categories with recommendations has been compiled by the EPA - refer to <http://www.epa.gov/wastes/conservation/tools/cpg/products/>.
 2. Materials or products specified by this section may be obligated to satisfy this Federal mandate and Comprehensive Procurement Guidelines program.
 3. The EPA website also provides tools such as a Product Supplier Directory search engine and product resource guides.
- B. Fulfillment of regulatory requirements does not relieve the Contractor of satisfying sustainability requirements stipulated by Section 01 81 11, SUSTAINABLE DESIGN REQUIREMENTS, as it relates to recycled content; additional product and material selections with recycled content may be required, as determined by Contractor's Sustainability Action Plan.

1.8 WARRANTY

- A. Roofing work subject to the terms of the Article "Warranty of Construction", FAR clause 52.246-21, except extend the warranty period to five years.

1.9 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. American Architectural Manufacturer Association (AAMA):

AAMA 621-02 High Performance Organic Coatings on Coil Coated
Architectural Hot Dipped Galvanized (HDG) & Zinc-
Aluminum Coated Steel Substrates

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

A463/A463M-09 Steel Sheet, Cold-Rolled, Aluminum-Coated, by the Hot-
Dip Process

C920-11 Elastomeric Joint Sealants

E1514-98(2011) Structural Standing Seam Steel Roof Panel Systems

E1592 Structural Performance of Sheet Metal Roof and Siding
Systems by Uniform Static Air Pressure Difference

D. American Society of Civil Engineers (ASCE):

ASCE 7-10 Minimum Design Loads for Buildings and Other Structures

E. Cool Roof Rating Council (CRR):

CRR-1-10 Product Rating Program, www.coolroofs.org

F. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):

Architectural Sheet Metal Manual 2012

G. Underwriters Laboratory (UL):

UL 580, 2006 Edition Tests for Uplift Resistance of Roof Assemblies

H. U.S. Department of Energy (DoE):

Roof Products Qualified Product List, www.energystar.gov

PART 2 - PRODUCTS

2.1 METAL ROOF PANEL

A. Aluminum-Zinc Alloy Coated Sheet Steel conforming to ASTM A463 and coated on both sides with 0.5 ounce of aluminum per square foot (0.15 Kg/sm); minimum 0.6 mm (24 gage) base metal thickness.

B. Conform to ASTM E1514.

C. Factory formed metal roof panels designed to be field assembled by lapping and interconnecting raised side edges of adjacent panels with joint type indicated, and

mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for a weathertight installation.

D. Panel Coverage: 406 mm (16 inches).

E. Seam Height: Minimum 44 mm (1-3/4 inch).

2.2 SEALANTS

A. Field-applied: ASTM C920.

B. Type, Grade, and Class as recommended in writing by the manufacturer.

2.3 SEALANT TAPE

A. Pressure sensitive, 100 percent solids, Gray Polyisobutylene compound with release-paper backing.

B. 12 mm (1/2 inch) wide x 3 mm (1/8 inch) thick.

2.4 UNDERLAYMENT

A. Self-Adhering with reinforcing scrim, High-Temperature Sheet: Minimum 50 thick minimum, consisting of slip-resisting top surface laminated to SBS-modified asphalt adhesive, with release-paper backing; cold applied.

2.5 FASTENERS

A. Self-drilling, or self-tapping zinc plated hex head carbon-steel screws with EPDM washer or stainless steel cap.

B. Concealed Standard Anchor Clips: Clips base must be minimum 1.2 mm (18 gauge) galvanized steel with 0.7 mm (22 gage) galvanized or stainless steel sliding top. Clips must be two (2) piece design; one-piece clips are not acceptable.

2.6 FINISHES

A. Factory finished complying with SMACNA's recommendations for applying and designating finishes.

B. Exterior Finish:

1. 2-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat.

2. Coating system must provide nominal 0.025 mm (1.0 mil) dry film thickness, consisting of primer and color coat.

3. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.0125 mm (0.5 mil).

C. Color: As indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal roof panel supports, and other conditions affecting performance of 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.
- B. Examine roughing-in for components and systems penetrating metal roof panels to verify actual locations of penetrations relative to seam locations of metal roof panels before metal roof panel installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment.
- B. Install fascia and trim.

3.3 METAL ROOF PANEL INSTALLATION, GENERAL

- A. General: Provide metal roof panels of full length from eave to ridge, unless otherwise indicated or restricted by shipping limitations. Anchor metal roof panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 1. Field cutting of metal roof panels by torch is not permitted.
 - 2. Rigidly fasten eave end of metal roof panels and allow ridge end free movement due to thermal expansion and contraction; predrill panels.
 - 3. Provide metal closures at peaks, rake walls and each side of ridge and hip caps.
 - 4. Flash and seal metal roof panels with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws.
 - 5. Locate and space fastenings in uniform vertical and horizontal alignment.
 - 6. Install ridge and hip caps as metal roof panel work proceeds.
 - 7. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 - 8. Lap metal flashing over metal roof panels to allow moisture to run over and off the material.

B. Fasteners:

1. Steel Roof Panels: Use stainless-steel fasteners for surfaces exposed to the exterior and galvanized steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.

D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal roof panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal roof panel manufacturer.

1. Seal metal roof panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal roof panel manufacturer.

3.4 FIELD-ASSEMBLED METAL ROOF PANEL INSTALLATION

A. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended by manufacturer.

1. Install clips to supports with self-tapping fasteners.
2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
3. Form field-formed seam type system seams in the field with an automatic mechanical seamer approved by the manufacturer.

3.5 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal roof panel assembly including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
2. Details of installation which are not indicated must be in accordance with the SMACNA, panel manufacturer's approved printed instructions and details, or the approved shop drawings. Allow for expansion and contraction of flashing.

- B. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

3.6 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align metal roof panel units within installed tolerance of 6 mm in 6 m (1/4 inch in 20 feet) on slope and location lines as indicated and within 3 mm (1/8 inch) offset of adjoining faces and of alignment of matching profiles.

3.7 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal roof panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal roof panel installation, clean finished surfaces as recommended by metal roof panel manufacturer. Maintain in a clean condition during construction.
- B. Replace metal roof panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures at no additional expense to owner.

- - - E N D - - -

SECTION 07 60 00 FLASHING AND SHEET METAL

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Formed sheet metal work for wall and roof flashing, copings, roof edge metal, fasciae, drainage specialties, and formed expansion joint covers are specified in this section.

1.2 RELATED WORK

- A. Flashing components of factory finished roofing and wall systems: Division 07 roofing and wall system sections.
- B. Joint Sealants: Section 07 92 00, JOINT SEALANTS.
- C. Color of factory coated exterior architectural metal and anodized aluminum items: Section 09 06 00, SCHEDULE FOR FINISHES.
- D. Integral flashing components of manufactured roof specialties and accessories or equipment: Section 07 72 00, ROOF ACCESSORIES, Division 22, PLUMBING sections and Division 23 HVAC sections.
- E. Paint materials and application: Section 09 91 00, PAINTING.

1.3 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to 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. 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 Architectural Manufacturers Association (AAMA):
- | | |
|----------|---|
| AAMA 620 | High Performance Organic Coatings on Coil Coated Architectural Aluminum |
|----------|---|

- AAMA 621 High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) and Zinc-Aluminum Coated Steel Substrates
- D. American National Standards Institute/Single-Ply Roofing Institute (ANSI/SPRI):
- ANSI/SPRI ES-1-03 Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems
- E. ASTM International (ASTM):
- A167-99(R2009) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
- A653/A653M-09 Steel Sheet Zinc-Coated (Galvanized) or Zinc Alloy Coated (Galvanized) by the Hot-Dip Process
- B32-08 Solder Metal
- B209-10 Aluminum and Aluminum-Alloy Sheet and Plate
- B370-09 Copper Sheet and Strip for Building Construction
- D173-03 Bitumen-Saturated Cotton Fabrics Used in Roofing and Waterproofing
- D412-06 Vulcanized Rubber and Thermoplastic Elastomers-Tension
- D1187-97(R2002) Asphalt Base Emulsions for Use as Protective Coatings for Metal
- D3656-07 Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns
- D4586-07 Asphalt Roof Cement, Asbestos Free
- F. FM Approvals: RoofNav Approved Roofing Assemblies and Products:
- 1-49-09 Loss Prevention Data Sheet: Perimeter Flashing
- G. International Code Commission (ICC):
- International Building Code, Current Edition
- H. National Association of Architectural Metal Manufacturers (NAAMM):
- AMP 500-06 Metal Finishes Manual
- I. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
- Architectural Sheet Metal Manual 2012

1.4 PERFORMANCE REQUIREMENTS

- A. Wind Uplift Forces: Resist the following forces per FM Approvals 1-49:

1. Wind Zone 1: 0.48 to 0.96 kPa (10 to 20 lbf/sq. ft.): 1.92-kPa (40-lbf/sq. ft.) perimeter uplift force, 2.87-kPa (60-lbf/sq. ft.) corner uplift force, and 0.96-kPa (20-lbf/sq. ft.) outward force.
2. Wind Zone 1: 1.00 to 1.44 kPa (21 to 30 lbf/sq. ft.): 2.87-kPa (60-lbf/sq. ft.) perimeter uplift force, 4.31-kPa (90-lbf/sq. ft.) corner uplift force, and 1.44-kPa (30-lbf/sq. ft.) outward force.
3. Wind Zone 2: 1.48 to 2.15 kPa (31 to 45 lbf/sq. ft.): 4.31-kPa (90-lbf/sq. ft.) perimeter uplift force, 5.74-kPa (120-lbf/sq. ft.) corner uplift force, and 2.15-kPa (45-lbf/sq. ft.) outward force.
4. Wind Zone 3: 2.20 to 4.98 kPa (46 to 104 lbf/sq. ft.): 9.96-kPa (208-lbf/sq. ft.) perimeter uplift force, 14.94-kPa (312-lbf/sq. ft.) corner uplift force, and 4.98-kPa (104-lbf/sq. ft.) outward force.

1.5 SUSTAINABILITY REQUIREMENTS

- A. Materials in this section may contribute towards contract compliance with sustainability requirements. See Section 01 81 11, SUSTAINABLE DESIGN REQUIREMENTS, for project local/regional materials, recycled content requirements.

1.6 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. Gutter and Conductors.
 3. Expansion joints.
 4. Fascia-cant.
- C. Manufacturer's Literature and Data: For all specified items, including:
 1. Two-piece counterflashing.
 2. Thru wall flashing.
 3. Non-reinforced, elastomeric sheeting.
 4. Copper clad stainless steel.
 5. Polyethylene coated copper.
 6. Bituminous coated copper.
 7. Fascia-cant.

- D. Certificates: Indicating compliance with specified finishing requirements, from applicator and contractor.

1.7 PRE-INSTALLATION CONFERENCE

- A. Convene a meeting on site, after submittals are received and approved but before any work, to review drawings and specifications, submittals, schedule, manufacturer instructions, site logistics and pertinent matters of coordination, temporary protection, governing regulations, tests and inspections; participants to include COTR and all parties whose work is effected or related to the work of this section.

PART 2 - PRODUCTS

2.1 FLASHING AND SHEET METAL MATERIALS

- A. Stainless Steel: ASTM A167, Type 302B, dead soft temper.
- B. Copper ASTM B370, cold-rolled temper.
- C. Bituminous Coated Copper: Minimum copper ASTM B370, weight not less than 1 kg/m² (3 oz/sf); bituminous coating weight not less than 2 kg/m² (6 oz/sf); or, copper sheets may be bonded between two layers of coarsely woven bitumen-saturated cotton fabric ASTM D173. Provide crimped exposed fabric surface.
- D. Polyethylene Coated Copper: Copper sheet ASTM B370, weighing 1 Kg/m² (3 oz/sf) bonded between two layers of (two mil) thick polyethylene sheet.
- E. Aluminum Sheet: ASTM B209, Alloy 3003-H14 except alloy used for color anodized aluminum to be as required to produce specified color. Alloy required to produce specified color must have the same structural properties as Alloy 3003-H14.
- F. Galvanized Sheet: ASTM A653.
- G. Non-reinforced, Elastomeric Sheeting: Elastomeric substances reduced to thermoplastic state and extruded into continuous homogenous sheet (0.056 inch) thick.
 - 1. Tensile Strength: Minimum 7 MPa (1,000 psi) tensile strength and not more than seven percent tension-set at 50 percent elongation when tested in accordance with ASTM D412.
 - 2. No cracking or flaking when bent through 180 degrees over a 1 mm (1/32 inch) diameter mandrel and then bent at same point over same size mandrel in opposite direction through 360 degrees at temperature of -30°C (-20 °F).
- H. Self-Adhered Rubberized Asphalt/Polyethylene: Minimum 40 mil (1 mm) total thickness self-adhesive, cold applied flashing membrane consisting of 32 mils (0.8 mm) of rubberized asphalt integrally bonded to an 8 mil (0.2 mm) high density, cross

laminated polyethylene film faced with disposable silicone-coated release sheet.

Provide membrane in sufficient width for one-piece continuous application as indicated.

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: Sheathing paper, weighing minimum 141 g m²(3 lbs/100 sf).
- C. Bituminous Paint: ASTM D1187, Type I.
- D. Fasteners:
 - 1. Use copper, copper alloy, bronze, brass, or stainless steel for copper and copper clad stainless steel, and stainless steel for stainless steel and aluminum alloy. Use galvanized steel or stainless steel for galvanized steel.
 - 2. Nails:
 - a. Minimum diameter for copper nails: 3 mm (0.109 inch).
 - b. Minimum diameter for aluminum nails 3 mm (0.105 inch).
 - c. Minimum diameter for stainless steel nails: 2 mm (0.095 inch) and annular threaded.
 - d. Length to provide not less than 22 mm (7/8 inch) penetration into anchorage.
 - 3. Rivets: Not less than 3 mm (1/8 inch) diameter.
- E. Sealant: As specified in Section 07 92 00, JOINT SEALANTS for exterior locations.
- F. Insect Screening: ASTM D3656, 18 by 18 regular mesh.
- G. Roof Cement: ASTM D4586.

2.3 SHEET METAL THICKNESS

- A. Except as otherwise shown or specified use thickness or weight of sheet metal as follows:
- B. Concealed Locations (Built into Construction):
 - 1. Copper: 30g (10 oz) minimum 0.33 mm (0.013 inch thick).
 - 2. Stainless steel: 0.25 mm (0.010 inch) thick.
 - 3. Copper clad stainless steel: 0.25 mm (0.010 inch) thick.
 - 4. Galvanized steel: 0.5 mm (0.021 inch) thick.
- C. Exposed Locations:
 - 1. Copper: 0.4 Kg (16 oz).
 - 2. Stainless steel: 0.4 mm (0.015 inch).

3. Copper clad stainless steel: 0.4 mm (0.015 inch).

D. Thickness of aluminum or galvanized steel is specified with each item.

2.4 FABRICATION, GENERAL

A. Jointing:

1. Lock and solder copper, stainless steel and copper clad stainless steel joints, except expansion and contraction joints.
2. Jointing of copper over 0.5 Kg (20 oz) weight or stainless steel over 0.45 mm (0.018 inch) thick to be done by lapping, riveting and soldering.
3. Provide joints conforming to following requirements:
 - a. Finish flat-lock joints not less than 19 mm (3/4 inch) wide.
 - b. Finish lap joints subject to stress not less than 25 mm (one inch) wide; soldered and riveted.
 - c. Finish unsoldered lap joints not less than 100 mm (4 inches) wide.
4. Make flat and lap joints in direction of flow.
5. Edges of bituminous coated copper, non-reinforced elastomeric sheeting and polyethylene coated copper to be jointed by lapping not less than 100 mm (4 inches) in the direction of flow and cementing with asphalt roof cement or sealant as required by the manufacturer's printed instructions.
6. Soldering:
 - a. Pre tin both mating surfaces with solder for a width not less than 38 mm (1 1/2 inches) of uncoated copper, stainless steel, and copper clad stainless steel.
 - b. Wire brush to produce a bright surface before soldering lead coated copper.
 - c. Treat in accordance with metal producers recommendations other sheet metal required to be soldered.
 - d. Completely remove acid and flux after soldering is completed.

B. Expansion and Contraction Joints:

1. Fabricate in accordance with the Architectural Sheet Metal Manual recommendations for expansion and contraction of sheet metal work in continuous runs.
2. Space joints as shown or as specified.
3. Space expansion and contraction joints for copper, stainless steel, and copper clad stainless steel at intervals not exceeding 7200 mm (24 feet).
4. Space expansion and contraction joints for aluminum at intervals not exceeding 5400 mm (18 feet), except do not exceed 3000 mm (10 feet) for gravel stops and fascia-cant systems.

5. Fabricate slip-type or loose locked joints and fill with sealant unless otherwise specified.
6. Fabricate joint covers of same thickness material as sheet metal served.

C. Cleats:

1. Fabricate cleats to secure flashings and sheet metal work over 300 mm (12 inches) wide and where specified.
2. Provide cleats for maximum spacing of 300 mm (12 inch) centers unless specified otherwise.
3. Form cleats of same metal and weights or thickness as the sheet metal being installed unless specified otherwise.
4. Fabricate cleats from 50 mm (2 inch) wide strip. Form end with not less than 19 mm (3/4 inch) wide loose lock to item for anchorage. Form other end of length to receive nails free of item to be anchored and end edge to be folded over and cover nail heads.

D. Edge Strips or Continuous Cleats:

1. Fabricate continuous edge strips where shown and specified to secure loose edges of the sheet metal work.
2. Except as otherwise specified, fabricate edge strips of minimum 0.6 mm (0.024 inch) thick stainless steel or 1.25 mm (0.050 inch) thick aluminum.
3. Use material compatible with sheet metal to be secured by the edge strip.
4. Fabricate in 3000 mm (10 feet) maximum lengths with not less than 19 mm (3/4 inch) loose lock into metal secured by edge strip.
5. Fabricate Strips for fascia anchorage to extend below the supporting wood construction to form a drip and to allow the flashing to be hooked over the lower edge at least 19 mm (3/4-inch).
6. Fabricate anchor edge maximum width of 75 mm (3 inches) or of sufficient width to provide adequate bearing area to insure a rigid installation using 0.8 mm (0.031 inch) thick stainless steel or 1.6 mm (0.0625 inch) thick aluminum.

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. Turn up edges of flashings concealed in masonry joints and opposite drain side 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 must meet requirements of IBC, current edition.

G. Metal Options:

1. Where options are permitted for different metals use only one metal throughout.
2. Stainless steel may be used in concealed locations for fasteners of other metals exposed to view.

2.5 FINISHES

- A. Use same finish on adjacent metal or components and exposed metal surfaces unless specified or shown otherwise.
- B. In accordance with NAAMM Metal Finishes Manual AMP 500, unless otherwise specified.

2.6 THROUGH-WALL FLASHINGS

- A. Form through-wall flashing to provide a mechanical bond or key against lateral movement in all directions. Install a sheet having 2 mm (1/16 inch) deep transverse channels spaced four to every 25 mm (one inch), or ribbed diagonal pattern, or having other deformation unless specified otherwise.
 1. Fabricate in not less than 2400 mm (8 feet) lengths; 3000 mm (10 feet) maximum lengths.
 2. Fabricate so keying nests at overlaps.
- B. For Masonry Work When Concealed Except for Drip:
 1. Use copper, stainless steel, or copper clad stainless steel.
 2. Form an integral dam at least 5 mm (3/16 inch) high at back edge.
 3. Form exposed portions of flashing with drip, approximately 6 mm (1/4 inch) projection beyond wall face.
- C. For Masonry Work When Exposed Edge Forms a Receiver for Counter Flashing:
 1. Use same metal and thickness as counter flashing.
 2. Form an integral dam at least 5 mm (3/16 inch) high at back edge.

3. Form exposed portion as snap lock receiver for counter flashing upper edge.

D. Window Sill Flashing and Lintel Flashing:

1. Use copper, stainless steel, copper clad stainless steel plane flat sheet, or non-reinforced elastomeric sheeting, bituminous coated copper, copper covered paper, or polyethylene coated copper.
2. Fabricate flashing at ends with folded corners to turn up 5 mm (3/16 inch) in first vertical masonry joint beyond masonry opening.
3. Turn up back edge as shown.
4. Form exposed portion with drip as specified or receiver.

EF. Door Sill Flashing:

1. Where concealed, use 0.5 Kg (20 oz) copper, 0.5 mm (0.018 inch) thick stainless steel, or 0.5 mm (0.018 inch) thick copper clad stainless steel.
2. Where shown on drawings as combined counter flashing under threshold, sill plate, door sill, or where subject to foot traffic, use 0.6 Kg (24 ounce) copper, 0.6 mm (0.024 inch) stainless steel, or 0.6 mm (0.024 inch) thick stainless steel.
3. Fabricate flashing at ends to turn up 5 mm (3/16 inch) in first vertical masonry joint beyond masonry opening with folded corners.

2.7 COUNTERFLASHING (CAP FLASHING OR HOODS)

- A. Use 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 instead 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.

2.8 HANGING GUTTERS

A. Fabricate gutters of not less than the following:

1. 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. Provide building side of gutter 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 down approximately 19 mm (3/4 inch) unless shown otherwise.

E. Gutter Spacers:

1. Fabricate of same material and thickness as gutter.
2. Fabricate 25 mm (one inch) wide strap and fasten to gutters not over 900 mm (36 inches) on center.
3. Turn back edge up 25 mm (one inch) and lap front edge over gutter bead.
4. Rivet and solder to gutter except rivet and seal to aluminum.

F. Outlet Tubes:

1. Form outlet tubes to connect gutters to conductors of same metal and thickness as gutters extend into the conductor 75 mm (3 inch). Flange upper end of outlet tube 13 mm (1/2 inch).
2. Lock and solder longitudinal seam except use sealant instead of solder with aluminum.
3. Seal aluminum tube to gutter and rivet to gutter.
4. Fabricate basket strainers of same material as gutters.

G. Gutter Brackets:

1. Fabricate of same metal as gutter. Use the following:
 - a. 6 by 25 mm (1/4 by 1 inch) aluminum.
2. Fabricate to gutter profile.
3. Drill two 5 mm (3/16 inch) diameter holes in anchor leg for countersunk flat head screws.

2.9 CONDUCTORS (DOWNSPOUTS)

- A. Fabricate conductors of same metal and thickness as gutters in sections approximately 3000 mm (10 feet) long with 19 mm (3/4 inch) wide flat locked seams.
 1. Fabricate open face channel shape with hemmed longitudinal edges.
- B. Fabricate elbows by mitering, riveting, and soldering except seal aluminum instead of solder. Lap upper section to the inside, of the lower piece.
- C. Fabricate conductor brackets or hangers of same material as conductor, 2 mm (1/16 inch) thick by 25 mm (1 inch) minimum width. Form to support conductors 25 mm (one inch) from wall surface in accordance with Architectural Sheet Metal Manual Plate 34, Design C for rectangular shapes and E for round shapes.

2.10 REGLETS

- A. Fabricate reglets of one of the following materials:
 1. 0.4 Kg (16 ounce) copper.
 2. Stainless steel, not less than 0.3 mm (0.012 inch) thick.
 3. Plastic coated extruded aluminum, not less than 1.4 mm (0.055 inch) thick prefilled with butyl rubber sealer and complete with plastic wedges inserted at 1000 mm (40 inches) on centers.
- B. Fill open-type reglets with fiberboard or other suitable separator, to prevent crushing of the slot during installation.

- C. Fabricate reglets for building into horizontal masonry mortar joints not less than 19 mm (3/4 inch) deep, nor more than 25 mm (one inch) deep.
- D. Fabricate mitered corners, fittings, and special shapes as may be required by details.

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. Anchor sheet metal flashing and trim and other components of the work securely in place with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants and other miscellaneous items as required, to complete flashing and trim assemblies.
 - 3. Apply Sealant as specified in Section 07 92 00, JOINT SEALANTS.
 - 4. Apply sheet metal and other flashing material to surfaces which are smooth, sound, clean, dry and free from defects that might affect the application.
 - 5. 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.
 - 6. 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.
 - 7. 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.
 - 8. Confine direct nailing of sheet metal to strips 300 mm (12 inch) or less wide. Nail flashing along one edge only. Space nails not over 100 mm (4 inches) on center unless specified otherwise.
 - 9. 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.

10. Coordinate with roofing work for the installation of metal base flashings and other metal items having roof flanges for anchorage and watertight installation.
11. Nail continuous cleats on 75 mm (3 inch) on centers in two rows in a staggered position.
12. Nail individual cleats with two nails and bend end tab over nail heads. Lock other end of cleat into hemmed edge.
13. Install flashings in conjunction with other trades so that flashings are inserted in other materials and joined together to provide a water tight installation.
14. 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.
15. Isolate aluminum in contact with dissimilar metals other than stainless steel, white bronze or other metal compatible with aluminum by:
 - a. Paint dissimilar metal with a prime coat of zinc-chromate or other suitable primer, followed by two coats of aluminum paint.
 - b. Paint dissimilar metal with a coat of bituminous paint.
 - c. Apply an approved caulking material between aluminum and dissimilar metal.
16. Paint aluminum in contact with or built into mortar, concrete, plaster, or other masonry materials with a coat of bituminous paint.
17. Paint aluminum in contact with absorptive materials that may become repeatedly wet with two coats of bituminous paint or two coats of aluminum paint.

3.2 THROUGH-WALL FLASHING

A. General:

1. Install continuous through-wall flashing between top of concrete foundation walls and bottom of masonry building walls; at top of concrete floors; under masonry, concrete, or stone copings and elsewhere as shown.
2. Where exposed portions are used as a counterflashings, lap base flashings at least 100 mm (4 inches) and use thickness of metal as specified for exposed locations.
3. Exposed edge of flashing may be formed as a receiver for two piece counter flashing as specified.
4. Terminate exterior edge beyond face of wall approximately 6 mm (1/4 inch) with drip edge where not part of counter flashing.
5. Turn back edge up 6 mm (1/4 inch) unless noted otherwise where flashing terminates in mortar joint or hollow masonry unit joint.

6. Terminate interior raised edge in masonry backup unit approximately 38 mm (1 1/2 inch) into unit unless shown otherwise.
 7. Under copings terminate both edges beyond face of wall approximately 6 mm (1/4 inch) with drip edge.
 8. Lap end joints at least two corrugations, but not less than 100 mm (4 inches). Seal laps with sealant.
 9. Where dowels, reinforcing bars and fastening devices penetrate flashing, seal penetration with sealing compound. Sealing compound is specified in Section 07 92 00, JOINT SEALANTS.
 10. Coordinate with other work to set in a bed of mortar above and below flashing so that total thickness of the two layers of mortar and flashing are same as regular mortar joint.
 11. Where ends of flashing terminate turn ends up 25 mm (1 inch) and fold corners to form dam extending to wall face in vertical mortar or veneer joint.
 12. Turn flashing up not less than 200 mm (8 inch) between masonry or behind exterior veneer.
 13. When flashing terminates in reglet extend flashing full depth into reglet and secure with lead or plastic wedges spaced 150 mm (6 inch) on center.
 14. Continue flashing around columns:
 - a. Where flashing cannot be inserted in column reglet hold flashing vertical leg against column.
 - b. Counterflash top edge with 75 mm (3 inch) wide strip of saturated cotton unless shown otherwise. Secure cotton strip with roof cement to column. Lap base flashing with cotton strip 38 mm (1-1/2 inch).
- B. Flashing at 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 stud framing, hem top edge 19 mm (3/4 inch) and secure to each stud with stainless steel fasteners through sheathing.
 4. At concrete backing, extend flashing into reglet as specified.

5. Coordinate with installation of waterproofing or asphalt felt for lap over top of flashing.
- D. Lintel flashing when not part of shelf angle flashing:
1. Install flashing full length of lintel to nearest vertical joint in masonry over veneer.
 2. Turn ends up 25 mm (one inch) and fold corners to form dam and extend end to face of wall.
 3. Turn back edge up to top of lintel; terminate back edge as specified for back-up wall.
- E. Window Sill Flashing:
1. Install flashing to extend not less than 100 mm (4 inch) beyond ends of sill into vertical joint of masonry or veneer.
 2. Turn back edge up to terminate under window frame.
 3. Turn ends up 25 mm (one inch) and fold corners to form dam and extend to face of wall.
- F. 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 manufacturer's instructions.
 - b. Completely fill space at the top edge of receiver with sealant.
 3. Insert counter flashing in receiver in accordance with fabricator or manufacturer's instructions and to fit tight against base flashing.
- D. Where vented edge occur install so lower edge of counterflashing is against base flashing.
- E. When counter flashing is a component of other flashing install as shown.

3.5 REGLETS

- A. Install reglets in a manner to provide a watertight installation.
- B. Locate reglets not less than 225 mm (9 inch) nor more than 400 mm (16 inch) above roofing, and not less than 125 mm (5 inch) nor more than 325 mm (13 inch) above cant strip.
- C. Butt and align end joints or each section of reglet and securely hold in position until concrete or mortar are hardened:
 1. Coordinate reglets for anchorage into concrete with formwork construction.
 2. Coordinate reglets for masonry to locate horizontally into mortar joints.

3.6 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 fascia or wood nailer by at least two screws or nails.
 1. For aluminum gutters use aluminum brackets or stainless steel brackets.
 2. Use 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.

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SECTION 07 72 00 ROOF ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies roof hatches, aluminum downspout boots and precast concrete splashblocks.

1.2 RELATED WORK

- A. Sealant material and installation: Section 07 92 00, JOINT SEALANTS.
- B. General insulation: Section 07 21 13, THERMAL INSULATION.
- C. Rigid insulations for roofing: Section 07 22 00, ROOF AND DECK INSULATION.

1.3 QUALITY CONTROL

- A. All roof accessories to be the products of manufacturers regularly engaged in producing the kinds of products specified.
- B. Each accessory type to be the same and be 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: Indicate each item specified showing design, details of construction, installation and fastenings.
- C. Manufacturer's Literature and Data: Provide for each item specified.
- D. Certificates: State that aluminum has been given specified thickness of anodizing.

1.5 PRE-INSTALLATION CONFERENCE

- A. Convene a meeting on site, after submittals are received and approved but before any work, to review drawings and specifications, submittals, schedule, manufacturer instructions, site logistics and pertinent matters of coordination, temporary protection, governing regulations, tests and inspections; participants to include COTR and all parties whose work is effected or related to the work of this section.

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. American Architectural Manufacturers Association (AAMA):

2605-11	High Performance Organic Coatings on Architectural Extrusions and Panels
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C. American Society for Testing and Material (ASTM):

A653/A653M-11	Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) By the Hot-Dip Process
B209-10	Aluminum and Aluminum Alloy-Sheet and Plate
B221-13	Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

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

AMP 500 Series	Metal Finishes Manual
MGB 531	Metal Bar Grating Manual

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum, Extruded: ASTM B221/B221M.
- B. Aluminum Sheet: ASTM B209/B209M.
- C. Galvanized Sheet Steel: ASTM A653/A653M; G-90 coating.
- D. Metal Grating for Roof Walkway: NAAMM MBG 531.

2.2 ROOF HATCH (SCUTTLE)

- A. Basis of Design: Type S roof hatch, nominal 36 inch x 30 inch size, as manufactured by The Bilco Company; PO Box 1203, New Haven, CT 06505; (www.bilco.com); Phone: 203-934-6363; Fax: 203-933-8478; or approved equal.
- B. Fabricate from aluminum with mill finish.
- B. Curb and Cover:
 - 1. Exterior Facing: Minimum 2.3 mm (0.09 inch) thick sheet aluminum.
 - 2. Interior Facing: Minimum 1 mm (0.04 inch) thick sheet aluminum.
 - 3. Minimum of 25 mm (one inch) thick mineral fiber insulation between facings of cover and over exterior face of curb.
 - 4. Form exterior curb facing with an integral three inch wide roof flange and cap flashing minimum 2.3 mm (0.09 inch) thick sheet aluminum.

5. Make curb 300 mm (12 inches).
6. Form cover to lap curb and cap flashing.
7. Size opening as shown.

C. Hardware:

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

D. Assembly:

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

2.3 DOWNSPOUT BOOTS

- A. Basis of Design: Model No. B25C, minimum 36 inch length, as manufactured by Barry Pattern and Foundry Company, Inc. (www.barrycraft.com); 3333 35th Avenue North, Birmingham, AL 35207; Phone: 800-524-1809; Fax: 205-841-1972 or approved equal.
- B. Downspout booth size to be coordinated with building aluminum gutter and downspout sizes and with civil storm drainage collection system.
- C. Provide downspout boot at each downspout location indicated on Drawings.
- D. For select locations as identified on Drawings; adjust installed height of specified downspout boot to discharge onto precast concrete splashblock placed at grade.

2.4 PRECAST CONCRETE SPLASHBLOCK

- A. Basis of Design: 30 inch splashblock as manufactured by Modern Precast, Inc. 370 W 1550 S, Salt Lake City, UT 84115; (www.modernprecast.com); Phone: 801-466-1374; Fax: 801-466-1835 or approved equal.
- B. Precast concrete splashblock to be provided at select downspout location identified on Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install roof specialties where shown.
- B. Secure with fasteners in accordance with manufacture's printed installation instructions and approved shop drawings unless shown otherwise.
- C. Coordinate to install insulation where shown; see Section 07 21 13, THERMAL INSULATION and Section 07 22 00, ROOF AND DECK INSULATION.
- D. Comply with section 07 92 00, JOINT SEALANTS to install sealants where manufactures installation instructions require sealant.
- E. Coordinate with roofing work for installation of items in sequence to prevent water infiltration.
 - 1. After completion of base flashing, bend down cap flashing flange and secure to blocking with screws.
- F. Install cast aluminum downspout boots where indicated on Drawings and as recommended by cast aluminum downspout boot manufacturer. Provide appropriate anchors per building substrate at each location.
- G. Install precast concrete splashblocks where indicated on Drawings.

3.2 PROTECTION OF ALUMINUM

- A. Provide protection for aluminum against galvanic action wherever dissimilar materials are in contact, by painting the contact surfaces of the dissimilar material with two coats of asphalt coating (complete coverage), or by separating the contact surfaces with a preformed neoprene tape having pressure sensitive adhesive coating on side.

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 84 00 FIRESTOPPING

ART 1 - GENERAL

1.1 DESCRIPTION

- A. Tested and listed firestopping systems, combination of materials, or devices to form an effective barrier against the spread of flame, smoke and gases, and maintain the integrity of fire resistance rated walls, partitions, floors, and ceiling-floor assemblies, including through-penetrations and construction joints and gaps.
 - 1. Through-penetrations include the annular space around pipes, tubes, conduit, wires, cables and vents.
 - 2. Construction joints include those used to accommodate expansion, contraction, wind, or seismic movement; firestopping material cannot interfere with the required movement of the joint.
 - 3. Gaps requiring firestopping include gaps between the top of the fire-rated walls and the roof or floor deck above and at the intersection of shaft assemblies and adjoining fire resistance rated assemblies.
- B. Closure of openings in walls against penetration of gases or smoke in smoke partitions.

1.2 RELATED WORK

- A. Sealants and application: Section 07 92 00, JOINT SEALANTS.
- B. Fire and smoke damper assemblies in ductwork: Section 23 31 00, HVAC DUCTS AND CASINGS Section 23 37 00, AIR OUTLETS AND INLETS.

1.3 SUSTAINABILITY REQUIREMENTS

- A. Materials in this section may contribute towards contract compliance with sustainability requirements. See Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT, for project // local/regional materials, low-emitting materials, recycled content requirements.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submit detail drawings including manufacturer's descriptive data, typical details conforming to UL Fire Resistance or other details certified by another nationally recognized testing laboratory, installation instructions or UL listing details for a firestopping assembly instead of fire-test data or report. For those firestop applications for which no UL tested system is available through a manufacturer, submit a

manufacturer's engineering judgment, derived from similar UL system designs or other tests, for review and approval prior to installation. Submittal must indicate the firestopping material to be provided for each type of application; when more than a total of 5 penetrations and/or construction joints are to receive firestopping, provide drawings that indicate location, "F", "T" and "L" ratings, and type of application.

- C. Submit certificates attesting that firestopping material complies with the specified requirements. For all intumescent firestop materials used in through penetration systems, manufacturer must provide certification from UL of passing the "Aging and Environmental Exposure Testing" portion of UL 1479.
- D. Submit manufacturer's representative certification stating that firestopping work has been inspected and found to be applied according to the manufacturer's recommendations and the specified requirements. Manufacturer's representative must be a direct employee of the manufacturer (not a distributor or an agent) and be qualified to perform the specified inspections and certify the firestopping installation.

1.5 DELIVERY AND STORAGE

- A. Deliver materials in their original unopened containers with manufacturer's name and product identification.
- B. Store in a location providing protection from damage and exposure to the elements.

1.6 WARRANTY

- A. Firestopping work subject to the terms of the Article "Warranty of Construction", FAR clause 52.246-21, except extend the warranty period to five years.

1.7 QUALITY ASSURANCE

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

1.8 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. American Society for Testing and Materials (ASTM):
 - E84-12c Surface Burning Characteristics of Building Materials
 - E814-11a Fire Tests of Penetration Firestop Systems
 - E2174-10ae1 On-Site Inspection of Installed Fire Stops

E2393-10a

On-Site Inspection of Installed Fire Resistive Joint Systems
and Perimeter Fire Barriers

C. FM Global (FM):

Annual Issue Approval Guide Building Materials

D. Underwriters Laboratories, Inc. (UL):

Annual Issue Building Materials Directory

Annual Issue Fire Resistance Directory

1479 Fire Tests of Through-Penetration Firestops

E. Warnock Hersey (WH):

Annual Issue Certification Listings

1.9 SEQUENCING

- A. Coordinate the specified work with other trades.
- B. Apply firestopping materials, at penetrations of pipes and ducts, prior to insulating, unless insulation meets requirements specified for firestopping.
- C. Apply firestopping materials at building joints and construction gaps, prior to completion of enclosing walls or assemblies.
- D. Inspect and receive approval for firestop material prior to final completion and enclosing of any assemblies that may conceal installed firestop.

PART 2 - PRODUCTS

2.1 FIRESTOP SYSTEMS

- A. Use factory built (Firestop Devices) or field erected (through-Penetration Firestop Systems) to form a specific building system maintaining required integrity of the fire barrier and stop the passage of gases or smoke.
- B. Through-penetration firestop systems and firestop devices tested in accordance with ASTM E814 or UL 1479 using the "F" or "T" rating must maintain the same rating and integrity as the fire barrier being sealed. "T" ratings are not required for penetrations smaller than or equal to 100 mm (4 in) nominal pipe or 0.01 m² (16 sq. in.) in overall cross sectional area.
- C. Products requiring heat activation that seal an opening by its intumescence must exhibit a demonstrated ability to function as designed to maintain the fire barrier.
- D. Provide firestop sealants used for firestopping or smoke sealing with the following properties:
 - 1. Contain no flammable or toxic solvents.

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

2.2 SMOKE STOPPING IN SMOKE PARTITIONS

- A. Use silicone sealant in smoke partitions as specified in Section 07 92 00, JOINT SEALANTS.
- B. Use mineral fiber filler and bond breaker behind sealant.
- C. Sealants must have a maximum flame spread of 25 and smoke developed of 50 when tested in accordance with E84.
- D. When used in exposed areas capable of being sanded and finished with similar surface treatments as used on the surrounding wall or floor surface.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Submit product data and installation instructions, as required by article, submittals, after an on-site examination of areas to receive firestopping.

3.2 PREPARATION

- A. Remove dirt, grease, oil, loose materials, or other substances that prevent adherence and bonding or application of the firestopping or smoke stopping materials.

- B. Remove insulation on insulated pipe for a distance of 150 mm (6 inches) on either side of the fire rated assembly prior to applying the firestopping materials unless the firestopping materials are tested and approved for use on insulated pipes.

3.3 INSTALLATION

- A. Do not begin work until the specified material data and installation instructions of the proposed firestopping systems have been submitted and approved.
- B. Install firestopping systems with smoke stopping in accordance with FM, UL, WH, or other approved system details and installation instructions.
- C. Install smoke stopping seals in smoke partitions.

3.4 INSPECTIONS

- A. Manufacturer's technical representative to inspect all firestopping in accordance to ASTM standards for firestop inspection, and document inspection results; ASTM E2174 and E2393.

3.5 CLEAN-UP AND ACCEPTANCE OF WORK

- A. As work on each floor is completed, remove materials, litter, and debris.
- B. Do not move materials and equipment to the next-scheduled work area until completed work is inspected and accepted by the COTR; COTR inspection does not supersede requirement for inspection by manufacturer's representative or requirements of local jurisdiction.
- C. Clean up spills of liquid type materials.

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SECTION 07 92 00 JOINT SEALANTS

PART 1 - GENERAL

1.1 DESCRIPTION

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

1.2 RELATED WORK

- A. Firestopping penetrations: Section 07 84 00, FIRESTOPPING.
- B. Glazing: Section 08 80 00, GLAZING.
- C. Sound rated gypsum partitions/sound sealants: Section 09 29 00, GYPSUM BOARD.
- D. Mechanical Work: Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING//
Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM
GENERATION.

1.3 QUALITY CONTROL

- A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.
- C. Meet VOC requirements of pertinent CARB and/or SCAQMD Rule for sealants VOC (4 percent by weight VOC or less in less than 16 ounce package or less than 250 g/L in larger package). All non-porous sealant primers must be below 250g/L and primers for porous substrates less than 775 g/L.

1.4 SUSTAINABILITY REQUIREMENTS

- A. Materials in this section may contribute towards contract compliance with sustainability requirements. See Section 01 81 11, SUSTAINABLE DESIGN REQUIREMENTS, for project local/regional materials, low-emitting materials, recycled content requirements.
- B. Biobased Material: For products designated by the USDA's BioPreferred® program, provide products that meet or exceed USDA recommendations for biobased content, subject to the products compliance with performance requirements in this Section. For

more information regarding the product categories covered by the BioPreferred® program, visit <http://www.biopreferred.gov>.

1.5 SUBMITTALS

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

1.6 PRE-INSTALLATION CONFERENCE

- A. Convene a meeting on site, after submittals are received and approved but before any work, to review drawings and specifications, submittals, schedule, manufacturer instructions, site logistics and pertinent matters of coordination, temporary protection, governing regulations, tests and inspections; participants to include COTR and all parties whose work is effected or related to the work of this section.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations:
 - 1. Do not proceed with installation of joint sealants under following conditions:
 - a. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4 °C (40 °F).
 - b. When joint substrates are wet.
- B. Joint-Width Conditions: 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: Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.8 DELIVERY, HANDLING, AND STORAGE

- A. Deliver materials in manufacturers' original unopened containers, with brand names, date of manufacture, shelf life, and material designation clearly marked thereon.

- B. Carefully handle and store to prevent inclusion of foreign materials.
- C. Do not subject to materials to sustained temperatures less than 5° C (40° F) or exceeding 32° C (90° F).

1.9 DEFINITIONS

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

1.10 WARRANTY

- A. Warranty exterior sealing against leaks, adhesion, and cohesive failure, and subject to terms of "Warranty of Construction", FAR clause 52.246-21, except that warranty period to be extended to five (5) years.
- B. General Warranty: Special warranty specified in this Article will not deprive NCA of other rights NCA may have under other provisions of Contract Documents and are in addition to, and run concurrent with, other warranties made by Contractor under requirements of Contract Documents.

1.11 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. American Society for Testing and Materials (ASTM):
 - C612-10 Mineral Fiber Block and Board Thermal Insulation
 - C717-12b Standard Terminology of Building Seals and Sealants
 - C734-06(2012) Low Temperature Flexibility of Latex Sealants after Artificial Weathering
 - C834-10 Latex Sealants
 - C919-12 Use of Sealants in Acoustical Applications
 - C920-11 Elastomeric Joint Sealants
 - C1021-08 Laboratories Engaged in Testing of Building Sealants
 - C1193-13 Use of Joint Sealants
 - C1248-08(2012) Staining of Porous Substrate by Joint Sealants

C1330-02(2013)	Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants
D217-10	Cone Penetration of Lubricating Grease
D1056-07	Flexible Cellular Materials—Sponge or Expanded Rubber
E84-12c	Surface Burning Characteristics of Building Materials

- C. California Air Resources Board (CARB)
- D. South Coast Air Quality Management District (SCAQMD)
- E. Sealant, Waterproofing and Restoration Institute (SWRI):
The Professionals' Guide

PART 2 - PRODUCTS

2.1 SEALANTS

- A. S-1:
 - 1. ASTM C920, polyurethane.
 - 2. Type M.
 - 3. Class 25.
 - 4. Grade NS.
 - 5. Shore A hardness of 20-40.
- B. S-2:
 - 1. ASTM C920, polyurethane.
 - 2. Type M.
 - 3. Class 25.
 - 4. Grade P.
 - 5. Shore A hardness of 25-40.
- C. S-3:
 - 1. ASTM C920, polyurethane.
 - 2. Type S.
 - 3. Class 25, joint movement range of plus or minus 50 percent.
 - 4. Grade NS.
 - 5. Shore A hardness of 15-25.
 - 6. Minimum elongation of 700 percent.
- D. S-4:
 - 1. ASTM C920 polyurethane.
 - 2. Type S.

3. Class 25.
4. Grade NS.
5. Shore A hardness of 25-40.

E. S-5:

1. ASTM C920, polyurethane.
2. Type S.
3. Class 25.
4. Grade P.
5. Shore hardness of 15-45.

F. S-6:

1. ASTM C920, silicone, neutral cure.
2. Type S.
3. Class: Joint movement range of plus 100 percent to minus 50 percent.
4. Grade NS.
5. Shore A hardness of 15-20.

G. S-7:

1. ASTM C920, silicone, neutral cure.
2. Type S.
3. Class 25.
4. Grade NS.
5. Shore A hardness of 25-30.
6. Structural glazing application.

H. S-8:

1. ASTM C920, silicone, acetoxy cure.
2. Type S.
3. Class 25.
4. Grade NS.
5. Shore A hardness of 25-30.
6. Structural glazing application.

I. S-9:

1. ASTM C920 silicone.
2. Type S.
3. Class 25.
4. Grade NS.

5. Shore A hardness of 25-30.
6. Non-yellowing, mildew resistant.

J. S-10:

1. ASTM C920, coal tar extended fuel resistance polyurethane.
2. Type M/S.
3. Class 25.
4. Grade P/NS.
5. Shore A hardness of 15-20.

K. S-11:

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

L. S-12:

1. ASTM C920, polyurethane.
2. Type M/S.
3. Class 25, joint movement range of plus or minus 50 percent.
4. Grade P/NS.
5. Shore A hardness of 25 to 50.

2.2 CAULKING COMPOUND

- A. C-1: ASTM C834, acrylic latex.
- B. C-2: Polymer-based acoustical sealant conforming to ASTM C919 must have a flame spread of 25 or less and a smoke developed rating of 50 or less when tested in accordance with ASTM E84. Acoustical sealant must have a consistency of 250 to 310 when tested in accordance with ASTM D217, and must remain flexible and adhesive after 500 hours of accelerated weathering as specified in ASTM C734, and must be non-staining.

2.3 COLOR

- A. Match color of mortar joints at exposed masonry.
- B. Match color of adjacent concrete at unpainted concrete.
- C. Provide light gray or aluminum, unless specified otherwise, for other locations.
- D. Provide light gray or white caulking, unless specified otherwise for selected locations.

2.4 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material and type that are non-staining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
 - 1. Type C: Closed-cell material with a surface skin.
- C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 32° C (minus 26° F). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.
- D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.5 FILLER

- A. Mineral fiber board: ASTM C612, Type IVA.
- B. Thickness same as joint width.
- C. Depth to fill void completely behind back-up rod.

2.6 PRIMER

- A. As recommended by manufacturer of caulking or sealant material.
- B. Stain free type.

2.7 CLEANERS-NON POURIOUS SURFACES

- A. Chemical cleaners acceptable to manufacturer of sealants and sealant backing material, free of oily residues and other substances capable of staining or harming joint substrates and adjacent non-porous surfaces and formulated to promote adhesion of sealant and substrates.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Inspect substrate surface for bond breaker contamination and unsound materials at adherent faces of sealant.
- B. Coordinate for repair and resolution of unsound substrate materials.
- C. Inspect for uniform joint widths and that dimensions are within tolerance established by sealant manufacturer.

3.2 PREPARATIONS

- A. Prepare joints in accordance with manufacturer's instructions and as specified only when installers are ready to initiate sealant application as soon as practicable after preparation and before subsequent surface deterioration.
- B. Clean surfaces of joint to receive caulking or sealants leaving joint dry to the touch, free from frost, moisture, grease, oil, wax, lacquer paint, or other foreign matter that would tend to destroy or impair adhesion.
 - 1. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants.
 - 2. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air. Porous joint surfaces include the following:
 - a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
 - 3. Remove laitance and form-release agents from concrete.
 - 4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
 - a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.
- C. Do not cut or damage joint edges.

- D. Apply masking tape to face of surfaces adjacent to joints before applying primers, caulking, or sealing compounds.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- E. Apply primer to sides of joints wherever required by compound manufacturer's printed instructions.
 - 1. Apply primer prior to installation of back-up rod or bond breaker tape.
 - 2. Use brush or other approved means that will reach all parts of joints.
- F. Take all necessary steps to prevent three sided adhesion of sealants.

3.3 BACKING INSTALLATION

- A. Install back-up material, to form joints enclosed on three sides as required for specified depth of sealant.
- B. Where deep joints occur, install filler to fill space behind the back-up rod and position the rod at proper depth.
- C. Cut fillers installed by others to proper depth for installation of back-up rod and sealants.
- D. Install back-up rod, without puncturing the material, to a uniform depth, within plus or minus 3 mm (1/8 inch) for sealant depths specified.
- E. Where space for back-up rod does not exist, install bond breaker tape strip at bottom (or back) of joint so sealant bonds only to two opposing surfaces.
- F. Take all necessary steps to prevent three sided adhesion of sealants.

3.4 SEALANT DEPTHS AND GEOMETRY

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

3.5 INSTALLATION

- A. General:
 - 1. Comply with manufacturer's written installation instructions for products and applications indicated.
- B. For application of sealants, follow requirements of ASTM C1193 unless specified otherwise.

- C. Where gypsum board partitions are of sound rated, fire rated, or smoke barrier construction, follow requirements of ASTM C919 only to seal all cut-outs and intersections with the adjoining construction unless specified otherwise.
1. Apply a 6 mm (1/4 inch) minimum bead of sealant each side of runners (tracks), including those used at partition intersections with dissimilar wall construction.
 2. Coordinate with application of gypsum board to install sealant immediately prior to application of gypsum board.
 3. Partition intersections: Seal edges of face layer of gypsum board abutting intersecting partitions, before taping and finishing or application of veneer plaster-joint reinforcing.
 4. Openings: Apply a 6 mm (1/4 inch) bead of sealant around all cut-outs to seal openings of electrical boxes, ducts, pipes and similar penetrations. To seal electrical boxes, seal sides and backs.
 5. Control Joints: Before control joints are installed, apply sealant in back of control joint to reduce flanking path for sound through control joint.

3.6 CLEANING

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

3.7 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.8 LOCATIONS

- A. Exterior Building Joints, Horizontal and Vertical:
 1. Metal to Metal: Type S-6, S-7.
 2. Metal to Masonry or Stone: Type S-1.
 3. Masonry to Masonry or Stone: Type S-1.
 4. Stone to Stone: Type S-1.

5. Cast Stone to Cast Stone: Type S-1.
 6. Threshold Setting Bed: Type S-1, S-3, S-4.
 7. Masonry Expansion and Control Joints: Type S-6.
 8. Wood to Masonry: Type S-1.
- B. Metal Reglets and Flashings:
1. Flashings to Wall: Type S-6.
 2. Metal to Metal: Type S-6.
- C. Sanitary Joints:
1. Walls to Plumbing Fixtures: Type S-9.
 2. Counter Tops to Walls: Type S-9.
 3. Pipe Penetrations: Type S-9.
- D. Horizontal Traffic Joints:
1. Concrete Paving, Unit Pavers: Type S-11 or S-12.
- E. Interior Caulking:
1. Typical Narrow Joint 6 mm, (1/4 inch) or less at Walls and Adjacent Components:
Types C-1, C-2 and C-3.
 2. Perimeter of Doors, Windows, Access Panels which Adjoin Concrete or Masonry
Surfaces: Types C-1, C-2 and C-3.
 3. Joints at Masonry Walls and Columns, Piers, Concrete Walls or Exterior Walls:
Types C-1, C-2 and C-3.
 4. Exposed Isolation Joints at Top of Full Height Walls: Types C-1, C-2 and C-3.
 5. Exposed Acoustical Joint at Sound Rated Partitions: Type C-2.
 6. Concealed Acoustic Sealant Type: S-4, C-1, C-2 and C-3.

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SECTION 08 11 13 HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies steel doors, steel frames and related components.
- B. Terms relating to steel doors and frames as defined in ANSI/SDI A250.7 and as specified.

1.2 RELATED WORK

- A. Overhead doors including loading docks: Section 08 33 00, COILING DOORS AND GRILLES.
- B. Door Hardware: Section 08 71 00, DOOR HARDWARE.

1.3 TESTING

- A. Perform testing with an independent testing laboratory.

1.4 SUSTAINABILITY REQUIREMENTS

- A. Materials in this section may contribute towards contract compliance with sustainability requirements. See Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT, for project local/regional materials, recycled content requirements.
- B. Biobased Material: For products designated by the USDA's BioPreferred® program, provide products that meet or exceed USDA recommendations for biobased content, subject to the products compliance with performance requirements in this Section. For more information regarding the product categories covered by the BioPreferred® program, visit <http://www.biopreferred.gov>.

1.5 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturers Literature and Data:
 - 1. Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced grade standard.
 - 2. Fire rated doors and frames, showing conformance with NFPA 80 and Underwriters Laboratory, Inc., or Intertek Testing Services or Factory Mutual fire rating requirements.

- C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and identifying location of different finishes, if any.
- D. Schedule: Provide a schedule prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on drawings; coordinate with final door hardware schedule.

1.6 SHIPMENT

- A. Prior to shipment label each door and frame to show location, size, door swing and other pertinent information.
- B. Fasten temporary steel spreaders across the bottom of each door frame.

1.7 STORAGE AND HANDLING

- A. Store doors and frames at the site under cover.
- B. Protect from rust and damage during storage and erection until completion.

1.8 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. American Society for Testing and Materials (ASTM):
 - A653/A653M-11 Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - A1008/A1008M-12a Steel, sheet, Cold-Rolled, Carbon, Structural, High Strength Low Alloy and High Strength Low Alloy with Improved Formability, Solution Hardened, and Bake Hardened
 - C665-12 Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
 - E136-12 Behavior of Materials in a Vertical Tube Furnace at 750 degrees C
- C. Builders Hardware Manufacturers Association (BHMA):
 - ANSI/BHMA A156.115-06 American National Standard for Hardware Preparation in Steel Doors and Steel Frames
- D. FM Global:
 - Approval Guide
- E. Intertek Testing Services (ITS):

Certifications Listings	Latest Edition
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F. National Fire Protection Association (NFPA):

80-10	Fire Doors and Fire Windows
105-13	Standard for the Installation of Smoke Door Assemblies and Other Opening Protectives.

G. Steel Door Institute (SDI):

ANSI/SDI A250.6-03(R09)	Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames
ANSI/SDI A250.7-1997	Nomenclature for Standard Steel Doors and Steel Frames
ANSI/SDI A250.8-03(R08)	Recommended Specifications for Standard Steel Doors and Frames
ANSI/SDI A250.11-2012	Recommended Erection Instructions for Steel Frames

H. Underwriters Laboratories, Inc. (UL):

Fire Resistance Directory

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Metallic-Coated Steel Sheet: ASTM A653, Commercial Steel (CS), Type B.
- B. Sheet Steel: ASTM A1008, cold-rolled for panels (face sheets) of doors.
- C. Anchors, Fastenings and Accessories: Fastenings anchors, clips connecting members and sleeves from zinc coated steel.
- D. Prime Paint: Paint that meets or exceeds the requirements of A250.8.
- E. Grout: Portland cement grout of maximum 4-inch slump for hand troweling; thinner pumpable grout is prohibited.
- F. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat; provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- G. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.

2.2 FABRICATION GENERAL

A. General:

- 1. Follow ANSI A250.8 for fabrication of steel doors, except as specified otherwise.
Doors to receive hardware specified in Section 08 71 00, DOOR HARDWARE.

Tolerances must comply to SDI A250.8. Thickness, 44 mm (1-3/4 inches), unless otherwise shown.

2. Close top edge of exterior doors flush and seal to prevent water intrusion.
3. When vertical steel stiffeners are used for core construction, fill spaces between stiffeners with mineral fiber insulation.

B. Smoke Doors and Frames:

1. Close top and vertical edges flush.
2. Provide seamless vertical edges.
3. Provide clearance at head, jamb and sill as specified in NFPA 80.

C. Fire Rated Doors and Frames (Labeled):

1. Conform to NFPA 80 when tested by Underwriters Laboratories, Inc., Inchcape Testing Services, or Factory Mutual for the class of door or door opening shown.
2. Permanently attach metal fire rated labels to doors, with raised or incised markings of approving laboratory.

2.3 CLASSIFICATION AND PERFORMANCE

A. Standard Duty Doors: ANSI/SDI A250.8, Level 1, physical performance Level C, Model 2, of size(s) and design(s) indicated and core construction as required by the manufacturer.

1. Provide at all typical interior locations not covered in B below.

B. Heavy Duty Doors: ANSI/SDI A250.8, Level 2, physical performance Level B, Model 2, with core construction as required by the manufacturer/ for interior doors and for exterior doors, of size(s) and design(s) indicated.

1. Where vertical stiffener cores are required, the space between the stiffeners to be filled with mineral board insulation.
2. Provide Level 2 at all typical exterior locations and interior locations where adjoining spaces serve maintenance or service functions.

C. Extra Heavy Duty Doors: ANSI/SDI A250.8, Level 3, physical performance Level A, Model 2 with core construction as required by the manufacturer for interior doors and for indicated exterior doors, of size(s) and design(s) indicated.

1. Where vertical stiffener cores are required, the space between the stiffeners to be filled with mineral board insulation.
2. Provide Level 3 where indicated.

D. Maximum Duty Doors: ANSI/SDI A250.8, Level 4, physical performance Level A, Model 2 with core construction as required by the manufacturer for interior doors and for indicated exterior doors, of size(s) and design(s) indicated.

1. Where vertical stiffener cores are required, the space between the stiffeners to be filled with mineral board insulation.
2. Provide Level 4 where indicated.

2.4 METAL FRAMES

A. General: SDI Level 2, formed frames to sizes and shapes indicated.

1. Frames for Labeled Fire Rated Doors:
 - a. Comply with NFPA 80; tested by Underwriters Laboratories, Inc., Intertek Testing Services, or Factory Mutual.
 - b. Fire rated labels of approving laboratory permanently attached to frames as evidence of conformance with these requirements. Provide labels of metal or engraved stamp, with raised or incised markings.
2. Type: Continuously weld frame faces at corner joints. Mechanically interlock or continuously weld stops and rabbets; grind welds smooth.

B. Reinforcement and Covers:

1. ANSI/SDI A250.8 for, minimum thickness of steel reinforcement welded to back of frames.
2. Provide mortar guards securely fastened to back of hardware reinforcements.
3. Comply with applicable requirements in ANSI/SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

C. Glazed Openings and Panel Opening:

1. Integral stop on exterior, corridor, or secure side of door.
2. Design rabbet width and depth to receive glazing material or panel shown or specified.

D. Anchors: Provide anchors to secure the frame to adjoining construction; steel anchors, zinc-coated or painted with rust-inhibitive paint, not lighter than 1.2 mm thick (18 gage).

1. Wall Anchors: Provide at least three anchors for each jamb. For frames which are more than 2285 mm (7.5 feet) in height, provide one additional anchor for each jamb for each additional 760 mm (2.5 feet) or fraction thereof.
 - a. Masonry: Provide anchors of corrugated or perforated steel straps or 5 mm (3/16 inch) diameter steel wire; adjustable or T-shaped.

- b. Stud partitions: Weld or otherwise securely fasten anchors to backs of frames.
Design anchors to be fastened to closed steel studs with sheet metal screws,
and to open steel studs by wiring or welding.
- 2. Floor Anchors: Provide floor anchors drilled for 10 mm (3/8 inch) anchor bolts at
bottom of each jamb member.

2.5 TRANSOM PANELS

- A. Fabricate panels as specified for flush doors.
- B. Fabricate bottom edge with rabbet stop to fit top of door where no transom bar occurs.

2.6 LOUVERS

- A. Interior Louvers: Stationary, sightproof, and lightproof // type
 - 1. Provide detachable moldings on room or non-security side of door; on security side
of door, moldings to be integral part of louver.
 - 2. Form louver frames of 0.9 mm thick (20 gage) steel and louver blades of a minimum
0.6 mm (24 gage).
- B. Exterior Louvers: Inverted "Y" type with minimum of 35 percent net-free opening.
 - 1. Weld or tenon louver blades to continuous channel frame and weld assembly to door
to form watertight assembly.
 - 2. Form louvers of hot-dip galvanized steel of same gage as door facings.
 - 3. Provide louvers with steel-framed insect screens secured to room side and readily
removable. Provide aluminum wire cloth, 7 by 7 per 10 mm or 7 by 6 per 10 mm (18
by 18 or 18 by 16 inch) mesh, for insect screens. Determine net-free louver area
before screening.

2.7 HARDWARE PREPARATION

- A. Provide minimum hardware reinforcing gages as specified in SDI A250.6.
- B. Drill and tap doors and frames to receive finish hardware.
- C. Prepare doors and frames for hardware in accordance with the applicable requirements
of SDI A250.8 and SDI A250.6; for additional requirements refer to ANSI/BHMA
A156.115.
- D. Drill and tap for surface-applied hardware at the project site.
- E. Build additional reinforcing for surface-applied hardware into the door at the factory.
- F. Punch door frames, with the exception of frames that will have weatherstripping or
gasketing, to receive a minimum of two rubber or vinyl door silencers on lock side of
single doors and one silencer for each leaf at heads of double doors; set lock strikes out
to provide clearance for silencers.

2.8 SHOP PAINTING

- A. ANSI/SDI A250.8.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Plumb, align and brace frames securely until permanent anchors are set, in accordance with SDI A250.11.
1. Use triangular bracing near each corner on both sides of frames with temporary wood spreaders at midpoint.
 2. Use wood spreaders at bottom of frame if the shipping spreader is removed.
 3. Protect frame from accidental abuse.
 4. Where construction will permit concealment, leave the shipping spreaders in place after installation, otherwise remove the spreaders after the frames are set and anchored.
 5. Remove wood spreaders and braces only after the walls are built and jamb anchors are secured.
- B. Floor Anchors:
1. Anchor the bottom of door frames to floor with two 6 mm (1/4 inch) diameter expansion bolts.
 2. Power actuated drive pins may be used to secure frame anchors to concrete floors.
- C. Jamb Anchors:
1. Anchors in Masonry Walls: Embed anchors in mortar. Fill space between frame and masonry wall with grout or mortar as walls are built.
 2. Coat frame back with a bituminous coating prior to lining of grout filling in masonry walls. Solidly pack mineral-fiber insulation inside frames in stud partitions.
 3. Secure anchors to sides of studs with two fasteners through anchor tabs. Use steel drill screws to steel studs.
 4. Frames set in prepared openings of masonry or concrete: Expansion bolt to wall with 6 mm (1/4 inch) expansion bolts through spacers. Where sub-frames or rough bucks are used, 6 mm (1/4 inch) expansion bolts on 600 mm (24 inch) centers or power activated drive pins 600 mm (24 inches) on centers. Secure two piece frames to sub-frame or rough buck with machine screws on both faces.
- D. Install anchors for labeled fire rated doors to provide rating as required.
- E. Hang doors in accordance with clearances specified in SDI/DOOR A250.8.
- F. Install fire doors and frames, including hardware, in accordance with NFPA 80.

- G. Install fire rated and frames in accordance with NFPA 80.

3.2 INSTALLATION OF HARDWARE

- A. Install hardware as specified in this Section and Section 08 71 00, DOOR HARDWARE.
- B. After erection and glazing, clean and adjust hardware.

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