

## SECTION 05 05 23.16

## STRUCTURAL WELDING

**08/18**

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 360 (2016) Specification for Structural Steel Buildings

## AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTING (ASNT)

ANSI/ASNT CP-189 (2016) ASNT Standard for Qualification and Certification of Nondestructive Testing Personnel (ANSI/ASNT CP-105-2006)

## AMERICAN WELDING SOCIETY (AWS)

AWS A2.4 (2012) Standard Symbols for Welding, Brazing and Nondestructive Examination

AWS D1.1/D1.1M (2020) Structural Welding Code - Steel

AWS D1.3/D1.3M (2018) Structural Welding Code - Sheet Steel

AWS D1.4/D1.4M (2011) Structural Welding Code - Reinforcing Steel

AWS D1.8/D1.8M (2016) Structural Welding Code-Seismic Supplement

AWS D14.4/D14.4M (2012) Specification for Welded Joints for Machinery and Equipment

AWS QC1 (2016) Specification for AWS Certification of Welding Inspectors

AWS Z49.1 (2012) Safety in Welding and Cutting and Allied Processes

## ASTM INTERNATIONAL (ASTM)

ASTM E165/E165M (2018) Standard Practice for Liquid Penetrant Examination for General Industry

ASTM E709 (2015) Standard Guide for Magnetic Particle Examination

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

### SD-01 Preconstruction Submittals

Welding Quality Assurance Plan; G[, [\_\_\_\_\_]]

### SD-03 Product Data

Welding Procedure Qualifications; G[, [\_\_\_\_\_]]

Welder, Welding Operator, and Tacker Qualification

Previous Qualifications

Pre-Qualified Procedures; G[, [\_\_\_\_\_]]

Welding Electrodes and Rods

### SD-06 Test Reports

Nondestructive Testing

Weld Inspection Log

### SD-07 Certificates

Certified Welding Procedure Specifications (WPS)

Certified Brazing Procedure Specifications (BPS)

Certified Procedure Qualification Records (PQR)

Certified Welder Performance Qualifications (WPQ)

Certified Brazer Performance Qualifications (BPQ)

Certified Welding Inspector

Nondestructive Testing Personnel

## 1.3 QUALITY ASSURANCE

Except for pre-qualified (in accordance with AWS D1.1/D1.1M) and previously qualified procedures, each Contractor performing welding must record in detail and qualify the welding procedure specification for any welding procedure followed in the fabrication of weldments. Conform welding procedure qualifications to AWS D1.1/D1.1M[, AWS D1.8/D1.8M] and to the specifications in this section. Submit for approval copies of the welding procedure specification and the procedure qualification records for each type of welding being performed. Submission of the welder, welding operator, or tacker qualification test records is also required. Approval of any procedure, however, does not relieve the Contractor of the



sole responsibility for producing a finished structure meeting all the specified requirements. Submit this information on the forms in Annex M of AWS D1.1/D1.1M. Individually identify and clearly reference on the detail drawings and erection drawings all welding procedure specifications, or suitably key them to the contract drawings. In case of conflict between this specification and AWS D1.1/D1.1M, this specification governs.

#### 1.3.1 General Requirements

Fabricate work in an AISC Certified Fabrication Plant, Category BU. Erect work by an AISC Certified Erector, Category CSE.

a. For Structural Projects, provide documentation of the following:

- (1) Component Thickness 1/8 inch and greater: Qualification documents (WPS, PQR, and WPQ) in accordance with AWS D1.1/D1.1M[and AWS D1.8/D1.8M].
- (2) Component Thickness Less than 1/8 inch: Qualification documents (WPS, PQR, and WPQ) in accordance with AWS D1.3/D1.3M.
- (3) Reinforcing Steel: Qualification documents (WPS, PQR, and WPQ) in accordance with AWS D1.4/D1.4M.

b. For other applications, provide documentation of the following:

- (1) Submit [two] [\_\_\_\_\_] copies of the Certified Welding Procedure Specifications (WPS), Certified Brazing Procedure Specifications (BPS) and Certified Procedure Qualification Records (PQR) to the Contracting Officer for [approval] [review].
- (2) Submit [two] [\_\_\_\_\_] copies of the Certified Welder Performance Qualifications (WPQ) and Certified Brazer Performance Qualifications (BPQ) to the Contracting Officer for [approval] [review] within [fifteen] [\_\_\_\_\_] calendar days prior to any employee welding on the project material.
- (3) Machinery: Qualification documents (WPS, PQR, and WPQ) in accordance with AWS D14.4/D14.4M.

#### 1.3.2 Previous Qualifications

Welding procedures previously qualified by test in accordance with AWS D1.1/D1.1M, may be accepted for this contract without re-qualification, upon receipt of the test results, if the following conditions are met:

- a. Testing was performed by an approved testing laboratory, technical consultant, or the Contractor's approved quality control organization.
- b. The qualified welding procedure conforms to the requirements of this specification and is applicable to welding conditions encountered under this contract.
- c. The welder, welding operator, and tacker qualification tests conform to the requirements of this specification and are applicable to welding conditions encountered under this contract.

### 1.3.3 Pre-qualified Procedures

[Welding procedures which are considered pre-qualified as specified in AWS D1.1/D1.1M will be accepted without further qualification. Submit for approval a listing or an annotated drawing to indicate the joints not pre-qualified. Procedure qualification is mandatory for these joints.] [No pre-qualified welding procedures are allowed. Qualify the welding procedures and welders by tests prescribed in the applicable code or specification not withstanding the fact the code or specification may allow pre-qualified procedures.]

### 1.3.4 Welder, Welding Operator, and Tacker Qualification

Each welder, welding operator, and tacker assigned to work on this contract must be qualified in accordance with the applicable requirements of AWS D1.1/D1.1M[, AWS D1.8/D1.8M] and as specified in this section. Welders, welding operators, and tackers who make acceptable procedure qualification test welds will be considered qualified for the welding procedure used within the applicable essential variables for welder qualification.

#### 1.3.4.1 Previous Personnel Qualifications

At the discretion of the Contracting Officer, welders, welding operators, and tackers qualified by test within the previous 6 months may be accepted for this contract without re-qualification if all the following conditions are met:

- a. Copies of the welding procedure specifications, the procedure qualification test records, and the welder, welding operator, and tacker qualification test records are submitted and approved in accordance with the specified requirements for detail drawings.
- b. Testing was performed by an approved testing laboratory, technical consultant, or the Contractor's approved quality control organization.
- c. The welder, welding operator, and tacker qualification tests conform to the requirements of this specification and are applicable to welding conditions encountered under this contract.

#### 1.3.4.2 Certificates

Before assigning any welder, welding operator, or tacker to work under this contract, submit the names and certification that each individual is qualified as specified. State in the certification the type of welding and positions for which the welder, welding operator, or tacker is qualified, the code and procedure under which the individual is qualified, the date qualified, and the name of the firm and person certifying the qualification tests. Keep the certification current, on file, and furnish 3 copies.

#### 1.3.4.3 Renewal of Qualification

Re-qualification of a welder or welding operator is required under any of the following conditions:

- a. It has been more than 6 months since the welder or welding operator has used the specific welding process for which he is qualified.

- b. There is specific reason to question the welder or welding operator's ability to make welds that meet the requirements of these specifications.
- c. The welder or welding operator was qualified by an employer other than those firms performing work under this contract, and a qualification test has not been taken within the past 12 months. Submit as evidence of conformance all records showing periods of employment, name of employer where welder, or welding operator, was last employed, and the process for which qualified.
- d. A tacker who passes the qualification test is considered eligible to perform tack welding indefinitely in the positions and with the processes for which he/she is qualified, unless there is some specific reason to question the tacker's ability or there has been a gap greater than 6 months since he/she last used the process. In such a case, the tacker is required to pass the prescribed tack welding test.

#### 1.3.5 Inspector Qualification

Submit certificates indicating that [certified welding inspectors](#) meet the requirements of [AWS QC1](#). Submit qualifications for [nondestructive testing personnel](#) in accordance with the requirements of [ANSI/ASNT CP-189](#) for Levels I or II in the applicable nondestructive testing method. Level I inspectors must have direct supervision of a Level II inspector.

#### 1.3.6 Symbols and Safety

Use symbols in accordance with [AWS A2.4](#), unless otherwise indicated. Follow safe welding practices and safety precautions during welding in conformance with [AWS Z49.1](#).

### PART 2 PRODUCTS

#### 2.1 SYSTEM DESCRIPTION

Conform the design of welded connections to [AISC 360](#), unless otherwise indicated or specified. Material with welds will not be accepted unless the welding is specified or indicated on the drawings or otherwise approved. Perform welding as specified in this section, except where additional requirements are shown on the drawings or are specified in other sections. Do not commence welding until welding procedures, inspectors, nondestructive testing personnel, welders, welding operators, and tackers have been qualified and the submittals approved by the Contracting Officer. Perform all testing at or near the work site. Maintain records of the test results obtained in welding procedure, welder, welding operator, and tacker performance qualifications.

##### 2.1.1 Pre-erection Conference

Hold a pre-erection conference prior to the start of the field welding, to bring all affected parties together and to gain a naturally clear understanding of the project and the Welding Procedure Specifications (WPS) (submitted for all welding, including welding done using pre-qualified procedures). Mandatory attendance is required by all Contractor's welding production and inspection personnel and appropriate Government personnel. Include as items for discussion: responsibilities of various parties; welding procedures and processes to be followed; welding sequence (both within a joint and joint sequence within the

building); inspection requirements and procedures, both visual and nondestructive testing; welding schedule; and other items deemed necessary by the attendees.

## 2.2 WELDING EQUIPMENT AND MATERIALS

Provide all welding equipment, welding electrodes and rods, welding wire, and fluxes capable of producing satisfactory welds when used by a qualified welder or welding operator. [Use [\_\_\_\_\_] welding electrodes.] [Perform welding using the [\_\_\_\_\_] process.] Provide welding equipment and materials that comply with the applicable requirements of AWS D1.1/D1.1M[ and AWS D1.8/D1.8M]. Submit product data on welding electrodes and rods.

## PART 3 EXECUTION

### 3.1 WELDING OPERATIONS

#### 3.1.1 Requirements

Conform workmanship and techniques for welded construction to the requirements of AWS D1.1/D1.1M[, AWS D1.8/D1.8M] and AISC 360. When AWS D1.1/D1.1M[, AWS D1.8/D1.8M] and the AISC 360 specification conflict, the requirements of AWS D1.1/D1.1M[, AWS D1.8/D1.8M] govern.

#### 3.1.2 Identification

Identify all welds in one of the following ways:

- a. Submit written records to indicate the location of welds made by each welder, welding operator, or tacker.
- b. Identify all work performed by each welder, welding operator, or tacker with an assigned number, letter, or symbol to identify welds made by that individual. The Contracting Officer may require welders, welding operators, and tackers to apply their symbol next to the weld by means of rubber stamp, felt-tipped marker with waterproof ink, or other methods that do not cause an indentation in the metal. Place the identification mark for seam welds adjacent to the weld at 3 foot intervals. Identification with die stamps or electric etchers is not allowed.

### 3.2 QUALITY CONTROL

Perform testing using an approved inspection or testing laboratory or technical consultant; or if approved, the Contractor's inspection and testing personnel may be used instead of the commercial inspection or testing laboratory or technical consultant. A Certified Welding Inspector must perform visual inspection on 100 percent of all welds. Document this inspection in the Visual Weld Inspection Log. Test [50%][\_\_\_\_\_] of CJP welds using ultrasonic testing per Table [6.2] [or 6.3] of AWS D1.1/D1.1M. Randomly test [50%][\_\_\_\_\_] of all PJP and fillet welds or as indicated by magnetic particle or dye penetrant testing. Verify the welds conform to paragraph STANDARDS OF ACCEPTANCE. Conform procedures and techniques for inspection with applicable requirements of AWS D1.1/D1.1M[, AWS D1.8/D1.8M], ASTM E165/E165M, and ASTM E709. Submit a Welding Quality Assurance Plan and records of tests and inspections.

### 3.3 STANDARDS OF ACCEPTANCE

Conform dimensional tolerances for welded construction, details of welds, and quality of welds with the applicable requirements of AWS D1.1/D1.1M[, AWS D1.8/D1.8M] and the contract drawings. Submit all records of nondestructive testing.

#### 3.3.1 Nondestructive Testing

The welding is subject to inspection and tests in the mill, shop, and field. Inspection and tests in the mill or shop do not relieve the Contractor of the responsibility to furnish weldments of satisfactory quality. When materials or workmanship do not conform to the specification requirements, the Government reserves the right to reject material or workmanship or both at any time before final acceptance of the structure containing the weldment. Any indication of a defect is regarded as a defect, unless re-evaluation by nondestructive methods or by surface conditioning shows that no unacceptable defect is present. Submit all records of nondestructive testing in accordance with paragraph STANDARDS OF ACCEPTANCE.

#### 3.3.2 Destructive Tests

Make all repairs when metallographic specimens are removed from any part of a structure. Employ only qualified welders or welding operators, and use the proper joints and welding procedures, including peening or heat treatment if required, to develop the full strength of the members and joints cut and to relieve residual stress.

### 3.4 GOVERNMENT INSPECTION AND TESTING

In addition to the inspection and tests performed by the Contractor for quality control, the Government will perform inspection and testing for acceptance to the extent determined by the Contracting Officer. The work may be performed by the Government's own forces or under a separate contract for inspection and testing. The Government reserves the right to perform supplemental nondestructive and destructive tests to determine compliance with paragraph STANDARDS OF ACCEPTANCE.

### 3.5 CORRECTIONS AND REPAIRS

If inspection or testing indicates defects in the weld joints, repair defective welds using a qualified welder or welding operator as applicable. Conduct corrections in accordance with the requirements of AWS D1.1/D1.1M[, AWS D1.8/D1.8M] and the specifications. Repair all defects in accordance with the approved procedures. Repair defects discovered between passes before additional weld material is deposited. Wherever a defect is removed and repair by welding is not required, blend the affected area into the surrounding surface to eliminate sharp notches, crevices, or corners. After a defect is thought to have been removed, and before re-welding, examine the area by suitable methods to ensure that the defect has been eliminated. Repaired welds must meet the inspection requirements for the original welds.

-- End of Section --

## SECTION 05 12 00

## STRUCTURAL STEEL

**08/18, CHG 1: 11/18**

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 303	(2016) Code of Standard Practice for Steel Buildings and Bridges
AISC 325	(2017) Steel Construction Manual
AISC 326	(2009) Detailing for Steel Construction
AISC 360	(2016) Specification for Structural Steel Buildings
AISC 420	(2010) Certification Standard for Shop Application of Complex Protective Coating Systems
AISC DESIGN GUIDE 10	(1997) Erection Bracing of Low-Rise Structural Steel Buildings

## ASME INTERNATIONAL (ASME)

ASME B46.1	(2020) Surface Texture, Surface Roughness, Waviness and Lay
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## AMERICAN WELDING SOCIETY (AWS)

AWS A2.4	(2012) Standard Symbols for Welding, Brazing and Nondestructive Examination
AWS D1.1/D1.1M	(2020) Structural Welding Code - Steel

## ASTM INTERNATIONAL (ASTM)

ASTM A6/A6M	(2017a) Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
ASTM A29/A29M	(2020) Standard Specification for General Requirements for Steel Bars, Carbon and Alloy, Hot-Wrought
ASTM A36/A36M	(2019) Standard Specification for Carbon Structural Steel
ASTM A53/A53M	(2020) Standard Specification for Pipe,

	Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A123/A123M	(2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A500/A500M	(2020) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A563	(2015) Standard Specification for Carbon and Alloy Steel Nuts
ASTM A780/A780M	(2020) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A992/A992M	(2020) Standard Specification for Structural Steel Shapes
ASTM B695	(2004; R 2016) Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel
ASTM C827/C827M	(2016) Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures
ASTM C1107/C1107M	(2020) Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM F436/F436M	(2019) Standard Specification for Hardened Steel Washers Inch and Metric Dimensions
ASTM F844	(2007a; R 2013) Washers, Steel, Plain (Flat), Unhardened for General Use
ASTM F1136/F1136M	(2011) Standard Specification for Zinc/Aluminum Corrosion Protective Coatings for Fasteners
ASTM F1554	(2018) Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength
ASTM F2329/F2329M	(2015) Standard Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners
ASTM F2833	(2011; R 2017) Standard Specification for Corrosion Protective Fastener Coatings with Zinc Rich Base Coat and Aluminum Organic/Inorganic Type
ASTM F3125/F3125M	(2019) Standard Specification for High

Strength Structural Bolts and Assemblies,  
Steel and Alloy Steel, Heat Treated, Inch  
Dimensions 120 ksi and 150 ksi Minimum  
Tensile Strength, and Metric Dimensions  
830 MPa and 1040 MPa Minimum Tensile  
Strength

#### SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC PA 1 (2016) Shop, Field, and Maintenance  
Coating of Metals

SSPC Paint 20 (2019) Zinc-Rich Primers (Type I,  
Inorganic, and Type II, Organic)

SSPC Paint 29 (2002; E 2004) Zinc Dust Sacrificial  
Primer, Performance-Based

SSPC SP 3 (2018) Power Tool Cleaning

SSPC SP 6/NACE No.3 (2007) Commercial Blast Cleaning

#### U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-301-01 (2019) Structural Engineering

#### U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR Part 1926, Subpart R Steel Erection

### 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-01 Preconstruction Submittals

Erection and Erection Bracing Drawings; G[, [\_\_\_\_\_]]

#### SD-02 Shop Drawings

Fabrication Drawings Including Details of Connections; G[, [\_\_\_\_\_]]

#### SD-03 Product Data

Shop Primer

Welding Electrodes and Rods

Non-Shrink Grout

#### SD-04 Test Reports

Class B Coating



- Bolts, Nuts, and Washers
- Weld Inspection Reports
- Bolt Testing Reports
- [ Embrittlement Test Reports
- ] SD-05 Certificates
- Steel
- Bolts, Nuts, and Washers
- [ Galvanizing
- ] Welding Procedures and Qualifications
- Welding Electrodes and Rods
- Certified Welding Inspector
- Welding Procedure Specifications (WPS)

### 1.3 QUALITY ASSURANCE

#### 1.3.1 Preconstruction Submittals

#### 1.3.2 Fabrication Drawing Requirements

Submit [fabrication drawings](#) for approval prior to fabrication. Prepare in accordance with [AISC 303](#), [AISC 326](#) and [AISC 325](#). Fabrication drawings must not be reproductions of contract drawings. Include complete information for the fabrication and erection of the structure's components, including the location, type, and size of bolts, welds, member sizes and lengths, connection details, blocks, copes, and cuts. Use [AWS A2.4](#) standard welding symbols. Clearly highlight any deviations from the details shown on the contract drawings highlighted on the fabrication drawings. Explain the reasons for any deviations from the contract drawings.

#### 1.3.3 Certifications

##### 1.3.3.1 [Welding Procedures and Qualifications](#)

Prior to welding, submit certification for each welder stating the type of welding and positions qualified for, the code and procedure qualified under, date qualified, and the firm and individual certifying the qualification tests.[ If the qualification date of the welder or welding operator is more than 6 months old, the welding operator's qualification certificate must be accompanied by a current certificate by the welder attesting to the fact that he has been engaged in welding since the date of certification, with no break in welding service greater than 6 months.]

Conform to all requirements specified in [AWS D1.1/D1.1M](#).

## PART 2 PRODUCTS

## 2.1 SYSTEM DESCRIPTION

Provide the structural steel system, including [shop primer] [galvanizing], complete and ready for use. Provide structural steel systems including design, materials, installation, workmanship, fabrication, assembly, erection, inspection, quality control, and testing in accordance with AISC 303, AISC 360, and UFC 3-301-01 except as modified in this contract.

## 2.2 STEEL

## 2.2.1 Structural Steel

Wide flange and WT shapes, ASTM A992/A992M. Angles, Channels and Plates, ASTM A36/A36M.

## 2.2.2 Structural Steel Tubing

ASTM A500/A500M, Grade B.

## 2.2.3 Steel Pipe

ASTM A53/A53M, Type E or S, Grade B, weight class STD (Standard) or as indicated.

## 2.3 BOLTS, NUTS, AND WASHERS

Submit the certified manufacturer's mill reports which clearly show the applicable ASTM mechanical and chemical requirements together with the actual test results for the supplied fasteners.

## 2.3.1 High-Strength Bolts

High strength bolts and nuts must be shipped together in the same shipping container. Fasteners indicated to be galvanized shall be tested by the supplier to show that the galvanized nut with the supplied lubricant provided may be rotated from the snug tight condition well in excess of the rotation required for pretensioned installation without stripping. The supplier shall supply nuts that have been lubricated and tested with the supplied bolts.

## 2.3.1.1 Bolts

ASTM F3125/F3125M, Grade A325M A325, Type 1 Heavy Hex Head Style, plain finish.

## 2.3.1.2 Nuts

ASTM A563, Grade and Style as specified in the applicable ASTM bolt standard.

## 2.3.1.3 Washers

ASTM F436/F436M, plain carbon steel.

### 2.3.2 Foundation Anchorage

#### 2.3.2.1 Anchor Rods

ASTM F1554 Gr 36 , Class 1A.

#### 2.3.2.2 Anchor Nuts

ASTM A563, Grade A, hex style.

#### 2.3.2.3 Anchor Washers

ASTM F844.

#### 2.3.2.4 Anchor Plate Washers

ASTM A36/A36M.

### 2.4 STRUCTURAL STEEL ACCESSORIES

#### 2.4.1 Welding Electrodes and Rods

AWS D1.1/D1.1M. Submit product data for welding electrodes and rods.

#### 2.4.2 Non-Shrink Grout

ASTM C1107/C1107M, with no ASTM C827/C827M shrinkage. Submit product data for non-shrink grout.

#### 2.4.3 Welded Shear Stud Connectors

ASTM A29/A29M, Grades 1010 through 1020. AWS D1.1/D1.1M, Table 7.1, Type B.

### 2.5 GALVANIZING

ASTM F2329/F2329M, ASTM F1136/F1136M, ASTM F2833 or ASTM B695 for threaded parts or ASTM A123/A123M for structural steel members, as applicable, unless specified otherwise galvanize after fabrication where practicable.

### ]2.6 FABRICATION

Fabrication must be in accordance with the applicable provisions of AISC 325. Fabrication and assembly must be done in the shop to the greatest extent possible. Punch, subpunch and ream, or drill bolt holes perpendicular to the surface of the member.

Compression joints depending on contact bearing must have a surface roughness not in excess of 500 micro inch as determined by ASME B46.1, and ends must be square within the tolerances for milled ends specified in ASTM A6/A6M.

Shop splices of members between field splices will be permitted only where indicated on the Contract Drawings. Splices not indicated require the approval of the Engineer of Record.

#### ]2.6.1 Markings

Prior to erection, identify members by a painted erection mark.

Connecting parts assembled in the shop for reaming holes in field connections must be match marked with scratch and notch marks. Do not locate erection markings on areas to be welded. Do not locate match markings in areas that will decrease member strength or cause stress concentrations. Affix embossed tags to hot-dipped galvanized members.

#### 2.6.2 Shop Primer

SSPC Paint 20 or SSPC Paint 29, (zinc rich primer). Shop prime structural steel, except as modified herein, in accordance with SSPC PA 1. Do not prime steel surfaces embedded in concrete, galvanized surfaces, or surfaces within 0.5 inch of the toe of the welds prior to welding (except surfaces on which metal decking and shear studs are to be welded). If flash rusting occurs, re-clean the surface prior to application of primer. Apply primer in accordance with endorsement "SPE-P1" of AISC 420 or approved equal NACE or SSPC certification to a minimum dry film thickness of 2.0 mil. Submit shop primer product data.

Prior to assembly, prime surfaces which will be concealed or inaccessible after assembly. Do not apply primer in foggy or rainy weather; when the ambient temperature is below 45 degrees F or over 95 degrees F; or when the primer may be exposed to temperatures below 40 degrees F within 48 hours after application, unless approved otherwise by the Engineer of Record. Repair damaged primed surfaces with an additional coat of primer.

##### 2.6.2.1 Cleaning

SSPC SP 6/NACE No.3, except steel exposed in spaces above ceilings, attic spaces, furred spaces, and chases that will be hidden to view in finished construction may be cleaned to SSPC SP 3 when recommended by the shop primer manufacturer. Maintain steel surfaces free from rust, dirt, oil, grease, and other contaminants through final assembly.

#### 2.7 DRAINAGE HOLES

Drill adequate drainage holes to eliminate water traps. Hole diameter must be 1/2 inch and location indicated on the detail drawings. Hole size and locations must not affect the structural integrity.

### PART 3 EXECUTION

#### 3.1 ERECTION

- a. Erection of structural steel, except as indicated in item b. below, must be in accordance with the applicable provisions of AISC 325, AISC 303 and 29 CFR Part 1926, Subpart R.
- b. For low-rise structural steel buildings ( 60 feet tall or less and a maximum of 2 stories), erect the structure in accordance with AISC DESIGN GUIDE 10.

After final positioning of steel members, provide full bearing under base plates and bearing plates using nonshrink grout. Place nonshrink grout in accordance with the manufacturer's instructions.

##### 3.1.1 STORAGE

Store the material out of contact with the ground in such manner and location as to minimize deterioration.

### 3.2 CONNECTIONS

Except as modified in this section, design connections indicated in accordance with [AISC 360](#). Build connections into existing work. Do not tighten anchor bolts set in concrete with impact torque wrenches. Holes must not be cut or enlarged by burning. Bolts, nuts, and washers must be clean of dirt and rust, and lubricated immediately prior to installation.

#### 3.2.1 High-Strength Bolts

Provide direct tension indicator washers in all [ASTM F3125/F3125M](#), Grade [A325](#) and Grade [A490](#) bolted connections. Bolts must be installed in connection holes and initially brought to a snug tight fit. After the initial tightening procedure, fully tension bolts, progressing from the most rigid part of a connection to the free edges.

Fastener components shall be protected from dirt and moisture in closed containers at the site of the installation. Fastener components that are not incorporated into the work shall be returned to protected storage at the end of the work shift.

##### 3.2.1.1 Installation of Direct Tension Indicator Washers (DTIW)

Where possible, install the DTIW under the bolt head and tighten the nut. If the DTIW is installed adjacent to the turned element, provide a flat washer between the DTIW and nut when the nut is turned for tightening, and between the DTIW and bolt head when the bolt head is turned for tightening. In addition to the DTIW, provide flat washers under both the bolt head and nut when [ASTM F3125/F3125M](#), Grade [A490](#) bolts are used.

### 3.3 GAS CUTTING

Use of gas-cutting torch in the field for correcting fabrication errors is not permitted on any major member in the structural framing. Use of a gas cutting torch will be permitted on minor members not under stress only after approval has been obtained from the Contracting Officer.

### 3.4 WELDING

Welding must be in accordance with [AWS D1.1/D1.1M](#). Provide [AWS D1.1/D1.1M](#) qualified welders, welding operators, and tackers.

Develop and submit the [Welding Procedure Specifications \(WPS\)](#) for all welding, including welding done using prequalified procedures. Submit for approval all WPS, whether prequalified or qualified by testing.

### 3.5 SHOP PRIMER REPAIR

Repair shop primer in accordance with the paint manufacturer's recommendation for surfaces damaged by handling, transporting, cutting, welding, or bolting.

#### 3.5.1 Field Priming

Field prime steel exposed to the weather, or located in building areas without HVAC for control of relative humidity. After erection, the field bolt heads and nuts, field welds, and any abrasions in the shop coat must be cleaned and primed with paint of the same quality as that used for the shop coat.

### 3.6 GALVANIZING REPAIR

Repair damage to galvanized coatings using [ASTM A780/A780M](#) zinc rich paint for galvanizing damaged by handling, transporting, cutting, welding, or bolting. Do not heat surfaces to which repair paint has been applied.

-- End of Section --

## SECTION 05 21 00

STEEL JOIST FRAMING  
**05/15, CHG 1: 08/18**

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2020) Structural Welding Code - Steel

## ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M (2019) Standard Specification for Carbon Structural Steel

## INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC (2018) International Building Code

## SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC PA 1 (2016) Shop, Field, and Maintenance Coating of Metals

SSPC Paint 15 (1999; E 2004) Steel Joist Shop Primer/Metal Building Primer

SSPC SP 2 (2018) Hand Tool Cleaning

## STEEL JOIST INSTITUTE (SJI)

SJI LOAD TABLES (2010; Errata 1 2011; Errata 2 2012) 42nd Edition Catalog of Standard Specifications Load Tables and Weight Tables for Steel Joists and Joist Girders

## U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1926 Safety and Health Regulations for Construction

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-01 Preconstruction Submittals

Welder Qualification

## SD-02 Shop Drawings

Steel Joist Framing; G

## SD-03 Product Data

Recycled Content Of Steel Products; S

## SD-05 Design Data

Design Calculations; G

## SD-06 Test Reports

Erection Inspection  
Welding Inspections

## SD-07 Certificates

Certification of Compliance

## 1.3 QUALITY ASSURANCE

Perform all work in compliance with the requirements set forth in  
29 CFR 1926.

## 1.3.1 Drawing Requirements

Submit drawings of steel joist framing including fabrication, specifications for shop painting, and identification markings of joists and joist girders. Show joist type and size, layout in plan, all applicable loads, deflection criteria, and erection details including methods of anchoring, framing at openings, type, size, and location and connections for and spacing of bridging, requirements for field welding, and details of accessories as applicable.

## 1.3.2 Certification of Compliance

Prior to construction commencement, submit certification for welder qualification, in compliance with AWS D1.1/D1.1M, welding operation, and tacker, stating the type of welding and positions qualified for, the code and procedure qualified under, date qualified, and the firm and individual certifying the qualification tests. Submit certification of compliance for the following:

- a. Statement from steel joist manufacturer, that work was performed in accordance with approved construction documents and with SJI standard specifications, in accordance with ICC IBC Section 1704.2.5.2.

## 1.4 DELIVERY, STORAGE, AND HANDLING

Handle, transport, and store joists [and joist girders] in a manner to prevent damage affecting their structural integrity. Verify piece count of all joist products upon delivery and inspect all joists products for damage. Report any damage to the joist supplier. Store all items off the



ground in a well drained location protected from the weather and easily accessible for inspection and handling. Store joists with top chord down and with joists in a vertical position. Store deep joists horizontally if they were shipped on their sides.

## PART 2 PRODUCTS

### 2.1 SYSTEM DESCRIPTION

Designate steel joists [and joist girders] on the drawings in accordance with the standard designations of the Steel Joist Institute. Joists of other standard designations or joists with properties other than those shown may be substituted for the joists designated provided the structural properties are equal to or greater than those of the joists shown and provided all other specified requirements are met.

### 2.2 STEEL JOISTS [AND JOIST GIRDERS]

Provide steel joists [and joist girders] conforming to [SJI LOAD TABLES](#). Design joists designated K, KCS, LH and DLH to support the loads given in the applicable standard load tables of [SJI LOAD TABLES](#). Submit [design calculations](#) for joist girders, net uplift loads, and non-SJI standard details. Include cover letter signed and sealed by the joist manufacturer's registered design professional.

#### 2.2.1 Steel Joist Camber

Camber joists according to [SJI LOAD TABLES](#).

#### 2.2.2 Joist Girders

Provide joist girders capable of withstanding the design loads indicated with a live-load deflection less than L/240 for roof girders.

### 2.3 ACCESSORIES AND FITTINGS

#### 2.3.1 Bridging

Provide bridging of material, size, and type required by [SJI LOAD TABLES](#) for type of joist, chord size, spacing and span. Furnish additional erection bridging if required for stability.

#### 2.3.2 Bearing Plates

Fabricate steel bearing plats from [ASTM A36/A36M](#) steel of size and thickness indicated.

#### 2.3.3 Ceiling Extensions

Furnish ceiling extensions, either bottom-chord elements or a separate extension unit of enough strength to support ceiling construction. Extend ends to within [1/2 inch](#) of finished wall surface unless otherwise indicated.

### 2.4 SHOP PAINTING

[SSPC Paint 15](#). Shop prime joists, except as modified herein, in accordance with [SSPC PA 1](#). Clean joists in accordance with [SSPC SP 2](#) before priming. If flash rusting occurs, re-clean the surface prior to

application of primer. For joists and joist girders which require finish painting under Section 09 90 00 PAINTS AND COATINGS, the primer paint must be compatible with the finish paint.

## PART 3 EXECUTION

### 3.1 ERECTION

Install joists and joist girders in conformance with SJI LOAD TABLES for the joist series indicated. Handle and set joists and joist girders avoiding damage to the members. Place the "tag end" of joists as shown on the joists placement plans. Ensure that square-end joists are erected right side up. Place joists on joist girders in accordance with the joist placement plan, noting that in many instances joist may not need to be placed at a joist girder panel point. Distribute temporary loads so that joist capacity is not exceeded. Remove damaged joists [and joist girders] from the site, except when field repair is approved and such repairs are satisfactorily made in accordance with the manufacturer's recommendations. Do not repair, field modify, or alter any joists or joist girder without specific written instructions from the Designer of Record and/or joist manufacturer.

Install and connect bridging concurrently with joist erection, before construction loads are applied. Do not apply loads to bridging. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams. Do not cut away vertical leg of bridging where bridging makes an elevation transition; weld a separate piece of bridging at the transition. Perform all welding in accordance with AWS D1.1/D1.1M.

### 3.2 BEARING PLATES

Provide bearing plates to accept full bearing after the supporting members have been plumbed and properly positioned, but prior to placing superimposed loads. The area under the plate must be damp-packed solidly with bedding mortar, except where nonshrink grout is indicated on the drawings. Provide bedding mortar and grout as specified in Section 03 30 00 CAST-IN-PLACE CONCRETE.

### 3.3 PAINTING

#### 3.3.1 Touch-Up Painting

After erection of joists [and joist girders], touch-up connections and areas of abraded shop coat with paint of the same type used for the shop coat.

### 3.4 VISUAL INSPECTIONS

Perform the following visual inspections:

- a. Verify that all joists are spaced properly.
- b. Verify that there is sufficient joist bearing on steel beams, concrete, and masonry.
- c. Verify all bridging lines are properly spaced and anchored.
- d. Verify that damage has not occurred to the joists and joist girder during erection.

- e. Verify the joists are aligned vertically and there is no lateral sweep in the joists.
- f. Where concentrated loads are present on the joists verify that they are located in accordance with the joists placement plan.
- g. Verify welding of bridging and joist seats in accordance with AWS D1.1/D1.1M, Section 6. Perform erection inspection and field welding inspections with AWS certified welding inspectors.
- h. Verify proper bolting of diagonal bridging and joist seats where the bolts are snug-tight.

-- End of Section --

## SECTION 05 30 00

## STEEL DECKS

**05/15, CHG 2: 08/18**

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI D100 (2017) Cold-Formed Steel Design Manual

## AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2020) Structural Welding Code - Steel

AWS D1.3/D1.3M (2018) Structural Welding Code - Sheet Steel

## ASTM INTERNATIONAL (ASTM)

ASTM A792/A792M (2010; R 2015) Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process

ASTM A1008/A1008M (2020) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable

## STEEL DECK INSTITUTE (SDI)

ANSI/SDI QA/QC (2017) Standard for Quality Control and Quality Assurance for Installation of Steel Deck

SDI DDM04 (2015; Errata 1-3 2016; Add 1 2015; Add 2 20162006) Diaphragm Design Manual; 4th Edition

SDI DDP (1987; R 2000) Deck Damage and Penetrations

SDI MOC3 (2016) Manual of Construction with Steel Deck (3rd Edition)

## U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1926 Safety and Health Regulations for Construction

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

Fabrication Drawings; G[, [\_\_\_\_\_]]

## SD-03 Product Data

Accessories

Deck Units

Galvanizing Repair Paint

[ Mechanical Fasteners

Touch-Up Paint

Sound Absorbing Materials

Welding Equipment

Welding Rods and Accessories

Recycled Content of Steel Products; S

## SD-04 Samples

Metal Roof Deck Units

Cellular Metal Floor Deck Units

Flexible Closure Strips

Acoustical Material

## SD-05 Design Data

Deck Units; G[, [\_\_\_\_\_]]

## SD-07 Certificates

Powder-Actuated Tool Operator

Welder Qualifications

Welding Procedures

Fire Safety

Wind Storm Resistance

### Manufacturer's Certificate

### Stud Manufacture's Certification

### Stud Manufacture's Test Reports

## 1.3 QUALITY ASSURANCE

### 1.3.1 Deck Units

Furnish deck units and accessory products from a manufacturer regularly engaged in manufacture of steel decking. Provide [manufacturer's certificates](#) attesting that the decking material meets the specified requirements.

### 1.3.2 Certification of [Powder-Actuated Tool Operator](#)

Provide manufacturer's certificate attesting that the operators are authorized to use the low velocity powder-actuated tool.

### 1.3.3 Qualifications for Welding Work

Follow [Welding Procedures](#) of [AWS D1.3/D1.3M](#) for sheet steel and [AWS D1.1/D1.1M](#) for stud welding. Submit qualified [Welder Qualifications](#) in accordance with [AWS D1.3/D1.3M](#) for sheet steel and [AWS D1.1/D1.1M](#) for stud welding, or under an equivalent approved qualification test. Perform tests on test pieces in positions and with clearances equivalent to those actually encountered. If a test weld fails to meet requirements, perform an immediate retest of two test welds until each test weld passes. Failure in the immediate retest will require the welder be retested after further practice or training, performing a complete set of test welds.

Submit manufacturer's catalog data for [Welding Equipment](#) and [Welding Rods and Accessories](#).

### 1.3.4 [Fabrication Drawings](#)

Show type and location of units, location and sequence of connections, bearing on supports, methods of anchoring, attachment of accessories, adjusting plate details, cant strips, ridge and valley plates, metal closure strips, size and location of holes to be cut and reinforcement to be provided, the manufacturer's erection instructions and other pertinent details.

## 1.4 DELIVERY, STORAGE, AND HANDLING

Deliver deck units to the site in a dry and undamaged condition. Store and handle steel deck in a manner to protect it from corrosion, deformation, and other types of damage. Do not use decking for storage or as working platform until units have been fastened into position. Exercise care not to damage material or overload decking during construction. The maximum uniform distributed storage load must not exceed the design live load. Stack decking on platforms or pallets and cover with weathertight ventilated covering. Elevate one end during storage to provide drainage. Maintain deck finish at all times to prevent formation of rust. Repair deck finish using touch-up paint. Replace damaged material.

## 1.5 DESIGN REQUIREMENTS FOR ROOF DECKS

### 1.5.1 Properties of Sections

Properties of metal roof deck sections must comply with engineering design width as limited by the provisions of [AISI D100](#).

### 1.5.2 Allowable Loads

Indicate total uniform dead and live load for detailing purposes.

## PART 2 PRODUCTS

### 2.1 [DECK UNITS](#)

Submit manufacturer's design calculations, or applicable published literature for the structural properties of the proposed deck units.

#### 2.1.1 Roof Deck

Conform to [ASTM A792/A792M](#) or [ASTM A1008/A1008M](#) for deck used in conjunction with insulation and built-up roofing. Fabricate roof deck units of the steel design thickness required by the design drawings and shop painted. Furnish sample of [Metal Roof Deck Units](#) used to illustrate actual cross section dimensions and configurations.

#### 2.1.2 Length of Deck Units

Provide deck units of sufficient length to span three or more spacings where possible.

#### 2.1.3 Shop Priming

Shop prime accessories and deck at the factory after coating. Clean surfaces in accordance with the manufacturer's standard procedure followed by a spray, dip or roller coat of rust-inhibitive primer, oven cured.

### ]2.2 [ACCESSORIES](#)

Provide accessories of same material as deck, unless specified otherwise. Provide manufacturer's standard type accessories, as specified.

#### 2.2.1 Adjusting Plates

Provide adjusting plates, or segments of deck units, of same thickness and configuration as deck units in locations too narrow to accommodate full size units. Provide factory cut plates of predetermined size where possible.

#### 2.2.2 End Closures

Fabricated of sheet metal by the deck manufacturer. Provide end closures minimum [0.0295 inch](#) thick to close open ends at openings through deck.

#### 2.2.3 Sheet Metal Collar

Where deck is cut for passage of pipes, ducts, columns, etc., and deck is to remain exposed, provide a neatly cut sheet metal collar to cover edges of deck. Do not cut deck until after installation of supplemental

supports.

#### 2.2.4 Cover Plates

Sheet metal to close panel edge and end conditions, and where panels change direction or butt. Polyethylene-coated, self-adhesive, 2 inch wide joint tape may be provided in lieu of cover plates on flat-surfaced decking butt joints.

Fabricate cover plates for abutting floor deck units from the specified structural-quality steel sheets not less than nominal 18 gage thick before galvanizing. Provide 6 inch wide cover plates and form to match the contour of the floor deck units.

#### 2.2.5 Ridge and Valley Plates for Roof Decks

Fabricate plates from the specified structural-quality steel sheets, not less than nominal 0.0358 inch thick before galvanizing. Provide plates of minimum 4-1/2 inch wide and bent to provide tight fitting closures at ridges and valleys. Provide a minimum length of ridge and valley plates of 10 feet.

#### 2.2.6 Metal Closure Strips for Roof Decks

Fabricate strips from the specified commercial-quality steel sheets not less than nominal 0.0358 inch thick before galvanizing. Provide strips from the configuration required to provide tight-fitting closures at open ends and sides of steel roof decking.

#### 2.2.7 Mechanical Fasteners

Provide mechanical fasteners, such as powder actuated fasteners, pneumatically driven fasteners or self-drilling screws, for anchoring the deck to structural supports and adjoining units that are designed to meet the loads indicated.

#### 2.2.8 Miscellaneous Accessories

Furnish the manufacturer's standard accessories to complete the deck installation. Furnish metal accessories of the same material as the deck and with the minimum design thickness as follows: saddles, 0.0474 inch welding washers, 0.0598 inch other metal accessories, 0.0358 inch unless otherwise indicated.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

Prior to installation of decking units and accessories, examine worksite to verify that as-built structure will permit installation of decking system without modification.

#### 3.2 INSTALLATION

Install steel deck units in accordance with 29 CFR 1926, Subpart R - Steel Erection, ANSI/SDI QA/QC, and approved shop drawings. Place units on structural supports, properly adjusted, leveled, and aligned at right angles to supports before permanently securing in place. Damaged deck and accessories including material which is permanently stained or contaminated, deformed, or with burned holes shall not be installed.



Extend deck units over three or more supports unless absolutely impractical. Report inaccuracies in alignment or leveling to the Contracting Officer and make necessary corrections before permanently anchoring deck units. Locate deck ends over supports only. Lap 2 inch deck ends. Do not use unanchored deck units as a work or storage platform. Permanently anchor units placed by the end of each working day. Do not support suspended ceilings, light fixtures, ducts, utilities, or other loads by steel deck unless indicated. Distribute loads by appropriate means to prevent damage.

### 3.2.1 Attachment

Immediately after placement and alignment, and after correcting inaccuracies, permanently fasten steel deck units to structural supports and to adjacent deck units by welding with normal 5/8 inch diameter puddle welds, or pneumatically driven fasteners as indicated on the design drawings and in accordance with manufacturer's recommended procedure. Clamp or weight deck units to provide firm contact between deck units and structural supports while performing welding or fastening. Attachment of adjacent deck units by button-punching is prohibited.

#### 3.2.1.1 Welding

Perform welding in accordance with AWS D1.3/D1.3M using methods and electrodes recommended by the manufacturers of the base metal alloys being used. Ensure only operators previously qualified by tests prescribed in AWS D1.3/D1.3M make welds. Immediately recertify, or replace qualified welders, that are producing unsatisfactory welding. Do not use welding washers at sidelaps. Holes and similar defects will not be acceptable. Attach all partial or segments of deck units to structural supports in accordance with Section 2.5 of SDI DDM04. Immediately clean welds by chipping and wire brushing. Heavily coat welds, cut edges and damaged portions of shop primed finish with the manufacturer's standard touch-up paint].

#### 3.2.1.2 Mechanical Fastening

Anchor deck to structural supports and adjoining units with mechanical fasteners. Drive the powder-actuated fasteners with a low-velocity piston tool by an operator authorized by the manufacturer of the powder-actuated tool.

#### 3.2.1.3 Sidelap Fastening

Lock sidelaps between adjacent floor deck units together by welding or screws as indicated.

### 3.2.2 Openings

Cut or drill all holes and openings required and be coordinated with the drawings, specifications, and other trades. Frame and reinforce openings through the deck in conformance with SDI DDP. Reinforce holes and openings 6 to 12 inch across by 0.0474 inch thick steel sheet at least 12 inch wider and longer than the opening and be fastened to the steel deck at each corner of the sheet and at a maximum of 6 inch on center. Reinforce holes and openings larger than 12 inch by steel angles installed perpendicular to the steel joists and supported by the adjacent steel joists as indicated on drawings. Install angles perpendicular to the deck ribs and fasten to the angles perpendicular to the steel joists.

### 3.2.3 Deck Damage

SDI MOC3, for repair of deck damage.

### 3.2.4 Touch-Up Paint

#### 3.2.4.1 Roof Deck

After roof decking installation, wire brush, clean, and touchup paint the scarred areas on top and bottom surfaces of metal roof decking. The scarred areas include welds, weld scars, bruises, and rust spots. Touchup galvanized surfaces with galvanizing repair paint. Touchup painted surfaces with repair paint of painted surfaces.

### 3.2.5 Accessory Installation

#### 3.2.5.1 Adjusting Plates

Provide in locations too narrow to accommodate full-size deck units and install as shown on shop drawings.

#### 3.2.5.2 End Closures

Provide end closure to close open ends of cells at columns, walls, and openings in deck.

### 3.2.6 Preparation of Fire-Proofed Surfaces

Provide deck surfaces, both composite and noncomposite, which are to receive sprayed-on fireproofing, galvanized and free of all grease, mill oil, paraffin, dirt, salt, and other contaminants which impair adhesion of the fireproofing. Complete any required cleaning prior to steel deck installation using a cleaning method that is compatible with the sprayed-on fireproofing.

## 3.3 RIDGE AND VALLEY PLATES FOR ROOF DECKS

Provide plates to be fusion welded to top surface of roof decking. Lap end joints a minimum 3 inch. For valley plates, provide endlaps to be in the direction of water flow.

## 3.4 CLOSURE STRIPS FOR ROOF DECKS

Provide closure strips at open, uncovered ends and edges of the roof decking and in voids between roof decking and top of walls and partitions where indicated. Install closure strips in position in a manner to provide a weathertight installation.

## 3.5 ROOF INSULATION SUPPORT FOR ROOF DECKS

Provide metal closure strips for support of roof insulation where rib openings in top surface of metal roof decking occur adjacent to edges and openings. Weld metal closure strips in position.

## 3.6 CLEANING AND PROTECTION FOR ROOF DECKS

Upon completion of the deck, sweep surfaces clean and prepare for installation of the roofing.

3.7 FIELD QUALITY CONTROL

3.7.1 Deck Weld Inspection

Visual inspect welds in accordance with AWS D1.3/D1.3M.

[] -- End of Section --

## SECTION 05 40 00

## COLD-FORMED METAL FRAMING

**05/15, CHG 1: 08/18**

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AMERICAN CONCRETE INSTITUTE (ACI)

ACI 318 (2014; Errata 1-2 2014; Errata 3-5 2015; Errata 6 2016; Errata 7-9 2017) Building Code Requirements for Structural Concrete (ACI 318-14) and Commentary (ACI 318R-14)

## AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI S100 (2012) North American Specification for the Design of Cold-Formed Steel Structural Members

AISI S110 (2007; Suppl 1; Reaffirmed 2012) Standard for Seismic Design of Cold-Formed Steel Structural Systems - Special Bolted Moment Frames

AISI S200 (2007) North American Standard for Cold-Formed Steel Framing - General Provision

AISI S201 (2007) North American Standard for Cold-Formed Steel Framing - Product Data

AISI S202 (2011) Code of Standard Practice for Cold-formed Steel Structural Framing

AISI S211 (2007) North American Standard for Cold-Formed Steel Framing - Wall Stud Design

AISI S212 (2007) North American Standard for Cold-Formed Steel Framing - Header Design

AISI S213 (2007; Suppl 1 2009) North American Standard for Cold-Formed Steel Framing - Lateral Design

AISI S214 (2012) North American Standard for Cold-Formed Steel Framing - Truss Design

## AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2020) Structural Welding Code - Steel

AWS D1.3/D1.3M (2018) Structural Welding Code - Sheet Steel

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M (2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A153/A153M (2016a) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A307 (2014; E 2017) Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength

ASTM A653/A653M (2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A1003/A1003M (2015) Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members

ASTM C955 (2017) Standard Specification for Cold-Formed Steel Structural Framing Members

ASTM C1007 (2020) Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories

ASTM C1513 (2018) Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections

ASTM E119 (2020) Standard Test Methods for Fire Tests of Building Construction and Materials

ASTM E329 (2020) Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection

ASTM E488/E488M (2015) Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements

ASTM F1554 (2018) Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength

ASTM F1941 (2010) Standard Specification for Electrodeposited Coatings on Threaded Fasteners (Unified Inch Screw Threads

(UN/UNR))

ASTM F2329/F2329M (2015) Standard Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC (2018) International Building Code

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-301-01 (2019) Structural Engineering

## 1.2 SUBMITTALS

Approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29.05 20 SUSTAINABILITY REPORTING FOR DESIGN-BUILD. Submit the following in accordance with Section 01 33 00.05 20 CONSTRUCTION SUBMITTAL PROCEDURES:

### SD-02 Shop Drawings

Framing Components; G

### SD-03 Product Data

Steel Studs, Joists, Tracks, Bracing, Bridging and Accessories

Recycled Content of Steel Products; S

### SD-05 Design Data

Metal Framing Calculations; G

### SD-07 Certificates

Load-Bearing Cold-Formed Metal Framing

Welds

## 1.3 DELIVERY, STORAGE, AND HANDLING

Steel framing and related accessories shall be stored and handled in accordance with the AISI S202, "Code of Standard Practice for Cold-Formed Steel Structural Framing".

## 1.4 MAXIMUM DEFLECTION

Deflections of structural members shall not exceed the more restrictive of the limitations of ICC IBC and UFC 3-301-01.

## 1.5 QUALITY ASSURANCE

- a. Engineering Responsibility: Preparation of Shop Drawings, design

calculations, and other structural data by a registered professional engineer.

- b. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to [ASTM E329](#) for testing indicated.
- c. Product Tests: Mill certificates or data from a qualified independent testing agency[, or in-house testing with calibrated test equipment] indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
- d. Welding Qualifications: Qualify procedures and personnel according to the following:
  - (1) [AWS D1.1/D1.1M](#), "Structural Welding Code - Steel".
  - (2) [AWS D1.3/D1.3M](#), "Structural Welding Code - Sheet Steel".
- e. Fire-Test-Response Characteristics: Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per [ASTM E119](#) by, and displaying a classification label from, a testing and inspecting agency acceptable to authorities having jurisdiction.
- f. AISI Specifications and Standards: Comply with:
  - (1) [AISI S100](#), "North American Specification for the Design of Cold-Formed Steel Structural Members".
  - (2) [AISI S110](#), "Standard for Seismic Design of Cold-Formed Steel Structural Systems - Special Bolted Moment Frames".
  - (3) [AISI S200](#), "North American Standard for Cold-Formed Steel Framing - General Provision".
  - (4) [AISI S201](#), "North American Standard for Cold-Formed Steel Framing - Product Data".
  - (5) [AISI S202](#), "Code of Standard Practice for Cold-Formed Steel Structural Framing".
  - (6) [AISI S211](#), "North American Standard for Cold-Formed Steel Framing - Wall Stud Design".
  - (7) [AISI S212](#), "North American Standard for Cold-Formed Steel Framing - Header Design".
  - (8) [AISI S213](#), "North American Standard for Cold-Formed Steel Framing - Lateral Design".
  - (9) [AISI S214](#), "North American Standard for Cold-Formed Steel Framing - Truss Design".

#### 1.5.1 Drawing Requirements

Submit [framing components](#) to show sizes, thicknesses, layout, material designations, methods of installation, and accessories including the

following:

- a. Cross sections, plans, and/or elevations showing component types and locations for each framing application; including shop coatings and material thicknesses for each framing component.
- b. Connection details showing fastener type, quantity, location, and other information to assure proper installation.
- c. Drawings depicting panel configuration, dimensions, components, locations, and construction sequence if the Contractor elects to install prefabricated/prefinished frames.

[ Sign and seal fabrication drawings by a registered professional engineer.

#### ]1.5.2 Design Data Required

Submit [metal framing calculations](#) with design criteria and structural loading to verify sizes, thickness, and spacing of members and connections signed and sealed by a registered professional engineer. Show methods and practices used in installation.

### ]PART 2 PRODUCTS

#### 2.1 STEEL [STUDS](#), [JOISTS](#), TRACKS, BRACING, BRIDGING AND ACCESSORIES

Framing components shall comply with [ASTM C955](#) and the following.

- a. Provide products with an average [recycled content of steel products](#) so postconsumer recycled content plus one half of preconsumer recycled content not less than 25 percent.
- b. Steel Sheet: [ASTM A1003/A1003M](#), Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
  - (1) Grade: As required by structural performance.
  - (2) Coating: G60 (Z180), A60 (ZF180), AZ50 (AZ150), or GF30 (ZGF90).
- c. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
  - (1) Minimum Base-Metal Thickness: [0.0329 inch](#).
  - (2) Flange Width: [1-3/8 inches](#).
- d. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:
  - (1) Minimum Base-Metal Thickness: Matching steel studs.
  - (2) Flange Width: [1-1/4 inches](#).

##### 2.1.1 Studs and Joists of [54 mils \(0.054 Inch\)](#) and Heavier

Galvanized steel, [ASTM A653/A653M](#) and [ASTM A1003/A1003M](#), SS Grade 50, [G60](#).



### 2.1.2 Studs and Joists of 43 mils (0.043 Inch) and Lighter

Studs and Joists of 43 mils (0.043 Inch) and Lighter, Track, and Accessories (All thicknesses): Galvanized steel, ASTM A653/A653M and ASTM A1003/A1003M, SS, Grade 33 33,000 psi G60.

### 2.1.3 Sizes, Thickness, Section Modulus, and Other Structural Properties

Size and thickness as indicated.

## 2.2 MARKINGS

Studs and track shall have product markings stamped on the web of the section. The markings shall be repeated throughout the length of the member at a maximum spacing of 4 feet on center and shall be legible and easily read. The product marking shall include the following:

- a. An ICC number.
- b. Manufacturer's identification.
- c. Minimum delivered uncoated steel thickness.
- d. Protective coating designator.
- e. Minimum yield strength.

## 2.3 CONNECTIONS

### 2.3.1 Steel-To-Concrete Connections

- a. Anchor Rods: ASTM F1554, [Grade 36][Grade 55]; galvanized per ASTM A153/A153M.
- b. Post-Installed Concrete Anchors: Adhesive or expansion anchors fabricated from corrosion-resistant materials with allowable load capacities in accordance with ICC-ES AC193 and ACI 318 greater than or equal to the design load as determined by testing per ASTM E488/E488M conducted by a qualified testing agency.
- c. Power-Actuated Fasteners: Fabricated from corrosion-resistant materials with allowable load capacities in accordance with ICC-ES AC 70 greater than or equal to the design load as determined by testing per ASTM E1190 conducted by a qualified testing agency.

### 2.3.2 Steel-To-Steel Connections

- a. Screws: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping steel screws of the type and size indicated. Provide low-profile head beneath sheathing and manufacturer's standard elsewhere. Electroplated to a minimum of 5 micron zinc coating per ASTM F1941 or hot-dipped galvanized per ASTM A123/A123M or ASTM A153/A153M.
- b. Bolts: ASTM A307 coated by hot-dip process per ASTM F2329/F2329M or zinc-coated by mechanical-deposition process per ASTM B695, Class 55.
- c. Welding Electrodes: Comply with AWS standards.

## 2.4 PLASTIC GROMMETS

Supply plastic grommets for stud webs as recommended by stud manufacturer, to protect electrical wires and plumbing piping. Prevent metal-to-metal contact between wiring/piping and studs.

## 2.5 SEALER GASKET

Closed-cell neoprene foam, 1/4-inch thick, selected from manufacturer's standard widths to match width of bottom track on concrete slab or foundation.

# PART 3 EXECUTION

## 3.1 TRUSS FABRICATION

- a. Fabricate cold-formed steel trusses and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
- b. Truss must be fabricated either on site or off site prior to erection.
- c. Fabricate trusses using jigs or templates.
- d. Splices can only occur at joints.
- e. Cut truss members by sawing or shearing: do not torch cut.
- f. Fasten cold-formed steel truss members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator.
- g. Fasten other materials to cold-formed steel trusses by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.
- h. Reinforce, stiffen, and brace trusses to withstand handling, delivery, and erection stresses. Lift fabricated trusses to prevent damage or permanent distortion.

## 3.2 FASTENING

Fasten framing members together by welding or by using self-drilling, self-tapping screws. Electrodes and screw connections shall be as required and indicated in the design calculations.

### 3.2.1 Welds

All welding shall be performed in accordance with AWS D1.3/D1.3M, as modified by AISI S100. All welders, welding operations, and welding procedures shall be qualified according to AWS D1.3/D1.3M. Submit certified copies of welder qualifications test records showing qualification in accordance with AWS D1.3/D1.3M. All welds shall be cleaned and coated with rust inhibitive galvanizing paint. Do not field weld materials lighter than 43 mils.

### 3.2.2 Screws

Screws shall be of the self-drilling self-tapping type, size, and location as required. Screw penetration through joined materials shall not be less than three exposed threads. Minimum spacings and edge distances for screws shall be as specified in [AISI S100](#). Screws covered by sheathing materials shall have low profile heads.

### 3.2.3 Anchors

Anchors shall be of the type, size, and location as required.

### 3.2.4 Powder-Actuated Fasteners

Powder-actuated fasteners shall be of the type, size, and location [as indicated][as required].

## 3.3 INSTALLATION

Install cold-formed framing in accordance with [ASTM C1007](#) and [AISI S200](#).

Install cold-formed steel framing according to [AISI S202](#) and to manufacturer's written instructions unless more stringent requirements are indicated.

### 3.3.1 Tracks

Provide accurately aligned runners at top and bottom of studs. Install sealer gasket under bottom of track on concrete slab or foundation. Anchor tracks as indicated in design calculations. Butt weld joints in tracks or splice with stud inserts. Fasteners shall be at least [3 inches](#) from the edge of concrete slabs.

### 3.3.2 Studs

Cut studs square and set with firm bearing against webs of top and bottom tracks. Position studs vertically in tracks and space as indicated in design. Do not splice studs. Provide at least two studs at jambs of doors and other openings [2 feet](#) wide or larger. Provide jack studs over openings, as necessary, to maintain indicated stud spacing. Provide tripled studs at corners, positioned to receive interior and exterior finishes. Fasten studs to top and bottom tracks by welding or screwing both flanges to the tracks. Framed wall openings shall include headers and supporting components as shown on the drawings. Headers shall be installed in all openings that are larger than the stud spacing in a wall. In curtain wall construction, provide for vertical movement where studs connect to the structural frame. Provide horizontal bracing in accordance with the design calculations and [AISI S100](#). Bracing shall be not less than the following:

<u>LOAD</u>	<u>HEIGHT</u>	<u>BRACING</u>
Wind load only	Up to <a href="#">10 feet</a>	One row at mid-height

<u>LOAD</u>	<u>HEIGHT</u>	<u>BRACING</u>
	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

### 3.3.3 Erection Tolerances

- a. Framing members which will be covered by finishes such as wallboard, plaster, or ceramic tile set in a mortar setting bed, shall be within the following limits:
  - (1) Layout of walls and partitions: 1/4 inch from intended position;
  - (2) Plates and runners: 1/4 inch in 8 feet from a straight line;
  - (3) Studs: 1/4 inch in 8 feet out of plumb, not cumulative; and
  - (4) Face of framing members: 1/4 inch in 8 feet from a true plane.
- b. Framing members which will be covered by ceramic tile set in dry-set mortar, latex-portland cement mortar, or organic adhesive shall be within the following limits:
  - (1) Layout of walls and partitions: 1/4 inch from intended position;
  - (2) Plates and runners: 1/8 inch in 8 feet from a straight line;
  - (3) Studs: 1/8 inch in 8 feet out of plumb, not cumulative; and
  - (4) Face of framing members: 1/8 inch in 8 feet from a true plane.

-- End of Section --

## SECTION 05 50 13

## MISCELLANEOUS METAL FABRICATIONS

**05/17, CHG 1: 08/18**

## PART 1 GENERAL

## 1.1 REFERENCES

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

## ALUMINUM ASSOCIATION (AA)

AA DAF45 (2003; Reaffirmed 2009) Designation System for Aluminum Finishes

## AMERICAN CONCRETE INSTITUTE (ACI)

ACI 318 (2014; Errata 1-2 2014; Errata 3-5 2015; Errata 6 2016; Errata 7-9 2017) Building Code Requirements for Structural Concrete (ACI 318-14) and Commentary (ACI 318R-14)

## AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 303 (2016) Code of Standard Practice for Steel Buildings and Bridges

## ASME INTERNATIONAL (ASME)

ASME B18.2.1 (2012; Errata 2013) Square and Hex Bolts and Screws (Inch Series)

ASME B18.2.2 (2015) Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)

ASME B18.6.2 (1998; R 2010) Slotted Head Cap Screws, Square Head Set Screws, and Slotted Headless Set Screws: Inch Series

ASME B18.6.3 (2013; R 2017) Machine Screws, Tapping Screws, and Machine Drive Screws (Inch Series)

ASME B18.21.1 (2009; R 2016) Washers: Helical Spring-Lock, Tooth Lock, and Plain Washers (Inch Series)

ASME B18.21.2M (1999; R 2014) Lock Washers (Metric Series)

ASME B18.22M (1981; R 2017) Metric Plain Washers

## AMERICAN SOCIETY OF SAFETY PROFESSIONALS (ASSP)

ASSP A10.3 (2013) Safety Requirements for

Powder-Actuated Fastening Systems American  
National Standard for Construction and  
Demolition Operations

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2020) Structural Welding Code - Steel

ASTM INTERNATIONAL (ASTM)

ASTM A29/A29M (2020) Standard Specification for General  
Requirements for Steel Bars, Carbon and  
Alloy, Hot-Wrought

ASTM A36/A36M (2019) Standard Specification for Carbon  
Structural Steel

ASTM A47/A47M (1999; R 2018; E 2018) Standard  
Specification for Ferritic Malleable Iron  
Castings

ASTM A53/A53M (2020) Standard Specification for Pipe,  
Steel, Black and Hot-Dipped, Zinc-Coated,  
Welded and Seamless

ASTM A108 (2013) Standard Specification for Steel  
Bar, Carbon and Alloy, Cold-Finished

ASTM A123/A123M (2017) Standard Specification for Zinc  
(Hot-Dip Galvanized) Coatings on Iron and  
Steel Products

ASTM A153/A153M (2016a) Standard Specification for Zinc  
Coating (Hot-Dip) on Iron and Steel  
Hardware

ASTM A307 (2014; E 2017) Standard Specification for  
Carbon Steel Bolts, Studs, and Threaded  
Rod 60 000 PSI Tensile Strength

ASTM A467/A467M (2020) Standard Specification for Machine  
Coil Chain

ASTM A475 (2003; R 2020) Standard Specification for  
Zinc-Coated Steel Wire Strand

ASTM A500/A500M (2020) Standard Specification for  
Cold-Formed Welded and Seamless Carbon  
Steel Structural Tubing in Rounds and  
Shapes

ASTM A653/A653M (2020) Standard Specification for Steel  
Sheet, Zinc-Coated (Galvanized) or  
Zinc-Iron Alloy-Coated (Galvannealed) by  
the Hot-Dip Process

ASTM A780/A780M (2020) Standard Practice for Repair of  
Damaged and Uncoated Areas of Hot-Dip  
Galvanized Coatings

ASTM A786/A786M	(2015a) Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates
ASTM A924/A924M	(2020) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM B26/B26M	(2014; E 2015) Standard Specification for Aluminum-Alloy Sand Castings
ASTM B108/B108M	(2019) Standard Specification for Aluminum-Alloy Permanent Mold Castings
ASTM B209	(2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B209M	(2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
ASTM B221	(2014) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B221M	(2013) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
ASTM C1513	(2018) Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections
ASTM D1187/D1187M	(1997; E 2011; R 2011) Asphalt-Base Emulsions for Use as Protective Coatings for Metal
ASTM E488/E488M	(2015) Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements
ASTM F1554	(2018) Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength

MASTER PAINTERS INSTITUTE (MPI)

MPI 79	(2016) Primer, Alkyd, Anti-Corrosive for Metal
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SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC SP 3	(2018) Power Tool Cleaning
SSPC SP 6/NACE No.3	(2007) Commercial Blast Cleaning

U.S. ARMY CORPS OF ENGINEERS (USACE)

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

## 1.2 SUBMITTALS

Approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29.05 20 SUSTAINABILITY REPORTING FOR DESIGN-BUILD. Submit the following in accordance with Section 01 33 00.05 20 CONSTRUCTION SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

Structural Steel Door Frames, Fabrication Drawings; G

Bollards/Pipe Guards; G

Embedded Angles and Plates, Installation Drawings; G

## SD-03 Product Data

Corner Guards

Structural Steel Door Frames; G

Recycled Content; S

## SD-07 Certificates

Certificates of Compliance; G

## 1.3 QUALIFICATION OF WELDERS

Qualify welders in accordance with AWS D1.1/D1.1M. Use procedures, materials, and equipment of the type required for the work.

## 1.4 DELIVERY, STORAGE, AND PROTECTION

Protect from corrosion, deformation, and other types of damage. Store items in an enclosed area free from contact with soil and weather. Remove and replace damaged items with new items.

## 1.5 MISCELLANEOUS REQUIREMENTS

## 1.5.1 Fabrication Drawings

Submit fabrication drawings showing layout(s), connections to structural system, and anchoring details as specified in AISC 303.

## 1.5.2 Installation Drawings

Submit templates, erection, and installation drawings indicating thickness, type, grade, class of metal, and dimensions. Show construction details, reinforcement, anchorage, and installation in relation to the building construction.



## PART 2 PRODUCTS

### 2.1 RECYCLED CONTENT

Provide products with recycled content. Provide [certificates of compliance](#) for recycled content.

### 2.2 MATERIALS

Provide exposed fastenings of compatible materials (avoid contact of dissimilar metals). Coordinate color and finish with the material to which fastenings are applied.

#### 2.2.1 Structural Carbon Steel

Provide in accordance with [ASTM A36/A36M](#).

#### 2.2.2 Structural Tubing

Provide in accordance with [ASTM A500/A500M](#).

#### 2.2.3 Steel Pipe

Provide in accordance with [ASTM A53/A53M](#), Type E or S, Grade B.

#### 2.2.4 Fittings for Steel Pipe

Provide standard malleable iron fittings in accordance with [ASTM A47/A47M](#).

#### 2.2.5 Floor Plates, Patterned

Provide floor plate in accordance with [ASTM A786/A786M](#). Provide steel plate not less than 14 gage.

#### 2.2.6 Anchor Bolts

Provide in accordance with [ASTM F1554](#). Where exposed, provide anchor bolts of the same material, color, and finish as the metal to which they are applied.

##### 2.2.6.1 Expansion Anchors

Provide [3/8 in.](#) diameter expansion anchors. Minimum concrete embedment of [3 in.](#) Design values listed are as tested in accordance with [ASTM E488/E488M](#).

- a. Provide minimum allowable pullout value [as required](#). Calculate pullout capacity according to [ACI 318](#).
- b. Provide minimum allowable shear value [as required](#). Calculate shear capacity according to [ACI 318](#).

##### 2.2.6.2 Lag Screws and Bolts

Provide in accordance with [ASME B18.2.1](#), type and grade best suited for the purpose.

#### 2.2.6.3 Toggle Bolts

Provide in accordance with ASME B18.2.1.

#### 2.2.6.4 Bolts, Nuts, Studs and Rivets

Provide in accordance with ASME B18.2.2 or ASTM A307.

#### 2.2.6.5 Powder Actuated Fasteners

Follow safety provisions in accordance with ASSP A10.3.

#### 2.2.6.6 Screws

Provide in accordance with ASME B18.2.1, ASME B18.6.2, ASME B18.6.3 and ASTM C1513.

#### 2.2.6.7 Washers

Provide plain washers in accordance with ASME B18.22M, ASME B18.21.1. Provide beveled washers for American Standard beams and channels, square or rectangular, tapered in thickness, and smooth. Provide lock washers in accordance with ASME B18.21.2M, ASME B18.21.1.

#### 2.2.6.8 Welded Headed Shear Studs

Provide in accordance with ASTM A108 or ASTM A29/A29M-12.

#### 2.2.7 Aluminum Alloy Products

Provide in accordance with ASTM B209M, ASTM B209 for sheet plate, ASTM B221M, ASTM B221M, ASTM B221 for extrusions and ASTM B26/B26M or ASTM B108/B108M for castings. Provide aluminum extrusions at least 1/8 inch thick and aluminum plate or sheet at least 0.050 inch thick.

### 2.3 FABRICATION FINISHES

#### 2.3.1 Galvanizing

Hot-dip galvanize items specified to be zinc-coated, after fabrication where practicable. Provide galvanizing in accordance with ASTM A123/A123M, ASTM A153/A153M, ASTM A653/A653M or ASTM A924/A924M, Z275 G90.

#### 2.3.2 Galvanize

Anchor bolts, grating fasteners, washers, and parts or devices necessary for proper installation, unless indicated otherwise.

#### 2.3.3 Repair of Zinc-Coated Surfaces

Repair damaged surfaces with galvanizing repair method and paint in accordance with ASTM A780/A780M or by application of stick or thick paste material specifically designed for repair of galvanizing, as approved by Contracting Officer. Clean areas to be repaired and remove slag from welds. Heat, with a torch, surfaces to which stick or paste material will be applied. Heat to a temperature sufficient to melt the metals in the stick or paste. Spread molten material uniformly over surfaces to be coated and wipe off excess material.

#### 2.3.4 Shop Cleaning and Painting

##### 2.3.4.1 Surface Preparation

Blast clean surfaces in accordance with [SSPC SP 6/NACE No.3](#). Surfaces that will be exposed in spaces above ceiling or in attic spaces, crawl spaces, furred spaces, and chases may be cleaned in accordance with [SSPC SP 3](#) in lieu of being blast cleaned. Wash cleaned surfaces which become contaminated with rust, dirt, oil, grease, or other contaminants with solvents until thoroughly clean. Steel to be embedded in concrete must be free of dirt and grease prior to embed. Do not paint or galvanize bearing surfaces, including contact surfaces within slip critical joints. Shop coat these surfaces with rust prevention.

##### 2.3.4.2 Pretreatment, Priming and Painting

Apply pre-treatment, primer, and paint in accordance with manufacturer's printed instructions. On surfaces concealed in the finished construction or not accessible for finish painting, apply an additional prime coat to a minimum dry film thickness of [1.0 mil](#). Tint additional prime coat with a small amount of tinting pigment.

#### 2.3.5 Nonferrous Metal Surfaces

Protect by plating, anodic, or organic coatings.

#### 2.3.6 Aluminum Surfaces

##### 2.3.6.1 Surface Condition

Before finishes are applied, remove roll marks, scratches, rolled-in scratches, kinks, stains, pits, orange peel, die marks, structural streaks, and other defects which will affect uniform appearance of finished surfaces.

##### 2.3.6.2 Aluminum Finishes

Unexposed sheet, plate and extrusions may have mill finish as fabricated. Sandblast castings' finish, medium, [AA DAF45](#). Unless otherwise specified, provide all other aluminum items with an anodized finish. Provide a coating thickness not less than that specified for protective and decorative type finishes for items used in interior locations or architectural Class I type finish for items used in exterior locations. Provide in accordance with [AA DAF45](#). Provide a polished satin finish on items to be anodized.

#### 2.4 CORNER GUARDS

For jambs and sills of openings and edges of platforms provide steel shapes and plates anchored in masonry or concrete with welded steel straps or end-weld stud anchors. Form corner guards for use with glazed or ceramic tile finish on walls with [0.0625 inch](#) thick corrosion-resisting steel with satin finish, extend [5 feet](#) above the top of cove base or to the top of the wainscot, whichever is less, and securely anchor to the supporting wall. Provide corner guards [as indicated](#) on exterior.

#### 2.5 BOLLARDS/PIPE GUARDS

Provide [8 inch](#) prime coated weight steel pipe in accordance with

ASTM A53/A53M. Anchor posts in concrete as indicated and fill solidly with concrete with minimum compressive strength of 2500 psi.

## 2.6 MISCELLANEOUS PLATES AND SHAPES

Provide 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. 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 and fasteners. Construct to have at least 8 in bearing on masonry at each end.

Provide angles and plates in accordance with ASTM A36/A36M, for embedment as indicated. Galvanize embedded items exposed to the elements in accordance with ASTM A123/A123M.

## 2.7 SAFETY CHAINS

Construct safety chains of galvanized steel, straight link type, minimum 3/16 inch diameter, with a minimum of twelve links per one foot, and snap hooks on each end. Test safety chain in accordance with ASTM A467/A467M, Class CS. Provide boat type snap hooks. Provide galvanized 3/8 inch bolt with 3/4 inch eye diameter for attachment of chain, anchored as indicated. Supply two chains, 4 inches longer than the anchorage spacing, for each guarded area.

## 2.8 SECURITY GRILLES

Fabricate of channel frames with not less than two masonry anchors at each jamb and 1/2 inch hardened steel bars spaced not over 4 inches both ways and welded to frame. Provide 18 by 16 mesh screen and two layers of 1/4 inch hardware cloth clamped to frame.

## 2.9 GUY CABLES

Provide guy cables as pre-stretched, galvanized wire rope of sizes indicated. Provide wire rope in accordance with ASTM A475, high strength grade with Class A coating. Guys must have a factory attached clevis top-end fitting, a factory attached open-bridge strand socket bottom-end fitting, and must be complete with oval eye, threaded anchor rods. Provide hot-dip galvanized fittings and accessories.

# PART 3 EXECUTION

## 3.1 GENERAL INSTALLATION REQUIREMENTS

Install items at locations indicated in accordance with manufacturer's instructions. Verify all field dimensions prior to fabrication. Include materials and parts necessary to complete each assembly, whether indicated or not. Miss-alignment and miss-sizing of holes for fasteners is cause for rejection. Conceal fastenings where practicable. Joints exposed to weather must be watertight.

## 3.2 WORKMANSHIP

Provide miscellaneous metalwork that is true and accurate in shape, size, and profile. Make angles and lines continuous and straight. Make curves consistent, smooth and unfaceted. Provide continuous welding along the

entire area of contact except where tack welding is permitted. Do not tack weld exposed connections. Unless otherwise indicated and approved, provide a smooth finish on exposed surfaces. Provide countersunk rivets where exposed. Provide coped and mitered corner joints aligned flush and without gaps.

### 3.3 ANCHORAGE, FASTENINGS, AND CONNECTIONS

Provide anchorage as necessary, whether indicated or not, for fastening miscellaneous metal items securely in place. Include slotted inserts, expansion shields, powder-driven fasteners, toggle bolts (when approved for concrete), through bolts for masonry, headed shear studs, machine and carriage bolts for steel, through bolts, lag bolts, and screws for wood. Do not use wood plugs. Provide non-ferrous attachments for non-ferrous metal. Provide exposed fastenings of compatible materials (avoid contact of dissimilar metals), that generally match in color and finish the surfaces to which they are applied. Conceal fastenings where practicable. Provide all fasteners flush with the surfaces they fasten, unless indicated otherwise.

### 3.4 BUILT-IN WORK

Where necessary and not otherwise indicated, form built-in metal work for anchorage with concrete or masonry. Provide built-in metal work in ample time for securing in place as the work progresses.

### 3.5 WELDING

Perform welding, welding inspection, and corrective welding in accordance with [AWS D1.1/D1.1M](#). Use continuous welds on all exposed connections. Grind visible welds smooth in the finished installation. Provide welded headed shear studs in accordance with [AWS D1.1/D1.1M](#), Clause 7, except as otherwise specified. Provide in accordance with the safety requirements of [EM 385-1-1](#).

### 3.6 DISSIMILAR METALS

Where dissimilar metals are in contact, protect surfaces with a coating in accordance with [MPI 79](#) to prevent galvanic or corrosive action. Where aluminum is in contact with concrete, plaster, mortar, masonry, wood, or absorptive materials subject to wetting, protect in accordance with [ASTM D1187/D1187M](#), asphalt-base emulsion. Clean surfaces with metal shavings from installation at the end of each work day.

### 3.7 PREPARATION

#### 3.7.1 Material Coatings and Surfaces

Remove rust preventive coating just prior to field erection, using a remover approved by the metal manufacturer. Surfaces, when assembled, must be free of rust, grease, dirt and other foreign matter.

#### 3.7.2 Environmental Conditions

Do not clean or paint surfaces when damp or exposed to foggy or rainy weather, when metallic surface temperature is less than minus 5 degrees F above the dew point of the surrounding air, or when surface temperature is below 45 degrees F or over 95 degrees F, unless approved by the Contracting Officer. Metal surfaces to be painted must be dry for a

minimum of 48 hours prior to the application of primer or paint.

### 3.8 INSTALLATION OF BOLLARDS/PIPE GUARDS

Set bollards/pipe guards vertically in concrete piers. Fill hollow cores with concrete having a compressive strength of 3000 psi.

### 3.9 INSTALLATION MISCELLANEOUS PLATES AND SHAPES

Provide lintels fabricated from structural steel shapes over openings in masonry walls and partitions as indicated and as required to support wall loads over openings. Provide with connections and fasteners and welds. Construct to have at least 8 inches bearing on masonry at each end.

-- End of Section --

## SECTION 05 50 14

## STRUCTURAL METAL FABRICATIONS

**08/18**

## PART 1 GENERAL

## 1.1 REFERENCES

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

## ALUMINUM ASSOCIATION (AA)

AA ADM (2020) Aluminum Design Manual

## AMERICAN GEAR MANUFACTURERS ASSOCIATION (AGMA)

AGMA ISO 22849-A12 (2012) Design Recommendations for Bevel Gears

AGMA ISO 23509-A08 (2008) Bevel and Hypoid Gear Geometry

ANSI/AGMA 6001 (2008E; R 2014) Design and Selection of Components for Enclosed Gear Drives

## AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTING (ASNT)

ANSI/ASNT CP-189 (2016) ASNT Standard for Qualification and Certification of Nondestructive Testing Personnel (ANSI/ASNT CP-105-2006)

## ASME INTERNATIONAL (ASME)

ASME B4.1 (1967; R 1994; R 2004; R 2009; R 2020) Preferred Limits and Fits for Cylindrical Parts

ASME B46.1 (2020) Surface Texture, Surface Roughness, Waviness and Lay

## AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2020) Structural Welding Code - Steel

AWS D1.2/D1.2M (2014; Errata 1 2014; Errata 2 2020) Structural Welding Code - Aluminum

AWS QC1 (2016) Specification for AWS Certification of Welding Inspectors

## ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M (2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A380/A380M	(2017) Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems
ASTM A780/A780M	(2020) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM B177/B177M	(2011; R 2017) Standard Guide for Engineering Chromium Electroplating
ASTM B766	(1986; R 2015) Standard Specification for Electrodeposited Coatings of Cadmium
ASTM D962	(1981; R 2014) Aluminum Powder and Paste Pigments for Paints
ASTM E94/E94M	(2017) Standard Guide for Radiographic Examination Using Industrial Radiographic Film
ASTM E165/E165M	(2018) Standard Practice for Liquid Penetrant Examination for General Industry
ASTM E446	(2014) Radiographs for Steel Castings Up to 2 In. (51mm) in Thickness
ASTM E709	(2015) Standard Guide for Magnetic Particle Examination
ASTM F3125/F3125M	(2019) Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength

## RESEARCH COUNCIL ON STRUCTURAL CONNECTIONS (RCSC)

RCSC S348	(2014; Errata 2015) RCSC Specification for Structural Joints Using High-strength Bolts
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## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

Detail Drawings; G[, [\_\_\_\_\_]]

Welding Procedures; G[, [\_\_\_\_\_]]



Welding Repair Plan

Castings

SD-03 Product Data

Filler Metal

Lubricant

SD-06 Test Reports

Tests, Inspections, and Verifications

SD-07 Certificates

Welding Qualifications

Application Qualification for Steel Studs; G[, [\_\_\_\_]]

Welding of Aluminum

Weld Inspection Log

Certified Welding Inspector

Nondestructive Testing Personnel

### 1.3 QUALITY ASSURANCE

#### 1.3.1 Detail Drawings

Submit detail drawings for metalwork and machine work, prior to fabrication, include within the detail drawings catalog cuts, templates, fabrication and assembly details and type, grade and class of material as appropriate. Indicate methods of protecting the work during shipping, storage, field assembly, and installation.

#### 1.3.2 Welding Qualifications

Prior to welding, submit certification for each welder stating the type of welding and positions qualified for, the code and procedure qualified under, date qualified, and the firm and individual certifying the qualification tests. [If the qualification date of the welder or welding operator is more than 6 months old, accompany the welding operator's qualification certificate with a current certificate by the welder attesting to the fact that he has been engaged in welding since the date of certification, with no break in welding service greater than 6 months.]

Conform to all requirements specified in [AWS D1.1/D1.1M] and [AA ADM] [or AWS D1.2/D1.2M].

## PART 2 PRODUCTS

### 2.1 FABRICATION

#### 2.1.1 Structural Fabrication

Material must be straight before being laid off or worked. Perform

straightening, if necessary, by methods that will not impair the metal. Sharp kinks or bends are cause for rejection of the material. Material with welds will not be accepted except where welding is definitely specified, indicated or otherwise approved. Make bends using approved dies, press brakes or bending rolls. Where heating is required, take precautions to avoid overheating the metal and allow it to cool in a manner that will not impair the original properties of the metal. Proposed flame cutting of material, other than structural steel, is subject to approval and must be indicated on detail drawings. Shearing must be accurate and all portions of the work neatly finished. Make corners square and true unless otherwise shown. Fillet re-entrant cuts to a minimum radius of  $3/4$  inch unless otherwise approved. Provide finished members free of twists, bends and open joints. Tighten bolts, nuts and screws.

#### 2.1.1.1 Dimensional Tolerances for Structural Work

Measure dimensions using an approved calibrated steel tape of approximately the same temperature as the material being measured. The overall dimensions of an assembled structural unit must be within the tolerances indicated on the drawings or as specified in the particular section of these specifications for the item of work. Where tolerances are not specified in other sections of these specifications or shown, an allowable variation of  $1/32$  inch is permissible in the overall length of component members with both ends milled; component members without milled ends must not deviate from the dimensions shown by more than  $1/16$  inch for members 30 feet or less in length, and by more than  $1/8$  inch for members over 30 feet in length.

#### 2.1.1.2 Structural Steel Fabrication

Structural steel may be cut by mechanically guided or hand-guided torches, provided an accurate profile with a surface that is smooth and free from cracks and notches is obtained. Prepare surfaces and edges in accordance with AWS D1.1/D1.1M, Prequalification of WPSs Clause. Where structural steel is not to be welded, chipping or grinding will not be required except as necessary to remove slag and sharp edges of mechanically guided or hand-guided cuts not exposed to view. Chip, grind or machine to sound metal hand-guided cuts which are to be exposed or visible.

#### 2.1.1.3 Structural Aluminum Fabrication

Lay out and cut aluminum in accordance with the AA ADM, Section 6.

### 2.1.2 Welding

#### 2.1.2.1 Welding of Structural Steel

##### 2.1.2.1.1 Welding Procedures for Structural Steel

Use prequalified welding procedures for structural steel as described in AWS D1.1/D1.1M, Prequalification of WPSs Clause or qualify by tests as prescribed in AWS D1.1/D1.1M, Qualification Clause. For welding procedures qualified by tests, the coupon welding and specimen testing will be witnessed and the test report document signed by the Contracting Officer. Approval of any welding procedure does not relieve the Contractor of the responsibility for producing a finished structure meeting all requirements of these specifications. The Contractor will be directed or authorized to make any changes in previously approved welding

procedures that are deemed necessary or desirable by the Contracting Officer.

- a. Submit a complete schedule of welding procedures for each steel structure to be welded prior to commencing fabrication. Provide the schedule in conformance with the requirements specified in the provisions of AWS D1.1/D1.1M
- b. Provide within the schedule detailed procedure specifications and tables or diagrams showing the procedures to be used for each required joint. Include in the welding procedures filler metal, preheat, interpass temperature and stress-relief heat treatment requirements. Clearly identify each welding procedure as being prequalified or required to be qualified by tests.
- c. Show types and locations of welds designated or in the specifications to receive nondestructive testing in the welding procedures.

#### 2.1.2.1.2 Welding Process

Perform welding of structural steel by an electric arc welding process using a method which excludes the atmosphere from the molten metal and conforms to the applicable provisions of AWS D1.1/D1.1M. Minimize residual stresses, distortion and shrinkage from welding.

#### 2.1.2.1.3 Welding Technique

##### 2.1.2.1.3.1 Filler Metal

Provide the electrode, electrode-flux combination and grade of filler metal conforming to the appropriate AWS specification for the base metal and welding process being used or be as shown where a specific choice of AWS specification allowables is required. Submit filler metal product data. Include the AWS designation of the electrodes to be used in the schedule of welding procedures. Use only low hydrogen electrodes for manual shielded metal-arc welding regardless of the thickness of the steel. Use a controlled temperature storage oven at the job site as prescribed by AWS D1.1/D1.1M, Fabrication Clause to maintain low moisture of low hydrogen electrodes.

##### 2.1.2.1.3.2 Preheat and Interpass Temperature

Perform preheating as required by AWS D1.1/D1.1M, Fabrication Clause or as otherwise specified except that the temperature of the base metal must be at least 70 degrees F. Slowly and uniformly preheat the joint area by approved means to the prescribed temperature, held at that temperature until the welding is completed and then permitted to cool slowly in still air.

##### 2.1.2.1.3.3 Stress-Relief Heat Treatment

Where stress relief heat treatment is specified or shown, perform in accordance with the requirements of AWS D1.1/D1.1M, Fabrication Clause unless otherwise authorized or directed.

##### 2.1.2.1.4 Workmanship

Perform welding workmanship in accordance with AWS D1.1/D1.1M, Fabrication Clause and other applicable requirements of these specifications.

#### 2.1.2.1.4.1 Preparation of Base Metal

Prior to welding inspect surfaces to be welded to ensure compliance with AWS D1.1/D1.1M, Fabrication Clause.

#### 2.1.2.1.4.2 Temporary Welds

Make temporary welds, required for fabrication and erection, under the controlled conditions prescribed for permanent work. Make temporary welds using low-hydrogen welding electrodes and by welders qualified for permanent work as specified in these specifications. Conduct preheating for temporary welds as required by AWS D1.1/D1.1M for permanent welds except that the minimum temperature must be 120 degrees F in any case. In making temporary welds, do not strike arcs in other than weld locations. Remove each temporary weld and grind flush with adjacent surfaces after serving its purpose.

#### 2.1.2.1.4.3 Tack Welds

Tack welds that are to be incorporated into the permanent work are to exhibit the same quality requirements as the permanent welds; clean and thoroughly fuse them with permanent welds. Perform preheating as specified above for temporary welds. Provide cascaded ends on multiple-pass tack welds. Remove defective tack welds before permanent welding.

#### 2.1.2.2 Welding of Steel Castings

Remove unsound material from the surfaces of steel castings, to be incorporated into welded connections, by chipping, machining, air-arc gouging or grinding. Do not weld major connections designed for transfer of stresses if the temperature of the casting is lower than 100 degrees F. Preheat castings containing over 0.35 percent carbon or over 0.75 percent manganese to a temperature not to exceed 450 degrees F and conduct welding while the castings are maintained at a temperature above 350 degrees F. Welding is not permitted on castings containing carbon in excess of 0.45 percent except on written authorization. Castings requiring welding repairs after the first annealing and castings involving welding fabrication must be stress-relieved annealed prior to receiving final machining unless otherwise permitted.

#### 2.1.2.3 Welding of Steel Studs

Welding of steel studs must conform to the requirements of AWS D1.1/D1.1M, Stud Welding Clause, except as otherwise specified for the procedures for welding steel studs to structural steel, including mechanical, workmanship, technique, stud application qualification, production quality control and fabrication and verification inspection procedures.

##### 2.1.2.3.1 Application Qualification for Steel Studs

As a condition of approval of the stud application process, submit certified test reports and certification that the studs conform to the requirements of AWS D1.1/D1.1M, Stud Welding Clause, certified results of the stud manufacturer's stud base qualification test, and certified results of the stud application qualification test as required by AWS D1.1/D1.1M, Stud Welding Clause, prior to commencing fabrication, except as otherwise specified.

## 2.1.2.3.2 Production Control

Production control of stud welding must conform to the requirements of [AWS D1.1/D1.1M](#), Stud Welding Clause, except as otherwise specified for quality control for production welding of studs. Weld studs on which pre-production testing is to be performed must be in the same general position as required on production studs (flat, vertical, overhead or sloping). If the reduction of the length of studs becomes less than normal as they are welded, stop welding immediately and do not resume until the cause has been corrected.

## 2.1.2.4 Welding of Aluminum

Welding of aluminum must conform to the requirements of [\[AA ADM\]](#) [and] [\[AWS D1.2/D1.2M\]](#). Submit a certified report giving the results of the qualifying tests, and a complete schedule of the welding process for each aluminum fabrication to be welded prior to commencing fabrication.

## 2.1.3 Bolted Connections

## 2.1.3.1 Bolted Structural Steel Connections

Provide bolts, nuts and washers of the type specified or indicated. Equip all nuts with washers except for high strength bolts. Use beveled washers where bearing faces have a slope of more than 1:20 with respect to a plane normal to the bolt axis. Where the use of high strength bolts is specified or indicated, conform the materials, workmanship and installation to the applicable provisions of [ASTM F3125/F3125M](#). Install High Strength Bolts [ASTM F3125/F3125M](#) Grade A325 or Grade A490 in accordance with the requirements of [RCSC S348](#). All High Strength Bolted Connections are fully pretensioned to the minimum pretension as specified in [RCSC S348](#). Follow the pre-installation verification procedures outlined in [RCSC S348](#). All other bolted connections are snug tight in accordance with [RCSC S348](#).

- a. Accurately locate bolt holes, smooth, perpendicular to the member and cylindrical.
- b. Drill or subdrill holes for regular bolts and ream in the shop and not more than [1/16 inch](#) larger than the diameter of the bolt.
- c. Match-ream or drill holes for fitted bolts in the shop. Remove burrs resulting from reaming. Keep bolt threads entirely outside of the holes. The body diameter of bolts must have tolerances as recommended by [ASME B4.1](#) for the class of fit specified. Place fitted bolts in reamed holes by selective assembly to provide an LN-2 fit.
- d. Holes for high strength bolts must not have diameters more than [1/16 inch](#) larger than bolt diameters. If the thickness of the material is not greater than the diameter of the bolts, the holes may be punched. If the thickness of the material is greater than the diameter of the bolts the holes may be drilled full size or subpunched or subdrilled at least [1/8 inch](#) smaller than the diameter of the bolts and then reamed to full size. Poor matching of holes will be cause for rejection. Drifting occurring during assembly cannot distort the metal or enlarge the holes. Reaming to a larger diameter of the next standard size bolt will be allowed for slight mismatching.

## 2.1.3.2 Bolted Aluminum Connections

Conform to the requirements of AA ADM, Section J.3 and M.10 for bolted aluminum connections.

## 2.1.4 Riveted Aluminum Connections

Conform to the requirements of AA ADM, Section J.4 and M.11 for riveted aluminum connections.

## 2.1.5 Patterns

Take care to avoid sharp corners or abrupt changes in cross section; ample fillets are to be used in the construction of patterns. Add, as required, draft and increases in pattern thicknesses to conform to the standard foundry practice applied and as necessary to ensure that all metal thicknesses of the finished castings conform to the dimensions shown and are within the tolerances specified in paragraph INSPECTION OF STEEL CASTINGS. [All patterns [, except those loaned to the Contractor by the Government,] remain the property of the Contractor.] [Patterns for those parts listed below are furnished by the Contractor, become the property of the Government and cannot be used for work under any other contract unless specifically authorized. All other patterns [, except those loaned to the Contractor by the Government,] remain the property of the Contractor.]

## [2.1.5.1 Fabrication of Patterns and Core Boxes

Substantially make patterns and core boxes that become the property of the Government from thoroughly seasoned Grade B or better sugar pine, northern white pine or an approved equal. Securely glue and screw together built-up patterns and core boxes. Use approved high grade, water resistant glue that is suitably treated for resistance to fungus and insect infestation. Only light sections are permitted to be nailed. Counterbore and neatly fill screw holes with wood plugs. Dovetail or fasten with pull-out dowels loose pieces. Split patterns and core boxes must have metal dowels at partings. Skelton or sweep patterns will not be accepted unless specifically authorized. Fill all nail and tool marks on molding surfaces with beeswax and sand all surfaces with No. 0 grade sandpaper. Finish patterns with not less than three coats of an approved phenolic-resin sealer colored in accordance with the standard trade practices for pattern colors. Stamp each pattern, core box and loose piece with the part mark shown. Provide patterns complete with necessary core boxes and templates.

## ][2.1.5.2 Available Patterns

The patterns listed below are available for loan to the Contractor. They are stored at [\_\_\_\_\_] and may be secured f.o.b. their place of storage upon request.

PART NO.	PATTERN NO.	CONDITION
[_____]	[_____]	[_____]
[_____]	[_____]	[_____]

PART NO.	PATTERN NO.	CONDITION
[_____]	[_____]	[_____]

The Contractor assumes responsibility for the accuracy and adaptability of all parts made with the above listed patterns, as if the parts had been made from new patterns produced under this contract, and bears the expense of correcting any inaccuracies found in them.

#### ] [2.1.5.3 Disposition of Patterns, Core Boxes, and Templates

Substantially make and put together with screws the boxes and crates for the packing and shipment of patterns, core boxes and templates so that they can be used several times. Plainly mark each box and crate to indicate its contents. Thoroughly clean all patterns, core boxes and templates [including those loaned to the Contractor by the Government] used, crate and deliver in first-class condition with a list of same in duplicate to [\_\_\_\_\_] before final payment is made. The Contracting Officer reserves the right to withhold payment for final parts made from any pattern until such pattern is delivered. Varnish patterns and core boxes and give all templates a coat of an approved paint before being crated. Replace any pattern, core box or template lost in shipment or damaged.

#### ] 2.1.6 Castings

Each casting and castings weighing more than 500 required pounds must bear cast or stamped heat numbers. Submit detail drawings for each casting. Deviations from the dimensions of castings shown must not exceed amounts that impair the strength of castings by more than 10 percent as computed from the dimensions shown. Dimensions of castings shown on approved detail drawings are finished dimensions. Castings that are warped or otherwise distorted or that are oversize to an extent that interfere with proper fit with other parts of the machinery or structure will be rejected. The structure of metal in castings must be homogeneous and free from excessive nonmetallic inclusions. Excessive segregation of impurities or alloys at critical points in castings will be cause for rejection. Do not make repairs to castings prior to approval. Minor surface imperfections not affecting the strength of casting may be welded in the "green" if approved. Surface imperfections will be considered minor when the depth of the cavity prepared for welding is the lesser of 20 percent of the actual wall thickness or 1 inch. Defects other than minor surface imperfections may be welded only when specifically authorized in accordance with the following requirements:

- a. The defects have been entirely removed and are judged not to affect the strength, use or machineability of the castings when properly welded and stress relieved.
- b. The proposed welding procedure, stress relief and method of examination of the repair work have been submitted and approved.

#### 2.1.7 Machine Work

Tolerances, allowances and gauges for metal fits between plain, non-threaded, cylindrical parts conform to ASME B4.1 for the class of fit shown or required unless otherwise shown on approved detail drawings. Where fits are not shown they will be suitable as approved. Tolerances

for machine-finished surfaces designated by non-decimal dimensions must be within  $1/64$  inch. Sufficient machining stock will be allowed on placing pads to ensure true surfaces of solid material. Provide finished contact or bearing surfaces true and exact to secure full contact. Polish journal surfaces and finish all surfaces with sufficient smoothness and accuracy to ensure proper operation when assembled. Accurately machine parts entering any machine and all like parts be interchangeable except that parts assembled together for drilling or reaming of holes or machining will not be required to be interchangeable with like parts. Accurately locate all drilled bolt holes.

#### 2.1.7.1 Finished Surfaces

Provide surface finishes, indicated or specified, in accordance with ASME B46.1. Values of required roughness heights are arithmetical average deviations expressed in microinches. These values are maximum. Lesser degrees will be satisfactory unless otherwise indicated. Compliance with surface requirements is determined by sense of feel and visual inspection of the work compared to Roughness Comparison Specimens in accordance with the provisions of ASME B46.1. Values of roughness width and waviness height must be consistent with the general type of finish specified by roughness height. Where the finish is not indicated or specified use that which is most suitable for the particular surface, provide the class of fit required and be indicated on the detail drawings by a symbol which conforms to ASME B46.1 when machine finishing is provided. Flaws such as scratches, ridges, holes, peaks, cracks or checks which make the part unsuitable for the intended use will be cause for rejection.

#### 2.1.7.2 Unfinished Surfaces

Lay out all work to secure proper matching of adjoining unfinished surfaces unless otherwise directed. Where there is a large discrepancy between adjoining unfinished surfaces chip and grind smooth or machine to secure proper alignment. Unfinished surfaces must be true to the lines and dimensions shown and be chipped or ground free of all projections and rough spots. Fill in depressions or holes not affecting the strength or usefulness of the parts in an approved manner.

#### 2.1.7.3 Pin Holes

Pin holes are to be bored true to gauges, smooth, straight and at right angles to the axis of the member. Do the boring after the member is securely fastened in position.

#### 2.1.7.4 Gears

Provide gears that have machine cut teeth of a form conforming to applicable design requirements of AGMA ISO 22849-A12, AGMA ISO 23509-A08 and ANSI/AGMA 6001 unless otherwise specified or shown.

#### 2.1.7.5 Shafting

Turn or grind shafting with hot-rolled or cold-rolled steel, as required, unless otherwise specified or authorized. Provide fillets where changes in section occur. Cold-finished shafting may be used where keyseating is the only machine work required.



#### 2.1.7.6 Bearings

Bearings may be lined with babbit or bronze unless otherwise specified or shown. Where the bearing pressure is in excess of 200 psi, line bearings with bronze. Pressures on lined bearings must not exceed [\_\_\_\_\_] psi of projected area unless otherwise required or authorized. Anti-friction bearings of approved types and of sizes not less than those recommended by the bearing manufacturer for the duty intended will be permitted subject to approval. Properly align all bearings provided with a suitable means of lubrication. Install anti-friction bearings as required to provide for retention of the lubricant and to exclude dirt and grit.

#### 2.1.8 Miscellaneous Provisions

##### 2.1.8.1 Metallic Coatings

- a. Zinc Coatings - Apply zinc coatings in a manner and of a thickness and quality conforming to ASTM A123/A123M. Where zinc coatings are destroyed by cutting, welding or other causes regalanize the affected areas. Regalanize coatings 2 ounces or heavier with a suitable low-melting zinc base alloy similar to the recommendations of the American Hot-Dip Galvanizers Association to the thickness and quality specified for the original zinc coating. Repair coatings less than 2 ounces in accordance with ASTM A780/A780M.
- b. Cadmium Coatings - Provide cadmium coatings of a quality and thickness conforming to the requirements of ASTM B766 and inspections conforming to the requirements of ASTM E165/E165M, Type [\_\_\_\_\_] .
- c. Chromium Coatings - Apply chromium coatings for engineering in conformance with ASTM B177/B177M.

##### 2.1.8.2 Cleaning of Corrosion-Resisting Steel

Remove oil, paint and other foreign substances from corrosion-resisting steel surfaces after fabrication. Perform cleaning by vapor degreasing or by the use of cleaners of the alkaline, emulsion or solvent type. After the surfaces have been cleaned give a final rinsing with clean water followed by a 24 hour period during which the surfaces are intermittently wet with clean water and then allowed to dry for the purpose of inspecting the clean surfaces. Visually inspect the surfaces for evidence of paint, oil, grease, welding slag, heat treatment scale, iron rust or other forms of contamination. If evidence of foreign substance is found, clean again in accordance with the applicable provisions of ASTM A380/A380M. Furnish the proposed method of treatment for approval. Visually reinspect after treatment. Use only stainless steel or nonmetallic bristle brushes to remove foreign substances. Remove any contamination occurring subsequent to the initial cleaning by one or more of the methods indicated above.

##### 2.1.8.3 Lubrication

Provide the arrangement and details for lubrication as indicated. Thoroughly clean and lubricate, with an appropriate lubricant, all bearing surfaces before erection or assembly. Prior to use of the lubricant submit for approval product data supporting its use in the assembly that includes the following lubricating properties as they apply, temperature range, protection against corrosion, ability to remain in bearing, ability to seal out contaminants, cooling and friction.

### 2.1.9 Shop Assembly

Assemble [only those machinery and structural units listed below] [each machinery and structural unit furnished] in the shop to determine the correctness of the fabrication and matching of the component parts unless otherwise specified. Do not exceed those tolerances shown. Closely check each unit assembled to ensure that all necessary clearances have been provided and that binding does not occur in any moving part. Assembly in the shop must be in the same position as final installation in the field unless otherwise specified. Perform assembly and disassembly work in the presence of the Contracting Officer unless waived in writing. Immediately remedy errors or defects disclosed by the Contractor without cost to the Government. Before disassembly for shipment match-mark each piece of a machinery or structural unit to facilitate erection in the field. Indicate the location of match-marks by circling with a ring of white paint after the shop coat of paint has been applied or as otherwise directed.

## 2.2 TESTS, INSPECTIONS, AND VERIFICATIONS

Perform material tests and analyses certified by an approved laboratory to demonstrate that materials are in conformity with the specifications. These tests and analyses must be performed and certified at the Contractor's expense. Perform tests, inspections, and verifications conforming to the requirements of the particular sections of these specifications for the respective items of work unless otherwise specified or authorized. Conduct tests in the presence of the Contracting Officer if so required. Furnish specimens and samples for additional independent tests and analyses upon request by the Contracting Officer. Properly label specimens and samples and prepare for shipment. Submit certified test reports for materials with all materials delivered to the site.

### 2.2.1 Nondestructive Testing

When doubt exists as to the soundness of any material part, such part may be subjected to any form of nondestructive testing determined by the Contracting Officer. This may include ultrasonic, magnaflux, dye penetrant, x-ray, gamma ray or any other test that will thoroughly investigate the part in question. The cost of such investigation will be borne by the Government if the part is found to be sound and by the Contractor if the part is found to be defective. Any defects will be cause for rejection; replace and retest rejected parts at the Contractor's expense.

### 2.2.2 Tests of Machinery and Structural Units

The details for tests of machinery and structural units must conform to the requirements of the particular sections of these specifications covering these items. Assemble each complete machinery and structural unit and test them in the shop, in the presence of the Contracting Officer, unless otherwise directed. Waiving of tests does not relieve the Contractor of responsibility for any fault in operation, workmanship or material that occurs before the completion of the contract or guarantee. After being installed at the site, operate each complete machinery or structural unit through a sufficient number of complete cycles to demonstrate to the satisfaction of the Contracting Officer that it meets the specified operational requirements in all respects.

### 2.2.3 Inspection of Structural Steel Welding

Nondestructive testing of designated welds will be required. Supplemental examination of any joint or coupon cut from any location in any joint may also be required.

#### 2.2.3.1 Visual Examination

All visual inspection will be conducted in accordance with AWS D1.1/D1.1M, by a Certified Welding Inspector. Document this inspection in the Visual Weld Inspection Log. Submit certificates indicating that certified welding inspectors meet the requirements of AWS QC1.

#### 2.2.3.2 Nondestructive Testing

Perform as designated or described in the sections of these specifications, the nondestructive testing of shop and field welds covering the particular items of work. Record final nondestructive testing results in the Weld Inspection Log which identifies final NDT inspection of all welds requiring inspection and submit the log.

##### 2.2.3.2.1 Testing Agency

The nondestructive testing of welds and the evaluation of tests as to the acceptability of the welds must be performed by a testing agency adequately equipped and competent to perform such services or by the Contractor using suitable equipment and qualified personnel. All personnel performing nondestructive testing shall be certified Level I or II in the method of NDT being utilized in accordance with ANSI/ASNT CP-189. Level I inspectors must have direct supervision of a Level II inspector. Submit certification for nondestructive testing personnel prior to all testing. In either case, written approval of the examination procedures is required and performance of the examination tests must be done in the presence of the Contracting Officer. The evaluation of tests are subject to the approval and all records become the property of the Government.

##### 2.2.3.2.2 Examination Procedures

Conform to the following requirements.

###### 2.2.3.2.2.1 Ultrasonic Testing

Examine, evaluate and report ultrasonic testing of welds in conformance to the requirements of AWS D1.1/D1.1M, Inspection Clause, for [statically] [cyclically] loaded connections. Provide ultrasonic equipment capable of making a permanent record of the test indications. Make a record of each weld tested.

###### 2.2.3.2.2.2 Magnetic Particle Inspection

Conform magnetic particle inspection of welds to the applicable provisions of ASTM E709.

###### 2.2.3.2.2.3 Dye Penetrant Inspection

Perform dye penetrant inspection of welds conforming to the applicable provisions of ASTM E165/E165M.

#### 2.2.3.2.3 Welds to be Subject to Nondestructive Testing

Test [50%][\_\_\_\_\_] of CJP welds using ultrasonic testing per Table [6.2] [or 6.3] of AWS D1.1/D1.1M. Randomly test [50%][\_\_\_\_\_] of all PJP and fillet welds or as indicated by magnetic particle or dye penetrant testing.

#### 2.2.3.3 Test Coupons

The Government reserves the right to require the Contractor to remove coupons from completed work when doubt as to soundness cannot be resolved by nondestructive testing. When coupons are removed from any part of a structure, repair the members cut in a neat manner with joints of the proper type to develop the full strength of the members. Peen repaired joints as approved or directed to relieve residual stress. The expense for removing and testing coupons, repairing cut members and the nondestructive testing of repairs is borne by the Government or the Contractor in accordance with the Contract Clauses INSPECTION AND ACCEPTANCE.

#### 2.2.3.4 Supplemental Examination

When the soundness of any weld is suspected of being deficient due to faulty welding or stresses that might occur during shipment or erection, the Government reserves the right to perform nondestructive supplemental examinations before final acceptance. The cost of such inspection will be borne by the Government.

#### 2.2.4 Welding Repair Plan

Repair defective welds in accordance with AWS D1.1/D1.1M, Fabrication Clause. Remove defective weld metal to sound metal by use of air carbon-arc or oxygen gouging. Thoroughly clean surfaces before welding. Retest welds that have been repaired by the same methods used in the original inspection. Except for the repair of members cut to remove test coupons and found to have acceptable welds costs of repairs and retesting will be borne by the Contractor. Submit welding repair plans for steel, prior to making repairs.

#### 2.2.5 Inspection and Testing of Steel Stud Welding

Perform fabrication and verification inspection and testing of steel stud welding conforming to the requirements of AWS D1.1/D1.1M, Welding Clause except as otherwise specified. The Contracting Officer will serve as the verification inspector. Bend or torque test one stud in every 100, including studs that do not show a full 360 degree weld flash, have been repaired by welding or whose reduction in length due to welding is less than normal as required by AWS D1.1/D1.1M, Stud Welding Clause. If any of these studs fail, bend or torque test two additional studs. If either of the two additional studs fails, all of the studs represented by the tests will be rejected. Studs that crack under testing in the weld, base metal or shank will be rejected and replaced by the Contractor at no additional cost.

#### 2.2.6 Inspection of Steel Castings

Perform radiographic inspection of steel castings at the casting plant as designated and as described in the section of these specifications covering the particular item of work. The procedure for making, evaluating and reporting the radiographic inspection must conform to the

requirements of [ASTM E94/E94M](#). The castings will be unacceptable if shown to have defects of greater severity than the applicable reference standard specified in the following table:

DISCONTINUITY TYPE	SEVERITY LEVELS OR CLASSES
[_____]	[_____]
[_____]	[_____]

Use the applicable referenced standards as illustrated in [ASTM E446](#). The evaluation of the radiographs will be subject to approval and all records become the property of the Government.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

Thoroughly clean all parts to be installed. Remove packing compounds, rust, dirt, grit and other foreign matter. Clean holes and grooves for lubrication. Examine enclosed chambers or passages to make sure that they are free from damaging materials. Where units or items are shipped as assemblies they will be inspected prior to installation. Disassembly, cleaning and lubrication will not be required except where necessary to place the assembly in a clean and properly lubricated condition. Do not use pipe wrenches, cold chisels or other tools likely to cause damage to the surfaces of rods, nuts or other parts used for assembling and tightening parts. Tighten bolts and screws firmly and uniformly but take care not to overstress the threads. When a half nut is used for locking a full nut place the half nut first followed by the full nut. Lubricate threads of all bolts except high strength bolts, nuts and screws with an appropriate lubricant before assembly. Coat threads of corrosion-resisting steel bolts and nuts with an approved antigalling compound. Driving and drifting bolts or keys will not be permitted.

##### 3.1.1 Alignment and Setting

Accurately align each machinery or structural unit by the use of steel shims or other approved methods so that no binding in any moving parts or distortion of any member occurs before it is fastened in place. The alignment of all parts with respect to each other must be true within the respective tolerances required. Set true machines to the elevations shown.

##### 3.1.2 Blocking and Wedges

Remove all blocking and wedges used during installation for the support of parts to be grouted in foundations before final grouting unless otherwise directed. Blocking and wedges left in the foundations with approval must be of steel or iron.

##### 3.1.3 Foundations and Grouting

Provide concrete subbases and frames and final grout under parts of machines in accordance with the procedures as specified in Section [03 30 53 MISCELLANEOUS CAST-IN-PLACE CONCRETE](#).

### 3.2 TESTS

#### 3.2.1 Workmanship

Workmanship must be of the highest grade and in accordance with the best modern practices to conform with the specifications for the item of work being furnished.

#### 3.2.2 Production Welding

Perform production welding conforming to the requirements of AWS D1.1/D1.1M or AWS D1.2/D1.2M, as applicable. Studs, on which pre-production testing is to be performed, must be welded in the same general position as required on production items (flat, vertical, overhead or sloping). Test and production stud welding will be subjected to visual examination or inspection. If the reduction of the length of studs becomes less than normal as they are welded, stop welding immediately and do not resume until the cause has been corrected.

### 3.3 PROTECTION OF FINISHED WORK

#### 3.3.1 Machined Surfaces

Thoroughly clean foreign matter off machined surfaces. Protect all finished surfaces. Oil and wrap unassembled pins and bolts with moisture resistant paper or protect them by other approved means. Wash finished surfaces of ferrous metals to be in bolted contact, with an approved rust inhibitor and coat them with an approved rust resisting compound for temporary protection during fabrication, shipping and storage periods. Paint finished surfaces of metals which will be exposed after installation, except corrosion resisting steel or nonferrous metals as specified in Section 09 97 02 PAINTING: HYDRAULIC STRUCTURES.

#### 3.3.2 Lubrication After Assembly

After assembly fill all lubricating systems with the appropriate lubricant and apply additional lubricant at intervals as required to maintain the equipment in satisfactory condition until acceptance of the work.

#### 3.3.3 Aluminum

Protect aluminum that will be in contact with grout or concrete from galvanic or corrosive action, with a coat of zinc-chromate primer and a coat of aluminum paint. Protect aluminum in contact with structural steel against galvanic or corrosive action with a coat of zinc-chromate primer and a coat of aluminum paint. Provide aluminum paint consisting of a aluminum paste conforming to ASTM D962, spar varnish and thinner compatible with the varnish. Field mix the aluminum paint in proportion of 2 pounds of paste, not more than one gallon of spar varnish and not more than one pint of thinner.

-- End of Section --

## SECTION 05 52 00

## METAL RAILINGS

**02/18**

## PART 1 GENERAL

## 1.1 REFERENCES

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

## ASME INTERNATIONAL (ASME)

ASME B18.2.1 (2012; Errata 2013) Square and Hex Bolts and Screws (Inch Series)

ASME B18.6.1 (2016) Wood Screws (Inch Series)

## AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2020) Structural Welding Code - Steel

## ASTM INTERNATIONAL (ASTM)

ASTM A27/A27M (2020) Standard Specification for Steel Castings, Carbon, for General Application

ASTM A36/A36M (2019) Standard Specification for Carbon Structural Steel

ASTM A47/A47M (1999; R 2018; E 2018) Standard Specification for Ferritic Malleable Iron Castings

ASTM A123/A123M (2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A153/A153M (2016a) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A283/A283M (2013) Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates

ASTM A307 (2014; E 2017) Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength

ASTM B26/B26M (2014; E 2015) Standard Specification for Aluminum-Alloy Sand Castings

ASTM B429/B429M (2010; E 2012) Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube

## 1.2 ADMINISTRATIVE REQUIREMENTS

### 1.2.1 Preinstallation Meetings

Within 30 days of contract award, submit [fabrication drawings](#) for the following items:

- a. Steel shapes, plates, bars and strips
- b. Aluminum railings and handrails
- c. Anchorage and fastening systems

Submit manufacturer's catalog data, including two copies of manufacturers specifications, load tables, dimension diagrams, and anchor details for the following items:

- a. Structural-steel plates, shapes, and bars
- b. Structural-steel tubing
- c. Cold-drawn steel tubing
- d. Concrete inserts
- e. Protective coating
- f. Aluminum railings and handrails
- g. [Anchorage and fastening systems](#)

### 1.3 SUBMITTALS

Approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29.05 20 SUSTAINABILITY REPORTING FOR DESIGN-BUILD. Submit the following in accordance with Section 01 33 00.05 20 CONSTRUCTION SUBMITTAL PROCEDURES:

#### [SD-02 Shop Drawings](#)

[Fabrication Drawings; G](#)

[Steel Shapes, Plates, Bars and Strips; G](#)

#### [SD-03 Product Data](#)

[Structural-Steel Plates, Shapes, and Bars; G](#)

[Structural-Steel Tubing; G](#)

[Concrete Inserts; G](#)

[Masonry Anchorage Devices; G](#)

[Protective Coating; G](#)



Aluminum Railings and Handrails; G

Anchorage and Fastening Systems; G

SD-08 Manufacturer's Instructions

Installation Instructions

## PART 2 PRODUCTS

### 2.1 FABRICATION

Preassemble items in the shop to the greatest extent possible. Disassemble units only to the extent necessary for shipping and handling. Clearly mark units for reassembly and coordinated installation.

For the fabrication of work exposed to view, use only materials that are smooth and free of surface blemishes, including pitting, seam marks, roller marks, rolled trade names, and roughness. Remove blemishes by grinding, or by welding and grinding, before cleaning, treating, and applying surface finishes, including zinc coatings.

Provide railing and handrail detail plans and elevations at not less than 1 inch to 1 foot. Provide details of sections and connections at not less than 3 inches to 1 foot. Also detail setting drawings, diagrams, templates for installation of anchorages, including concrete inserts, anchor bolts, and miscellaneous metal items having integral anchors.

Use materials of size and thicknesses indicated or, if not indicated, of the size and thickness necessary to produce adequate strength and durability in the finished product for its intended use. Work the materials to the dimensions indicated on approved detail drawings, using proven details of fabrication and support. Use the type of materials indicated or specified for the various components of work.

Form exposed work true to line and level, with accurate angles and surfaces and straight sharp edges. Ensure that all exposed edges are eased to a radius of approximately 1/32 inch. Bend metal corners to the smallest radius possible without causing grain separation or otherwise impairing the work.

Weld corners and seams continuously and in accordance with the recommendations of AWS D1.1/D1.1M. Grind exposed welds smooth and flush to match and blend with adjoining surfaces.

Form the exposed connections with hairline joints that are flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of the type indicated or, if not indicated, use countersunk Phillips flathead screws or bolts.

Provide anchorage of the type indicated and coordinated with the supporting structure. Fabricate anchoring devices and space as indicated and as required to provide adequate support for the intended use of the work.

Use hot-rolled steel bars for work fabricated from bar stock unless work is indicated or specified to be fabricated from cold-finished or cold-rolled stock.

### 2.1.1 Aluminum Railings

Fabrication: Provide fabrication jointing by one of the following methods:

- a. Use flush-type rail fittings, welded and ground smooth with splice locks secured with 3/8 inch recessed-head set screws.
- b. Ensure that mitered and welded joints made by fitting; post to top rail; intermediate rail to post; and corners, are groove welded and ground smooth. Where allowed by the Contracting Officer, provide butt splices reinforced by a tight-fitting dowel or sleeve not less than 6 inches in length. Tack-weld or epoxy-cement the dowel or sleeve to one side of the splice.
- c. Assemble railings using slip-on aluminum-magnesium alloy fittings for joints. Fasten fittings to pipe or tube with 1/4 or 3/8 inch stainless-steel recessed-head setscrews. Provide assembled railings with fittings only at vertical supports or at rail terminations attached to walls. Provide expansion joints at the midpoint of panels. Provide a setscrew in only one side of the slip-on sleeve. Provide alloy fittings to conform to ASTM B26/B26M.

Provide removable railing sections as indicated. Provide toe-boards and brackets where indicated, using flange castings as appropriate.

### 2.1.2 Protective Coating

Shop-prime the steelwork as indicated in accordance with Section 09 90 00 PAINTS AND COATINGS except the following:

- a. steel surfaces encased in concrete
- b. steel surfaces for welding
- c. high-strength bolt-connected contact surfaces
- d. crane rail surfaces

Provide hot-dipped galvanized steelwork as indicated in accordance with ASTM A123/A123M. Touch up abraded surfaces and cut ends of galvanized members with zinc-dust, zinc-oxide primer, or an approved galvanizing repair compound.

## 2.2 COMPONENTS

### 2.2.1 Structural Steel Plates, Shapes And Bars

Provide structural-size shapes and plates, except plates to be bent or cold-formed, conforming to ASTM A36/A36M, unless otherwise noted.

Provide steel plates, to be bent or cold-formed, conforming to ASTM A283/A283M, Grade C.

Provide steel bars and bar-size shapes conforming to ASTM A36/A36M, unless otherwise noted.

### 2.2.2 Concrete Inserts

Provide threaded-type concrete inserts consisting of galvanized ferrous

castings, internally threaded to receive 3/4 inch diameter machine bolts; either malleable iron conforming to ASTM A47/A47M or cast steel conforming to ASTM A27/A27M, hot-dip galvanized in accordance with ASTM A153/A153M.

### 2.2.3 Fasteners

Provide galvanized zinc-coated fasteners in accordance with ASTM A153/A153M used for exterior applications or where built into exterior walls or floor systems. Select fasteners for the type, grade, and class required for the installation of steel stair items.

Provide standard hexagon-head bolts, conforming to ASTM A307, Grade A.

Provide square-head lag bolts conforming to ASME B18.2.1.

Provide flat-head carbon steel wood screws conforming to ASME B18.6.1.

Provide helical spring, carbon steel lockwashers conforming to ASME B18.2.1.

### 2.2.4 Aluminum Railings And Handrails

Provide railings and handrails consisting of 1 1/2 inch nominal schedule 40 pipe ASTM B429/B429M. Provide anodized aluminum railings. Ensure that all fasteners are Series 300 stainless steel.

## PART 3 EXECUTION

### 3.1 PREPARATION

Adjust stair railings and handrails before securing in place in order to ensure proper matching at butting joints and correct alignment throughout their length. Space posts not more than 8 feet on center. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:

- a. Anchor posts in concrete by means of pipe sleeves set and anchored into concrete. Provide sleeves of galvanized, standard-weight, steel pipe, not less than 6 inches long, and having an inside diameter not less than 1/2 inch greater than the outside diameter of the inserted pipe post. Provide steel plate closure secured to the bottom of the sleeve, with closure width and length not less than 1 inch greater than the outside diameter of the sleeve. After posts have been inserted into sleeves, fill the annular space between the post and sleeve with nonshrink grout or a quick-setting hydraulic cement. Cover anchorage joint with a round steel flange welded to the post.
- b. Anchor rail ends into concrete and masonry with round steel flanges welded to rail ends and anchored into the wall construction with lead expansion shields and bolts.

Secure handrails to walls by means of wall brackets and wall return fitting at handrail ends. Provide brackets of malleable iron castings, with not less than 3 inch projection from the finished wall surface to the center of the pipe, drilled to receive one 3/8 inch bolt. Locate brackets not more than 60 inches on center. Provide wall return fittings of cast iron castings, flush type, with the same projection as that specified for wall brackets. Secure wall brackets and wall return fittings to building construction as follows:

- a. For concrete and solid masonry anchorage, use bolt anchor expansion shields and lag bolts.
- b. For hollow masonry and stud partition anchorage, use toggle bolts having square heads.

Install toe boards and brackets where indicated. Make splices, where required, at expansion joints. Install removable sections as indicated.

### 3.2 INSTALLATION

Submit manufacturer's [installation instructions](#) for the following products to be used in the fabrication of hand rail work:

- a. Structural-steel plates, shapes, and bars
- b. Protective coating
- c. Masonry anchorage devices
- d. Aluminum railings and handrails
- e. Anchorage and fastening systems

Provide complete, detailed fabrication and installation drawings for all [iron and steel hardware](#), and for all [steel shapes, plates, bars, and strips](#) used in accordance with the design specifications cited in this section.

#### 3.2.1 Aluminum Handrail

Affix to base structure by flanges through-bolted to a backing plate on the other side of a wall. Provide Series 300 stainless-steel bolts to anchor aluminum alloy flanges, of a size appropriate to the standard product of the manufacturer. Where aluminum or alloy fittings or extrusions are to be in contact with dissimilar metals or concrete, coat the contact surface with a heavy coating of bituminous paint.

#### 3.2.2 Touchup Painting

Immediately after installation, clean field welds, bolted connections, abraded areas of the shop paint, and exposed areas painted with the paint used for shop painting. Apply paint by brush or spray to provide a minimum dry-film thickness of [2 mils](#).

-- End of Section --

## SECTION 05 72 00

## DECORATIVE METAL SPECIALTIES

**05/18**

## PART 1 GENERAL

## 1.1 REFERENCES

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

## ALUMINUM ASSOCIATION (AA)

- AA ADM (2020) Aluminum Design Manual
- AA ASM-35 (2000) Specifications for Aluminum Sheet Metal Work in Building Construction, Construction Manual Series Section 5
- AA DAF45 (2003; Reaffirmed 2009) Designation System for Aluminum Finishes
- AA PK-1 (2015) Pink Sheets: Designations and Chemical Composition Limits for Aluminum Alloys in the Form of Castings & Ingot

## ASME INTERNATIONAL (ASME)

- ASME B18.2.1 (2012; Errata 2013) Square and Hex Bolts and Screws (Inch Series)
- ASME B18.2.2 (2015) Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)
- ASME B18.6.1 (2016) Wood Screws (Inch Series)
- ASME B18.6.3 (2013; R 2017) Machine Screws, Tapping Screws, and Machine Drive Screws (Inch Series)
- ASME B18.13 (2017; ERTA 2018) Screw and Washer Assemblies - Sems (Inch Series)
- ASME B18.21.1 (2009; R 2016) Washers: Helical Spring-Lock, Tooth Lock, and Plain Washers (Inch Series)
- ASME B18.24 (2020) Part Identifying Number (PIN) Code System Standard for B18 Fastener Products

## AMERICAN WELDING SOCIETY (AWS)

- AWS A5.3/A5.3M (1999; R 2007) Specification for Aluminum and Aluminum-Alloy Electrodes for Shielded Metal Arc Welding

AWS D1.2/D1.2M (2014; Errata 1 2014; Errata 2 2020)  
Structural Welding Code - Aluminum

ASTM INTERNATIONAL (ASTM)

ASTM B26/B26M (2014; E 2015) Standard Specification for  
Aluminum-Alloy Sand Castings

ASTM B209 (2014) Standard Specification for Aluminum  
and Aluminum-Alloy Sheet and Plate

ASTM B211/B211M (2019) Standard Specification for Aluminum  
and Aluminum-Alloy Rolled or Cold Finished  
Bar, Rod, and Wire

ASTM B221 (2014) Standard Specification for Aluminum  
and Aluminum-Alloy Extruded Bars, Rods,  
Wire, Profiles, and Tubes

ASTM B221M (2013) Standard Specification for Aluminum  
and Aluminum-Alloy Extruded Bars, Rods,  
Wire, Profiles, and Tubes (Metric)

ASTM B247 (2020) Standard Specification for Aluminum  
and Aluminum-Alloy Die Forgings, Hand  
Forgings, and Rolled Ring Forgings

ASTM B316/B316M (2010) Standard Specification for Aluminum  
and Aluminum-Alloy Rivet and Cold-Heading  
Wire and Rods

ASTM C636/C636M (2013) Standard Practice for Installation  
of Metal Ceiling Suspension Systems for  
Acoustical Tile and Lay-In Panels

ASTM D1730 (2009; R 2020) Standard Practices for  
Preparation of Aluminum and Aluminum-Alloy  
Surfaces for Painting

ASTM D1752 (2018) Standard Specification for  
Preformed Sponge Rubber, Cork and Recycled  
PVC Expansion Joint Fillers for Concrete  
Paving and Structural Construction

ASTM G71 (1981; R 2014) Standard Guide for  
Conducting and Evaluating Galvanic  
Corrosion Tests in Electrolytes

ASTM G82 (1998; R 2014) Standard Guide for  
Development and Use of a Galvanic Series  
for Predicting Galvanic Corrosion  
Performance

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

CS 23.00/AWS C2.23M/NACE #12 (2003) Specification for the Application  
of Thermal Spray Coatings (Metallizing) of  
Aluminum, Zinc, and Their Alloys and

Composites for the Corrosion Protection of Steel

SSPC PA 1

(2016) Shop, Field, and Maintenance Coating of Metals

SSPC PS 11.01

(1982; E 2004) Black (or Dark Red) Coal Tar Epoxy Polyamide Painting System

## 1.2 SUBMITTALS

Approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29.05 20 SUSTAINABILITY REPORTING FOR DESIGN-BUILD. Submit the following in accordance with Section 01 33 00.05 20 CONSTRUCTION SUBMITTAL PROCEDURES:

### SD-01 Preconstruction Submittals

Existing Conditions; G

### SD-02 Shop Drawings

Ornamental Metal Items; G

Installation Drawings; G

Shop and Field Connections; G

Construction Details; G

### SD-03 Product Data

Materials; G

Ornamental Metal Items; G

Aluminum-Alloy Extrusions

Aluminum-Alloy Sheets And Plates

Aluminum-Alloy Castings

Aluminum-Alloy Forgings

### SD-04 Samples

Manufacturer's Standard Color Charts; G

Shop Paint; G

Finish Paint; G

Anchorage Devices and Fasteners; G

### SD-06 Test Reports

Welding Tests; G

#### SD-07 Certificates

Welding Procedures

Ornamental Metal Items; G

Welder Qualifications

#### SD-08 Manufacturer's Instructions

Cleaning Materials

Preventative Maintenance and Inspection

Maintenance Instructions

Application Methods

### 1.3 QUALITY CONTROL

#### 1.3.1 Samples

Submit samples for each type of anchorage devices and fasteners.

Submit samples for aluminum finishes, one for each type used in the project. Provide samples of standard size as used in construction. After approval, full-sized samples may be used in construction, provided that each sample is clearly identified and its location recorded.

#### 1.3.2 Color Charts

Submit manufacturer's standard color charts for shop paint and finish paint for approval by the Contracting Officer before work begins.

#### 1.3.3 Field Measurements

Records of existing conditions may be provided by the Contracting Officer before the start of work. Submit survey data showing existing conditions before preparation of shop drawings and fabrication.

### 1.4 DELIVERY, STORAGE, AND HANDLING

Store all architectural metal items off the ground on clean raised platforms or pallets one level high in dry locations with adequate ventilation, such as an enclosed building or closed trailer.

Keep materials free from dirt and grease and protected from corrosion.

Store packaged materials in their original, unbroken containers in a dry area, until ready for installation.

## PART 2 PRODUCTS

### 2.1 MATERIALS

Submit manufacturer's catalog data for the following items, listing all ornamental metal accessories including casting, forgings, fasteners, and anchorage devices.



### 2.1.1 Concrete Inserts

Provide concrete inserts that are nonremovable when embedded in concrete of 3000-pounds per square inch compressive strength and subjected to a 6000-pound tension load test in an axial direction. Ensure that concrete indicates no evidence of failure attributable to the anchoring device itself.

### 2.1.2 Toggle Bolts

Provide corrosion-resistant chromium-nickel steel conforming to AISI Type 303, 304, or 316 toggle bolts of the class and style best suited for the work, conforming to ASTM C636/C636M, Type II.

### 2.1.3 Standard Bolts and Nuts

Provide standard bolts, regular hexagon-head, corrosion-resistant steel, coarse-thread series, conforming to, Type II.

Provide standard nuts, plain hexagon, regular-style, corrosion-resistant steel, conforming to ASME B18.2.2, Type II, Style 4.

### 2.1.4 Lag Bolts

Provide lag bolts, square-head, gimlet point or cone point, corrosion-resistant steel, conforming to ASME B18.2.1, Type I, Grade C.

### 2.1.5 Machine Screws

Provide machine screws, corrosion-resistant steel, cross-recess drive, flathead, conforming to ASME B18.6.3, Type III, Style [2C] [3C].

### 2.1.6 Wood Screws

Provide wood screws, corrosion-resistant steel, single-thread, flathead with cross-recess drive, conforming to ASME B18.6.1.

### 2.1.7 Plain Washers

Provide plain washers, round, general-assembly, corrosion-resistant steel, conforming to ASME B18.21.1, Type A, Grade I, Class B.

### 2.1.8 Lock Washers

Provide lock washers, helical-spring, corrosion-resistant steel (nonmagnetic), conforming to ASME B18.13 and ASME B18.21.1.

### 2.1.9 Welding Filler Metal

Provide aluminum-alloy welding filler metal for welding of aluminum alloys, conforming to AWS A5.3/A5.3M and as recommended by the aluminum producer for the work.

## 2.2 FABRICATION

Submit fabrication drawings for ornamental metal items.

### 2.2.1 Workmanship

Fabricate metalwork to the shape and size, with lines, angles, and curves true to form. Provide necessary rabbets, lugs, and brackets so that the work can be assembled. Conceal fasteners where practical.

Design exterior ornamental metal items to withstand expansion and contraction of the component parts at an ambient temperature of 100 degrees F without causing harmful buckling, opening of joints, overstressing of fasteners, or other harmful effects.

Ensure that the welded fabrication meets requirements as specified in AWS D1.2/D1.2M. Execute all welds behind finished surfaces without distortion or discoloration of the exposed side. Clean flux from welded joints and dress all exposed and contact surfaces.

Drill or punch holes for fasteners.

Mill joints to a close fit. Cope or miter the corner joints to a well-formed shape and true alignment with the adjacent item. Fabricate and form joints exposed to weather to prevent water intrusion.

Ensure that all castings are sound and free from warp or defects that impair their strength and appearance, with a smooth finish and sharp well-defined vertical and horizontal lines on all exposed surfaces.

### 2.2.2 Aluminum-Alloy Extrusions

Provide aluminum fabrications conforming to AA ADM, AA ASM-35, and AA PK-1.

Provide 6063, temper T5 extrusions conforming to ASTM B221 ASTM B221M.

Provide aluminum-alloy and tempered extrusions recommended by the aluminum producer with the specified finish of integral-color anodized coating having mechanical properties equal to or exceeding those of aluminum alloy 6063, temper T5, conforming to ASTM B221 ASTM B221M.

### 2.2.3 Aluminum-Alloy Sheets and Plates

Provide aluminum-alloy and tempered sheets and plates recommended by the aluminum producer with the specified finish of integral-color anodized coating having mechanical properties equal to or exceeding those of alloy 5005, temper H16, conforming to ASTM B209.

### 2.2.4 Aluminum-Alloy Castings

Provide aluminum-alloy castings containing the casting alloy and condition recommended by the aluminum producer with the specified finish of integral-color anodized coating having mechanical properties equal to or exceeding those of alloy 5140, temper F, conforming to ASTM B26/B26M.

### 2.2.5 Aluminum-Alloy Forgings

Provide aluminum-alloy and tempered forgings recommended by the aluminum producer with the specified finish of integral-color anodized coating having mechanical properties equal to or exceeding those of aluminum alloy 6061, temper T6, conforming to ASTM B247.

#### 2.2.6 Metals for Fasteners

Provide fastener identification conforming to ASME B18.24.

Provide aluminum-alloy bolts and screws made from rod conforming to ASTM B211/B211M, alloy 2024, and temper T351.

Provide aluminum-alloy nuts made from rod conforming to ASTM B211/B211M, alloy 6061, and temper T6.

Provide aluminum-alloy washers made from sheet conforming to ASTM B209, alloy 2024, and temper T4.

Provide aluminum-alloy rivets made from rod or wire conforming to ASTM B316/B316M, alloy 6053, and temper T61.

Provide corrosion-resistant steel fasteners made of chromium-nickel steel, AISI Type 303, 304, or 316, with form and condition best suited for the application.

#### 2.2.7 Shop Paint for Aluminum

Provide a shop paint with an inhibitive epoxy polyamide primer conforming to SSPC PS 11.01, CS 23.00/AWS C2.23M/NACE #12, ASTM G71 and ASTM G82.

#### 2.2.8 Protection of Aluminum from Dissimilar Materials

Protect aluminum surfaces that will come in contact with dissimilar metals, or masonry, concrete, or wood, with epoxy polyamide conforming to SSPC PS 11.01, and topcoated with aliphatic polyurethane conforming to ASTM G71 and ASTM G82

Prepare aluminum surfaces to be painted by the acid pickling method conforming to ASTM D1730, Type B, Method 2 or Method 3.

Apply paint to dry, clean surfaces by brush or spraying to provide a minimum dry-film thickness of 1.5 mils.

#### 2.2.9 Aluminum Finishes

Provide a finish for exposed-to-view aluminum surfaces of architectural metal items conforming to AA DAF45 and finished as specified for each of the following items:

- a. Match the finish color and appearance to that of the aluminum finish sample approved for each architectural metal item within the aluminum producer's standard color range.

#### 2.2.10 Ornamental Metal Items

##### 2.2.10.1 Aluminum Joint Cover Assemblies

Design aluminum joint cover assemblies for horizontal movement and the joint width indicated.

Provide mill finish for exposed-to-view surfaces.

Provide floor joint cover assemblies consisting of a continuous frame unit on each side of floor-to-floor joints or on one side of floor-to-wall

joints as required by construction conditions. Include floor cover plates, filler strips, anchors, and other accessories as required to complete the installation, and as follows:

Fabricate floor frame units from aluminum-alloy extrusions with an integral curb edge bar for the expansion joint edges. Provide integral grooves to receive anchor bolts, and floor cover plate with filler strip surfaces that will finish flush to the finished floor elevation when the floor cover assembly is installed. Provide corrosion-resistant coated aluminum alloy or steel anchor bolts and nuts, spaced not more than 3 inches from each end and not more than 18 inches on center between end anchors. Furnish coated steel anchor bolts and nuts conforming to SSPC PA 1. Provide frame splice connectors as required to complete the installation.

#### 2.2.10.1.1 Wall And Ceiling Joint Cover Assemblies

Provide rubber and cork composition tape filler strips with pressure-sensitive adhesive coating on one face and smooth suede surface on the exposed face, conforming to ASTM D1752, not less than 1 1/2 inches wide and a depth as required to provide a surface flush with the finished floor elevation.

Provide wall and ceiling joint cover assemblies consisting of continuous anchor strips on one side of the wall or ceiling expansion joint; wall and ceiling cover plates; and seals, anchors, and other accessories as required to complete the installation, and as follows:

- a. Provide aluminum-alloy wall and ceiling anchor strip extrusions fabricated to provide an integral curb bar edge and integral lugs to receive snap-on cover plates. Field-drill fixed edge of anchor strips with holes to receive screws, spaced not more than 3 inches from each end and not more than 12 inches on center between the end screw holes. Provide cadmium-plated screws with masonry anchorage devices or toggle bolts as required by construction conditions.
- b. Provide aluminum-alloy wall and ceiling cover plate extrusions of the patterns and widths indicated, designed for snap-on application over anchor strips, fabricated with integral grooves to receive sealing gaskets, and having a smooth exposed-to-view surface.

Provide vinyl sealing gaskets for wall and ceiling joint cover assemblies.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

Submit installation drawings for ornamental metal items, shop and field connections and construction details showing location, dimensions, size, and weight or gauge as applicable of each ornamental item; type and location of shop and field connections; and other pertinent construction and erection details. Show on drawings location and details of anchorage devices embedded in cast-in-place concrete and masonry construction.

##### 3.1.1 Anchorage Devices Embedded In Other Construction

Install decorative metal work in accordance with the approved shop drawings and descriptive data for each ornamental metal item, as specified.

Securely fasten decorative metal items plumb and true to horizontal and vertical lines and levels.

### 3.1.2 Holes for Other Work

Provide holes where indicated for securing other work to metal work.

### 3.1.3 Fastening to Construction-In-Place

Provide anchorage devices and fasteners where necessary for fastening ornamental metal items to construction-in-place. Include threaded fasteners for concrete inserts embedded in cast-in-place concrete; masonry anchorage devices and threaded fasteners for solid masonry and concrete-in-place; toggle bolts for hollow masonry and stud partitions; through-bolting for masonry and wood construction; lag bolts and wood screws for wood construction; and threaded fasteners for structural steel. Provide fastening as indicated and as specified. Do not fasten to wood plugs in masonry or concrete-in-place.

### 3.1.4 Cutting and Fitting

Perform required cutting, drilling, and fitting for the installation of ornamental metal work. Execute cutting, drilling, and fitting carefully; when required; fit in-place work before fastening.

### 3.1.5 Setting Masonry Anchorage Devices

Set all masonry anchorage devices in masonry or concrete-in-place construction in accordance with the anchorage device manufacturer's printed instructions. Drill anchorage holes to the depth, diameter, and size recommended by the manufacturer of the particular anchorage device used. Leave drilled anchorage holes rough, not reamed, and free of drill dust.

### 3.1.6 Threaded Connections

Countersink flat bolts and screw heads where anchors are exposed to view, and tightly secure threaded connections so that the threads are entirely concealed by fitting, unless otherwise specified.

## 3.2 FIELD QUALITY CONTROL

### 3.2.1 Finished Ornamental Metal Work Requirements

Ornamental metal work will be rejected for any of the following deficiencies:

- a. Finish of exposed-to-view aluminum surfaces having color or appearance that is outside the color or appearance range of the approved samples for aluminum finish.
- b. Installed ornamental metal items having stained, discolored, abraded, or otherwise damaged exposed-to-view aluminum surfaces that cannot be removed by cleaning or repairing.
- c. Installed ornamental metal items that do not match the approved sample.
- d. Aluminum surfaces in contact with dissimilar materials that are not protected as specified.

### 3.3 ADJUSTING AND CLEANING

Before final acceptance, wash exposed-to-view aluminum surfaces with clean water and soap and rinse with clean water. Do not use acid solutions, steel wool, or other harsh abrasives. Remove stains that remain after cleaning or restore the finish in accordance with the aluminum producer's recommendations

Perform all [preventative maintenance and inspection](#) in accordance with the aluminum producer's recommended [cleaning materials](#) and [application methods](#) including precautions in the use of cleaning materials that maybe detrimental to the aluminum finish when improperly applied.

### 3.4 MAINTENANCE INSTRUCTIONS

Submit the aluminum producer's recommended [maintenance instructions](#) for cleaning materials and application.

-- End of Section --

## SECTION 06 10 00

## ROUGH CARPENTRY

**08/16, CHG 2: 11/18**

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AMERICAN LUMBER STANDARDS COMMITTEE (ALSC)

ALSC PS 20 (2015) American Softwood Lumber Standard

## ASME INTERNATIONAL (ASME)

ASME B18.2.1 (2012; Errata 2013) Square and Hex Bolts and Screws (Inch Series)

ASME B18.2.2 (2015) Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)

ASME B18.5.2.1M (2006; R 2011) Metric Round Head Short Square Neck Bolts

ASME B18.5.2.2M (1982; R 2010) Metric Round Head Square Neck Bolts

ASME B18.6.1 (2016) Wood Screws (Inch Series)

## AMERICAN WOOD COUNCIL (AWC)

AWC NDS (2015) National Design Specification (NDS) for Wood Construction

AWC WFCM (2012) Wood Frame Construction Manual for One- and Two-Family Dwellings

## AMERICAN WOOD PROTECTION ASSOCIATION (AWPA)

AWPA BOOK (2015) AWPA Book of Standards

AWPA M2 (2019) Standard for the Inspection of Preservative Treated Wood Products for Industrial Use

AWPA M6 (2013) Brands Used on Preservative Treated Materials

AWPA P5 (2015) Standard for Waterborne Preservatives

AWPA P18 (2014) Nonpressure Preservatives

AWPA P49 (2015) Standard for Fire Retardant FR-1

AWPA T1 (2020) Use Category System: Processing and Treatment Standard

AWPA U1 (2020) Use Category System: User Specification for Treated Wood

ASTM INTERNATIONAL (ASTM)

ASTM A153/A153M (2016a) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A307 (2014; E 2017) Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength

ASTM A653/A653M (2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM D2898 (2010; R 2017) Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing

ASTM F547 (2017) Standard Terminology of Nails for Use with Wood and Wood-Base Materials

ASTM F1667 (2018a) Standard Specification for Driven Fasteners: Nails, Spikes, and Staples

CALIFORNIA AIR RESOURCES BOARD (CARB)

CARB 93120 (2007) Airborne Toxic Control Measure (ATCM) to Reduce Formaldehyde Emissions from Composite Wood Products

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

CDPH SECTION 01350 (2010; Version 1.1) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers

FM GLOBAL (FM)

FM 4435 (2013) Roof Perimeter Flashing

GREEN SEAL (GS)

GS-36 (2013) Adhesives for Commercial Use

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC (2018) International Building Code



NATIONAL HARDWOOD LUMBER ASSOCIATION (NHLA)

NHLA Rules (2015) Rules for the Measurement &  
Inspection of Hardwood & Cypress

NORTHEASTERN LUMBER MANUFACTURERS ASSOCIATION (NELMA)

NELMA Grading Rules (2013) Standard Grading Rules for  
Northeastern Lumber

REDWOOD INSPECTION SERVICE (RIS) OF THE CALIFORNIA REDWOOD  
ASSOCIATION (CRA)

RIS Grade Use (1998) Redwood Lumber Grades and Uses

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule 1168 (2017) Adhesive and Sealant Applications

SOUTHERN CYPRESS MANUFACTURERS ASSOCIATION (SCMA)

SCMA Spec (1986; Supple. No. 1, Aug 1993) Standard  
Specifications for Grades of Southern  
Cypress

SOUTHERN PINE INSPECTION BUREAU (SPIB)

SPIB 1003 (2014) Standard Grading Rules for Southern  
Pine Lumber

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-1923 (Rev A; Notice 3) Shield, Expansion (Lag,  
Machine and Externally Threaded Wedge Bolt  
Anchors)

CID A-A-1924 (Rev A; Notice 3) Shield, Expansion (Self  
Drilling Tubular Expansion Shell Bolt  
Anchors)

CID A-A-1925 (Rev A; Notice 3) Shield Expansion (Nail  
Anchors)

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 770 Formaldehyde Standards for Composite Wood  
Products

UNDERWRITERS LABORATORIES (UL)

UL 2818 (2013) GREENGUARD Certification Program  
For Chemical Emissions For Building  
Materials, Finishes And Furnishings

WEST COAST LUMBER INSPECTION BUREAU (WCLIB)

WCLIB 17 (2015) Standard Grading Rules

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

WWPA G-5

(2017) Western Lumber Grading Rules

1.2 SUBMITTALS

Approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29.05 20 SUSTAINABILITY REPORTING FOR DESIGN-BUILD. Submit the following in accordance with Section 01 33 00.05 20 CONSTRUCTION SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Nailers and Nailing Strips;

Drawings of field erection details, including materials and methods of fastening nailers in conformance with Factory Mutual wind uplift rated systems specified in other Sections of these specifications.

SD-03 Product Data

Underlayment

Fire-retardant Treatment

Adhesives

SD-06 Test Reports

Preservative-treated Lumber and Plywood

SD-07 Certificates

Preservative Treatment

Indoor Air Quality for Aerosol Adhesives; S

Indoor Air Quality for Non-aerosol Adhesives; S

SD-10 Operation and Maintenance Data

Take-back Program

Include contact information, summary of procedures, and the limitations and conditions applicable to the project. Indicate manufacturer's commitment to reclaim materials for recycling or reuse.

1.3 DELIVERY AND STORAGE

Deliver materials to the site in an undamaged condition. Store, protect, handle, and install prefabricated structural elements in accordance with manufacturer's instructions and as specified. Store materials off the ground to provide proper ventilation, with drainage to avoid standing water, and protection against ground moisture and dampness. Store materials with a moisture barrier at both the ground level and as a cover

forming a well ventilated enclosure. Store wood I-beams and glue-laminated beams and joists on edge. Adhere to requirements for stacking, lifting, bracing, cutting, notching, and special fastening requirements. Do not use materials that have visible moisture or biological growth. Remove defective and damaged materials and provide new materials. Store separated reusable wood waste convenient to cutting station and area of work.

#### 1.4 GRADING AND MARKING

##### 1.4.1 Lumber

Mark each piece of framing and board lumber or each bundle of small pieces of lumber with the grade mark of a recognized association or independent inspection agency. Such association or agency must be certified by the Board of Review, American Lumber Standards Committee, to grade the species used. Surfaces that are to be exposed to view must not bear grademarks, stamps, or any type of identifying mark. Hammer marking will be permitted on timbers when all surfaces will be exposed to view.

##### 1.4.2 Preservative-Treated Lumber and Plywood

The Contractor is responsible for the quality of treated wood products. Each treated piece must be inspected in accordance with [AWPA M2](#) and permanently marked or branded, by the producer, in accordance with [AWPA M6](#). The Contractor must provide Contracting Officer's Representative (COR) with the inspection report of an approved independent inspection agency that offered products comply with applicable AWPA Standards. The appropriate Quality Mark on each piece will be accepted, in lieu of inspection reports, as evidence of compliance with applicable AWPA treatment standards.

##### 1.4.3 Fire-Retardant Treated Lumber

Mark each piece in accordance with [AWPA M6](#), except pieces that are to be natural or transparent finished. In addition, exterior fire-retardant lumber must be distinguished by a permanent penetrating blue stain. Labels of a nationally recognized independent testing agency will be accepted as evidence of conformance to the fire-retardant requirements of [AWPA M6](#).

##### 1.4.4 Hardboard, Gypsum Board, and Fiberboard

Mark each sheet or bundle to identify the standard under which the material is produced and the producer.

#### 1.5 SIZES AND SURFACING

[ALSC PS 20](#) for dressed sizes of yard and structural lumber. Lumber must be surfaced four sides. Size references, unless otherwise specified, are nominal sizes, and actual sizes must be within manufacturing tolerances allowed by the standard under which the product is produced. Other measurements are IP or SI standard.

#### 1.6 MOISTURE CONTENT

Air-dry or kiln-dry lumber. Kiln-dry treated lumber after treatment. Maximum moisture content of wood products must be as follows at the time of delivery to the job site:

- a. Framing lumber and board, 19 percent maximum
- b. Materials other than lumber; moisture content must be in accordance with standard under which the product is produced

#### 1.7 PRESERVATIVE TREATMENT

Treat wood products with waterborne wood preservatives conforming to [AWPA P5](#). Pressure treatment of wood products must conform to the requirements of [AWPA BOOK Use Category System Standards U1 and T1](#). Pressure-treated wood products must not contain arsenic, chromium, or other agents classified as carcinogenic, probably carcinogenic, or possibly carcinogenic to humans (compounds in Groups 1, 2A, or 2B) by the International Agency for Research on Cancer (IARC), Lyon, France. Pressure-treated wood products must not exceed the limits of the U.S. EPA's Toxic Characteristic Leaching Procedure (TCLP), and must not be classified as hazardous waste. Submit certification from treating plant stating chemicals and process used and net amount of preservatives retained are in conformance with specified standards. In accordance with [AWPA U1](#) provide non-copper preservative treatment such as EL2, PTI or SBX, DOT for products in direct contact with sheet metal.

- a. 0.25 pcf intended for above ground use.

##### 1.7.1 New Construction

Use a boron-based preservative conforming to [AWPA P18](#), sodium silicate wood mineralization process, or Ammoniacal Copper Quaternary Compound to treat wood. Use boron-based preservatives for above-ground applications only.

#### 1.8 FIRE-RETARDANT TREATMENT

Fire-retardant treated wood must be pressure treated with fire retardants conforming to [AWPA P49](#). Fire retardant treatment of wood products must conform to the requirements of [AWPA U1](#), Commodity Specification H and [AWPA T1](#), Section H. Treatment and performance inspection must be by an independent and qualified testing agency that establishes performance ratings. Each piece or bundle of treated material must bear identification of the testing agency to indicate performance in accordance with such rating. Treated materials to be exposed to rain wetting must be subjected to an accelerated weathering technique in accordance with [ASTM D2898](#) prior to being tested. Such items which will not be inside a building, and such items which will be exposed to heat or high humidity, must receive exterior fire-retardant treatment. Fire-retardant-treated wood products must be free of halogens, sulfates, ammonium phosphate, and formaldehyde. Items to be treated include the following:

#### 1.9 ENVIRONMENTAL REQUIREMENTS

During and immediately after installation of treated wood, engineered wood products, and laminated wood products at interior spaces, provide temporary ventilation.

## 1.10 CERTIFICATIONS

### 1.10.1 Certified Wood Grades

Provide [certificates of grade](#) from the grading agency on graded but unmarked lumber or plywood attesting that materials meet the grade requirements specified herein.

### 1.10.2 Indoor Air Quality Certifications

Submit required indoor air quality certifications in one submittal package.

#### 1.10.2.1 Adhesives and Sealants

Provide products certified to meet indoor air quality requirements by [UL 2818](#) (Greenguard) Gold, SCS Global Services Indoor Advantage Gold or provide certification or validation by other third-party programs that products meet the requirements of this Section. Provide current product certification documentation from certification body. When product does not have certification, provide validation that product meets the indoor air quality product requirements cited herein.

#### 1.10.2.2 Composite Wood, Wood Structural Panel and Agrifiber Products

For purposes of this specification, composite wood and agrifiber products include particleboard, medium density fiberboard (MDF), strawboard, panel substrates, and door cores. Provide products certified to meet requirements of both [40 CFR 770](#) and [CARB 93120](#). Provide current product certification documentation from certification body.

## PART 2 PRODUCTS

### 2.1 LUMBER

#### 2.1.1 Framing Lumber

Framing lumber such as studs, plates, caps, collar beams, cant strips, bucks, sleepers, [nailing strips](#), and nailers and board lumber such as subflooring and wall and roof sheathing must be one of the species listed in the table below. Minimum grade of species must be as listed.

<u>Table of Grades for Framing and Board Lumber</u>			
<u>Grading Rules</u>	<u>Species</u>	<u>Framing</u>	<u>Board Lumber</u>
WWPA G-5 standard grading rules	Aspen, Douglas Fir-Larch, Douglas Fir South, Engelmann Spruce-Lodgepole Pine, Engelmann Spruce, Hem-Fir, Idaho White Pine, Lodgepole Pine, Mountain Hemlock, Mountain Hemlock-Hem-Fir, Ponderosa Pine-Sugar Pine, Ponderosa Pine-Lodgepole Pine, Subalpine Fir, White Woods, Western Woods, Western Cedars, Western Hemlock	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 10 feet and shorter)	All Species: No. 3 Common
WCLIB 17 standard grading rules	Douglas Fir-Larch, Hem-Fir, Mountain Hemlock, Sitka Spruce, Western Cedars, Western Hemlock	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 10 feet and shorter)	All Species: Standard

<u>Table of Grades for Framing and Board Lumber</u>			
<u>Grading Rules</u>	<u>Species</u>	<u>Framing</u>	<u>Board Lumber</u>
SPIB 1003 standard grading rules	Southern Pine	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 10 feet and shorter)	No. 2 Boards
SCMA Spec standard specifications	Cypress	No. 2 Common	No. 2 Common
NELMA Grading Rules standard grading rules	Balsam Fir, Eastern Hemlock-Tamarack, Eastern Spruce, Eastern White Pine, Northern Pine, Northern Pine-Cedar	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 10 feet and shorter)	All Species: No. 3 Common except Standard for Eastern White and Northern Pine
RIS Grade Use standard specifications	Redwood	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 10 feet and shorter)	Construction Heart

Table of Grades for Framing and Board Lumber			
Grading Rules	Species	Framing	Board Lumber
NHLA Rules rules for the measurement and inspection of hardwood and cypress lumber	Cypress	No. 2 Dimension	No. 2 Common

## 2.2 NONSTRESS GRADED MEMBERS

Members must include bridging, corner bracing, furring, grounds, and nailing strips. Members must be in accordance with TABLE I for the species used. Sizes must be as follows unless otherwise shown:

Member	Size inch
Bridging	1 x 3 or 1 x 4 for use between members 2 x 12 and smaller; 2 x 4 for use between members larger than 2 x 12.
Corner bracing	1 x 4.
Furring	1 x [2] [3]
Grounds	Plaster thickness by 38.
Nailing strips	1 x 3 or 1 x 4 when used as shingle base or interior finish, otherwise 2 inch stock.

## 2.3 BLOCKING

Blocking must be standard or number 2 grade.

## 2.4 ROUGH BUCKS AND FRAMES

Rough bucks and frames must be straight standard or number 2 grade.

## 2.5 ADHESIVES

Comply with applicable regulations regarding toxic and hazardous materials and as specified. Provide non-aerosol adhesive products used on the interior of the building (defined as inside of the weatherproofing system) meeting either emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of SCAQMD Rule 1168. Provide aerosol adhesives used on the interior of the building meeting either emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of GS-36. Provide certification or validation of indoor air quality for non-aerosol adhesives applied on the interior of the building (inside of



the weatherproofing system). Provide certification or validation of indoor air quality for aerosol adhesives used on the interior of the building (inside of the weatherproofing system).

## 2.6 ROUGH HARDWARE

Unless otherwise indicated or specified, rough hardware must be of the type and size necessary for the project requirements. Sizes, types, and spacing of fastenings of manufactured building materials must be as recommended by the product manufacturer unless otherwise indicated or specified. Rough hardware exposed to the weather or embedded in or in contact with preservative treated wood, exterior masonry, or concrete walls or slabs must be hot-dip zinc-coated in accordance with [ASTM A153/A153M](#). Nails and fastenings for fire-retardant treated lumber and woodwork exposed to the weather must be copper alloy or hot-dipped galvanized fasteners as recommended by the treated wood manufacturer.

### 2.6.1 Bolts, Nuts, Studs, and Rivets

[ASME B18.2.1](#), [ASME B18.5.2.1M](#), [ASME B18.5.2.2M](#) and [ASME B18.2.2](#).

### 2.6.2 Anchor Bolts

[ASTM A307](#), size as indicated, complete with nuts and washers.

### 2.6.3 Expansion Shields

[CID A-A-1923](#), [CID A-A-1924](#), and [CID A-A-1925](#). Except as shown otherwise, maximum size of devices must be 3/8 inch.

### 2.6.4 Lag Screws and Lag Bolts

[ASME B18.2.1](#).

### 2.6.5 Wood Screws

[ASME B18.6.1](#).

### 2.6.6 Nails

[ASTM F547](#), size and type best suited for purpose. For sheathing and subflooring, length of nails must be sufficient to extend 1 inch into supports. In general, 8-penny or larger nails must be used for nailing through 1 inch thick lumber and for toe nailing 2 inch thick lumber; 16-penny or larger nails must be used for nailing through 2 inch thick lumber. Nails used with treated lumber and sheathing must be hot-dipped galvanized in accordance with [ASTM A153/A153M](#). Nailing must be in accordance with the recommended nailing schedule contained in [AWC WFCM](#). Where detailed nailing requirements are not specified, nail size and spacing must be sufficient to develop an adequate strength for the connection. The connection's strength must be verified against the nail capacity tables in [AWC NDS](#). Reasonable judgment backed by experience must ensure that the designed connection will not cause the wood to split. If a load situation exceeds a reasonable limit for nails, a specialized connector must be used.

### 2.6.7 Wire Nails

[ASTM F1667](#).

### 2.6.8 Clip Angles

Steel, 3/16 inch thick, size [as indicated][best suited for intended use]; or zinc-coated steel or iron commercial clips designed for connecting wood members.

### 2.6.9 Door Buck Anchors

Metal anchors, 1/8 by 1-1/4 inch steel, 12 inches long, with ends bent 2 inches, except as indicated otherwise. Anchors must be screwed to the backs of bucks and built into masonry or concrete. Locate 8 inches above sills and below heads and not more than 24 inches intermediately between. Anchorage of bucks to steel framing must be as necessary to suit the conditions.

### 2.6.10 Toothed Rings and Shear Plates

AWC NDS.

### 2.6.11 Beam Anchors

Steel U-shaped strap anchors 1/4 inch thick by 1-1/2 inches wide [, except as indicated otherwise].

### 2.6.12 Metal Framing Anchors

Construct anchors to the configuration shown using hot dip zinc-coated steel conforming to ASTM A653/A653M, G90. Steel must be not lighter than 18 gage. Special nails supplied by the manufacturer must be used for all nailing.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Do not install building construction materials that show visual evidence of biological growth.

Conform to AWC WFCM and install in accordance with the National Association of Home Builders (NAHB) Advanced Framing Techniques: Optimum Value Engineering, unless otherwise indicated or specified. Select lumber sizes to minimize waste. Fit framing lumber and other rough carpentry, set accurately to the required lines and levels, and secure in place in a rigid manner. Space plastic lumber boards as necessary to allow for lengthwise expansion and contraction. Do not splice framing members between bearing points. Set joists, rafters, and purlins with their crown edge up. Frame members for the passage of pipes, conduits, and ducts. Provide adequate support as appropriate to the application, climate, and modulus of elasticity of the product. Do not cut or bore structural members for the passage of ducts or pipes without approval. Reinforce all members damaged by such cutting or boring by means of specially formed and approved sheet metal or bar steel shapes, or remove and provide new, as approved. Provide as necessary for the proper completion of the work all framing members not indicated or specified. Spiking and nailing not indicated or specified otherwise must be in accordance with the Nailing Schedule contained in ICC IBC; perform bolting in an approved manner. Spikes, nails, and bolts must be drawn up tight. Install plastic lumber with screws or bolts; if nails are used, use ring shank or spiral shank

nails. [Timber connections and fastenings must conform to AWC NDS.][ Provide 2 inch minimum clearance between chimneys and wood framing; provide 4 inch minimum clearance at fireplaces. Fill the spaces with strips of approved noncombustible material.] Use slate or steel shims when leveling joists, beams, and girders on masonry or concrete. Do not use shimming on wood or metal bearings. When joists, beams, and girders are placed on masonry or concrete, a wood base plate must be positioned and leveled with grout. The joist, beam, or girder must then be placed on the plate. When joists, beams, and girders are set into masonry or concrete, a pocket must be formed into the wall. The joist, beam, or girder must then be placed into the pocket and leveled with a steel shim.

### 3.1.1 Anchors in Concrete

Except where indicated otherwise, Embed anchor bolts not less than 8 inches in poured concrete walls and provide each with a nut and a 2 inch diameter washer at bottom end. A bent end may be substituted for the nut and washer; bend must be not less than 90 degrees. Powder-actuated fasteners spaced 3 feet o.c. may be provided in lieu of bolts for single thickness plates on concrete.

### 3.1.2 Metal Cross-Bridging

Must be the manufacturer's standard product, not less than 16 gage before forming and coating. Metal bridging must be the compression type, lodged into or nailed to the wide faces of opposite joists at points diagonally across from each other near the bottoms and tops of joists.

## 3.2 MISCELLANEOUS

### 3.2.1 Wood Roof Nailers, Edge Strips, Crickets, Curbs, and Cants

Provide sizes and configurations indicated or specified and anchored securely to continuous construction.

#### 3.2.1.1 Roof Nailing Strips

Provide roof nailing strips for roof decks as indicated. Apply nailing strips in straight parallel rows in the direction and spacing indicated. Strips must be surface applied.

- a. Surface-Applied Nailers: Must be 3 inches wide and of thickness to finish flush with the top of the insulation. Anchor strips securely to the roof deck with powder actuated fastening devices or expansion shields and bolts, spaced not more than 24 inches o.c.
- b. Embedded Nailers: Must be nominal 2 by 3 with 2 inch sides beveled. Set and anchor nailers to finish flush with the roof deck surface.

#### 3.2.1.2 Roof Edge Strips and Nailers

Provide at perimeter of roof, around openings through roof, and where roofs abut walls, curbs, and other vertical surfaces. Except where indicated otherwise, nailers must be 6 inches wide and the same thickness as the insulation. Anchor nailers securely to underlying construction. Anchor perimeter nailers in accordance with FM 4435.

### 3.2.2 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.

### 3.2.3 Temporary Closures

Provide with hinged doors and padlocks and install during construction at exterior doorways and other ground level openings that are not otherwise closed. Cover windows and other unprotected openings with polyethylene or other approved material, stretched on wood frames. Provide dustproof barrier partitions to isolate areas as directed.

### 3.2.4 Sill Plates

Sill plates must be set level and square and anchor bolted at not more than 6 feet on centers and not more than 12 inches from end of each piece. A minimum of two anchors must be used for each piece.

## 3.3 INSTALLATION OF TIMBER CONNECTORS

Install timber connectors in conformance with requirements of AWC NDS.

## 3.4 ERECTION TOLERANCES

- a. Framing members which will be covered by finishes such as wallboard, plaster, or ceramic tile set in a mortar setting bed, must be within the following limits:
  - (1) Layout of walls and partitions: 1/4 inch from intended position;
  - (2) Plates and runners: 1/4 inch in 8 feet from a straight line;
  - (3) Studs: 1/4 inch in 8 feet out of plumb, not cumulative; and
  - (4) Face of framing members: 1/4 inch in 8 feet from a true plane.
- b. Framing members which will be covered by ceramic tile set in dry-set mortar, latex-portland cement mortar, or organic adhesive must be within the following limits:
  - (1) Layout of walls and partitions: 1/4 inch from intended position;
  - (2) Plates and runners: 1/8 inch in 8 feet from a straight line;
  - (3) Studs: 1/8 inch in 8 feet out of plumb, not cumulative; and
  - (4) Face of framing members: 1/8 in 8 feet from a true plane.

## 3.5 SPECIAL INSPECTION AND TESTING FOR SEISMIC-RESISTING SYSTEMS

Special inspections and testing for seismic-resisting systems and components must be done in accordance with Section 01 45 35 SPECIAL INSPECTIONS.

## 3.6 WASTE MANAGEMENT OF WOOD PRODUCTS

In accordance with the Waste Management Plan and as specified. Separate

and reuse scrap sheet materials larger than 2 square feet, framing members larger than 16 inches, and multiple offcuts of any size larger than 12 inches. Clearly separate damaged wood and other scrap lumber for acceptable alternative uses on site, including bracing, blocking, cripples, ties, and shims.

-- End of Section --

SECTION 06 20 00

FINISH CARPENTRY

**08/16, CHG 2: 11/18**

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN HARDBOARD ASSOCIATION (AHA)

AHA A135.4 (1995; R 2004) Basic Hardboard

AMERICAN LUMBER STANDARDS COMMITTEE (ALSC)

ALSC PS 20 (2015) American Softwood Lumber Standard

ASME INTERNATIONAL (ASME)

ASME B18.2.1 (2012; Errata 2013) Square and Hex Bolts and Screws (Inch Series)

ASME B18.2.2 (2015) Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)

ASME B18.6.1 (2016) Wood Screws (Inch Series)

AMERICAN WOOD PROTECTION ASSOCIATION (AWPA)

AWPA M4 (2015) Standard for the Care of Preservative-Treated Wood Products

AWPA U1 (2020) Use Category System: User Specification for Treated Wood

APA - THE ENGINEERED WOOD ASSOCIATION (APA)

APA L870 (2010) Voluntary Product Standard, PS 1-09, Structural Plywood

ASTM INTERNATIONAL (ASTM)

ASTM D2898 (2010; R 2017) Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing

ASTM F547 (2017) Standard Terminology of Nails for Use with Wood and Wood-Base Materials

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

ANSI/BHMA A156.9 (2015) Cabinet Hardware

CALIFORNIA AIR RESOURCES BOARD (CARB)

CARB 93120 (2007) Airborne Toxic Control Measure  
(ATCM) to Reduce Formaldehyde Emissions  
from Composite Wood Products

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

CDPH SECTION 01350 (2010; Version 1.1) Standard Method for  
the Testing and Evaluation of Volatile  
Organic Chemical Emissions from Indoor  
Sources using Environmental Chambers

COMPOSITE PANEL ASSOCIATION (CPA)

CPA A208.1 (2016) Particleboard

GREEN SEAL (GS)

GS-36 (2013) Adhesives for Commercial Use

HARDWOOD PLYWOOD AND VENEER ASSOCIATION (HPVA)

HPVA HP-1 (2016) American National Standard for  
Hardwood and Decorative Plywood

NATIONAL HARDWOOD LUMBER ASSOCIATION (NHLA)

NHLA Rules (2015) Rules for the Measurement &  
Inspection of Hardwood & Cypress

NORTHEASTERN LUMBER MANUFACTURERS ASSOCIATION (NELMA)

NELMA Grading Rules (2013) Standard Grading Rules for  
Northeastern Lumber

REDWOOD INSPECTION SERVICE (RIS) OF THE CALIFORNIA REDWOOD  
ASSOCIATION (CRA)

RIS Grade Use (1998) Redwood Lumber Grades and Uses

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule 1168 (2017) Adhesive and Sealant Applications

SOUTHERN PINE INSPECTION BUREAU (SPIB)

SPIB 1003 (2014) Standard Grading Rules for Southern  
Pine Lumber

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 770 Formaldehyde Standards for Composite Wood  
Products

UNDERWRITERS LABORATORIES (UL)

UL 2818 (2013) GREENGUARD Certification Program

For Chemical Emissions For Building  
Materials, Finishes And Furnishings

WEST COAST LUMBER INSPECTION BUREAU (WCLIB)

WCLIB 17 (2015) Standard Grading Rules

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

WWPA G-5 (2017) Western Lumber Grading Rules

WINDOW AND DOOR MANUFACTURERS ASSOCIATION (WDMA)

WDMA I.S.4 (2015A) Preservative Treatment for Millwork

WOOD MOULDING AND MILLWORK PRODUCERS ASSOCIATION (WMPMA)

WMPMA WM 6 (2007) Quality Industry Standards Booklet

WOODWORK INSTITUTE (WI)

NAAWS 3.1 (2017; 2018 Errata Edition) North American  
Architectural Woodwork Standards

## 1.2 SUBMITTALS

Approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29.05 20 SUSTAINABILITY REPORTING FOR DESIGN-BUILD. Submit the following in accordance with Section 01 33 00.05 20 CONSTRUCTION SUBMITTAL PROCEDURES:

### SD-02 Shop Drawings

Detail Drawings Indicating All Wood Assemblies; G

### SD-03 Product Data

Wood Products; G

Hardware and Accessories; G

Recycled Content for MDF/Particleboard; S

### SD-04 Samples

Samples; G

### SD-07 Certificates

Certificates of Grade; G

Indoor Air Quality for MDF and Particleboard; S

Indoor Air Quality for Non-aerosol Adhesives; S

Indoor Air Quality for Aerosol Adhesives; S



### 1.3 DETAIL DRAWINGS

Submit detail drawings indicating all wood assemblies proposed for use in the project. Indicate materials, species, grade, density, grain, finish details of construction, location of use in the project, finishes, types, method and arrangement of fasteners, and installation details. This includes all fabricated assemblies.

### 1.4 PRODUCT DATA

Submit Manufacturers printed data including proposed species, grade, density grain, and finish as applicable; sufficient to demonstrate compliance with this specification for each type of wood product specified. For treated wood products also provide documentation of environmentally safe preservatives for each type of wood product specified.

Provide Manufacturers printed data for hardware and all wood accessories including but not limited to edge banding, adhesives, and sealers.

### 1.5 SAMPLES

Samples indicating proposed species, grade, density grain, and finish for each type of wood product specified. Provide samples of sufficient size to show pattern and color ranges of proposed products.

### 1.6 DELIVERY, STORAGE, AND HANDLING

Deliver wood products to the jobsite in an undamaged condition. Stack materials to ensure ventilation and drainage. Protect against dampness before and after delivery. Store materials under cover in a well ventilated enclosure and protect against extreme changes in temperature and humidity. Keep materials wrapped and separated from off-gassing materials (such as drying paints and adhesives). Do not use materials that have visible moisture or biological growth. Do not store products in building until wet trade materials are dry and humidity of the space is within wood manufacturer's tolerance limits for storage.

### 1.7 QUALITY ASSURANCE

#### 1.7.1 Certifications

##### 1.7.1.1 Certified Wood Grades

Provide certificates of grade from the grading agency on graded but unmarked lumber or plywood attesting that materials meet the grade requirements specified herein.

##### 1.7.1.2 Indoor Air Quality Certifications

###### 1.7.1.2.1 Adhesives and Sealants

Provide products certified to meet indoor air quality requirements by UL 2818 (Greenguard) Gold, SCS Global Services Indoor Advantage Gold or provide certification or validation by other third-party programs that products meet the requirements of this Section. Provide current product certification documentation from certification body. When product does not have certification, provide validation that product meets the indoor air quality product requirements cited herein.

#### 1.7.1.2.2 Composite Wood Products

For purposes of this specification, composite wood products include hardwood plywood, particleboard, medium density fiberboard (MDF), panel substrates, and door cores. Provide products certified to meet requirements of both 40 CFR 770 and CARB 93120. Provide current product certification documentation from certification body.

#### 1.7.2 Non-Pressure Treated Woodwork and Millwork

Mark, stamp, or label to indicate compliance with WDMA I.S.4.

#### 1.7.3 Fire-Retardant Treated Lumber

Each piece must bear an Underwriters Laboratories fire resistance label or comparable label of another nationally recognized independent fire retardant materials testing laboratory.

### PART 2 PRODUCTS

#### 2.1 WOOD PRODUCTS

##### 2.1.1 Sizes and Patterns of Wood Products

Provide yard and board lumber sizes in accordance with ALSC PS 20. Provide shaped lumber and millwork in the patterns indicated and in standard patterns of the association covering the species. Size references, unless otherwise specified, are nominal sizes. Provide actual sizes within manufacturing tolerances allowed by the applicable standard.

##### 2.1.2 Species and Grades

Provide in accordance with AWPA U1 Use Category System Tables unless otherwise specified herein.

##### 2.1.3 Trim, Finish, and Frames

Provide species and grades listed in the table below for wood materials that must be painted. For materials that must be stained, have a natural, or a transparent finish, provide materials one grade higher than those listed in the table below. Provide trim, except window stools and aprons with hollow backs. [ Provide certified sustainably harvested wood for trim and frames.]

TABLE OF GRADES FOR WOOD TO RECEIVE PAINT FINISH		
Grading Rules	Species	Exterior and Interior Trim, Finish, and Frames
WWPA G-5 standard grading rules	Aspen, Douglas Fir-Larch, Douglas Fir South, Engelmann Spruce-Lodgepole Pine, Engelmann Spruce, Hem-Fir, Idaho White Pine, Lodgepole Pine, Mountain Hemlock, Mountain Hemlock-Hem-Fir, Ponderosa Pine-Sugar Pine, (Ponderosa Pine-Lodgepole Pine,) White Woods, (Western Woods,) Western Cedars, Western Hemlock	All Species: C & BTR. Select (Choice & BTR Idaho White Pine) or Superior Finish. Western Red Cedar may be graded C & BTR. Select or A & BTR in accordance with Special Western Red Cedar Rules.
WCLIB 17 standard grading rules	Douglas Fir-Larch, Hem-Fir, Mountain Hemlock, Sitka Spruce, Western Cedars, Western Hemlock	All Species: C & BTR VG, except A for Western Red Cedar
SPIB 1003 standard grading rules	Southern Pine	C & BTR
NHLA Rules	Cypress	C-Select
NELMA Grading Rules standard grading rules **	Balsam Fir, Eastern Hemlock-Tamarack, Eastern Spruce, Eastern White Pine, Northern Pine, Northern Pine, Northern White Cedar	All Species: C-Select except C & BTR for Eastern White Pine and Norway Pine
RIS Grade Use standard specifications	Redwood	Clear, Clear All Heart
NHLA Rules	Cypress	B Finish
	Red Gum, Soft Elm, Birch	Select or BTR (for interior use only)

Note: \*\*

<http://www.nelma.org/library/2013-standard-grading-rules-for-northeastern-lumber/>

## 2.1.4 Utility Shelving

Provide utility shelving in a suitable species equal to or exceeding the requirements of No. 3 common white fir under [WWPA G-5](#), 1 inch thick; or plywood, interior type, Grade A-B, 1/2 inch thick, any species group.

## 2.1.5 Softwood Plywood

Provide in accordance with [APA L870](#). When located on the interior of buildings, provide products with no added urea-formaldehyde resins.

- a. Plywood for Shelving: Interior type, A-B Grade, any species group.
- b. Plywood for Countertops: Exterior type, A-C Grade.

## 2.1.6 Hardwood Plywood

[HPVA HP-1](#), Type Premium (A) Grade, hardwood veneer core construction, face veneers of [\_\_\_\_], of thickness indicated. When located on the interior of buildings, provide products with no added urea-formaldehyde resins. For products located on the interior of the building (inside of the weatherproofing system), provide certification of [indoor air quality for hardwood plywood](#).

## 2.1.7 Hardboard

[AHA A135.4](#), standard type, 1/4 inch thick.

## 2.1.8 Medium Density Fiberboard (MDF) and Particleboard

[CPA A208.1](#), Grade 1-M-2 or 2-M-2 or better. For products located on the interior of the building (inside of the weatherproofing system), provide certification of [indoor air quality for MDF and particleboard](#).

Provide products with 80 percent total recovered materials content. Provide data identifying percentage of [recycled content for MDF/particleboard](#).

## 2.1.9 Shoe Mould

Clear red or white oak, 1/2 by 5/8 inch unless otherwise indicated.

## 2.1.10 Wood Seats

Clear maple, oak, or other suitable hardwood, not less than 1-5/8 inches thick, with rounded edges. Provide stainless steel stanchions or brackets.

## 2.1.11 Wood Bumpers

Clear oak, maple, birch, dressed to size indicated and with outer edges beveled.

## 2.2 COUNTERTOPS

## 2.2.1 Solid Surface

For solid surface countertops refer to Section [06 61 16](#), SOLID POLYMER (SOLID SURFACING) FABRICATIONS.

## 2.3 MOISTURE CONTENT OF WOOD PRODUCTS

Air dry or kiln dry lumber. Kiln dry treated lumber after treatment. Maximum moisture content of wood products at time of delivery to the jobsite, and when installed, must be as follows:

- a. Interior Paneling: 12 percent.
- b. Interior Finish Lumber, Trim, and Millwork: 1-1/4 Inches Nominal or Less in Thickness: 12 percent on 85 percent of the pieces and 15 percent on remainder.
- c. Exterior Treated and Untreated Finish Lumber and Trim: 4 inches Nominal or Less in Thickness: 19 percent.
- d. Exterior Wood Siding: 15 percent.
- e. Provide moisture content of other materials in accordance with the applicable standards.

## 2.4 PRESERVATIVE TREATMENT OF WOOD PRODUCTS

### 2.4.1 Non-Pressure Treatment

Treat woodwork and millwork, such as cabinets in accordance with [WDMA I.S.4](#), with either 2 percent copper naphthenate, 3 percent zinc naphthenate, or 1.8 percent copper-8-quinolinolate. Provide a liberal brush coat of preservative treatment to field cuts and holes.

### 2.4.2 Pressure Treatment

Treat lumber and plywood used on the exterior of buildings or in contact with masonry or concrete with a waterborne preservative listed in [AWPA U1](#) (P series is included therein by reference) as applicable, and inspected in accordance with [AWPA U1](#). Identify treatment on each piece of material by the quality mark of an agency accredited by the Board of Review of the American Lumber Standards Committee. Provide treated plywood to a reflection level as follows:

Preservative treat exterior wood moulding and millwork that will be within [18 inches](#) of soil or in contact with water or concrete in accordance with [WMMPA WM 6](#). Provide a field treatment in accordance with [AWPA M4](#) of exposed areas of treated wood that have been cut or drilled. Items of all-heart material of cedar, cypress, or redwood do not require preservative treatment except when in direct contact with soil.

## 2.5 FIRE-RETARDANT TREATMENT

### 2.5.1 Wood Products

Pressure treat fire-retardant treated lumber and plywood in accordance with [AWPA U1](#). Comply with material use as defined in [AWPA U1](#) for Interior Type A and Exterior Type. Treatment and performance inspection must be conducted by a qualified independent testing agency that establishes performance ratings. Each piece or bundle of treated material must bear identification of the testing agency to indicate performance with such rating. Subject treated materials that will be exposed to rain wetting to an accelerated weathering technique in accordance with [ASTM D2898](#), Method A, prior to being tested for compliance with [AWPA U1](#).

## 2.6 HARDWARE AND ACCESSORIES

Provide sizes, types, and spacings of hardware and accessories as recommended in writing by the wood product manufacturer, except as otherwise specified.

### 2.6.1 Wood Screws

ASME B18.6.1.

### 2.6.2 Bolts, Nuts, Lag Screws, and Studs

ASME B18.2.1 and ASME B18.2.2.

### 2.6.3 Nails

Use nails of a size and type best suited for each application and in accordance with ASTM F547. Use hot-dipped galvanized or aluminum nails for exterior applications. For siding, provide nails of sufficient length to extend 1-1/2 inches into supports, including wood sheathing over framing. Where nailing is impractical, provide screws of a size and type best suited for each application.

### 2.6.4 Adjustable Shelf Standards

ANSI/BHMA A156.9, Type [\_\_\_\_], with shelf rests Type [\_\_\_\_].

### 2.6.5 Vertical Slotted Shelf Standards

ANSI/BHMA A156.9, Type [\_\_\_\_], with shelf brackets Type [\_\_\_\_].

### 2.6.6 Closet Hanger Rods

Chromium plated steel rods, not less than 1 inch diameter by 18 gage. Rods may be adjustable with integral mounting brackets if smaller tube is 1 inch by 18 gage. Provide intermediate support brackets for rods more than 48 inches long.

## 2.7 FABRICATION

### 2.7.1 Quality Standards (QS)

#### 2.7.1.1 Grades

The terms "Premium," "Custom," and "Economy" refer to the quality grades defined in NAAWS 3.1. Provide items not otherwise specified in a specific grade as "Custom" grade.

#### 2.7.1.2 Adhesives

Select adhesives for durability and permanent bonding. Address factors such as materials that must be bonded, expansion and contraction, bond strength, fire rating, moisture resistance, and manufacturer's recommendations.

Provide non-aerosol adhesive products used on the interior of the building (defined as inside of the weatherproofing system) meeting either emissions requirements of CDPH SECTION 01350 (limit requirements for either office

or classroom spaces regardless of space type) or VOC content requirements of [SCAQMD Rule 1168](#). Provide aerosol adhesives used on the interior of the building meeting either emissions requirements of [CDPH SECTION 01350](#) (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of [GS-36](#). Provide certification or validation of [indoor air quality for non-aerosol adhesives](#) applied on the interior of the building (inside of the weatherproofing system). Provide certification or validation of [indoor air quality for aerosol adhesives](#) used on the interior of the building.

## 2.7.2 Cabinets

Unless specified otherwise, provide wall and base cabinets of the same construction, materials, and finishes as countertops. Fabricate cabinets with solid ends and frame fronts, or with frames all around. Provide frames of solid hardwood not less than [3/4 by 1-1/2 inches](#). Provide ends, bottoms, backs, partitions, and doors as hardwood plywood. Mortise and tenon, dovetail, or dowel and glue joints to produce a rigid unit. Cover exposed edges of plywood with hardwood strips. Provide cabinet doors, frames, and solid exposed ends [3/4 inch](#) thick minimum. Provide cabinet bottoms, partitions, and framed ends to be [1/2 inch](#) minimum. Provide shelves to be [5/8 inch](#) thick minimum. Provide cabinet backs [1/4 inch](#) thick minimum.

### 2.7.2.1 Cabinet Hardware

[ANSI/BHMA A156.9](#). Provide cabinet hardware including two self, closing hinges for each door, two side mounted metal drawer slides for each drawer, and pulls for all doors and drawers as follows. Provide hardware exposed to view as bright chromium plated. Comply with the following requirements for all cabinet hardware:

- a. Provide frameless concealed European style, back mounted hinges with 165 degree opening and a self closing feature when at less than 90 degrees open.
- b. Provide drawer slides having a static rating capacity of [100 lbs](#). Slides to have a self closing/stay closed action, zinc or epoxy coated steel finish, ball bearing rollers, and positive stop with lift out design.
- c. Provide drawer pulls as wire type pulls with center-to-center dimension of not less than [3-1/2 inches](#) and a cross sectional diameter of [5/16 inch](#). Provide handle projections not less than [1-5/16 inches](#).
- d. Provide heavy duty magnetic drawer catches.

### 2.7.2.2 Finish

Provide a clear factory finish on wood surfaces after fabrication. Provide fabricator's standard natural finish equivalent to one coat of sealer, one coat of varnish on all surfaces and a second coat of varnish on surfaces exposed to view. Provide spar varnish in exterior or wet area applications. Sand lightly and wipe clean between coats.

### 2.7.3 Casework with High Pressure Laminate Finish

#### 2.7.3.1 AWI Quality Grade

Custom grade.

#### 2.7.3.2 Construction

Provide flush overlay design details.

#### 2.7.3.3 Exposed Surfaces

High pressure plastic laminate, color and pattern as selected by Contracting Officer's Representative from manufacturer's full range.

#### 2.7.3.4 Semi-Exposed Surfaces

As specified in the [NAAWS 3.1](#) for the grade selected.

#### 2.7.3.5 Edge Banding

Provide edge banding for casework doors and drawer fronts in PVC vinyl [0.125 inch](#) thick. Provide width [15/16 inches](#). Match color and pattern to exposed door and drawer front laminate pattern and color.

## PART 3 EXECUTION

Do not install building construction materials that show visual evidence of biological growth.

### 3.1 FINISH WORK

Apply primer to finish work before installing. Where practicable, shop assemble and finish millwork items. Construct joints tight and in a manner to conceal shrinkage but to avoid cupping, twisting and warping after installation. Miter trim and mouldings at exterior angles; cope at interior angles and at returns. Provide millwork and trim in maximum practical lengths. Fasten finish work with finish nails. Provide blind nailing where practicable. Set face nails for putty stopping.

#### 3.1.1 Interior Finish Work

After installation, sand exposed surfaces smooth. Provide window and door trim in single lengths.

#### 3.1.2 Bases

Provide flat member with a moulded top and oak shoe mould. Fasten base to framing or to grounds. Set one-piece wood base after finish flooring is in place.

### 3.2 SHELVING

Support [1 inch](#) nominal thick wood shelf material or [3/4](#) or [23/32 inch](#) thick plywood shelf material with end and intermediate supports arranged to prevent buckling and sagging. Provide cleats except where hook strips are specified or indicated. Where adjustable shelving is indicated, provide standards and brackets or shelf rests for each shelf. Anchor standards to wall at not more than [2 feet](#) on center.



### 3.2.1 Storage Rooms

Unless otherwise indicated, provide storage rooms with shelves 11-1/4 inches wide, bottom shelf 18 inches above the floor, top shelf 18 inches below the ceiling, and intermediate shelves approximately 18 inches apart.

### 3.2.2 Room Closets

Provide two shelves 11-1/4 inches wide. Support lower shelf by hook strips at back and ends, and provide full length wood or metal clothes hanger rods unless indicated otherwise.

### 3.2.3 Cleaning Gear Closets

Provide shelves of size and arrangement indicated.

## 3.3 MISCELLANEOUS

### 3.3.1 Countertops

Conceal fastenings where practicable. Fit counters tight to adjoining surfaces and scribe where necessary. Provide scribed joints neat and flush. Provide counter sections in longest lengths practicable with a minimum number of joints. Where joints are necessary, provide tight joints drawn up with concealed type heavy pull-up bolts. Glue joints with water resistant glue and make rigid with screws, bolts, or other approved fastenings.

### 3.3.2 Cabinets

Provide cabinets level, plumb, true, and tight to adjacent walls. Secure cabinets to walls with concealed toggle bolts. Secure top to cabinet with concealed screws. Make cutouts for fixtures from templates supplied by fixture manufacturer. Locate cutouts for pipes so that edges of holes are covered by escutcheons after installation.

## 3.4 MOULDING AND INTERIOR TRIM

Install mouldings and interior trim straight, plumb, level and with closely fitted joints. Provide exposed surfaces machine sanded at the shop. Cope returns and interior angles at moulded items and miter external corners. Shoulder intersections of flatwork to ease any inherent changes in plane. Provide window and door trim in single lengths. Blind nail to the extent practicable. Set and stop face nailing with a nonstaining putty to match the applied finish. Use screws for attachment to metal; set and stop screws in accordance with the same quality requirements for nails.

-- End of Section --

SECTION 06 41 16.00 10

PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

**08/10, CHG 1: 11/18**

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A161.2 (1998) Decorative Laminate Countertops, Performance Standards for Fabricated High Pressure

ASTM INTERNATIONAL (ASTM)

ASTM D1037 (2012) Evaluating Properties of Wood-Base Fiber and Particle Panel Materials

ASTM F547 (2017) Standard Terminology of Nails for Use with Wood and Wood-Base Materials

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

ANSI/BHMA A156.9 (2015) Cabinet Hardware

COMPOSITE PANEL ASSOCIATION (CPA)

CPA A208.1 (2016) Particleboard

CPA A208.2 (2016) Medium Density Fiberboard (MDF) for Interior Applications

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI/NEMA LD 3 (2005) Standard for High-Pressure Decorative Laminates

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED BD+C (2009; R 2010) Leadership in Energy and Environmental Design(tm) Building Design and Construction (LEED-NC)

WINDOW AND DOOR MANUFACTURERS ASSOCIATION (WDMA)

ANSI/WDMA I.S.1A (2013) Interior Architectural Wood Flush Doors

WOODWORK INSTITUTE (WI)

NAAWS 3.1 (2017; 2018 Errata Edition) North American

## Architectural Woodwork Standards

## 1.2 SYSTEM DESCRIPTION

Work in this section includes laminate clad custom casework cabinets as shown on the drawings and as described in this specification. This Section includes high-pressure laminate surfacing and cabinet hardware. Comply with EPA requirements in accordance with Section 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING. All exposed and semi-exposed surfaces, whose finish is not otherwise noted on the drawings or finish schedule, shall be sanded smooth and shall receive a clear finish of polyurethane. Wood finish may be shop finished or field applied in accordance with Section 09 90 00 PAINTS AND COATINGS.

## 1.3 SUSTAINABILITY REPORTING

Materials in this technical specification may contribute towards contract compliance with sustainability requirements. See Section 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING for project LEED BD+C low-emitting materials, recycled content, and LEED documentation requirements.

## 1.4 SUBMITTALS

Approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29.05 20 SUSTAINABILITY REPORTING FOR DESIGN-BUILD. Submit the following in accordance with Section 01 33 00.05 20 CONSTRUCTION SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

- Shop Drawings
- Installation

## SD-03 Product Data

- Wood Materials
- Wood Finishes
- Finish Schedule
- Certification

## SD-04 Samples

- Plastic Laminates
- Cabinet Hardware

## SD-07 Certificates

- Quality Assurance
- Laminate Clad Casework

## 1.5 QUALITY ASSURANCE

## 1.5.1 General Requirements

Unless otherwise noted on the drawings, all materials, construction methods, and fabrication shall conform to and comply with the custom grade

quality standards as outlined in [NAAWS 3.1](#), Section for laminate clad cabinets. These standards shall apply in lieu of omissions or specific requirements in this specification. Contractors and their personnel engaged in the work shall be able to demonstrate successful experience with work of comparable extent, complexity and quality to that shown and specified. Submit a quality control statement which illustrates compliance with and understanding of [NAAWS 3.1](#) requirements, in general, and the specific [NAAWS 3.1](#) requirements provided in this specification. The quality control statement shall also certify a minimum of ten years Contractor's experience in laminate clad casework fabrication and construction. The quality control statement shall provide a list of a minimum of five successfully completed projects of a similar scope, size, and complexity.

#### 1.5.2 Mock-ups

Prior to final approval of [shop drawings](#), provide a full-size mock-up of a typical wall cabinet, including all components and hardware necessary to illustrate a completed unit with a minimum of one door and one drawer assembly. The completed mock-up shall include countertops and back splashes where specified. The mock-up shall utilize specified finishes in the patterns and colors as indicated in Section [09 06 00 SCHEDULES FOR FINISHES](#). Upon disapproval, rework or remake the mock-up until approval is secured. Remove rejected units from the jobsite. Approved mock-up may remain as part of the finished work. Submit shop drawings showing all fabricated casework items in plan view, elevations and cross-sections to accurately indicate materials used, details of construction, dimensions, methods of fastening and erection, and installation methods proposed. Shop drawing casework items shall be clearly cross-referenced to casework items located on the project drawings. Shop drawings shall include a color schedule of all casework items to include all countertop, exposed, and semi-exposed cabinet finishes to include finish material manufacturer, pattern, and color.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

Casework may be delivered knockdown or fully assembled. Deliver all units to the site in undamaged condition, stored off the ground in fully enclosed areas, and protected from damage. The storage area shall be well ventilated and not subject to extreme changes in temperature or humidity.

#### 1.7 SEQUENCING AND SCHEDULING

Coordinate work with other trades. Units shall not be installed in any room or space until painting, and ceiling installation are complete within the room where the units are located. Floor cabinets shall be installed before finished flooring materials are installed.

### PART 2 PRODUCTS

#### 2.1 WOOD MATERIALS

##### 2.1.1 Lumber

- a. All framing lumber shall be kiln-dried Grade III to dimensions as shown on the drawings. Frame front, where indicated on the drawings, shall be nominal [3/4 inch](#) hardwood.
- b. Standing or running trim casework components, which are specified to

receive a transparent finish, shall be hardwood species, plain sawn. AWI grade shall be custom. Location, shape, and dimensions shall be as indicated on the drawings.

## 2.1.2 Panel Products

### 2.1.2.1 Plywood

All plywood panels used for framing purposes shall be veneer core hardwood plywood, [NAAWS 3.1](#) Grade AA. Nominal thickness of plywood panels shall be as indicated in this specification and on the drawings.

### 2.1.2.2 Particleboard

All particleboard shall be industrial grade, medium density ( [40 to 50 pounds per cubic foot](#)), [3/4 inch](#) thick. A moisture-resistant particleboard in grade Type 2-M-2 or 2-M-3 shall be used as the substrate for plastic laminate covered countertops, backsplashes, and other areas subjected to moisture. Particleboard shall meet the minimum standards listed in [ASTM D1037](#) and [CPA A208.1](#).

### 2.1.2.3 Medium Density Fiberboard

Medium density fiberboard (MDF) shall be an acceptable panel substrate where noted on the drawings. Medium density fiberboard shall meet the minimum standards listed in [CPA A208.2](#).

## 2.2 SOLID POLYMER MATERIAL

Solid surfacing casework components shall conform to the requirements of Section [06 61 16](#) SOLID SURFACING FABRICATIONS.

## 2.3 HIGH PRESSURE DECORATIVE LAMINATE (HPDL)

All [plastic laminates](#) shall meet the requirements of [ANSI/NEMA LD 3](#) and [ANSI A161.2](#) for high-pressure decorative laminates. Design, colors, surface finish and texture, and locations shall be as indicated on Section [09 06 00](#) SCHEDULES FOR FINISHES. Submit two samples of each plastic laminate pattern and color. Samples shall be a minimum of [5 by 7 inches](#) in size. Plastic laminate types and nominal minimum thicknesses for casework components shall be as indicated in the following paragraphs.

### 2.3.1 Horizontal General Purpose Standard (HGS) Grade

Horizontal general purpose standard grade plastic laminate shall be [0.048 inches \(plus or minus 0.005 inches\)](#) in thickness. This laminate grade is intended for horizontal surfaces where postforming is not required.

### 2.3.2 Vertical General Purpose Standard (VGS) Grade

Vertical general purpose standard grade plastic laminate shall be [0.028 inches \(plus or minus 0.004 inches\)](#) in thickness. This laminate grade is intended for exposed exterior vertical surfaces of casework components where postforming is not required.

### 2.3.3 Cabinet Liner Standard (CLS) Grade

Cabinet liner standard grade plastic laminate shall be [0.020 inches](#) in thickness. This laminate grade is intended for light duty semi-exposed

interior surfaces of casework components.

#### 2.3.4 Backing Sheet (BK) Grade

Undecorated backing sheet grade laminate is formulated specifically to be used on the backside of plastic laminated panel substrates to enhance dimensional stability of the substrate. Backing sheet thickness shall be 0.020 inches. Backing sheets shall be provided for all laminated casework components where plastic laminate finish is applied to only one surface of the component substrate.

#### 2.4 THERMOSET DECORATIVE OVERLAYS (MELAMINE)

Thermoset decorative overlays (melamine panels) shall be used for all semi-exposed surfaces.

#### 2.5 EDGE BANDING

Edge banding for casework doors and drawer fronts shall be PVC vinyl and shall be 0.125 inch thick. Material width shall be as indicated on the drawings. Color and pattern shall match exposed door and drawer front laminate pattern and color.

#### 2.6 CABINET HARDWARE

Submit one sample of each cabinet hardware item specified to include [hinges], [pulls], [drawer glides], and [\_\_\_\_\_]. All hardware shall conform to ANSI/BHMA A156.9, unless otherwise noted, and shall consist of the following components:

##### 2.6.1 Door Hinges

[\_\_\_\_\_] type, BHMA No. [\_\_\_\_\_].

##### 2.6.2 Cabinet Pulls

[\_\_\_\_\_] type, BHMA No. [\_\_\_\_\_].

##### 2.6.3 Drawer Slide

Side mounted [\_\_\_\_\_] type, BHMA No. [\_\_\_\_\_] with full extension and a minimum 100 pound load capacity. Slides shall include an integral stop to avoid accidental drawer removal.

##### 2.6.4 Adjustable Shelf Support System

Recessed (mortised) metal standards, BHMA No. BO4071, finish: [\_\_\_\_\_]. Support clips for the standards shall be multiple holes with metal pin supports.

#### 2.7 FASTENERS

Nails, screws, and other suitable fasteners shall be the size and type best suited for the purpose and shall conform to ASTM F547 where applicable.

## 2.8 ADHESIVES, CAULKS, AND SEALANTS

### 2.8.1 Adhesives

Adhesives shall be of a formula and type recommended by AWI. Adhesives shall be selected for their ability to provide a durable, permanent bond and shall take into consideration such factors as materials to be bonded, expansion and contraction, bond strength, fire rating, and moisture resistance. Adhesives shall meet local regulations regarding VOC emissions and off-gassing.

#### 2.8.1.1 Wood Joinery

Adhesives used to bond wood members shall be a Type II for interior use polyvinyl acetate resin emulsion. Adhesives shall withstand a bond test as described in [ANSI/WDMA I.S.1A](#).

#### 2.8.1.2 Laminate Adhesive

Adhesive used to join high-pressure decorative laminate to wood shall be adhesive consistent with AWI and laminate manufacturer's recommendations. PVC edgbanding shall be adhered using a polymer-based hot melt glue.

### 2.8.2 Caulk

Caulk used to fill voids and joints between laminated components and between laminated components and adjacent surfaces shall be clear, 100 percent silicone.

### 2.8.3 Sealant

Sealant shall be of a type and composition recommended by the substrate manufacturer to provide a moisture barrier at sink cutouts and all other locations where unfinished substrate edges may be subjected to moisture.

## 2.9 WOOD FINISHES

Paint, stain, varnish and their applications required for [laminate clad casework](#) components shall be as indicated in Section [09 06 00 SCHEDULES FOR FINISHES](#). Color and location shall be as indicated on the drawings.

## 2.10 ACCESSORIES

### 2.10.1 Grommets

Grommets shall be rubber material for cutouts. Locations shall be as indicated on the drawings.

## 2.11 FABRICATION

Verify field measurements as indicated in the [shop drawings](#) before fabrication. Fabrication and assembly of components shall be accomplished at the shop site to the maximum extent possible. Construction and fabrication of cabinets and their components shall meet or exceed the requirements for AWI custom grade unless otherwise indicated in this specification. Cabinet style, in accordance with [NAAWS 3.1](#), Section 400-G descriptions, shall be flush overlay flush inset with face frame.

## 2.11.1 Base and Wall Cabinet Case Body

## 2.11.1.1 Cabinet Components

Frame members shall be glued-together, kiln-dried hardwood lumber. Top corners, bottom corners, and cabinet bottoms shall be braced with either hardwood blocks or water-resistant glue and nailed in place metal or plastic corner braces. Cabinet components shall be constructed from the following materials and thicknesses:

## 2.11.1.1.1 Body Members (Ends, Divisions, Bottoms, and Tops)

3/4 inch medium density fiberboard (MDF) panel product

## 2.11.1.1.2 Face Frames and Rails

3/4 inch hardwood lumber

## 2.11.1.1.3 Shelving

3/4 inch medium density fiberboard (MDF) panel product

## 2.11.1.1.4 Cabinet Backs

1/4 inch medium density fiberboard (MDF) panel product

## 2.11.1.1.5 Drawer Sides, Backs, and Subfronts

1/2 inch panel product

## 2.11.1.1.6 Drawer Bottoms

1/4 inch medium density fiberboard (MDF) panel product

## 2.11.1.1.7 Door and Drawer Fronts

3/4-inch medium density fiberboard (MDF) panel product

## 2.11.1.2 Joinery Method for Case Body Members

## 2.11.1.2.1 Tops, Exposed Ends, and Bottoms

- a. Steel "European" assembly screws ( 1-1/2 inch from end, 5 inch on center, fasteners will not be visible on exposed parts).
- b. Doweled, glued under pressure (approx. 4 dowels per 12 inches of joint).
- c. Stop dado, glued under pressure, and either nailed, stapled or screwed (fasteners will not be visible on exposed parts).
- d. Spline or biscuit, glued under pressure.

## 2.11.1.2.2 Exposed End Corner and Face Frame Attachment

## 2.11.1.2.2.1 Mitered Joint

lock miter or spline or biscuit, glued under pressure (no visible fasteners)



2.11.1.2.2.2 Non-Mitered Joint (90 degree)

butt joint glued under pressure (no visible fasteners)

2.11.1.2.2.3 Butt Joint

glued and nailed

2.11.1.2.3 Cabinet Backs (Wall Hung Cabinets)

Wall hung cabinet backs must not be relied upon to support the full weight of the cabinet and its anticipated load for hanging/mounting purposes. Method of back joinery and hanging/mounting mechanisms should transfer the load to case body members. Fabrication method shall be:

2.11.1.2.3.1 Full Bound

Full bound, captured in grooves on cabinet sides, top, and bottom. Cabinet backs for floor standing cabinets shall be side bound, captured in grooves; glued and fastened to top and bottom.

2.11.1.2.3.2 Full Overlay

Full overlay, plant-on backs with minimum back thickness of 1/2 inch and minimum No. 12 plated (no case hardened) screws spaced a minimum 3 inches on center. Edge of back shall not be exposed on finished sides. Anchor strips are not required when so attached.

2.11.1.2.3.3 Side Bound

Side bound, captured in groove or rabbets; glued and fastened.

2.11.1.2.4 Cabinet Backs (Floor Standing Cabinets)

2.11.1.2.4.1 Side Bound

Side bound, captured in grooves; glued and fastened to top and bottom.

2.11.1.2.4.2 Full Overlay

Full overlay, plant-on backs with minimum back thickness of 1/2 inch and minimum No. 12 plated (no case hardened) screws spaced a minimum 3 inches on center. Edge of back shall not be exposed on finished sides. Anchor strips are not required when so attached.

2.11.1.2.4.3 Side Bound with Rabbets

Side bound, placed in rabbets; glued and fastened in rabbets.

2.11.1.2.5 Wall Anchor Strips

Wall Anchor Strips shall be required for all cabinets with backs less than 1/2 inch thick. Strips shall consist of minimum 1/2 inch thick lumber, minimum 2-1/2 inches width; securely attached to wall side of cabinet back - top and bottom for wall hung cabinets, top only for floor standing cabinets.

## 2.11.2 Cabinet Floor Base

Floor cabinets shall be mounted on a base constructed of [nominal 2 inch thick lumber] [ 3/4 inch particleboard] [ 3/4 inch fiberboard] [ 3/4 inch veneer core exterior plywood]. Base assembly components shall be a moisture-resistant panel product. Finished height for each cabinet base shall be not less than the full height of the installed, specified wall base. Bottom edge of the cabinet door or drawer face shall be flush with top of base.

## 2.11.3 Cabinet Door and Drawer Fronts

Door and drawer fronts shall be fabricated from 3/4 inch medium density fiberboard (MDF. All door and drawer front edges shall be surfaced with high pressure plastic laminate, color and pattern as indicated in Section 09 06 00 SCHEDULES FOR FINISHES.

## 2.11.4 Drawer Assembly

### 2.11.4.1 Drawer Components

Drawer components shall consist of a removable drawer front, sides, backs, and bottom. Drawer components shall be constructed of the following materials and thicknesses:

#### 2.11.4.1.1 Drawer Sides and Backs For Transparent Finish

1/2 inch thick 7-ply hardwood veneer core plywood (no voids), any species

#### 2.11.4.1.2 Drawer Sides and Backs For Laminate Finish

1/2 inch thick 7-ply hardwood veneer core substrate

#### 2.11.4.1.3 Drawer Sides and Back For Thermoset Decorative Overlay (Melamine) Finish

1/2 inch thick medium density particleboard or MDF fiberboard substrate

#### 2.11.4.1.4 Drawer Bottom

1/4 inch thick thermoset decorative overlay melamine panel product

### 2.11.4.2 Drawer Assembly Joinery Method

- a. Multiple dovetail (all corners) or French dovetail front/dadoed back, glued under pressure.
- b. Doweled, glued under pressure.
- c. Lock shoulder, glued and pin nailed.
- d. Bottoms shall be set into sides, front, and back, 1/4 inch deep groove with a minimum 3/8 inch standing shoulder.

## 2.11.5 Shelving

### 2.11.5.1 General Requirements

Shelving shall be fabricated from 3/4 inch medium density fiberboard (MDF.

All shelving top and bottom surfaces shall be finished with thermoset decorative overlay (melamine). Shelf edges shall be finished in a PVC edgebanding.

#### 2.11.5.2 Shelf Support System

The shelf support system shall be:

##### 2.11.5.2.1 Recessed (Mortised) Metal Shelf Standards

Mortise standards flush with the finishes surface of the cabinet interior side walls, two per side. Position and space standards on the side walls to provide a stable shelf surface that eliminates tipping when shelf front is weighted. Install and adjust standards vertically to provide a level, stable shelf surface when clips are in place.

#### 2.11.6 Laminate Application

Laminate application to substrates shall follow the recommended procedures and instructions of the laminate manufacturer and ANSI/NEMA LD 3, using tools and devices specifically designed for laminate fabrication and application. Provide a balanced backer sheet (Grade BK) wherever only one surface of the component substrate requires a plastic laminate finish. Apply required grade of laminate in full uninterrupted sheets consistent with manufactured sizes using one piece for full length only, using adhesives specified herein or as recommended by the manufacturer. Fit corners and joints hairline. All laminate edges shall be machined flush, filed, sanded, or buffed to remove machine marks and eased (sharp corners removed). Clean up at easing shall be such that no overlap of the member eased is visible. Fabrication shall conform to ANSI A161.2. Laminate types and grades for component surfaces shall be as follows unless otherwise indicated on the drawings:

##### 2.11.6.1 Base/Wall Cabinet Case Body

- a. Exterior (exposed) surfaces to include exposed and semi-exposed face frame surfaces: HPDL Grade VGS.
- b. Interior (semi-exposed) surfaces to include interior back wall, bottom, and side walls: Thermoset Decorative Overlay (melamine).

##### 2.11.6.2 Adjustable Shelving

###### 2.11.6.2.1 Top and Bottom Surfaces

Thermoset Decorative Overlay (melamine)

###### 2.11.6.2.2 All Edges

PVC edgebanding

##### 2.11.6.3 Fixed Shelving

###### 2.11.6.3.1 Top and Bottom Surfaces

Thermoset Decorative Overlay (melamine)

#### 2.11.6.3.2 Exposed Edges

Thermoset Decorative Overlay (melamine) PVC edgebanding

#### 2.11.6.4 Door, Drawer Fronts, Access Panels

##### 2.11.6.4.1 Exterior (Exposed) and Interior (Semi-Exposed) Faces

HPDL Grade VGS

##### 2.11.6.4.2 Edges

HPDL Grade VGS

#### 2.11.6.5 Drawer Assembly

All interior and exterior surfaces: Thermoset Decorative Overlay (melamine).

#### 2.11.6.6 Tolerances

Flushness, flatness, and joint tolerances of laminated surfaces shall meet the [NAAWS 3.1](#) custom grade requirements.

#### 2.11.7 Finishing

##### 2.11.7.1 Filling

No fasteners shall be exposed on laminated surfaces. All nails, screws, and other fasteners in non-laminated cabinet components shall be countersunk and the holes filled with wood filler consistent in color with the wood species.

##### 2.11.7.2 Sanding

All surfaces requiring coatings shall be prepared by sanding with a grit and in a manner that scratches will not show in the final system.

##### 2.11.7.3 Coatings

Types, method of application and location of casework finishes shall be in accordance with the [finish schedule](#), drawings and Section [09 90 00](#) PAINTS AND COATINGS. All cabinet reveals shall be painted. Submit descriptive data which provides narrative written verification of all types of construction materials and finishes, methods of construction, etc. not clearly illustrated on the submitted shop drawings. Data shall provide written verification of conformance with [NAAWS 3.1](#) for the quality indicated to include materials, tolerances, and types of construction. Both the manufacturer of materials and the fabricator shall submit available literature which describes re-cycled product content, operations and processes in place that support efficient use of natural resources, energy efficiency, emissions of ozone depleting chemicals, management of water and operational waste, indoor environmental quality, and other production techniques supporting sustainable design and products.

### PART 3 EXECUTION

#### 3.1 [INSTALLATION](#)

Installation shall comply with applicable requirements for [NAAWS 3.1](#) custom

quality standards. Countertops and fabricated assemblies shall be installed level, plumb, and true to line, in locations shown on the drawings. Cabinets and other laminate clad casework assemblies shall be attached and anchored securely to the floor and walls with mechanical fasteners that are appropriate for the wall and floor construction.

### 3.1.1 Anchoring Systems

#### 3.1.1.1 Floor

Base cabinets shall utilize a floor anchoring system. Anchoring and mechanical fasteners shall not be visible from the finished side of the casework assembly. Cabinet assemblies shall be attached to anchored bases without visible fasteners. Where assembly abuts a wall surface, anchoring shall include a minimum 1/2 inch thick lumber or panel product hanging strip, minimum 2-1/2 inch width; securely attached to the top of the wall side of the cabinet back.

#### 3.1.1.2 Wall

Cabinet to be wall mounted shall utilize minimum 1/2 inch thick lumber or panel product hanging strips, minimum 2-1/2 inch width; securely attached to the wall side of the cabinet back, both top and bottom.

### 3.1.2 Hardware

Casework hardware shall be installed in types and locations as indicated on the drawings. Where fully concealed European-style hinges are specified to be used with particleboard or fiberboard doors, the use of plastic or synthetic insertion dowels shall be used to receive 3/16 inch "Euro screws". The use of wood screws without insertion dowels is prohibited.

### 3.1.3 Doors, Drawers and Removable Panels

The fitting of doors, drawers and removable panels shall be accomplished within target fitting tolerances for gaps and flushness in accordance with NAAWS 3.1 [premium] [custom] grade requirements.

### 3.1.4 Plumbing Fixtures

Install sinks, sink hardware, and other plumbing fixtures in locations as indicated on the drawings and in accordance with Section 22 00 00 PLUMBING, GENERAL PURPOSE.

-- End of Section --

## SECTION 06 61 16

## SOLID SURFACING FABRICATIONS

**08/20**

## PART 1 GENERAL

## 1.1 REFERENCES

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

## ASTM INTERNATIONAL (ASTM)

ASTM C920	(2018) Standard Specification for Elastomeric Joint Sealants
ASTM D570	(1998; E 2010; R 2010) Standard Test Method for Water Absorption of Plastics
ASTM D638	(2014) Standard Test Method for Tensile Properties of Plastics
ASTM D696	(2016) Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30 degrees C and 30 degrees C With a Vitreous Silica Dilatometer
ASTM D790	(2017) Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
ASTM D2583	(2013a) Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor
ASTM E84	(2020) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM G21	(2015) Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi

## CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

CDPH SECTION 01350	(2010; Version 1.1) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers
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## CSA GROUP (CSA)

CSA B45.5-17/IAPMO Z124	(2017; Errata 2017; Errata 2018) Plastic Plumbing Fixtures
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INTERNATIONAL CAST POLYMER ASSOCIATION (ICPA)

ICPA SS-1 (2001) Performance Standard for Solid Surface Materials

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI/NEMA LD 3 (2005) Standard for High-Pressure Decorative Laminates

NSF INTERNATIONAL (NSF)

NSF/ANSI 51 (2012) Food Equipment Materials

1.2 SYSTEM DESCRIPTION

- a. Work under this section includes items utilizing solid surfacing material fabrications as indicated on the drawings and as described in this specification. Do not change source of supply for materials after work has started, if the appearance of finished work would be affected.
- b. In most instances, installation of solid surfacing material fabricated components and assemblies requires strong correctly located structural support provided by other trades. To provide a stable, sound, secure installation, close coordination is required between the solid surfacing material fabricator/installer and other trades to ensure that necessary structural wall support, cabinet counter top structural support, proper clearances, and other supporting components are provided for the installation of wall panels, counter tops, shelving, and all other solid surfacing material fabrications to the degree and extent recommended by the solid surfacing material manufacturer.
- c. Provide appropriate staging areas for solid surfacing material fabrications. Allow variation in component size and location of openings of plus or minus 1/8 inch.

1.3 SUBMITTALS

Approval is required for submittals with a "G" designation. Submittals not having a "G" designation are for Contractor Quality Control approval. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29.0520 SUSTAINABILITY REPORTING FOR DESIGN BUILD. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Fabrication Drawings; G

Installation; G

SD-03 Product Data

Solid Polymer; G

Indoor air quality for solid surface seam and sealant products; S

## SD-04 Samples

Material; G

Counter Tops; G

## SD-06 Test Reports

Test Report Results

## SD-07 Certificates

Qualifications

Indoor Air Quality for solid surface fabrication products; S

## SD-10 Operation and Maintenance Data

Solid Polymer, Data Package 1; G

## 1.4 QUALITY ASSURANCE

## 1.4.1 Qualifications

To ensure warranty coverage, provide manufacturer certified solid surfacing fabricators to fabricate the solid surfacing material being utilized. Mark all fabrications with the fabricator's certification label affixed in an inconspicuous location. Minimum of 5 years of experience working with solid surfacing materials is required of fabricators. Submit solid surfacing material manufacturer's certification attesting to fabricator qualification approval.

## 1.4.2 Mock-ups

Submit [Detail Fabrication Drawings](#) indicating locations, dimensions, component sizes, fabrication and joint details, attachment provisions, installation details, and coordination requirements with adjacent work. Prior to final approval of shop drawings, provide a full-size mock-up of a typical counter top [shelving](#) where multiple units are required. Include all solid surfacing material components required to provide a completed unit. Utilize finishes in patterns and colors as indicated; colors listed are not intended to limit the selection of equal colors from other manufacturers. in the mock-up. Should the mock-up not be approved, re-work or remake it until approval is secured. Remove rejected units from the jobsite. Approved mock-up may remain as part of the finished work.

## 1.5 DELIVERY, STORAGE, AND HANDLING

Do not deliver materials to project site until areas are ready for installation. Deliver components and materials to the site undamaged, in containers clearly marked and labeled with manufacturer's name. Store materials indoors and take adequate precautions to prevent damage to finished surfaces. Provide protective coverings to prevent physical damage or staining following installation, for duration of project.

## 1.6 WARRANTY

Provide manufacturer's warranty to repair or replace defective materials



and workmanship for a period of 10 years from date of final acceptance of the work.

## PART 2 PRODUCTS

### 2.1 MATERIAL

Submit detail fabrication drawings and installation drawings of each solid surfacing fabrication indicated. Include elevations, dimensions, clearances, details of construction and anchorage, and details of joints and connections.

Submit manufacturers' descriptive product data for each type of solid polymer fabrication indicated. Include manufacturers' literature, finishes, profiles and thicknesses of materials.

Submit manufacturers' operations and maintenance data for each type of solid polymer fabrication in accordance with Section 01 78 23 OPERATIONS AND MAINTENANCE DATA.

#### 2.1.1 Solid Surfacing Material

Provide solid polymer that is a homogeneous filled solid polymer; not coated, laminated or of a composite construction, complying with ICPA SS-1. Provide material that meets or exceeds the minimum physical and performance properties specified. Superficial damage to a depth of 0.01 inch must be repairable by sanding or polishing. Material thickness is as indicated on the drawings; required minimum thickness is 1.4 inch. Submit a minimum 4 inch by 4 inch sample of each color and pattern for approval; include full range of color and pattern variation. Retain approved samples as a standard for this work. Submit test report results from an independent testing laboratory attesting that the submitted solid surfacing materials meet or exceed each of the specified performance requirements.

- a. Horizontal Surfaces: 3/4 inch thick material
- b. Vertical Surfaces: 1/2 inch thick material
- c. Provide materials that meet the emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type). Provide certification or validation of indoor air quality for solid surface fabrication products.

#### 2.1.2 Cast, 100 Percent Acrylic Polymer Solid Surfacing Material

Cast, 100 percent acrylic solid polymer material composed of acrylic polymer, mineral fillers, and pigments. Provide acrylic polymer that meets or exceeds the following minimum performance requirements:

PROPERTY	REQUIREMENT (min. or max.)	TEST PROCEDURE
Tensile Strength	4000 psi (max.)	ASTM D638

PROPERTY	REQUIREMENT (min. or max.)	TEST PROCEDURE
Hardness	55-Barcol Impressor (min.)	ASTM D2583
Thermal Expansion	.000023 in/in/F (max.)	ASTM D696
Boiling Water Surface Resistance	No Change	ANSI/NEMA LD 3-3.05
High Temperature Resistance	No Change	ANSI/NEMA LD 3-3.06
Impact Resistance (Ball drop)		ANSI/NEMA LD 3-303
1/4 inch sheet	36-inches, 1/2 lb ball, no failure	
1/2 inch sheet	140-inches, 1/2 lb ball, no failure	
3/4 inch sheet	200-inches, 1/2 lb ball, no failure	
Mold & Mildew Growth	No growth	ASTM G21
Bacteria Growth	No growth	ASTM G21
Liquid Absorption (Weight in 24 hrs.)	0.1 percent max.	ASTM D570
Flammability		ASTM E84
Flame Spread	25 max.	
Smoke Developed	30 max.	
Sanitation	"Food Contact" approval	NSF/ANSI 51
Flexural Strength	[6,800][10,400] psi (min.)	ASTM D790

### 2.1.3 Material Patterns and Colors

Provide pattern and color for all solid surfacing material components and fabrications as specified in Section 09 96 00 SCHEDULES FOR FINISHES. Provide products with consistent patterned color throughout thickness of the product.

### 2.1.4 Surface Finish

Provide a uniform appearance on exposed finished surfaces and edges. Exposed surface finish is as indicated.

## 2.2 ACCESSORY PRODUCTS

Provide accessory products, as specified below, as manufactured by the solid surfacing material manufacturer or as approved by the solid

surfacing material manufacturer for use with the solid surfacing materials being specified.

#### 2.2.1 Adhesives

Provide a two-part seam adhesive kit to create permanent, inconspicuous, non-porous, hard seams and joints by chemical bond between solid surfacing materials and components to create a monolithic appearance of the fabrication. Provide adhesive approved by the solid surfacing material manufacturer. Color-match adhesive to the surfaces being bonded where solid-colored, solid surfacing materials are being bonded together. Provide clear or color matched seam adhesive where particulate patterned, solid surfacing materials are being bonded together.

#### 2.2.2 Seam and Sealant Emissions

Provide seam and other accessory materials that meet the emissions requirements of [CDPH SECTION 01350](#) (limit requirements for either office or classroom spaces regardless of space type). Provide validation of [indoor air quality for solid surface seam and sealant products](#).

#### 2.2.3 Silicone Sealant

Provide silicone sealant, mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, acid-curing; [ASTM C920](#), Type S, Grade NS, Class 25, Use NT; clear formulation; approved for use by the solid surfacing material manufacturer.

#### 2.2.4 Conductive Tape

Provide manufacturer's standard conductive foil tape, [4 mils](#) thick, applied around the edges of cut outs containing hot or cold appliances.

#### 2.2.5 Insulating Tape

Provide manufacturer's standard insulating tape for use with drop-in food wells used in commercial food service applications to insulate solid surfacing material from hot or cold appliances.

#### 2.2.6 Heat Reflective Tape

Provide heat reflective tape as recommended by the solid surfacing material manufacturer for use with cutouts for heat sources.

#### 2.2.7 Mounting Hardware

Provide mounting hardware, including sink/bowl clips, inserts and fasteners for attachment of undermount sinks and lavatories.

### 2.3 FABRICATIONS

Provide factory or shop fabricate components to sizes and shapes indicated, to the greatest extent practical, in accordance with approved Shop Drawings and manufacturer's requirements. Provide factory cutouts for sinks, lavatories, and plumbing fixtures where indicated on the drawings. Contours and radii must be routed to template, with edges smooth. Defective and inaccurate work will be rejected. Submit product data indicating product description, fabrication information, and compliance with specified performance requirements for solid surfacing

material, joint adhesive, sealants, and heat reflective tape. Both the manufacturer of materials and the fabricator are required to submit a detailed description of operations and processes in place that support efficient use of natural resources, energy efficiency, emissions of ozone depleting chemicals, management of water and operational waste, indoor environmental quality, and other production techniques supporting sustainable design and products.

#### 2.3.1 Joints and Seams

Form joints and seams between solid surfacing material components using manufacturer's approved seam adhesive. Provide inconspicuous joints in appearance without voids to create a monolithic appearance.

#### 2.3.2 Edge Finishing

Rout and finish component edges to a smooth, uniform appearance and finish. Provide edge shapes and treatments, including any inserts, as detailed on the drawings. Rout all cutouts, then sand all edges smooth. Repair or reject defective or inaccurate work.

#### 2.3.3 Counter Top Splashes

Fabricate backsplashes and end splashes from thick solid surfacing material to be 4 inches high. Provide backsplashes and end splashes for all counter tops. Shop fabricate backsplashes and provide loose, to be field attached.

##### 2.3.3.1 Permanently Attached Backsplash

Provide permanently attached backsplashes straight with seam adhesive to form a 90 degree transition.

##### 2.3.3.2 End Splashes

Provide end splashes loose for installation at the jobsite after horizontal surfaces to which they are to be attached have been installed.

#### 2.3.4 Window Stools

Fabricate window stools from 1/2 inch thick solid surfacing material; dimensions, edge shape, and other details as indicated. Provide square edge profile.

#### 2.3.5 Counter Tops

Fabricate all solid surfacing material, counter top components from 3/4 inch thick material. Indicate details, dimensions, locations, and quantities on the drawings. Provide counter tops with 4 inch high loose as indicated. Attach 2 inch wide reinforcing strip of solid surfacing material under each horizontal counter top seam. Submit a minimum 1 foot wide by 6 inch deep, full size sample for each type of counter top shown on the project drawings; include the edge profile and backsplash as detailed on the drawings and at least one seam. Retain approved sample as standard for this work. Provide bullnose edge profile.

##### 2.3.5.1 Counter Tops with Sinks

b. Provide manufacturer's standard solid polymer sinks, pre-molded

product specifically designed for attachment to solid surfacing material counter tops. See paragraph SOLID POLYMER SINKS for additional requirements.

#### 2.3.5.2 Counter Tops with Bowls

- b. Provide manufacturer's standard solid polymer bowls, pre-molded product specifically designed for attachment to solid surfacing material counter tops. See paragraph SOLID POLYMER BOWLS for additional requirements

#### 2.3.5.3 Cafeteria Counter Tops

Include cutouts for cold or hot appliances to templates furnished by the equipment manufacturers. Reinforce joints and cutouts as recommended by the solid surfacing material manufacturer. Provide insulation between the solid surface material and all appliances, hot or cold. Thermally isolate hot applications from cold applications in accordance with the solid surfacing material manufacturer's recommendations. Provide expansion joints as necessary to accommodate hot appliances. Provide adequate ventilation for cabinets beneath counter tops to prevent heat build-up.

#### 2.3.6 Solid Polymer Sinks

Provide solid polymer sinks that are a standard product of the solid polymer manufacturer, in compliance with [CSA B45.5-17/IAPMO Z124](#) requirements, designed specifically to be installed in solid surfacing material counter tops. Provide sinks of the same polymer composition as the adjoining counter top. Sink design must support a seam adhesive undermount installation method. Sinks must be single bowl configuration. Bowl dimensions must be as indicated. Sink to be Corian 8254.

#### 2.3.7 Tub/Shower Wall Panel System

Provide tub/shower wall enclosures with a system of solid surfacing material components to include: panels corner trim shampoo shelf panel edge trim ; dimensions of all components are as indicated . Form panels from manufacturer's standard 1/2 inch thick sheet product. Provide panels full width and height with seams occurring only at the inside corners of the enclosure. 1/2-inch solid surface wall panels will extend vertically from top of shower pan. Solid surface material will overlap top of shower pan with an air gap, as required by manufacturer installation instructions. Wall panels in shower areas will extend horizontally beyond the "wet area" to the exterior line of the shower receptor threshold. A solid surface transition will be required where solid surface meets wall tile. Locate wall panel seams at corners only. No material seams will be acceptable, except at corners. All shower seams at corners will be lap joints with solid surface corner trim from floor to ceiling. Chemically fuse seams. Include a matching corner shower shelf in each shower compartment. Full-height solid surface transitions will be provided at adjacent wall surfaces. Substrate behind solid surface shower walls will be equal to cementitious ceramic tile backer board. Solid surface shower receptors will be installed prior to wall system. Shower pan receptors will be a minimum thickness of 1/2-inch thick, with a 3/4-inch thick area at least 12 inches in diameter at the drain. Receptors will be one-piece, factory formed shower pans with integral thresholds. Thresholds will have structural supports every 4 inches on center

## PART 3 EXECUTION

### 3.1 INSTALLATION

#### 3.1.1 Components

Install all components and fabricated units plumb, level, and rigid. Make field joints between solid surfacing material components using solid surfacing material manufacturer's approved seam adhesives, to provide a monolithic appearance with joints inconspicuous in the finished work. Attach metal or vitreous china sinks and lavatory bowls to counter tops using solid surfacing material manufacturer's recommended clear silicone sealant and mounting hardware. Install solid polymer sinks and bowls using a color-matched seam adhesive.

##### 3.1.1.1 Loose Counter Top Splashes

Mount loose splashes in the locations noted on the drawings. Adhere loose splashes to the counter top with a color matched silicone sealant when the solid surfacing material components are solid colors. Use a clear silicone sealant to provide adhesion of particulate patterned solid surfacing material splashes to counter tops.

##### 3.1.1.2 Wall Panels & Panel Systems

Installation of wall panels and system components to substrates must include the use of a specified panel adhesive. Use specified seam adhesive to adhere all solid surfacing material components to each other with the exception of expansion joints and inside corners. All inside corners and expansion joints between solid surfacing material components must be joined with specified silicone sealant. All joints between solid surfacing material components and non-solid polymer surfaces must be sealed with specified silicone sealant.

#### 3.1.2 Silicone Sealant

Use specified silicone sealant to seal all expansion joints between solid surfacing material components and all joints between solid surfacing material components and other adjacent surfaces such as walls, floors, ceiling, and plumbing fixtures. Provide sealant bead smooth and uniform in appearance and minimum size necessary to bridge any gaps between the solid surfacing material and the adjacent surface. Provide continuous bead and run the entire length of the joint being sealed.

#### 3.1.3 Plumbing

Make plumbing connections to sinks and lavatories in accordance with Section 22 00 00 PLUMBING, GENERAL PURPOSE .

### 3.2 CLEAN-UP

Components must be cleaned after installation and covered to protect against damage during completion of the remaining project items. Damaged components must be repaired or replaced at the Contractor's sole expense.

-- End of Section --

## SECTION 07 05 23

## PRESSURE TESTING AN AIR BARRIER SYSTEM FOR AIR TIGHTNESS

**08/19**

## PART 1 GENERAL

## 1.1 SUMMARY

Employ an independent agency to conduct the pressure test on the building envelope in accordance with this specification section and [ASTM E779](#).

## 1.2 REFERENCES

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

## AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTING (ASNT)

<a href="#">ANSI/ASNT CP-189</a>	(2016) ASNT Standard for Qualification and Certification of Nondestructive Testing Personnel (ANSI/ASNT CP-105-2006)
<a href="#">ASNT CP-105</a>	(2011) ASNT Standard Topical Outlines for Qualification of Nondestructive Testing Personnel - Item No. 2821
<a href="#">ASNT SNT-TC-1A</a>	(2020) Recommended Practice for Personnel Qualification and Certification in Nondestructive Testing

## ASTM INTERNATIONAL (ASTM)

<a href="#">ASTM D3464</a>	(1996; R 2014) Standard Test Method for Average Velocity in a Duct Using a Thermal Anemometer
<a href="#">ASTM E779</a>	(2019) Standard Test Method for Determining Air Leakage Rate by Fan Pressurization
<a href="#">ASTM E1186</a>	(2017) Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems
<a href="#">ASTM E1258</a>	(1988; R 2018) Standard Test Method for Airflow Calibration of Fan Pressurization Devices
<a href="#">ASTM E1827</a>	(2011; R 2017) Standard Test Methods for Determining Airtightness of Buildings Using an Orifice Blower Door
<a href="#">ASTM E2029</a>	(2011) Standard Test Method for Volumetric and Mass Flow Rate Measurement in a Duct Using Tracer Gas Dilution

## INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 6781	(1983) Thermal Insulation - Qualitative Detection of Thermal Irregularities in Building Envelopes - Infrared Method
ISO 6781-2	(2010) Performance of Buildings - Detection of Heat, Air, and Moisture Irregularities in Buildings by Infrared Methods - Part2: Equipment Requirements
ISO 6781-3	(2015) Performance of Buildings - Detection of Heat, Air, and Moisture Irregularities in Buildings by Infrared Methods - Part 3: Qualifications of Equipment Operators, Data Analysts, and Report Writers

## 1.3 DEFINITIONS

The following terms as they apply to this section:

## 1.3.1 Air Barrier Envelope

The surface that separates the inside air from the outside air. The combination of air barrier assemblies and air barrier components, connected by air barrier accessories are designed to provide a continuous barrier to the movement of air through an environmental separator. A single building may have more than one air barrier envelope. The air barrier surface includes the top, bottom, and sides of the envelope. The term "air barrier envelope" is also known as "air barrier system" or simply "air barrier".

## 1.3.2 Air Leakage Rate

How leaky, or conversely how air tight a building envelope is. The air leakage is normally described in terms of air flow rate for the surface area of the envelope at a defined differential pressure.

## 1.3.3 Bias Pressure

Also known as zero flow pressure, baseline pressure, offset pressure or background pressure. With the envelope not artificially pressurized, bias is the differential pressure that always exists between the envelope that has been prepared (sealed) for the pressure test and the outdoors. Bias pressure is made up of two components, fixed static offset (usually due to stack effect or the HVAC system) and fluctuating pressure (usually due to wind or a moving elevator). Because of pressure fluctuations many bias pressure readings are recorded and averaged for use in the calculations.

## 1.3.4 Blower Door

Commonly used term for an apparatus used to pressurize and depressurize the space within the building envelope and quantify air leakage through the envelope. The blower door typically includes a door fan and an air resistant fabric or a series of hard panels that extends to cover and seal the door opening between the fan shroud and door frame. The door fan is a calibrated fan capable of measuring air flow and is usually placed in the



opening of an exterior door. With the air barrier otherwise sealed, air produced by the door fan pressurizes or de-pressurizes the envelope, depending on the fan's orientation.

#### 1.3.5 Environmental Separator

The parts of a building that separate the controlled interior environment from the uncontrolled exterior environment, or that separate spaces within a building that have dissimilar environments. The term "environmental separator" is also known as the "control layer".

#### 1.3.6 Pressure Test

A generic term for a test in which the envelope is either pressurized or de-pressurized with respect to the outdoors.

##### 1.3.6.1 Negative Pressure Test (Depressurization Test)

A test wherein air inside the envelope is drawn to the outdoors. This places the envelope at a lower (negative) pressure with respect to the outdoors.

##### 1.3.6.2 Positive Pressure Test (Pressurization Test)

A test wherein outdoor air is pushed into the envelope. This air movement places the envelope at a higher (positive) pressure with respect to the outdoors.

#### 1.4 WORK PLAN

Submit the following not later than 120 calendar days before start of pressure testing work, steps to be taken by the lead pressure test technician to accomplish the required testing.

- a. Memorandum of test procedure.
  - (1) Proposed dates for conducting the pressure, thermographic and fog tests.
  - (2) Submit detailed pressure test procedures prior to the test. Provide a plan view showing proposed locations (personnel doors or other similar openings) to install blower doors or flexible ducts (for trailer-mounted fans), if used.
- b. Test equipment to be used.
- c. Scaffolding, scissor lifts, power, electrical extension cords, duct tape, plastic sheeting and other Contractor's support equipment required to perform all tests.
- d. Other Contractor's support personnel who will be on site for testing.

#### 1.5 SUBMITTALS

Approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29.05 20 SUSTAINABILITY REPORTING FOR DESIGN-BUILD. Submit the following in accordance with Section

## 01 33 00.05 20 CONSTRUCTION SUBMITTAL PROCEDURES:

## SD-01 Preconstruction Submittals

Work Plan; G

## SD-03 Product Data

Thermal Imaging Camera; G

## SD-05 Design Data

Envelope Surface Area Calculations; G

## SD-07 Certificates

Pressure Test Agency

Thermographer Qualifications

Test Instruments

Date Of Last Calibration

## SD-06 Test Reports

Pressure Test Procedures; G

Air Leakage Test Report; G

Diagnostic Test Report; G

## 1.6 QUALITY ASSURANCE

## 1.6.1 Modification of References

Perform all pressure and diagnostic tests according to the referenced publications listed in paragraph REFERENCES and as modified by this section. Consider the advisory or recommended provisions, of the referred references, as mandatory.

## 1.6.2 Qualifications

## 1.6.2.1 Pressure Test Agency

Submit, no later than 15 calendar days after **start of construction**, information certifying that the pressure test agency is not affiliated with any other company participating in work on this contract. The work of the test agency is limited to pressure testing the building envelope, performing a thermography test and fog test, and investigating, through various methods, the location of air leaks through the air barrier. See paragraph PRESSURE TEST AGENCY for additional requirements. For thermographer qualifications, see paragraph THERMOGRAPHER QUALIFICATIONS.

Use the sample TEST AGENCY QUALIFICATIONS SHEET form (Appendix C), to submit the following information.

- a. Verification of 2 years of experience as an agency in pressure testing commercial and/or industrial buildings.

- b. List of at least ten commercial/industrial facilities with building envelopes that the agency has tested within the past 2 years. Include building name, address, and name of prime construction contractor and contractor's point-of-contact information.
- c. Confirmation of 2 years of commercial and or industrial building pressure test experience for the lead pressure test technician and the thermographer in using the specified [ASTM E779](#) testing standard. References from five Contracting Officers for facilities where the lead test technician has supervised commercial and or industrial building pressure tests in the last 2 years.
- d. Verification that the lead pressure test technician has been employed by a building pressure testing agency in the capacity of a lead pressure test technician for not less than 1 year.

#### 1.6.2.2 Thermographer Qualifications

To perform an infrared diagnostic evaluation, use a lead thermographer who has at least an active Level II Certification that is based on the requirements in [ASNT CP-105](#) or [ANSI/ASNT CP-189](#) and is in accordance with [ASNT SNT-TC-1A](#). The course of study is to be specifically focused on infrared thermography for building science. The thermographer must have at least two years of building science thermography experience in IR testing commercial or industrial buildings. The thermographer must also have experience in building envelopes and building science in order to make effective recommendations to the contractor should the envelope require additional sealing. Thermographic equipment operators, data analysts and report writers must comply with the requirements of [ISO 6781-3](#). Submit the thermographer's certificate for approval. Submit a list of at least ten commercial/industrial buildings on which the thermographer has performed IR thermography in the past two years. The thermographer is to have a current active certification. Submit certification at least 60 days prior to thermography testing.

#### 1.6.3 Test Instruments and Date of Last Calibration

Submit a signed and dated list of test instruments, their application, manufacturer, model, serial number, range of operation, accuracy and date of most recent calibration. Calibration data applicable to fan systems must be in accordance with [ASTM E1258](#).

#### 1.6.4 Test Reports

No later than 14 days after completion of the pressure test, submit electronic copies of an organized report. The report is to contain a table of contents, an executive summary, an introduction, a results section and a discussion of the results. Submit the [air leakage test report](#) as described in paragraph AIR LEAKAGE TEST REPORT. Submit a [diagnostic test report](#) as described in paragraph LOCATING LEAKS BY DIAGNOSTIC TESTING. The diagnostic test report is to include the Thermographic Investigation Report and the Fog Test Report (if performed).

Submit field data and completed report forms found in the appendices. Use the sample forms, Test Agency Qualification Sheet, Air Leakage Test Form and Air Leakage Test Results Form to summarize the tests for the appropriate building envelope. Submit both electronically populated and field hand filled-in forms.

Report Data. Include in the report the following information for all tests:

- a. Date of issue
- b. Project title and number
- c. Name, address, and telephone number of testing agency
- d. Dates and locations of samples and tests or inspections
- e. Names of individuals making the inspection or test
- f. Designation of the work and test method
- g. Identification of product and specification section
- h. Complete inspection or test data
- i. Test results and an interpretation of test results
- j. Comments or professional opinion on whether inspected or tested work complies with contract document requirements
- k. Recommendations on retesting

#### 1.7 CLIMATE CONDITIONS SUITABLE FOR A PRESSURE TEST

As the test date approaches, monitor the weather forecast for the test site. Avoid testing on days forecast to experience high winds, rain, or snow. Monitor weather forecasts prior to shipping pressure test equipment to the site. Based on current and forecast weather conditions, the Contracting Officer's representative is to grant final approval for testing to occur.

##### 1.7.1 Rain

For safety reasons, avoid testing during rain or if rain is anticipated during testing. If pneumatic hoses are installed and exposed to rain inspect the hose to insure rainwater has not migrated into the hose ends. Orient all exposed hose ends to keep them out of water puddles. Success in temporarily sealing outdoor ventilation components such as louvers and exhaust fans may also be compromised by rain. Don't seal roof-mounted ventilation components during times of potential lightning.

##### 1.7.2 Wind

Because wind can skew pressure test results, test only on days and at times when winds are anticipated to be the calmest. Avoid pressure testing during gusty or high wind conditions. Avoid installing test fans on the windward side of the building if wind gusts during the test are anticipated to be greater than 10 miles per hour.

## PART 2 PRODUCTS

### 2.1 PRESSURE TEST EQUIPMENT

Depending on site conditions and size of the envelope, the test may be

conducted using blower door equipment and/or trailer-mounted fans or the building's own supply air system. The testing agency is to supply sufficient quantity of blower equipment that will produce a minimum of 75 Pa differential pressure between the envelope and outdoors using the test methods described herein. Supplying additional blower test equipment to provide additional airflow capacity or to act as a backup is highly recommended.

#### 2.1.1 Blower Door Fans and Trailer Mounted Fans

Each air flow measuring system including blower door fans and trailer mounted fans are to be calibrated within the last 5 years. Calibrated blower door fans and trailer mounted fans must measure accurately to within plus or minus 5 percent of the flow reading. Blower door equipment and trailer mounted fans are to be specifically designed to pressurize building envelopes. Each set of blower door equipment is to include fan(s), digital gage(s), door frame, door fabric or hard panels.

#### 2.1.2 Digital Gages as Test Instruments

Use only digital gages as measuring instruments in the pressure test; analog gages are not acceptable. The gauges must be accurate to within 1.0 percent of the pressure reading or 0.15 Pa, whichever is greater. Each gage is to have been calibrated within two years of the test. The calibration is to be checked against a National Institute of Standards and Technology (NIST, formerly National Bureau of Standards) traceable standard.

### 2.2 THERMAL IMAGING CAMERA REQUIREMENTS

The thermal imaging camera used in the thermography test must have a thermal sensitivity (Noise Equivalent Temperature Difference.) of +/- 0.18 degrees F at 86 degrees F or less. Ensure the camera's operating spectral range falls between 2 and 15 micrometers. Ensure the camera's IR image viewing screen resolution measures at least 320x240 pixels. Ensure the camera has a means of recording thermal images seen on the camera viewing screen. The camera is to display output as individual still frame images that also can be downloaded and inserted into an electronic Thermographic Investigation Report. All thermographic equipment must comply with the requirements of ISO 6781-2. Submit camera make and model, and catalog information that defines the camera thermal sensitivity for approval.

## PART 3 EXECUTION

### 3.1 PRESSURE TEST AGENCY

The test agency is to be an independent third party subcontractor, not an affiliated or subsidiary of the prime contractor, subcontractors or A/E firm. The agency is to be regularly engaged in pressure testing of commercial/industrial building envelopes. If using blower door or trailer-mounted fans, the lead test technician must have at least two years of experience in using such equipment in building envelope pressurization tests. Formal training using pressure test equipment is highly recommended. Technicians using the building's air handling system for pressure testing are to have tested at least five commercial/industrial buildings within the past two years with each building having over 50,000 square feet of floor area. Submit the name, address and floor areas of each of these five buildings for approval.

### 3.1.1 Field Work

The lead pressure test technician and thermographer are to be present at the project site while testing is performed and is to be responsible for conducting, supervising, and managing of their respective test work. Management includes health and safety of test agency employees.

### 3.1.2 Reporting Work

The lead pressure test technician is to prepare, sign, and date the test agenda, equipment list, and submit a certified Air Leakage Test Report. The thermographer is to prepare, sign, and date the test agenda, equipment list, and submit a certified Thermographic Investigation Report. The contractor is to prepare a final report that identifies improvements that were made to the envelope to reduce air leaks, mitigate thermal bridging, eliminate moisture migration, and repair insulation voids discovered during diagnostic tests. Jointly submit all reports.

## 3.2 ENVELOPE SURFACE AREA CALCULATION

The architectural air barrier boundary includes the floor, walls, and ceiling. After construction of the air barrier envelope is complete, field measure the envelope to ensure the physical measurements match the design drawings and the air barrier envelope surface area calculations are generated. If the calculation result is not within 10 percent of the defined air barrier boundary calculation result as indicated, submit the envelope surface area calculation and results for review.

## 3.3 PREPARING THE BUILDING ENVELOPE FOR THE PRESSURE TEST

### 3.3.1 Testing During Construction

The pressure test cannot be conducted until all components of the air barrier system have been installed. After all sealing as described herein has been completed, inspect the envelope to ensure it has been adequately prepared. During the pressure test, stop all ongoing construction within and neighboring the envelope which may impact the test or the air barrier integrity. The pressure test may be conducted before finishes that are not part of the air barrier envelope have been installed. For example, if suspended ceiling tile, interior gypsum board or cladding systems are not part of the air barrier the test can be conducted before they are installed. Recommend testing prior to installing the finished ceilings within the envelope and immediately surrounding it. The absence of finished ceilings allows for inspection and diagnostic testing of the roof/wall interface and for implementation of repairs to the air barrier, if necessary to comply with the maximum allowed leakage.

### 3.3.2 Sealing the Air Barrier Envelope

Seal all penetrations through the air barrier. Unavoidable penetrations due to electrical boxes or conduit, plumbing, and other assemblies that are not air tight are to be made so by sealing the assembly and the interface between the assembly and the air barrier or by extending the air barrier over the assembly. Support the air barrier so as to withstand the maximum positive and negative air pressure to be placed on the building without displacement or damage, and transfer the load to the structure. Durably construct the air barrier to last the anticipated service life of the assembly and to withstand the maximum positive and negative pressures placed on it during pressure testing. Do not install lighting fixtures

that are equipped with ventilation holes through the air barrier.

### 3.3.3 Sealing Plumbing

Prime all plumbing traps located within the envelope full of water.

### 3.3.4 Close and Lock Doors

Close and lock all doors and windows in the envelope perimeter. For doors not equipped with latching hardware, temporarily secure them in the closed position. Secure the doors in such a way that they remain fully closed even when the maximum anticipated differential air pressure produced during the test acts on them.

### 3.3.5 Hold Excluded Building Areas at the Outdoor Pressure Level

Keep building areas immediately surrounding but excluded from the test envelope at the outdoor pressure level during the pressure test. Maintain these areas at the outdoor pressure level by propping exterior doors open, opening windows and de-energizing all air moving devices in or serving these areas.

### 3.3.6 Maintain an Even Pressure within the Envelope

Ensure the pressure differences within the envelope are minimized by opening all internal air pathways including propping open all interior doors. Distribute test fans throughout the envelope as necessary to ensure the internal pressures are uniform (within 10 percent of the average differential pressure). Ideally, do not install suspended ceilings until after all pressure tests have been completed. If, however the envelope includes finished suspended ceiling spaces, temporarily remove approximately 5 percent of all ceiling tiles or a minimum of 1 tile from each isolated suspended ceiling space, whichever comprises the greatest surface area. Temporarily remove additional ceiling tiles during testing to allow for inspection and diagnostic testing of the ceiling/wall interface. An alternative to removing ceiling tiles is to measure the differential pressure between each isolated suspended ceiling space and the outdoors when the area below the suspended ceiling is maintained at a differential pressure of 75 Pa with respect to the outdoors. If the suspended ceiling differential pressure measurement is within ten percent of the 75 Pa pressure below the suspended ceiling no ceiling tiles need to be removed.

### 3.3.7 Maintain Access to Mechanical and Electrical Rooms

Maintain access to mechanical rooms and electrical rooms associated with the envelope to allow for de-energizing ventilation equipment and resetting circuit breakers tripped by blower door equipment, if used.

### 3.3.8 Minimize Potential for Blowing Dust and Debris

Because high velocity air will be blown into and out of the envelope during the test, debris, including dust and litter, may become airborne. Airborne debris may become trapped or entangled in test equipment, thereby skewing test results. Ensure areas within and surrounding the envelope are free of dust, litter and construction materials that are easily airborne. If pressurizing existing, occupied areas, provide adequate notice to building occupants of blowing dust and debris, and general disruption of normal activities during the test.

### 3.3.9 De-energize Air Moving Devices

De-energize all air moving devices serving the envelope to keep air within the envelope as still as reasonably achievable. De-energize all fans that deliver air to, exhaust air from, or recirculate air within the envelope. Also de-energize all fans serving areas adjacent to but excluded from the envelope.

### 3.3.10 Installing Blower Door Equipment in a Door Opening

Where blower door fans are used, before installing blower door equipment, select a door opening that does not restrict air flow into and out of the envelope and has at least 5 feet clear distance in front of and behind the door opening. Disconnect the door actuator and secure the door open to prevent it from being drawn into the fan by fan pressure. Avoid installing blower door equipment on the windward side of the building.

## 3.4 BUILDING ENVELOPE AIR TIGHTNESS REQUIREMENT

For each building envelope, perform the Architectural Only test and if noted below, the Architectural Plus HVAC System test. The purpose of the pressure (air leakage) test is to determine final compliance with the airtightness requirement by demonstrating the performance of the continuous air barrier. An effective air barrier envelope minimizes infiltration and exfiltration through unintended air paths (leaks). The tests may be performed in any desired order.

### 3.4.1 Architectural Only Test

The test envelope is the architectural air barrier boundary as defined on the contract drawings. This boundary includes connecting walls, roof and floor which comprise a complete, whole, and continuous three dimensional envelope. Perform both a positive pressure test and a negative pressure test on this envelope, unless otherwise directed.

#### 3.4.1.1 Test Goal

Input data from the test into the Air Leakage Rate by Fan Pressurization spreadsheet as described in paragraph CALCULATION PROGRAM via the Air Leakage Test Form. Compare output from the spreadsheet against the maximum allowable leakage defined in Section 07 27 10.00 10 BUILDING AIR BARRIER SYSTEM. The envelope passes the test if the leakage rate, as calculated using the spreadsheet, is equal to or lower than the Architectural Only leakage rate goal.

#### 3.4.1.2 Preparing the Envelope for the Pressure Test - Seal All Openings through the Air Barrier

Temporarily close all perimeter windows, roof hatches and doors in the envelope perimeter except for those doors that are to remain open to accommodate blower door or trailer mounted fan test equipment installation. Seal, or isolate all other intentional openings, pathways and fenestrations through the architectural envelope prior to pressure testing. Follow the Recommended Test Envelope Conditions identified in ASTM E1827, Table 1, for the Closed Envelope condition. These openings may include boiler flues, fuel-burning water heater flues, fuel-burning kitchen equipment, clothes dryer vents, fireplaces, wall or ceiling grilles, diffusers etc. Before sealing flues, close their associated fuel



valves and verify the associated pilot lights are extinguished. Prime all plumbing traps located within the envelope full of water. In lieu of applying tape and/or plastic, typical temporary sealing materials include tape and sheet plastic or a self-adhesive grille wrap. Use and apply tape and plastic in a manner that does not deface or remove paint or mar the finish of permanent surfaces. Be especially aware of residue that remains from tape applied to stainless steel surfaces such as kitchen hoods or rollup doors. For painted surfaces, use tape types that do not remove finish paint when the tape is removed. If paint is removed from the finished surface, repaint to match existing surfaces. Secure dampers closed either manually or by using the building's HVAC system controls. Use the table below for further guidance in building preparation.

Building Component	Envelope Condition
Air handling units, duct fans	As found (open) or temporarily sealed as necessary
Clothes dryer	Off
Clothes dryer vents	Temporarily sealed
Dampers - intake, exhaust	Physically closed or closed using control power or temporarily sealed
Diffusers, registers, grilles within the envelope	Temporarily sealed
Doors, personnel type, at the envelope perimeter	Secured closed
Doors, personnel type, within the envelope	Secured (propped) open
Doors, roll-up type, at the envelope perimeter	Closed (no additional sealing)
Exhaust hoods	Closed* and temporarily sealed
Fireplace hearth	Temporarily sealed *
Kitchen hoods	Temporarily sealed *
Pilot light and associated fuel valve	Extinguished and closed, respectively
Vented combustion appliance	Temporarily sealed *
Vented combustion appliance exhaust flue	Off
Windows	Secured closed
* If the building component has an associated manual or automatic damper, consider securing the damper closed in lieu of temporarily sealing.	

### 3.4.2 Architectural Plus HVAC System Test

This test envelope includes the architectural air barrier boundary as defined on the contract drawings plus all HVAC supply, return and exhaust systems that penetrate and terminate within said architectural air barrier

boundary and that extends outward from said boundary. All associated ductwork, intake and exhaust dampers, and air moving devices, including air handling units and fans, are included in this test envelope even if they are physically located outside of the architectural air barrier boundary. The boundary extends to and includes the low leakage intake and exhaust dampers. Perform both a positive pressure test and a negative pressure test on this envelope, unless otherwise indicated.

#### 3.4.2.1 Test Goal

Data from the test is to be input into the Air Leakage Rate by Fan Pressurization spreadsheet as described in paragraph CALCULATION PROGRAM via the Air Leakage Test Form. If both a positive and negative pressure tests were performed, both data sets are together to be input in the spreadsheet. Compare output from the spreadsheet against the leakage rate goal. The envelope passes the test if the leakage rate, as calculated using the spreadsheet, is equal to or lower than the Architectural Plus HVAC System leakage rate goal.

#### 3.4.2.2 Preparing the Building for the Pressure Test

In preparation of this test, de-energize all air moving devices within this envelope by putting their controls in the Unoccupied mode. This allows the building's HVAC controls to close all associated motorized intake, exhaust, and relief dampers. Make no other changes to the HVAC systems. Temporarily sealing diffusers, grilles, registers, kitchen hoods, exhaust hoods, fans, air handling units and all other HVAC system elements with tape and/or plastic sheeting or any other means is not allowed. If the envelope includes a fireplace hearth do not seal it with tape and plastic. Use the table below for further guidance in building preparation.

Building Component	Envelope Condition
Air handling units, duct fans	As found (open)
Clothes dryer	Off
Clothes dryer vents	As found (no preparation)
Dampers - intake, exhaust	As found (no preparation)
Diffusers, registers, grilles within the envelope	As found (open)
Doors, personnel type, at the envelope perimeter	Secured closed
Doors, personnel type, within the envelope	Secured (propped) open
Doors, roll-up type, at the envelope perimeter	Closed (no preparation)
Exhaust hoods	Closed
Fireplace hearth	As found (open)

Building Component	Envelope Condition
Kitchen hoods	As found (open)
Pilot light and associated fuel valve	Extinguished and closed, respectively
Vented combustion appliance	Off
Vented combustion appliance exhaust flue	As found (open)
Windows	Secured closed

### 3.5 CONDUCTING THE PRESSURE TEST

Notify the Contracting Officer at least 10 working days before conducting the pressure tests to provide the Government the opportunity to witness the tests and to monitor weather forecasts for conditions favorable for testing. Do not pressure test until verifying that the continuous air barrier is in place and installed without failures in accordance with installation instructions. During the pressure test periodically inspect temporarily sealed items to ensure they are still sealed. Seals on temporarily sealed items tend to release more readily at higher pressures. Test data obtained after temporarily sealed items become unsealed cannot be used as input into the calculation program. Follow the Envelope Pressure Test Procedures in the paragraphs below. Submit detailed [pressure test procedures](#) indicating the test apparatus, the test methods and procedures, and the analysis methods to be employed for the building envelope pressure (air tightness) test. Submit these procedures not later than 60 days after Notice to Proceed.

#### 3.5.1 Extend Pneumatic Tubes and Establish a Reference Differential Pressure

Confirm the various zones within the envelope have a relatively uniform interior pressure distribution by establishing a representative differential pressure between the envelope and the outdoors with blower door or trailer-mounted fans operating. The number of indoor pressure difference measurements (pneumatic hoses) required depends on the number of interior zones separated by bottle necks that could create significant pressure drops (e.g. doorways and stairwells). Extend at least four pneumatic hoses (differential pressure monitoring ports) to locations within the envelope that are physically opposite of each other. In multiple story buildings, especially those over three stories, extend hoses to multiple floors. Locate the hose ends away from the effects of air discharge from blower test equipment. Select one of the four (or more) interior hoses, one judged by the test agency to be the most unaffected by air velocity produced by blower test equipment, to serve as the interior reference pressure port. Extend at least one additional pneumatic hose to the outdoors (outdoor pressure port). To the end of this hose manifold at least four hoses together and terminate each hose on a different side of the building. With the envelope sealed and the blowers energized, measure the differential pressure using the interior reference pressure port and the four outdoor pressure ports. Then measure and record the differential pressure by individually using each of the remaining three interior hoses. Ensure each reading is within plus or minus 10 percent of the reference reading. Thus at an average 75 Pa

maximum pressure difference across the envelope, the difference between the highest and lowest interior pressure difference measurements should be 15 Pa or less. If this condition cannot be met, attempt to create additional air pathways within the envelope to minimize pressure differences within the envelope. If necessary, move the interior hose ends. See step 2.13 of the Air Leakage Test Form in Appendix A.

### 3.5.2 Bias Pressure Readings

With the fan pressurization equipment de-energized and the envelope sealed, obtain the differential pressure between the outdoors and the envelope. Record 12 bias pressure readings before the pressure test and 12 bias pressure readings after the pressure test. Each reading is the average of ten or more 1-second measurements. Include positive and negative signs for each reading. To help dampen bias pressures that significantly contribute to test pressure, reduce temperature differences between indoor and outdoor air. Temperature differences can be reduced by operating test fan equipment for a few minutes to replace most of the indoor air with outdoor air.

### 3.5.3 Testing in Both Positive and Negative Directions

The preferred method for testing a building envelope is to test in both the pressurized and depressurized directions. Testing in one direction is only allowed if opposite direction testing cannot logistically be performed due to test equipment limitations or restrictions. After obtaining the pre-test bias differential pressure readings, conduct the pressure test. Record the envelope pressures (in units of Pascals) from one interior pneumatic hose (monitoring port) and the outdoor pneumatic hose(s), averaged or manifolded, with corresponding flows (in units of cfm) for each fan. Record the flow rates at at least 10 to 12 positive and 10 to 12 negative building pressure readings. If conducting both positive and negative pressure tests the lowest allowable test pressure is 40 Pa and the highest test pressure is 85 Pa. Keep at least 25 Pa difference between the lowest and highest test pressure readings. Include the 75 Pa pressure value between the lowest and highest readings. The 10 to 12 readings in each direction are to be roughly evenly spaced along the range of pressures and flows. After testing is complete de-energize the equipment used to provide pressurization and obtain an additional 10 to 12 post-test bias pressure readings. None of the bias pressure readings are allowed to exceed 30 percent of the minimum test pressure. If these limits are exceeded the test fails and must be repeated.

### 3.5.4 Single Direction Testing

After obtaining the 12 aforementioned bias pressure readings, conduct the positive pressure test. Obtain flow rates at 10 to 12 roughly evenly spaced pressure readings over a pressure range of 25 to 50 Pa. After the data is recorded, de-energize the blower equipment and obtain an additional 10 to 12 bias pressure readings. None of the bias pressure readings may exceed 10 percent of the minimum test pressure. If these limits are exceeded the test fails.

### 3.5.5 Using a Building's Own Air Handling System to Pressure Test an Envelope

#### 3.5.5.1 Test Setup

Temporarily seal the envelope in a manner similar to that for testing with

blower door or trailer-mounted fans. To positively pressurize the envelope, de-energize all ventilation equipment and close all associated dampers, except those outside air intake dampers associated with supply fans that will be used to pressurize the building envelope. Fully open these dampers. For the negative pressure test, de-energize all ventilation equipment except for those fans that will be used to de-pressurize the envelope. All dampers associated with de-energized fans are to be closed and all exhaust dampers associated with fans used to de-pressurize the envelope will be fully opened.

#### 3.5.5.2 Measuring Airflows

When using the building's own air handling system to pressure test the envelope, air flows can generally be measured using one of the following methods:

- a. When testing using the building's own air handling system, ensure flow readings obtained by anemometer comply with [ASTM D3464](#). Pitot tube or hot wire anemometer traverse in accordance with [ASTM D3464](#).
- b. Pressure compensated shrouds (especially recommended for rooftop exhaust fans)
- c. Tracer gas methods for measuring airflows in ducts in accordance with [ASTM E2029](#). Do not use tracer gas decay, constant injection and constant concentration methods for estimating the total ventilation rate of the envelope.

#### 3.5.5.3 Outdoor Air Flow Measuring Stations

Air flow stations may be used to measure outdoor airflows if one of the above methods is used to check accuracy of at least one air flow reading for each station or if the design of the HVAC system specifically placed outdoor air flow stations in locations that will yield accurate results. Field verify the accuracy of readings at the air flow measuring stations before obtaining pressure test readings.

#### 3.5.6 Failed Pressure Test

If the pressure test fails to meet the established criteria, use diagnostic test methods described in paragraph LOCATING LEAKS BY DIAGNOSTIC TESTING to discover the leak locations. Provide additional permanent sealing measures to reduce or eliminate leak sources discovered during diagnostic testing. Retest (perform another pressure test) after sealing has been completed. Repeat this sequence of documenting test results in the test report, performing diagnostic tests, documenting recommendations for additional sealing measures in the test report, sealing leak locations per recommendations, and re-testing as necessary until the building envelope passes the pressure test and is in compliance with the performance requirements.

#### 3.5.7 Air Leakage Test Report

Report volumetric flow rates and corresponding differential pressures in [cubic feet per minute \(cfm\)](#) and Pascals (Pa), respectively, on the Air Leakage Test Form sample form found in Appendix A. Populate the accompanying spreadsheet file entitled Pressure Test Data Analysis with information obtained during the test. The spreadsheet uses equations found in [ASTM E779](#) as a basis for calculating the envelope leakage rate.

Other similar leakage rate calculation programs cannot be used or submitted for review. Submit a printout of the data input and output in the report. Should any air tightness (pressure) test fail, the pressure test report is to include data and results from all previous failed tests along with the final successful test data and results. Indicate if the resulting leakage rate did or did not meet the goal leakage requirement. Identify and document deficiencies in the building construction upon failure of a test to meet the specified maximum leakage rate.

Include the Test Agency Qualification Sheet, Air Leakage Test Form and Air Leakage Test Results Form in the written report. Document every test set-up condition with diagrams and photos to ensure the tests can be made repeatable. Document all pneumatic hose termination locations. Record in detail how the building envelope was prepared for the tests. Also describe in detail which building items were temporarily sealed. Include photos of test equipment and sealing measures in the report. Include an electronic (pdf) version of all test reports on a CD. If the building envelope fails to meet the leakage rate goal, provide recommendations to further seal the envelope and document these recommendations in the test report.

### 3.6 LOCATING LEAKS BY DIAGNOSTIC TESTING

Use diagnostic test methods described herein to discover obvious leaks through the envelope. Perform diagnostic tests on the building envelope regardless of the envelope meeting or failing to meet the designated leakage rate goal. Use diagnostic test methods in accordance with [ASTM E1186](#) and in conjunction with pressurization equipment as necessary. Use the thermography diagnostic test to establish a baseline for envelope leakage. Apply additional diagnostic tests (find, feel, fog or other tests) as necessary to further define leak locations and pathways discovered using thermography or to find additional leaks not readily detected by thermography. Using a variety of diagnostic tests may help locate leaks that would otherwise go undetected if only a single diagnostic test were used. Pay special attention to locating leaks at interfaces where there is a change in materials or a change in direction of like materials. These interfaces, at a minimum, include roof/wall, wall/wall, floor/wall, wall/window, wall/door, wall/louver, roof mounted equipment/roof curb interfaces and all utility penetrations (ducts, pipes, conduit, etc) through the envelope's architecture. Also use diagnostic tests to check for leakage between the air duct and duct damper, when the damper, under normal control power, is placed in the closed position. Should leaks be discovered during diagnostic tests, thoroughly document their exact locations on a floor plan so that sealing can be later applied, if required or as directed. If the envelope passes the leakage test, use the diagnostic test procedure described above to identify obvious leakage locations. Seal the leaks at the discretion of the COR based on the magnitude, location, potential for liquid moisture penetration or retention, potential for condensation, presence of daylight through an architectural surface or if the leakage location could potentially cause rapid deterioration or mold growth of, or in the building envelope materials and assemblies. Apply sealing measures after diagnostic testing is complete and all pressurization blowers are off. To verify that the applied sealing measures that are effective, re-test for leaks using the same diagnostic methods that discovered the leak. Reseal and retest until the envelope meets the leakage rate goal and all obvious leaks through the envelope are sealed.

### 3.6.1 Find Test

Use visual observation to locate daylight and/or artificial light streaming from the opposite side of the envelope. Observe all interfaces identified above.

### 3.6.2 Feel Test

Use the building's air handling system or blower door equipment to negatively pressurize the building envelope, to at least 25 Pa but no greater than 85 Pa, with respect to the outdoors. The larger the pressure difference, the easier discovering leaks by feeling them becomes. While inside the envelope, hand feel roof/wall, wall/wall, and floor/wall interfaces and utility penetrations (ducts, pipes, conduit, etc) for leaks and note the leak locations on a floor plan. The "Feel" test may also be used to check for leaks between the ductwork and ductwork damper. To do this, positively pressurize the envelope and check for air movement from the envelope exterior.

### 3.6.3 Infrared Thermography Test

Avoid performing thermography tests just after pressure testing the building envelope (pressurizing and/or depressurizing the building envelope) as thermography readings may be inaccurate due to excessive air-wash. Perform thermography either before the pressure test or wait an appropriate amount of time after pressure test completion for the temperatures within the building envelope to stabilize before starting the thermography tests. Coordinate thermography examination with the pressure test agency and the test agency's pressurization equipment. The pressure test agency is to allow adequate time for the thermographer to perform a complete thermographic examination, as described hereinafter, of the envelope interior and exterior.

#### 3.6.3.1 Thermography Test Methods

Before thermographic testing, remove furniture, construction equipment, and all other obstructions both inside and outside the building as necessary to gain a clear field of view. In the Thermographic Investigation Report, document all areas where obstructions remain. For exterior thermal examination of the envelope, verify that no direct solar radiation has heated the envelope surfaces to be examined for a period of approximately 3 hours for frame construction and for approximately 8 hours for masonry veneer construction. Conduct exterior investigations after sunset, before sunrise, or on an overcast day when the influence of solar radiation can be determined to be minimal. Limit exterior examinations to times when the influence of solar radiation is minimal, such as after sunset or before sunrise or during an overcast day. Conduct thermal imaging tests only when wind speeds are less than 8 mph at the time of analysis and at the end of analysis. Document any variations in wind during the test. Document all variations of test conditions in the Thermographic Investigation Report. Test only when exterior surfaces are dry. Monitor and document ongoing test parameters, such as the temperatures inside and outside the air barrier envelope, wind speed, and differential pressure.

##### 3.6.3.1.1 Thermography Testing of the Air Barrier

Test the building envelope in accordance with [ISO 6781](#), and [ASTM E1186](#). Perform a complete thermographic inspection consisting of the full

inspection of the interior and exterior of the complete air barrier envelope. Document envelope areas that are inaccessible for testing. Use infrared thermography technology in concert with standard pressurization methods (blower doors, trailer mounted fans and/or the building's own air handling systems) to locate leaks through the air barrier. Because thermography works best with at least a 18 degree F temperature difference between the envelope interior and the exterior, adjust the HVAC system, if possible, to create or enhance this temperature difference. The minimum allowable temperature difference is 3 degrees F. Maintain this temperature difference for at least 3 hours prior to the test. Use pressurization methods to establish a minimum of +20 Pa pressure difference with respect to the outdoors while using an infrared camera to view the envelope from outdoors. When viewing with the camera from inside the envelope, keep the envelope at a pressure differential of -20 Pa with respect to the outdoors using pressure testing equipment or the building's own air handling system.

#### 3.6.3.2 Thermography Test Results

Document the location of all leaks, anomalies, and unusual thermal features on a floor plan and/or elevation view and catalog them with a visible light picture for locating the defect for correction. The thermographer is to recommend corrective actions to eliminate the leaks, anomalies and unusual thermal features. Where leaks are found perform corrective sealing as necessary to achieve the whole envelope air leakage rate specified. After sealing, again use thermography in concert with standard pressurization methods to verify that the air leakage has been reduced. After these leaks have been permanently sealed note all actions taken on the drawings or in the Thermographic Investigation Report. Submit the drawings for approval as part of the Thermographic Investigation Report. Also include thermographic photos that show where leaks were discovered. Include thermograms using an imaging palette that clearly shows the observed thermal patterns indicating air leakage. The Contracting Officer's Representative is to witness all testing.

#### 3.6.4 Fog Test

Before using a theatrical fog generator, disable all building smoke detectors as they may alarm when fog is issued. Coordinate fog tests and the disabling of all smoke detectors with the Contracting Officer's representative and the local fire department as necessary. Use pressure test equipment or the buildings own air handling system to positively pressurize the building envelope to at least 25 Pa but not greater than 85 Pa over the outdoors. Using a theatrical fog generator within the envelope, direct fog at suspected leakage points such as at building interfaces. Test the following interfaces: roof/wall, wall/wall, floor/wall, wall/window, roof/mounted mechanical equipment. From the vantage point immediately outside the envelope and opposite that of the interface being tested, observe the effect as the fog is issued. Detection may also be further enhanced by using a scented fog liquid or a fog liquid that produces a colored fog. Look for fog and smell for associated odor percolating through the interface. Also use smoke puffers and smoke sticks as necessary to locate leaks at these and other interface locations. If the Architectural Plus HVAC System pressure test will be/was performed introduce fog into ductwork to check for leakage between ductwork and associated dampers. After fog testing has ended, reactivate the building smoke detectors and notify the Contracting Officer and local fire department that the test has ended. After sealing has been completed retest these areas using fog. Seal additional leaks that are found.



### 3.6.5 Diagnostic Test Report

Once the diagnostic tests have been completed and the leakage locations identified and sealed, document these procedures, locations and recommendations in the diagnostic test report. Submit plan and/or profile drawings that thoroughly identify leak locations. Describe in detail all leak locations so that the seal-up crew knows where to apply sealing measures. After sealing measures have been applied, describe the methods used along with applicable photos of the final sealed condition.

#### 3.6.5.1 Thermographic Investigation Report

Submit a report of each thermographic investigation identifying the thermal discontinuities in the thermal control layer. Indicate in the final report locations to which improvements for both the air control layer and the thermal control layer were made to reduce air leaks and correct discontinuities in the thermal control layer. Include in the report some selected radiometric images of suspected failure points in the air barrier envelope that indicate before and after conditions. Indicate in the final report improvements that were made to the envelope to reduce air leaks. Include the following items in the report:

- a. Brief description of the building construction
- b. Types of interior and exterior surface materials used in the building.
- c. Geographical orientation of the building with a description of the exterior surroundings including other buildings, vegetation, landscaping, and surface water drainage.
- d. Camera brand, model and serial number, and date of most recent calibration date; optional lenses with serial numbers (if applicable)
- e. Thermographer's and Government Inspector's names
- f. Date and time of tests
- g. Air temperature and humidity inside the air barrier envelope
- h. Outdoor air temperature and humidity
- i. General information for the last 12 hours on the solar radiation conditions in the geographic area where the test is being performed.
- j. Ambient conditions such as precipitation and wind direction and speed occurring with the last 24 hours, as applicable. Refer to specific requirements in each section of each thermographic inspection type for requirements in each specific area.
- k. Documentation of those portions of the building envelop which were not within test conditions when the scan was performed and which portions were obstructed by adjacent structures, interior furnishings, intervening cavities or reflective surfaces.
- l. Other relevant information, which may have influenced test results.
- m. Drawings, sketches, floor plans and/or photographs detailing the locations in the buildings where thermograms were taken detailing

possible irregularities in the components being tested.

- n. Thermal images taken during the inspection with their relative locations and written or voiced recorded explanations of the anomaly listed along with visual and reference images.
- o. An identification of the aspects or components of the building being examined.
- p. Explanations for the type and the extent of each construction defect observed during the inspection.
- q. Any results from additional measurements and investigations. Identify additional equipment used and support with type, model number, serial number and date of most recent calibrated.

#### 3.6.5.2 Fog Test Report

Document all turbulent air flow and dead air spaces within the envelope. Report fog behavior as it exits from and/or is entrained within the building. Include a floor plan in the report that documents the locations where fog passed through the envelope.

#### 3.7 CALCULATION PROGRAM

To calculate the envelope leakage rate and other required outputs, input the data obtained during the pressure tests as documented in the Air Leakage Test Form (Appendix A) into the Air Leakage Rate by Fan Pressurization Excel spreadsheet. This spreadsheet can be found at the following web site:

<http://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/forms-graphic>

#### 3.8 AFTER COMPLETION OF THE PRESSURE AND/OR DIAGNOSTIC TEST

After all pressure and/or diagnostic testing has been completed unseal all temporarily sealed items. Unless otherwise directed by the Contracting Officer, return all dampers, doors, and windows to their pre-test condition. Remove tape and plastic from all temporarily sealed openings, being careful not to deface painted surfaces. If paint is removed from finished surfaces, repaint to match existing surfaces. Unless otherwise directed by the Contracting Officer's representative, return fuel (gas) valves to their pre-test position and relight pilot lights. Return all fans and air handling units to pre-test conditions.

#### 3.9 REPAIR AND PROTECTION

Repair and protection is the Contractor's responsibility, regardless of the assignment of responsibility for testing, inspection, and similar services. Upon completion of inspection, testing, or sample taking and similar services, repair damaged construction and restore substrates and finishes, protect construction exposed by or for quality control service activities, and protect repaired construction.

#### 3.10 APPENDICES

The following forms are available for download as a MS Word file at

<http://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/forms-graphic>

Appendix A - Air Leakage Test Form

Appendix B - Air Leakage Test Results Form

Appendix C - Test Agency Qualifications Sheet

-- End of Section --

SECTION 07 19 00

WATER REPELLENTS

**05/11, CHG 1: 08/17**

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 501.1 (2017) Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T 259 (2002; R 2017) Standard Method of Test for Resistance of Concrete to Chloride Ion Penetration

AASHTO T 260 (1997; R 2016) Standard Method of Test for Sampling and Testing for Chloride Ion in Concrete and Concrete Raw Materials

ASTM INTERNATIONAL (ASTM)

ASTM C140/C140M (2020a) Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units

ASTM C672/C672M (2012) Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals

ASTM D2369 (2010; R 2015; E 2015) Volatile Content of Coatings

ASTM D3278 (1996; R 2011) Flash Point of Liquids by Small Scale Closed-Cup Apparatus

ASTM E96/E96M (2016) Standard Test Methods for Water Vapor Transmission of Materials

ASTM E514/E514M (2014a) Standard Test Method for Water Penetration and Leakage Through Masonry

ASTM G154 (2016) Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.1000 Air Contaminants

## 1.2 SUBMITTALS

Approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29.05 20 SUSTAINABILITY REPORTING FOR DESIGN-BUILD. Submit the following in accordance with Section 01 33 00.05 20 CONSTRUCTION SUBMITTAL PROCEDURES:

### SD-03 Product Data

Water Repellents

### SD-06 Test Reports

Water Absorption

Accelerated Weathering

Resistance to Chloride Ion Penetration

Moisture Vapor Transmission

Scaling Resistance

Water Penetration and Leakage

### SD-07 Certificates

Manufacturer's Qualifications

Applicator's Qualifications

Evidence of Acceptable Variation

Warranty

### SD-08 Manufacturer's Instructions

Application Instructions

Provide manufacturer's instructions including preparation, application, recommended equipment to be used, safety measures, and protection of completed application.

Manufacturer's Safety Data Sheets

## 1.3 QUALITY ASSURANCE

### 1.3.1 Qualifications

- a. **Manufacturer's qualifications:** Minimum five years record of successful in-service experience of water repellent treatments manufactured for concrete application.
- b. **Applicator's qualifications:** Minimum five years successful experience in projects of similar scope using specified or similar treatment materials and manufacturer's approval for application.

### 1.3.2 Performance Requirements

- a. Water absorption: ASTM C140/C140M. Comparison of treated and untreated specimens.
- b. Moisture vapor transmission: ASTM E96/E96M. Comparison of treated and untreated specimens.
- c. Water penetration and leakage through masonry: ASTM E514/E514M.

### 1.3.3 Evidence of Acceptable Variation

If a product proposed for use does not conform to requirements of the referenced specification, submit for approval to the Contracting Officer, evidence that the proposed product is either equal to or better than the product specified. Include the following:

- a. Identification of the proposed substitution;
- b. Reason why the substitution is necessary;
- c. A comparative analysis of the specified product and the proposed substitution, including tabulations of the composition of pigment and vehicle;
- d. The difference between the specified product and the proposed substitution; and
- e. Other information necessary for an accurate comparison of the proposed substitution and the specified product.

## 1.4 SAMPLE TEST PANEL

The approved Sample Test Panel will serve as the standard of quality for all other water repellent coating work. Do not proceed with application until the sample panel has been approved by the Contracting Officer.

### 1.4.1 Sample Test Panel

Prior to commencing work, including bulk purchase and delivery of material, apply water repellent treatment to a minimum 4 feet high by 4 feet long concrete test-panel. Provide a full height expansion joint at mid-panel length. Prepare and seal joint with materials approved for project use.

#### 1.4.1.1 Testing

AAMA 501.1 Provide field water testing of water repellent treated surfaces in the presence of the Contracting Officer and the water repellent treatment manufacturer's representative.

- a. Apply water repellent to left side of mock-up and allow to cure prior to application of treatment to right side.
- b. Twenty days after completion of application of treatment, test mock-up with 5/8 inch garden hose, with spray nozzle, located 10 feet from wall and aimed upward so water strikes wall at 45 degree downward angle. After water has run continuously for three hours observe back

side of mock-up for water penetration and leakage. If leakage is detected make changes as needed and retest.

- c. Coordinate testing procedures and modify project treatment application as required to pass mock-up tests for water penetration and leakage resistance.

#### 1.4.1.2 Approval

Proceed with water repellent treatment work only after completion of field test application and approval of mock-up and tests by the Contracting Officer.

#### 1.4.2 Pre-Installation Meeting

- a. Attend pre-installation meeting required prior to commencement of concrete installation.
- b. Review procedures and coordination required between water repellent treatment work and work of other trades which could affect work to be performed under this section of the work.
- c. Convene additional pre-installation meeting prior to water repellent treatment application for coordination with work not previously coordinated including joint sealants.

### 1.5 REGULATORY REQUIREMENTS

#### 1.5.1 Environmental Protection

In addition to requirements specified in Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS for environmental protection, provide coating materials that conform to the restrictions of the Local Air Pollution Control jurisdiction. Notify the Contracting Officer of any water repellent coating specified herein which fails to conform to the local Air Quality Management District Rules at the location of the Project. In localities where the specified coating is prohibited, the Contracting Officer may direct the substitution of an acceptable coating.

### 1.6 DELIVERY, STORAGE, AND HANDLING

Deliver materials in original sealed containers, clearly marked with the manufacturer's name, brand name, type of material, batch number, percent solids by weight and volume, and date of manufacturer. Store materials off the ground, in a dry area where the temperature will be not less 50 degrees F nor more than 85 degrees F.

### 1.7 SAFETY METHODS

Apply coating materials using safety methods and equipment in accordance with Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS, and the following:

#### 1.7.1 Toxic Materials

To protect personnel from overexposure to toxic materials, conform to the most stringent guidance of:

- a. The coating manufacturer when using solvents or other chemicals. Use impermeable gloves, chemical goggles or face shield, and other

recommended protective clothing and equipment to avoid exposure of skin, eyes, and respiratory system. Conduct work in a manner to minimize exposure of building occupants and the general public.

- b. 29 CFR 1910.1000.
- c. Threshold Limit Values (R) of the American Conference of Governmental Industrial Hygienists.
- d. Manufacturer's Safety Data Sheets.

## 1.8 ENVIRONMENTAL CONDITIONS

### 1.8.1 Weather and Substrate Conditions

Do not proceed with application of water repellents under any of the following conditions, except with written recommendations of manufacturer.

- a. Ambient temperature is less than 40 degrees F.
- b. Substrate faces have cured less than one month.
- c. Rain or temperature below 40 degrees F are predicted for a period of 24 hours before or after treatment.
- d. Earlier than three days after surfaces are wet.
- e. Substrate is frozen or surface temperature is less than 40 degrees F and falling.

### 1.8.2 Moisture Condition

Determine moisture content of substrate meets manufacturer's requirements prior to application of water repellent material.

## 1.9 SEQUENCING AND SCHEDULING

### 1.9.1 Masonry Surfaces

Do not start water repellent coating until all joint tooling, pointing and masonry cleaning operations have been completed. Allow masonry to cure for at least 60 days under normal weather conditions before applying water repellent.

### 1.9.2 Concrete Surfaces

Do not start water repellent coating until all patching, pointing and cleaning operations have been completed and concrete has cured a minimum of 30 days under normal weather conditions.

### 1.9.3 Sealants

Do not apply water repellents until the sealants for joints adjacent to surfaces receiving water repellent treatment have been installed and cured.

- a. Water repellent work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those used in the work.



- b. Provide manufacturers' test results of compatibility.

#### 1.10 INSPECTIONS

Notify the manufacturer's representative a minimum of 72 hours prior to scheduled application of water repellents for field inspection. Inspect surfaces and obtain approval in writing from the manufacturer's representative prior to any application of any water repellent coating.

#### 1.11 SURFACES TO BE COATED

Coat all exterior concrete, masonry surfaces. This includes back faces of parapets, top of walls, edges and returns adjacent to windows and door frames and free standing walls.

#### 1.12 WARRANTY

Provide a warranty, issued jointly by the manufacturer and the applicator of the water repellent treatment against moisture penetration through the treated structurally sound surface for a period of five years. Warranty to provide the material, labor, and equipment necessary to remedy the problem. At the satisfactory completion of the work, complete the warranty sign, notarize, and submit to the Contracting Officer.

### PART 2 PRODUCTS

#### 2.1 MATERIALS

Water repellent solution shall be a clear, non-yellowing, deep-penetrating, VOC compliant solution. Material shall not stain or discolor and shall produce a mechanical and chemical interlocking bond with the substrate to the depth of the penetration.

#### 2.2 WATER REPELLENTS

##### 2.2.1 Siloxanes

Penetrating water repellent. Alkylalkoxysiloxanes that are oligomeric with alcohol, ethanol, mineral spirits, or water.

- a. Solids by weight: **ASTM D2369**, 7.5 to 16.0 percent.
- b. Volatile Organic Content (VOC) after blending: Less than 175 grams per liter.
- c. Density, activated: **8.4 pounds per gallon**, plus or minus one percent.
- d. Flash point, **ASTM D3278**: Greater than **212 degrees F**.

#### 2.3 PERFORMANCE CRITERIA

##### 2.3.1 Siloxanes

- a. Dry time for recoat, if necessary: One to two hours depending on weather conditions.
- b. Penetration: **3/8 inch**, depending on substrate.

- c. Water penetration and leakage through masonry, ASTM E514/E514M, percentage reduction of leakage: 97.0 percent minimum.
- d. Moisture vapor transmission, ASTM E96/E96M: 47.5 perms or 82 percent maximum compared to untreated sample.
- e. Resistance to accelerated weathering, ASTM G154. Testing 2,500 hours: No loss in repellency.
- f. Resistance to chloride ion penetration, AASHTO T 259 and AASHTO T 260.
- g. Scaling resistance, ASTM C672/C672M, non-air-entrained concrete: Zero rating, no scaling, 100 cycles treated concrete.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

Examine concrete or masonry surfaces to be treated to ensure that:

- a. All visible cracks, voids or holes have been repaired.
- b. All mortar joints in masonry are tight and sound, have not been re-set or misaligned and show no cracks or spalling.
- c. Moisture contents of walls does not exceed 15 percent when measured on an electronic moisture register, calibrated for the appropriate substrate.
- d. Concrete surfaces are free of form release agents, curing compounds and other compounds that would prevent full penetration of the water repellent material.

Do not start water repellent treatment work until all deficiencies have been corrected, examined and found acceptable to the Contracting Officer and the water repellent treatment manufacturer. Do not apply treatment to damp, dirty, dusty or otherwise unsuitable surfaces. Comply with the manufacturer's recommendations for suitability of surface.

#### 3.2 PREPARATION

##### 3.2.1 Surface Preparation

Prepare substrates in accordance with water repellent treatment manufacturer's recommendation. Clean surfaces of dust, dirt, efflorescence, alkaline, and foreign matter detrimental to proper application of water repellent treatment.

##### 3.2.2 Protection

Provide masking or protective covering for materials which could be damaged by water repellent treatment.

- a. Protect glass, glazed products, and prefinished products from contact with water repellent treatment.
- b. Protect landscape materials with breathing type drop cloths: plastic covers are not acceptable.

### 3.2.3 Compatibility

- a. Confirm treatment compatibility with each type of joint sealer within or adjacent to surfaces receiving water repellent treatment in accordance with manufacturer's recommendations.
- b. When recommended by joint sealer manufacturer, apply treatment after application and cure of joint sealers. Coordinate treatment with joint sealers.
- c. Mask surfaces indicated to receive joint sealers which would be adversely affected by water repellent treatment where treatment must be applied prior to application of joint sealers.

### 3.3 MIXING

Mix water repellent material thoroughly in accordance with the manufacturer's recommendations. Mix, in quantities required for that days work, all containers prior to application. Mix each container the same length of time.

### 3.4 APPLICATION

In strict accordance with the manufacturers written requirements. Do not start application without the manufacturer's representative being present or his written acceptance of the surface to be treated.

#### 3.4.1 Water Repellent Treatment

##### 3.4.1.1 Spray Application

Spray apply water repellent material to exterior concrete and masonry surfaces using low-pressure airless spray equipment in strict accordance with manufacturer's printed application, instructions, and precautions. Maintain copies at the job site. Apply flood coat in an overlapping pattern allowing approximately 8 to 10 inch rundown on the vertical surface. Maintain a wet edge at all overlaps, both vertical and horizontal. Hold gun maximum 18 inches from wall.

##### 3.4.1.2 Brush or Roller Application

Brush or roller apply water repellent material only at locations where overspray would affect adjacent materials and where not practical for spray applications.

##### 3.4.1.3 Covered Surfaces

Coat all exterior concrete or masonry surfaces including back faces of parapets, tops of walls, edges and returns adjacent to window and door frames, window sills, and free-standing walls.

##### 3.4.1.4 Rate of Application

Apply materials to exterior surfaces at the coverages recommended by the manufacturer and as determined from sample panel test. Increase or decrease application rates depending upon the surface texture and porosity of the substrate so as to achieve even appearance and total water repellency.

3.4.1.5 Number of Coats

The sample panel test shall determine the number of coats required to achieve full coverage and protection.

3.4.1.6 Appearance

If unevenness in appearance, lines of work termination or scaffold lines exist, or detectable changes from the approved sample panel occur, the Contracting Officer may require additional treatment at no additional cost to the Government. Apply any required additional treatment to a natural break off point.

3.5 CLEANING

Clean all runs, drips, and overspray from adjacent surfaces while the water repellent treatment is still wet in a manner recommended by the manufacturer.

3.6 FIELD QUALITY CONTROL

Do not remove drums containing water repellent material from the job site until completion of all water repellent treatment and until so authorized by the Contracting Officer.

3.6.1 Field Testing

**AAMA 501.1.** At a time not less than twenty days after completion of the water repellent coating application, subject a representative wall area of the building to the Navy Hose Stream Field Test similar to **AAMA 501.1** hose test to simulated rainfall for a period of three hours. Use a minimum 5/8 inch diameter hose and a fixed lawn sprinkler spray head which will direct a full flow of water against the wall. Place the sprinkler head so that the water will strike the wall downward at a 45 degree angle to the wall. If the inside of the wall shows any trace of moisture during or following the test, apply another coat of water repellent, at the manufacturer's recommended coverage rate to the entire building. Repeat testing and re-coating process until no moisture shows on the inside wall face. Accomplish any required work retesting and re-coating at no additional cost to the Government.

3.6.2 Site Inspection

Inspect treatment in progress by manufacturer's representative to verify compliance with manufacturer instructions and recommendations.

-- End of Section --

## SECTION 07 21 13

## BOARD AND BLOCK INSULATION

**02/16, CHG 2: 08/20**

## PART 1 GENERAL

## 1.1 REFERENCES

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

## ASTM INTERNATIONAL (ASTM)

ASTM C165	(2007; R 2017) Standard Test Method for Measuring Compressive Properties of Thermal Insulations
ASTM C272/C272M	(2016) Standard Test Method for Water Absorption of Core Materials for Sandwich Constructions
ASTM C553	(2013; R 2019) Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM C578	(2019) Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
ASTM C591	(2020) Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
ASTM C612	(2014; R 2019) Standard Specification for Mineral Fiber Block and Board Thermal Insulation
ASTM C930	(2019) Standard Classification of Potential Health and Safety Concerns Associated with Thermal Insulation Materials and Accessories
ASTM D1621	(2016) Standard Test Method for Compressive Properties of Rigid Cellular Plastics
ASTM D3833/D3833M	(1996; R 2011) Water Vapor Transmission of Pressure-Sensitive Tapes
ASTM D4397	(2016) Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications
ASTM E84	(2020) Standard Test Method for Surface Burning Characteristics of Building Materials

ASTM E96/E96M	(2016) Standard Test Methods for Water Vapor Transmission of Materials
ASTM E136	(2019a) Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C
ASTM E154/E154M	(2008a; R 2013; E 2013) Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC	(2018) International Building Code
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NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 31	(2020) Standard for the Installation of Oil-Burning Equipment
NFPA 54	(2021) National Fuel Gas Code
NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code
NFPA 211	(2019) Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	SCS Global Services (SCS) Indoor Advantage
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TECHNICAL ASSOCIATION OF THE PULP AND PAPER INDUSTRY (TAPPI)

TAPPI T803 OM	(2010) Puncture Test of Container Board
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U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.134	Respiratory Protection
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UNDERWRITERS LABORATORIES (UL)

UL 2818	(2013) GREENGUARD Certification Program For Chemical Emissions For Building Materials, Finishes And Furnishings
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1.2 SUBMITTALS

Approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29.05 20 SUSTAINABILITY REPORTING FOR DESIGN-BUILD. Submit the following in accordance with Section 01 33 00.05 20 CONSTRUCTION SUBMITTAL PROCEDURES:

SD-03 Product Data

Manufacturer's Standard Details; G

Block or Board Insulation; G

Vapor Retarder; G

Pressure Sensitive Tape; G

Protection Board or Coatings; G

Accessories including sealants; G

Recycled Content for Block or Board Insulation; S

#### SD-07 Certificates

Block or Board Insulation; G

Vapor Retarder; G

Protection Board or Coating; G

Draft Special Warranties; G

Final Special Warranties; G

Indoor Air Quality For Block Or Board Insulation; S

#### SD-08 Manufacturer's Instructions

Block or Board Insulation

Adhesive

### 1.3 MANUFACTURER'S DETAILS

Submit [manufacturer's standard details](#) indicating methods of attachment and spacing, transition and termination details, and installation details. Include verification of existing conditions.

### 1.4 PRODUCT DATA

Include data for material descriptions, recommendations for product shelf life, requirements for [protection board or coatings](#), and precautions for flammability and toxicity. Include data to verify compatibility of sealants with insulation.

### 1.5 CERTIFICATIONS

Provide products certified to meet indoor air quality requirements by [UL 2818](#) (Greenguard) Gold, [SCS Global Services Indoor Advantage Gold](#) or provide certification by other third-party programs. Provide current product certification documentation from certification body.

### 1.6 DELIVERY, STORAGE, AND HANDLING

#### 1.6.1 Delivery

Deliver materials to the site in original sealed wrapping bearing

manufacturer's name and brand designation, specification number, type, grade, R-value, and class. Store and handle to protect from damage. Do not allow insulation materials to become wet, soiled, crushed, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storing, and protecting of materials before and during installation.

#### 1.6.2 Storage

Inspect materials delivered to the site for damage and store out of weather in manufacturer's original packaging. Store only in dry locations, not subject to open flames or sparks, and easily accessible for inspection and handling. Keep materials wrapped and separated from off-gassing materials (such as drying paints and adhesives). Do not use materials that have visible moisture or biological growth. Comply with manufacturer's recommendations for handling, storage, and protection of materials before and during installation.

### 1.7 SAFETY PRECAUTIONS

#### 1.7.1 Respirators

Provide installers with dust/mist respirators, training in their use, and protective clothing, all approved by the National Institute for Occupational Safety and Health (NIOSH)/Mine Safety and Health Administration (MSHA) and in accordance with 29 CFR 1910.134.

#### 1.7.2 Other Safety Considerations

Comply with the safety requirements of ASTM C930.

### 1.8 SPECIAL WARRANTIES

#### 1.8.1 Guarantee

Guarantee insulation installation against failure due to ultraviolet light exposure for a period of three years from the date of Beneficial Occupancy or Substantial Completion. Submit draft and final guarantees in accordance with Sections 01 78 00 CLOSEOUT SUBMITTALS.

#### 1.8.2 Warranty

Provide manufacturer's material warranty for all system components for a period of three years from the date of Beneficial Occupancy or Substantial Completion. Submit draft and final warranties in accordance with Sections 01 78 00 CLOSEOUT SUBMITTALS.

## PART 2 PRODUCTS

### 2.1 BLOCK OR BOARD INSULATION

Provide thermal insulating materials as recommended by manufacturer for each type of application indicated. Provide insulation with the following physical properties and in accordance with the following standards:

- a. Mineral Fiber Block and Board: ASTM C612
- b. Unfaced Preformed Rigid Polyurethane and Polyisocyanurate Board: ASTM C591



## 2.1.1.1 Thermal Resistance

[ Unless otherwise indicated, Ceiling R-[\_\_\_\_\_] Wall R-[\_\_\_\_\_] Floor [R-\_\_\_\_\_] ].

## ]2.1.1.2 Fire Protection Requirements

- a. Flame spread index of 75 or less when tested in accordance with ASTM E84.
- b. Smoke developed index of 150 or less when tested in accordance with ASTM E84.
- c. Provide insulated assemblies in accordance ICC IBC Chapter Fire and Smoke Protection Features.

## 2.1.1.3 Other Material Properties

Provide thermal insulating materials with the following properties:

- a. Rigid cellular plastics: Compressive Resistance at Yield: Not less than 25 pounds per square inch (psi) when measured according to ASTM D1621.
- b. Mineral fiber board: Compressive strength: Minimum load required to produce a reduction in thickness of 10 percent pounds per square foot (lbf/sf): 25 when tested according to ASTM C165.
- c. Water Vapor Permeance: Not more than 1.1 perms or less when measured according to ASTM E96/E96M, desiccant method, in the thickness required to provide the specified thermal resistance, including facings, if any.
- d. Water Absorption: Not more than 2 percent by total immersion, by volume, when measured according to ASTM C272/C272M.
- e. Water Adsorption: Not more than 1 percent by volume when measured in accordance with paragraph 14 of ASTM C553.

## 2.1.1.4 Premolded Concrete Masonry Insert

Provide in accordance with ASTM C578 REV A. Provide inserts in concrete masonry units that are installed at the masonry unit manufacturing plant. Provide insert with thickness of not less than 1 1/4 inches.

## 2.1.1.5 Recycled Materials

Provide thermal insulation containing recycled materials to the extent practicable, provided that the material meets all other requirements of this section. The minimum required recycled material contents (by weight, not volume) are:

Polyisocyanurate/Polyurethane:	9 percent
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Phenolic Rigid Foam:	5 percent
Perlite Board:	75 percent post consumer paper

Provide data identifying percentage of recycled content for block or board insulation.

#### 2.1.6 Indoor Air Quality

Provide certification of indoor air quality for block or board insulation.

#### 2.1.7 Prohibited Materials

Do not provide materials containing asbestos.

### 2.2 VAPOR RETARDER AND DAMPPROOFING

#### 2.2.1 Vapor Retarder in Framed Walls and Roofs

- a. 6 mil thick polyethylene sheeting conforming to ASTM D4397 and having a water vapor permeance of 1 Perm or less when tested in accordance with ASTM E96/E96M.
- b. Membrane with the following properties:
  - (1) Water Vapor Permeance: ASTM E96/E96M: 1 Perm
  - (2) Maximum Flame Spread: ASTM E84: 25
  - (3) Combustion Characteristics: Passing ASTM E136
  - (4) Puncture Resistance: TAPPI T803 OM: 15

#### 2.2.2 Vapor Retarder under Floor Slab

- a. Water vapor permeance: 0.2 Perm or less when tested in accordance with ASTM E96/E96M.
- b. Puncture resistance: Maximum load no less than 40 pounds when tested according to ASTM E154/E154M REV A.

### 2.3 PRESSURE SENSITIVE TAPE

As recommended by manufacturer of vapor retarder(s). Match water vapor permeance rating for each vapor retarder specified. Provide tape in accordance with ASTM D3833/D3833M.

### 2.4 PROTECTION BOARD OR COATING

As recommended by insulation manufacturer.

### 2.5 ACCESSORIES

#### 2.5.1 Adhesive

As recommended by insulation manufacturer.

## 2.5.2 Mechanical Fasteners

Corrosion resistant fasteners as recommended by the insulation manufacturer.

## PART 3 EXECUTION

### 3.1 EXISTING CONDITIONS

Prior to installation, ensure all areas that are in contact with the insulation are dry and free of projections that could cause voids, compressed insulation, or punctured vapor retarders. For foundation perimeter or under slab applications, check that subsurface fill is flat, smooth, dry, and well tamped. Do not proceed with installation if moisture or other conditions are present, and notify the Contracting Officer of such conditions. Do not proceed with the work until conditions have been corrected and verified to be dry.

### 3.2 PREPARATION

#### 3.2.1 Blocking Around Heat Producing Devices

Provide noncombustible blocking at all spaces between heat producing devices and the floors, ceilings and roofs through which they pass. Provide in accordance with ICC IBC Section 2111.12 Fireplace Blocking and with the following clearances:

- a. Recessed lighting fixtures, including wiring compartments, ballasts, and other heat producing devices, unless certified for installation surrounded by insulation: 3 inches from outside face of fixtures and devices or as required by NFPA 70 and, if insulation is placed above fixture or device, 24 inches above fixture.
- b. Masonry chimneys or masonry enclosing a flue: 2 inches from outside face of masonry. Masonry chimneys for medium and high heat operating appliances: Minimum clearances required by NFPA 211.
- c. Vents and vent connectors used for venting products of combustion, flues, and chimneys other than masonry chimneys: Minimum clearances as required by NFPA 211.
- d. Gas Fired Appliances: Clearances as required in NFPA 54.
- e. Oil Fired Appliances: Clearances as required in NFPA 31.

Blocking is not required if chimneys or flues are certified in writing by the chimney or flue manufacturer for use in contact with specific insulating materials.

### 3.3 INSTALLATION

#### 3.3.1 Installation and Handling

Provide insulation in accordance with the manufacturer's printed installation instructions. Keep material dry and free of extraneous materials.

### 3.3.2 Electrical Wiring

Do not install insulation in a manner that would enclose electrical wiring between two layers of insulation.

### 3.3.3 Cold Climate Requirement

Place insulation on the outside of pipes.

### 3.3.4 Continuity of Insulation

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 thermal bridges and voids. Provide and verify continuity of insulative barrier throughout the building enclosure.

### 3.3.5 Coordination

Verify final installed insulation thicknesses comply with thicknesses indicated, R-values specified herein, and with the approved insulation submittal(s).

## 3.4 INSTALLATION ON WALLS

### 3.4.1 Installation using Furring Strips

Install insulation between members as recommended by insulation manufacturer.

### 3.4.2 Adhesive Attachment to Concrete Walls

Apply adhesive to wall and completely cover wall with insulation.

- a. Full back bed method
- b. As recommended by the insulation manufacturer.
- c. Use only full back method for pieces of 1 square foot or less.
- d. Butt all edges of insulation and seal edges with tape.

### 3.4.3 Protection Board or Coating

Install protection board or coating in accordance with manufacturer's printed instructions. Install protection over all exterior exposed insulation and to 1 foot below grade.

## 3.5 PERIMETER AND UNDER SLAB INSULATION

Install perimeter thermal insulation where heated spaces are adjacent to exterior walls, slab edges in slab-on-grade, or floating slab construction.

### 3.5.1 Manufacturer's Instructions

Layout insulation, tape edges, provide vapor retarder and other required accessories to protection against vermin, insects, and damage in accordance with manufacturer's printed instructions.

### 3.5.2 Insulation on Vertical Surfaces

Provide thermal insulation on grade beams below grade. Fasten insulation with adhesive.

### 3.5.3 Protection of Insulation

Protect insulation from damage during construction and back filling by application of protection board or a coating. Do not leave installed vertical insulation unprotected overnight. Protect installed insulation from weather, including rain and ultraviolet light, from mechanical abuse, compression, and dislocation.

### 3.6 VAPOR RETARDER

Apply vapor retarder continuous across all surfaces. Overlap all joints at least 6 inches and seal with pressure sensitive tape. Seal at sills, header, windows, doors and utility penetrations. Repair punctures or tears with pressure sensitive tape.

-- End of Section --

## SECTION 07 21 16

## MINERAL FIBER BLANKET INSULATION

**11/11, CHG 4: 08/18**

## PART 1 GENERAL

## 1.1 REFERENCES

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

## ASTM INTERNATIONAL (ASTM)

- ASTM C665 (2017) Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
- ASTM C930 (2019) Standard Classification of Potential Health and Safety Concerns Associated with Thermal Insulation Materials and Accessories
- ASTM D5359 (2015) Standard Specification for Glass Cullet Recovered from Waste for Use in Manufacture of Glass Fiber
- ASTM E84 (2020) Standard Test Method for Surface Burning Characteristics of Building Materials
- ASTM E136 (2019a) Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C

## CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

- CDPH SECTION 01350 (2010; Version 1.1) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers

## GREEN SEAL (GS)

- GS-36 (2013) Adhesives for Commercial Use

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

- NFPA 31 (2020) Standard for the Installation of Oil-Burning Equipment
- NFPA 54 (2021) National Fuel Gas Code
- NFPA 70 (2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code

NFPA 211 (2019) Standard for Chimneys, Fireplaces,  
Vents, and Solid Fuel-Burning Appliances

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS SCS Global Services (SCS) Indoor Advantage

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule 1168 (2017) Adhesive and Sealant Applications

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.134 Respiratory Protection

UNDERWRITERS LABORATORIES (UL)

UL 2818 (2013) GREENGUARD Certification Program  
For Chemical Emissions For Building  
Materials, Finishes And Furnishings

## 1.2 SUBMITTALS

Approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29.05 20 SUSTAINABILITY REPORTING FOR DESIGN-BUILD. Submit the following in accordance with Section 01 33 00.05 20 CONSTRUCTION SUBMITTAL PROCEDURES:

### SD-03 Product Data

Blanket Insulation

Recycled Content for Insulation Materials; S

Pressure Sensitive Tape

Accessories

### SD-07 Certificates

Indoor Air Quality for Insulation Materials; S

Indoor Air Quality for Adhesives; S

### SD-08 Manufacturer's Instructions

Insulation

## 1.3 CERTIFICATIONS

Submit required indoor air quality certifications and validations in one submittal package.

### 1.3.1 Insulation Products

Provide product certified to meet indoor air quality requirements by

UL 2818 (Greenguard) Gold, SCS Global Services Indoor Advantage Gold or provide certification by other third-party programs. Provide current product certification from certification body.

#### 1.3.2 Adhesives and Sealants

Provide products certified to meet indoor air quality requirements by UL 2818 (Greenguard) Gold, SCS Global Services Indoor Advantage Gold or provide certification or validation by other third-party programs that products meet the requirements of this Section. Provide current product certification documentation from certification body. When product does not have certification, provide validation that product meets the indoor air quality product requirements cited herein.

### 1.4 DELIVERY, STORAGE, AND HANDLING

#### 1.4.1 Delivery

Deliver materials to site in original sealed wrapping bearing manufacturer's name and brand designation, specification number, type, grade, R-value, and class. Store and handle to protect from damage. Do not allow insulation materials to become wet, soiled, crushed, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storing, and protecting of materials before and during installation.

#### 1.4.2 Storage

Inspect materials delivered to the site for damage; unload and store out of weather in manufacturer's original packaging. Store only in dry locations, not subject to open flames or sparks, and easily accessible for inspection and handling.

### 1.5 SAFETY PRECAUTIONS

#### 1.5.1 Respirators

Provide installers with dust/mist respirators, training in their use, and protective clothing, all approved by National Institute for Occupational Safety and Health (NIOSH)/Mine Safety and Health Administration (MSHA) in accordance with 29 CFR 1910.134.

#### 1.5.2 Other Safety Concerns

Consider other safety concerns and measures as outlined in ASTM C930.

## PART 2 PRODUCTS

### 2.1 BLANKET INSULATION

ASTM C665, Type I, blankets without membrane coverings, except a flame spread rating of 25 or less and a smoke developed rating of 150 or less when tested in accordance with ASTM E84.

#### 2.1.1 Thermal Resistance Value (R-VALUE)

The R-Value must be as indicated on drawings.



#### 2.1.2 Recycled Materials

Provide insulation materials containing the following minimum percentage of recycled material content by weight:

Fiberglass: 20 percent glass cullet complying with [ASTM D5359](#)

Provide data identifying percentage of [recycled content for insulation materials](#).

#### 2.1.3 Prohibited Materials

Do not provide asbestos-containing materials.

#### 2.1.4 Reduced Volatile Organic Compounds (VOC) for Insulation Materials

Provide certification of [indoor air quality for insulation materials](#).

### 2.2 BLOCKING

Wood, metal, unfaced mineral fiber blankets in accordance with [ASTM C665](#), Type I, or other approved materials. Use only non-combustible materials meeting the requirements of [ASTM E136](#) for blocking around chimneys and heat producing devices.

### 2.3 ACCESSORIES

#### 2.3.1 Adhesive

As recommended by the insulation manufacturer. Provide non-aerosol adhesive products used on the interior of the building (defined as inside of the weatherproofing system) that meet either emissions requirements of [CDPH SECTION 01350](#) (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of [SCAQMD Rule 1168](#). Provide aerosol adhesives used on the interior of the building that meet either emissions requirements of [CDPH SECTION 01350](#) (use the office or classroom requirements, regardless of space type) or VOC content requirements of [GS-36](#). Provide certification or validation of [indoor air quality for adhesives](#).

#### 2.3.2 Mechanical Fasteners

Corrosion resistant fasteners as recommended by the insulation manufacturer.

#### 2.3.3 Wire Mesh

Corrosion resistant and as recommended by the insulation manufacturer.

## PART 3 EXECUTION

### 3.1 EXISTING CONDITIONS

Before installing insulation, ensure that areas that will be in contact with the insulation are dry and free of projections which could cause voids, compressed insulation, or punctured vapor retarders. If moisture or other conditions are found that do not allow the workmanlike installation of the insulation, do not proceed but notify Contracting Officer of such conditions.

### 3.2 PREPARATION

#### 3.2.1 Blocking Around Heat Producing Devices

Install non-combustible blocking around heat producing devices to provide the following clearances:

- a. Recessed lighting fixtures, including wiring compartments, ballasts, and other heat producing devices, unless these are certified by the manufacturer for installation surrounded by insulation: 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, 24 inches above fixture.
- b. Masonry chimneys or masonry enclosing a flue: 2 inches from outside face of masonry. Masonry chimneys for medium and high heat operating appliances: Minimum clearances required by NFPA 211.
- c. Vents and vent connectors used for venting the products of combustion, flues, and chimneys other than masonry chimneys: Minimum clearances as required by NFPA 211.
- d. Gas Fired Appliances: Clearances as required in NFPA 54.
- e. Oil Fired Appliances: Clearances as required in NFPA 31.

Blocking around flues and chimneys is not required when insulation blanket, including any attached vapor retarder, passed ASTM E136, in addition to meeting all other requirements stipulated in Part 2. Blocking is also not required if the chimneys are certified by the manufacturer for use in contact with insulating materials.

### 3.3 INSTALLATION

#### 3.3.1 Insulation

Install and handle insulation in accordance with manufacturer's instructions. Keep material dry and free of extraneous materials. Any materials that show visual evidence of biological growth due to presence of moisture must not be installed on the building project. Ensure personal protective clothing and respiratory equipment is used as required. Observe safe work practices.

##### 3.3.1.1 Electrical wiring

Do not install insulation in a manner that would sandwich electrical wiring between two layers of insulation.

##### 3.3.1.2 Continuity of Insulation

Install blanket insulation to butt tightly against adjoining blankets and to studs, rafters, joists, sill plates, headers and any obstructions. Provide continuity and integrity of insulation at corners, wall to ceiling joints, roof, and floor. Avoid creating thermal bridges.

##### 3.3.1.3 Installation at Bridging and Cross Bracing

Insulate at bridging and cross bracing by splitting blanket vertically at

center and packing one half into each opening. Butt insulation at bridging and cross bracing; fill in bridged area with loose or scrap insulation.

#### 3.3.1.4 Cold Climate Requirement

Place insulation to the outside of pipes.

#### 3.3.1.5 Insulation without Affixed Vapor Retarder

Provide snug friction fit to hold insulation in place. Stuff pieces of insulation into cracks between trusses, joists, studs and other framing, such as at attic access doors, door and window heads, jambs, and sills, band joists, and headers.

#### 3.3.1.6 Sizing of Blankets

Provide only full width blankets when insulating between trusses, joists, or studs. Size width of blankets for a snug fit where trusses, joists or studs are irregularly spaced.

-- End of Section --

## SECTION 07 22 00

## ROOF AND DECK INSULATION

**02/16, CHG 3: 11/18**

## PART 1 GENERAL

## 1.1 REFERENCES

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

## ASTM INTERNATIONAL (ASTM)

ASTM C552	(2017; E 2018) Standard Specification for Cellular Glass Thermal Insulation
ASTM C726	(2017) Standard Specification for Mineral Wool Roof Insulation Board
ASTM C1177/C1177M	(2017) Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing
ASTM C1289	(2020) Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
ASTM D4263	(1983; R 2018) Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
ASTM E84	(2020) Standard Test Method for Surface Burning Characteristics of Building Materials

## FM GLOBAL (FM)

FM 4450	(1989) Approval Standard for Class 1 Insulated Steel Deck Roofs
FM 4470	(2016) Single-Ply, Polymer-Modified Bitumen Sheet, Built-up Roof (BUR), and Liquid Applied Roof Assemblies for Use in Class 1 and Noncombustible Roof Deck Construction
FM APP GUIDE	(updated on-line) Approval Guide <a href="http://www.approvalguide.com/">http://www.approvalguide.com/</a>

## INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC	(2018) International Building Code
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## SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	SCS Global Services (SCS) Indoor Advantage
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UNDERWRITERS LABORATORIES (UL)

UL 1256 (2002; Reprint Jul 2013) Fire Test of Roof Deck Constructions

UL 2818 (2013) GREENGUARD Certification Program For Chemical Emissions For Building Materials, Finishes And Furnishings

1.2 SUBMITTALS

Approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29.05 20 SUSTAINABILITY REPORTING FOR DESIGN-BUILD. Submit the following in accordance with Section 01 33 00.05 20 CONSTRUCTION SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Insulation Board Layout and Attachment; G

Verification of Existing Conditions; G

SD-03 Product Data

Insulation; G

Cover Board; G

Fasteners; G

Sheathing Paper; G

Moisture Control; G Recycled Content For Insulation; S

SD-06 Test Reports

Flame Spread Rating; G

SD-07 Certificates

Installer Qualifications; G

Certificates Of Compliance For Felt Materials; G

Indoor Air Quality For Insulation; S

SD-08 Manufacturer's Instructions

Nails and Fasteners; G

Roof Insulation; G

1.3 SHOP DRAWINGS

Submit insulation board layout and attachment indicating methods of attachment and spacing, transitions, tapered components, thicknesses of materials, and closure and termination conditions. Show locations of

ridges, valleys, crickets, interface with, and slope to, roof drains. Base shop drawings on verified field measurements and include [verification of existing conditions](#).

#### 1.4 PRODUCT DATA

Include data for material descriptions, recommendations for product shelf life, requirements for [cover board](#) or coatings, and precautions for flammability and toxicity. Include data to verify compatibility of sealants with insulation.

#### 1.5 MANUFACTURER'S INSTRUCTIONS

Include field of roof and perimeter attachment requirements.

Provide a complete description of installation sequencing for each phase of the roofing system. Include weatherproofing procedures.

#### 1.6 QUALITY CONTROL

Provide certification of [installer qualifications](#) from the insulation manufacturer confirming the specific installer has the required qualifications for installing the specific roof insulation system(s) indicated.

Provide [certificates of compliance for felt materials](#).

#### 1.7 FM APPROVAL REQUIREMENTS

Provide fastening patterns in accordance with [FM 1-60] [FM 1-90] [FM 1-120] for insulation on steel decks.

#### 1.8 FIRE PERFORMANCE REQUIREMENTS

##### 1.8.1 Insulation in Roof Systems

Comply with the requirements of [ICC IBC](#) [or [UL 1256](#)] [or [FM 4450](#)] [or [FM 4470](#)]. Roof insulation to have a [flame spread rating](#) of 75 or less when tested in accordance with [ASTM E84](#). Additional documentation of compliance with flame spread rating is not required when insulation of the type used for this project as part of the specific roof assembly is listed and labeled as FM Class 1 approved. [Only roof assemblies that pass [FM 4450](#) may be used.]

##### 1.8.2 Thermal Barrier Requirements

Separate polystyrene insulation from a steel deck with a thermal barrier of glass mat gypsum roof board or other approved barrier material in accordance with the requirements of the [ICC IBC](#).

##### 1.8.3 Fire Resistance Ratings for Roofs

Provide in accordance with [ICC IBC](#) Chapter 7 and Table 721.1(3) Min Fire and Smoke Protection For Floor and Roof Systems.

#### 1.9 CERTIFICATIONS

Provide products certified to meet indoor air quality requirements by [UL 2818](#) (Greenguard) Gold, [SCS](#) Global Services Indoor Advantage Gold or

provide certification by other third-party programs. Provide current product certification documentation from certification body.

#### 1.10 DELIVERY, STORAGE, AND HANDLING

##### 1.10.1 Delivery

Deliver materials to the project site in manufacturer's unopened and undamaged standard commercial containers bearing the following legible information:

- a. Name of manufacturer
- b. Brand designation
- c. Specification number, type, and class, as applicable, where materials are covered by a referenced specification

Deliver materials in sufficient quantity to allow continuity of the work.

##### 1.10.2 Storage and Handling

Store and handle materials in accordance with manufacturer's printed instructions. Protect from damage, exposure to open flame or other ignition sources, wetting, condensation, and moisture absorption. Keep materials wrapped and separated from off-gassing materials (such as drying paints and adhesives). Do not use materials that have visible moisture or biological growth. Store in an enclosed building or trailer that provides a dry, adequately ventilated environment. Replace damaged material with new material.

#### 1.11 ENVIRONMENTAL CONDITIONS

Do not install roof insulation during inclement weather or when air temperature is below 40 degrees F and interior humidity is 45 percent or greater, or when there is visible ice, frost, or moisture on the roof deck.

#### 1.12 PROTECTION

##### 1.12.1 Special Protection

Provide special protection as approved by the insulation manufacturer.

##### 1.12.2 Completed Work

Cover completed work with cover board for the duration of construction. Avoid traffic on completed work particularly when ambient temperature is above 80 degrees F. Replace crushed or damaged insulation prior to roof surface installation.

## PART 2 PRODUCTS

### 2.1 INSULATION

#### 2.1.1 Insulation Types

Provide one, or an assembly of a maximum of three, of the following roof insulation materials. Provide roof insulation that is compatible with attachment methods for the specified insulation and roof membrane.

- a. Polyisocyanurate Board: Provide in accordance with [ASTM C1289](#) REV A Type II, fibrous felt or glass mat membrane both sides, except minimum compressive strength of 20 pounds per square inch (psi).
- b. Cellular Glass Boards: [ASTM C552](#), Type IV.

#### 2.1.1.2 Mineral Fiber Insulation Board

Provide in accordance with [ASTM C726](#).

#### 2.1.1.3 Recycled Materials

Provide thermal insulation materials containing recycled content. Unless specified otherwise, the minimum required recycled content for listed materials are:

Perlite Composition Board:	75 percent postconsumer paper
Polyisocyanurate/polyurethane:	9 percent recovered material
Wood Fiberboard:	100 percent recovered material
Cellular Glass Insulation:	75 percent recovered content
Structural Fiberboard:	100 percent recovered content
Fiberglass Insulation:	25 percent recovered content
Fiber (felt) or Fiber composite:	75 percent recovered content
Rubber:	90 percent recovered content
Plastic or Plastic/Rubber composite:	90 percent recovered content
Wood/Plastic Composite:	90 percent total recovered content

Provide data identifying percentage of [recycled content for insulation](#).

#### 2.1.1.4 Indoor Air Quality

Provide certification of [indoor air quality for insulation](#).

#### 2.1.1.5 Insulation Thickness

As necessary to provide the thermal resistance (R-value) indicated. Base calculation on the R-value for aged insulation. For insulation over steel decks, satisfy both specified R-value and minimum thickness for width of rib opening recommended in insulation manufacturer's published literature.

### 2.2 COVER BOARD

For use as a thermal barrier (underlayment), fire barrier (overlayment), or cover board for hot-mopped, torched-down, or adhesive-applied roofing membrane over roof insulation.



### 2.2.1 Glass Mat Gypsum Roof Board

ASTM C1177/C1177M, 0 Flame Spread and 0 Smoke Developed when tested in accordance with ASTM E84, 500 psi, Class A, non-combustible, [1/4][1/2][5/8] inch thick, 4 by 8 feet board size.

## 2.3 MOISTURE CONTROL

### 2.3.1 Vapor Retarder

## 2.4 FASTENERS

Provide flush-driven fasteners through flat round or hexagonal steel or plastic plates. Provide zinc-coated steel plates, flat round not less than 1 3/8 inch diameter, hexagonal not less than 28 gage. Provide high-density plastic plates, molded thermoplastic with smooth top surface, reinforcing ribs and not less than 3 inches in diameter. Fully recess fastener head into plastic plate after it is driven. Form plates to prevent dishing. Do not use bell or cup shaped plates. Provide fasteners in accordance with insulation manufacturer's recommendations for holding power when driven, or a minimum of 40 pounds each in steel deck, whichever is the higher minimum. Provide fasteners for steel or concrete decks in accordance with FM APP GUIDE (<http://www.approvalguide.com/>) for Class I roof deck construction, and spaced to withstand uplift pressure of [60] [90] [\_\_\_\_\_] pounds per square foot.

### 2.4.1 Fasteners for Steel Decks

Approved hardened penetrating fasteners or screws in accordance with FM 4450 and listed in FM APP GUIDE for Class I roof deck construction. Quantity and placement to withstand a minimum uplift pressure of [60] [90] [\_\_\_\_\_] psf in accordance with FM APP GUIDE.

## 2.5 WOOD NAILERS

Pressure-preservative treated as specified in Section 06 10 00 ROUGH CARPENTRY.

## PART 3 EXECUTION

### 3.1 EXAMINATION AND PREPARATION

#### 3.1.1 Surface Inspection

Ensure surfaces are clean, smooth, and dry prior to application. Ensure surfaces receiving vapor retarder are free of projections that might puncture the vapor retarder. Check roof deck surfaces, including surfaces sloped to roof drains and outlets, for defects before starting work.

The Contractor must inspect and approve the surfaces immediately before starting installation. Prior to installing vapor retarder, perform the following:

- a. Examine steel decks to ensure that panels are properly secured to structural members and to each other and that surfaces of top flanges are flat or slightly convex.
- b. Prior to installing any roof system on a concrete deck, moisture test the deck in accordance with ASTM D4263. The deck is acceptable for

roof system application when there is no visible moisture on underside of plastic sheet after 24 hours.

### 3.1.2 Surface Preparation

Correct defects and inaccuracies in roof deck surface to eliminate poor drainage from hollow or low spots, perform the following:

- a. Provide wood nailers of the same thickness as the insulation at eaves, edges, curbs, walls, and roof openings for securing of cant strips, gravel stops, gutters, and flashing flanges. Space nailers in accordance with approved shop drawings.
- b. Cover steel decks with a layer of insulation board of sufficient width to span the width of a deck rib opening, and in accordance with fire safety requirements. Secure with piercing or self-drilling, self-tapping fasteners of quantity and placement in accordance with [FM APP GUIDE](#). Locate insulation joints parallel to ribs of deck on solid bearing surfaces only, not over open ribs.

## 3.2 INSTALLATION OF VAPOR RETARDER

Install vapor retarder in direct contact with roof deck surface.

### 3.2.1 Vapor Retarder on Steel Decks

Even mop the mechanically secured insulation surface with asphalt before installing vapor retarder. For a two-ply vapor retarder, install each sheet lapping [19 inches](#) over the preceding sheet. Lap ends not less than [4 inches](#). Stagger the laps a minimum of [12 inches](#). Cement felts together with solid mopping of asphalt. Apply asphalt moppings at rate of [20 to 35 lbs per 100 square feet](#). [For a vapor retarder consisting of one layer of asphalt base sheet, lap each sheet [4 inches](#) over preceding sheet. Lap ends not less than [4 inches](#), and stagger laps a minimum of [12 inches](#). Cement base sheets together with solid mopping of asphalt.]

## 3.3 INSULATION INSTALLATION

Apply insulation in two layers with staggered joints when total required thickness of insulation exceeds [1/2 inch](#). Lay insulation so that continuous longitudinal joints are perpendicular to direction of roofing, and end joints of each course are staggered with those of adjoining courses. When using multiple layers of insulation, provide joints of each succeeding layer that are parallel and offset in both directions with respect to the layer below. Keep insulation [1/2 inch](#) clear of vertical surfaces penetrating and projecting from roof surface. Verify required slopes to each roof drain.

### 3.3.1 Installation Using Only Mechanical Fasteners

Secure total thickness of insulation with penetrating type fasteners.

### 3.3.2 Special Precautions for Installation of Foam Insulation

#### 3.3.2.1 Polyisocyanurate Insulation

Where polyisocyanurate foam board insulation is provided, install [1/2 inch](#) thick wood fiberboard, glass mat gypsum roof board, or [3/4 inch](#) thick expanded perlite board insulation over top surface of foam board

insulation. Stagger joints of insulation with respect to foam board insulation below.

### 3.4 PROTECTION

#### 3.4.1 Protection of Applied Insulation

Completely cover each day's installation of insulation with finished roofing on same day. Phased construction is not permitted. Protect open spaces between insulation and parapets or other walls and spaces at curbs, scuttles, and expansion joints, until permanent roofing and flashing are applied. Storing, walking, wheeling, or trucking directly on insulation or on roofed surfaces is not permitted. Provide smooth, clean board or plank walkways, runways, and platforms near supports, as necessary, to distribute weight in accordance with indicated live load limits of roof construction. Protect exposed edges of insulation with cutoffs at the end of each work day or whenever precipitation is imminent. Fill all profile voids in cutoffs to prevent trapping moisture below the membrane. Remove cutoffs when work resumes.

#### 3.4.2 Damaged Work and Materials

Restore work and materials that become damaged during construction to original condition or replace with new materials.

### 3.5 INSPECTION

Establish and maintain inspection procedures to assure compliance of the installed roof insulation with contract requirements. Remove, replace, correct in an approved manner, any work found not in compliance. Quality control must include, but is not limited to, the following:

- a. Observation of environmental conditions; number and skill level of insulation workers; start and end time of work.
- b. Verification of certification, listing or label compliance with FM Data Sheets. (<https://www.fmglobal.com/fmglobalregistration/Downloads.aspx>)
- c. Verification of proper storage and handling of insulation and vapor retarder materials before, during, and after installation.
- d. Inspection of vapor retarder application, including edge envelopes and mechanical fastening.
- e. Inspection of mechanical fasteners; type, number, length, and spacing.

- f. Coordination with other materials, cants, sleepers, and nailing strips.
- g. Inspection of insulation joint orientation and laps between layers, joint width and bearing of edges of insulation on deck.
- h. Installation of cutoffs and proper joining of work on subsequent days.
- i. Continuation of complete roofing system installation to cover insulation installed same day.
- j. Verification of required slope to each roof drain.

-- End of Section --

## SECTION 07 27 10.00 10

## BUILDING AIR BARRIER SYSTEM

**08/19, CHG 1: 02/20**

## PART 1 GENERAL

## 1.1 SUMMARY

This Section specifies the construction and quality control of the installation of an air barrier system. Construct the air barrier system indicated, taking responsibility for the means, methods, and workmanship of the installation of the air barrier system. The air barrier must be contiguous and connected across all surfaces of the enclosed air barrier envelope indicated. The maximum leakage requirements of individual air barrier components and materials are specified in the other specification sections covering these items.

This section also defines the maximum allowable leakage of the final air barrier system. The workmanship must be adequate to meet the maximum allowable leakage requirements of this specification. Test the assembled air barrier system to demonstrate that the building envelope is properly sealed and insulated. Passing the air barrier system leakage test and thermography test will result in system acceptance. Conform air barrier system leakage and thermography testing and reporting to the requirements of Section 07 05 23 PRESSURE TESTING AN AIR BARRIER SYSTEM FOR AIR TIGHTNESS.

## 1.2 REFERENCES

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

## ASTM INTERNATIONAL (ASTM)

ASTM D4541	(2017) Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
ASTM E96/E96M	(2016) Standard Test Methods for Water Vapor Transmission of Materials
ASTM E2178	(2013) Standard Test Method for Air Permeance of Building Materials
ASTM E2357	(2017) Standard Test Method for Determining Air Leakage of Air Barrier Assemblies

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 285	(2012) Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components
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### 1.3 DEFINITIONS

The following terms as they apply to this section:

#### 1.3.1 Air Barrier Accessory

Products designated to maintain air tightness between air barrier materials, air barrier assemblies and air barrier components, to fasten them to the structure of the building, or both (e.g., sealants, tapes, backer rods, transition membranes, fasteners, strapping, primers).

#### 1.3.2 Air Barrier Assembly

The combination of air barrier materials and air barrier accessories that are designated and designed within the environmental separator to act as a continuous barrier to the movement of air through the environmental separator.

#### 1.3.3 Air Barrier Component

Pre-manufactured elements such as windows, doors, dampers and service elements that are installed in the environmental separator.

#### 1.3.4 Air Barrier Envelope

The combination of air barrier assemblies and air barrier components, connected by air barrier accessories that are designed to provide a continuous barrier to the movement of air through an environmental separator. There may be more than one air barrier envelope in a single building. Also known as Air Barrier System.

#### 1.3.5 Air Barrier Material

A building material that is designed, tested and/or produced to provide the primary resistance to airflow through an air barrier assembly of a wall system.

#### 1.3.6 Air Barrier System

Same as AIR BARRIER ENVELOPE.

#### 1.3.7 Air Leakage Rate

The rate of airflow (CFM) driven through a unit surface area (sq.ft.) of an assembly or system by a unit static pressure difference (Pa) across the assembly. (example: 0.25 CFM/sq.ft. @ 75 Pa)

#### 1.3.8 Air Leakage

The total airflow (CFM) driven through the air barrier system by a unit static pressure difference (Pa) across the air barrier envelope. (example: 6500 CFM @ 75 Pa)

#### 1.3.9 Air Permeance

The tested rate of airflow (CFM) through a unit area (sq.ft.) of a material driven by unit static pressure difference (Pa) across the material (example: 0.004 CFM/sq.ft. @ 75 Pa) as established by ASTM E2178.

### 1.3.10 Environmental Separator

The parts of a building that separate the controlled interior environment from the uncontrolled exterior environment, or that separate spaces within a building that have dissimilar environments. Also known as the Control Layer.

### 1.3.11 Vapor Permeance

Vapor permeance is separated into three classes based on the water vapor permeance of a material as tested via [ASTM E96/E96M](#)

Class I Vapor Barrier/Retarder 0.1 perm or less

Class II Vapor Barrier/Retarder 0.1 perm to 1.0 perm

Class III Vapor Barrier/Retarder 1.0 perm to 10 perm

## 1.4 PREPARATORY PHASE OR PRECONSTRUCTION CONFERENCE

Organize pre-construction conferences between the air barrier inspector and the sub-contractors involved in the construction of or penetration of the air barrier system to discuss where the work of each sub-contractor begins and ends, the sequence of installation, and each sub-contractor's responsibility to ensure airtight joints, junctures, penetrations and transitions between materials. Discuss the products, and assemblies of products specified in the different sections to be installed by the different sub-contractors.

## 1.5 SUBMITTALS

Approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29.05 20 SUSTAINABILITY REPORTING FOR DESIGN-BUILD. Submit the following in accordance with Section 01 33 00.05 20 CONSTRUCTION SUBMITTAL PROCEDURES:

### SD-02 Shop Drawings

Air Barrier System Shop Drawings; G, Manufacturer produced warranted air barrier system

### SD-03 Product Data

Air Barrier System Product Data; G

### SD-04 Samples

Mock-Up; G

Material Samples For Air Barrier System; G

### SD-05 Design Data

Design Data And Calculations For The Air Barrier System; G, Manufacturer produced warranted air barrier system

## SD-06 Test Reports

Design Review Report; G

Testing and Inspection; G

## SD-07 Certificates

Air Barrier Inspector; G, RO

## 1.6 AIR BARRIER ENVELOPE SURFACE AREA AND LEAKAGE REQUIREMENTS

The building air barrier systems must meet the following leakage requirements. The allowable leakage rate and the maximum leakage are at a differential test pressure of 75 Pa.

Air Barrier Envelope 1	
Surface Area	[_____] square feet
Architectural Only Test:	
Allowable leakage rate	0.25 CFM/sq.ft

## 1.7 AIR BARRIER INSPECTOR

Employ a designated Air Barrier Inspector on this project. The Air Barrier Inspector performs a Design Review, oversees quality control testing specified in these specifications, performs quality control air barrier inspection as specified, interfaces with the designer and product manufacturer's representatives to assure all installation requirements are met, and verifies that the constructed work is in accordance with both the manufacturer's recommendations for products used, the content of this specification and other contract drawings or documents. Qualification for the Air Barrier Inspector are as follows:

- a. Training and certification as an Air Barrier Auditor from the Air Barrier Association of America (ABAA) or other third party air barrier association.
- b. Or, provide documentation in resume format that demonstrates that the individual proposed has the experience, knowledge, skills and abilities to fulfill the above stated duties as the air barrier inspector.
- c. It is acceptable that this individual be employed by the firm who will be performing the building pressurization test or another independent third party entity, provided they meet the above requirements but shall not be a member of the installing contractor or firm.

Provide copies of Air Barrier Inspector qualifications 30 days after Notice to Proceed.

## 1.8 DESIGN REVIEW

Review the Contract Plans and Specifications and advise the Contracting Officer of any deficiencies that would prevent the construction of an effective air barrier system. Provide a [Design Review Report](#) individually



listing each deficiency and the corresponding proposed corrective action necessary for proper air barrier system. Provide copies of the Design Review Report not later than 14 days after approval of the Air Barrier Inspector Qualifications. Submit [design data and calculations for the Air Barrier System](#) for a manufacturer produced warranted air barrier system.

## PART 2 PRODUCTS

### 2.1 AIR BARRIER

Provide air barrier system of compatible parts from one or several manufacturers coordinated by the contractor or provide a single warranted system provided by a primary manufacturer. The air barrier system as part of a tested exterior wall assembly must meet the conditions of acceptance as tested in accordance with [NFPA 285](#). Materials used for roof assembly air barrier must conform to the appropriate UL and FM wind and fire requirements for the specified roof assemblies.

If a complete air barrier system from a single manufacturer is utilized, whether warranted or not warranted, the air barrier system must conform to [ASTM E2357](#).

Materials in the following categories as used in the air barrier system or assembly of the exterior wall system are tested and are required to conform to [ASTM E2178](#): Self-adhered sheet membranes, fluid applied membranes, spray polyurethane foam, mechanically fastened commercial building wrap, factory bonded membranes to sheathing, and adhesive backed commercial building wrap and accessory products.

Other materials used as an air barrier such as concrete, glass, wood, metal or gypsum board may or may not conform to [ASTM E2178](#) but are acceptable provided that when integrated into the air barrier system or assemblies that they are not subject to material or environmental induced degradation in their final produced state and once incorporated in the permanent construction.

All materials used must be identifiable through manufacturer testing data and/or literature to be compatible with all the attached or adjoining materials or substrates used in the system.

Provide [Air Barrier System Shop Drawings](#), [Material Samples for Air Barrier System](#) and [Air Barrier System Product Data](#).

## PART 3 EXECUTION

### 3.1 QUALITY CONTROL

#### 3.1.1 Documentation and Reporting

Document the entire installation process on daily job site reports. These reports include information on the Installer, substrates, substrate preparation, products used, ambient and substrate temperature, the location of the air barrier installation, the results of the quality control procedures, and testing results.

#### 3.1.2 Construction [Mock-Up](#)

Build mock-up prior to building envelope construction.

- a. Prepare a construction mock-up to demonstrate proper installation of the air barrier assemblies and components. Include air barrier system connections between floor and wall, wall and window, wall and roof. Also, include the sealing method between membrane joints at transitions from one material or component to another, at pipe or conduit penetrations of the wall and roof, and at duct penetration of the wall and roof. Work will not begin until the mock-up is satisfactory to the Contracting Officer.
- b. Size the mock-up to approximately 8 feet long by 8 feet high. The mock-up must be representative of primary exterior wall assemblies and glazing components including backup wall and typical penetrations as acceptable to the Contracting Officer. A corner of the actual building may be used as the mock-up.
- c. Mock-Up Tests for Adhesion: Test the mock-up of materials for adhesion in accordance with manufacturer's recommendations. Perform the test after the curing period recommended by the manufacturer. Record the mode of failure and the area which failed in accordance with ASTM D4541. When the air barrier material manufacturer has established a minimum adhesion level for the product on the particular substrate, the inspection report must indicate whether this requirement has been met. Where the manufacturer has not declared a minimum adhesion value for their product/substrate combination, simply record the value.

### 3.1.3 Quality Control Testing And Inspection

Conduct the following tests and inspections as applicable in the presence of the Contracting Officer during installation of the air barrier system, and submit quality control reports as indicated below.

- a. Provide a Daily Report of Observations with a copy to the Contracting Officer.
- b. Inspect to assure continuity of the air barrier system throughout the building enclosure and that all gaps are covered, the covering is structurally sound, and all penetrations are sealed allowing for no infiltration or exfiltration through the air barrier system.
- c. Inspect to assure structural support of the air barrier system to withstand design air pressures.
- d. Inspect to assure masonry surfaces receiving air barrier materials are smooth, clean, and free of cavities, protrusions and mortar droppings, with mortar joints struck flush or as required by the manufacturer of the air barrier material.
- e. Inspect and test to assure site conditions for application temperature, and dryness of substrates are within guidelines.
- f. Inspect to assure substrate surfaces are properly primed if applicable and in accordance with manufacturer's instructions. Priming must extend at least 2 inches beyond the air barrier material to make it obvious that the primer was applied to the substrate before the air barrier material.
- g. Inspect to assure laps in materials are at least a 2-inch minimum, shingled in the correct direction or mastic applied in accordance with

manufacturer's recommendations, and with no fishmouths.

- h. Inspect to assure that a roller has been used to enhance adhesion. Identify any defects such as fishmouths, wrinkles, areas of lost adhesion, and improper curing. Note the intended remedy for the deficiencies.
- i. Measure application thickness of liquid applied materials to assure that manufacturer's specifications for the specific substrate are met.
- j. Inspect to assure that the correct materials are installed for compatibility.
- k. Inspect to assure proper transitions for change in direction and structural support at gaps.
- l. Inspect to assure proper connection between assemblies (membrane and sealants) for cleaning, preparation and priming of surfaces, structural support, integrity and continuity of seal.
- m. Perform adhesion tests for fluid-applied and self-adhered air barrier membranes to assure that the manufacturer's specified adhesion strength properties are met. Determine the bond strength of coatings to substrate in accordance with [ASTM D4541](#).
- n. Provide cohesion tests for spray polyurethane foam (SPF). Perform the tests in accordance with the specification sections which specify these materials.
- o. Provide written test reports of all tests performed.

### 3.2 REPAIR AND PROTECTION

Upon completion of inspection, testing, sample removal and similar services, repair damaged construction and restore substrates, coatings and finishes. Protect construction exposed by or for quality control service activities, and protect repaired construction.

-- End of Section --

## SECTION 07 27 36

## SPRAY FOAM AIR BARRIERS

**05/17, CHG 2: 08/20**

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AIR BARRIER ASSOCIATION OF AMERICA (ABAA)

ABAA Accreditation

Accreditation

ABAA QAP

Quality Assurance Program

## AMERICAN SOCIETY OF SAFETY PROFESSIONALS (ASSP)

ASSP Z9.2

(2018) Fundamentals Governing the Design and Operation of Local Exhaust Ventilation Systems

ASSP Z88.2

(2015) American National Standard Practices for Respiratory Protection

## ASTM INTERNATIONAL (ASTM)

ASTM C518

(2017) Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus

ASTM C1029

(2015) Standard Specification for Spray-Applied Rigid Cellular Polyurethane Thermal Insulation

ASTM C1060

(2015) Standard Practice for Thermographic Inspection of Insulation Installations in Envelope Cavities of Frame Buildings

ASTM C1303/C1303M

(2015) Standard Test Method for Predicting Long-Term Thermal Resistance of Closed-Cell Foam Insulation

ASTM C1338

(2014) Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings

ASTM D1621

(2016) Standard Test Method for Compressive Properties of Rigid Cellular Plastics

ASTM D1622

(2014) Apparent Density of Rigid Cellular Plastics

ASTM D1623	(2017) Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics
ASTM D2126	(2009) Response of Rigid Cellular Plastics to Thermal and Humid Aging
ASTM D2842	(2012) Water Absorption of Rigid Cellular Plastics
ASTM D4541	(2017) Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
ASTM D6226	(2015) Standard Test Method for Open Cell Content of Rigid Cellular Plastics
ASTM E84	(2020) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E96/E96M	(2016) Standard Test Methods for Water Vapor Transmission of Materials
ASTM E283	(2019) Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
ASTM E2178	(2013) Standard Test Method for Air Permeance of Building Materials
ASTM E2357	(2017) Standard Test Method for Determining Air Leakage of Air Barrier Assemblies

ICC EVALUATION SERVICE, INC. (ICC-ES)

ICC-ES AC377	(2016) Acceptance Criteria for Spray-Applied Foam Plastic Insulation
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INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC	(2018) International Building Code
ICC IECC	(2015) International Energy Conservation Code

INTERNATIONAL SAFETY EQUIPMENT ASSOCIATION (ISEA)

ANSI/ISEA Z87.1	(2020) Occupational and Educational Personal Eye and Face Protection Devices
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NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 10	(2018; ERTA 1-2 2018) Standard for Portable Fire Extinguishers
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NFPA 70 (2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4)  
National Electrical Code

NFPA 211 (2019) Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances

NFPA 285 (2012) Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components

#### SPRAY POLYURETHANE FOAM ALLIANCE (SPFA)

SPFA TechDocs (2015) SPFA Technical Documents Library, four categories: General, Insulation, Roofing, Specialty

#### U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-600-01 (2016; with Change 5, 2020) Fire Protection Engineering for Facilities

#### U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.132 Personal Protective Equipment

29 CFR 1910.133 Eye and Face Protection

29 CFR 1910.134 Respiratory Protection

#### UNDERWRITERS LABORATORIES OF CANADA (ULC)

ULC S705.2 (2005) Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density - Application

### 1.2 RELATED REQUIREMENTS

Coordinate the requirements of Section 07 27 10.00 10 BUILDING AIR BARRIER SYSTEM, Section 07 05 23 PRESSURE TESTING AN AIR BARRIER SYSTEM FOR AIR TIGHTNESS, Section 07 27 26 FLUID-APPLIED MEMBRANE AIR BARRIERS, and other building envelope sections to provide a complete air barrier system. Submit all materials, components, and assemblies of the air barrier system together as one complete submittal package.

### 1.3 DEFINITIONS

#### 1.3.1 Long Term Thermal Resistance (LTTR)

The thermal resistance value of a closed cell foam insulation product measured using accelerated aging ASTM C1303/C1303M equivalent to the time-weighted average thermal resistance value over 15 years. Loss in thermal resistance is attributable to changes in cell gas composition caused by diffusion of air into and blowing agent out of the foam cells.

## 1.3.2 SPFA TechDocs

Reformatted documents, named **SPFA TechDocs** (<http://www.sprayfoam.org/technical/spfa-technical-documents>), places each document in one of four categories for easy reference and identification: Roofing, Insulation, Specialty and General.

Spray Polyurethane Foam: Thermal and air/vapor barrier system consisting of sprayed polyurethane foam (SPF).

## 1.4 SUBMITTALS

Approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29.05 20 SUSTAINABILITY REPORTING FOR DESIGN-BUILD. Submit the following in accordance with Section 01 33 00.05 20 CONSTRUCTION SUBMITTAL PROCEDURES:

## SD-01 Preconstruction Submittals

Qualification of Manufacturer; G

Qualification of Installer; G

Quality Control Plan; G

Safety Plan; G

Fire Prevention Plan; G

Respirator Plan; G

## SD-02 Shop Drawings

Spray Foam Air Barrier System

Foam Air Barrier System; G

Fire-Rated Assemblies; G

## SD-03 Product Data

Closed Cell SPF; G

Transition Membrane; G

Primers, Adhesives, and Mastics; G

Sealants; G

Safety Data Sheets; G

Thermal Barrier Materials; G

Ignition Barrier Coatings; G

Accessories; G

Recycled Content for Closed Cell Spray Foam Air Barrier; S

SD-04 Samples

Spray Foam Air Barrier Mockup; G

SD-06 Test Reports

Field Peel Adhesion Test; G

Thermographic Test; G

Air Barrier Test; G

Primers; G

Fire-Ratings Of Thermal Barrier Materials; G

Flame Spread And Smoke Developed Index Ratings Of SPF Products; G

Flame Propagation Of Wall Assemblies; G

Site Inspections Reports; G

SD-07 Certificates

Closed cell SPF; G

Transition Membrane; G

Indoor Air Quality for Spray Foam Air Barrier; S

SD-08 Manufacturer's Instructions

SPF Handling, Storage, and Spray Procedures; G

Substrate Preparation; G

Transition Membrane; G

Primers, Adhesives, and Mastics; G

SD-09 Manufacturer's Field Reports

Core Samples; G

Daily Work Record; G

Visual Inspection and Thermal Scanning; G

1.5 MISCELLANEOUS REQUIREMENTS

For the spray foam air barrier system provide the following:

1.5.1 Shop Drawings

Submit spray foam air barrier shop drawings showing locations, detailing, and extent of spray foam air barrier assemblies. Provide details of all typical conditions, intersections with other envelope assemblies and



materials, membrane counter-flashings. Provide details for [fire-rated assemblies](#). Show details for bridging of gaps in construction, treatment of inside and outside corners, expansion joints, methods of attachment of materials covering the SPF without compromising the barrier. Indicate how miscellaneous penetrations such as conduit, pipes, electric boxes, brick ties, and similar items will be sealed.

#### 1.5.2 Product Data

Submit manufacturer's technical data indicating compliance with performance and environmental requirements, manufacturer's printed instructions for evaluating, preparing, and treating substrates, temperature and other limitations of installation conditions, safety requirements for installation, and [Safety Data Sheets](#). Indicate flame and smoke spread ratings for all products. Submit literature including material description, physical properties, and fire-ratings.

#### 1.5.3 Mockup

Provide a mockup of each foam system specified. Apply foam in an area designated by the Contracting Officer. Apply an area of not less than [50 square feet](#). Include all components specified for the finished assembly including [primers](#), support components, expansion and contraction joints, and other accessories as representative of the complete system. Isolate the area and protect workers as required by [29 CFR 1910.132](#), [29 CFR 1910.133](#) and [29 CFR 1910.134](#). Notify the Contracting Officer a minimum of 48 hours prior to the test application. Select a test area representative of conditions to be sprayed including window or door openings, wall to ceiling transitions, flashings, and penetrations, as applicable.

#### 1.5.4 Test Reports

Submit test reports indicating that [field peel adhesion tests](#) on all materials have been performed and the changes made, if required, in order to achieve successful and lasting adhesion. Submit test reports for [flame spread and smoke developed index ratings of SPF products](#) tested in accordance with [ASTM E84](#). Submit test reports for [flame propagation of wall assemblies](#) tested in accordance with [NFPA 285](#).

### 1.6 DELIVERY, STORAGE, AND HANDLING

#### 1.6.1 Delivery

Deliver and store materials in sufficient quantity to allow for uninterrupted flow of work. Inspect materials delivered to the site for damage; unload and store out of weather. Deliver materials to the jobsite in their original unopened packages, clearly marked with the manufacturer's name, brand designation, description of contents, and shelf life of containerized materials. Store and handle to protect from damage. Submit [SPF Handling, Storage, and Spray Procedures](#) in accordance with submittal procedures.

#### 1.6.2 Storage

Store materials in clean, dry areas, away from excessive heat, sparks, and open flame. Maintain temperatures in the storage area below the materials' flash point(s) and within limits recommended by the manufacturer's printed instructions. Provide ventilation in accordance

with ASSP Z9.2 to prevent build-up of flammable gases. Store MDI (A-side) drums in locations that limit the risk of contact with water, acids, caustics (such as lye), alcohols, and strong oxidizing and reducing agents.

### 1.6.3 Handling

Handle materials and containers safely and in accordance with manufacturer's recommendations. Store liquids in airtight containers and keep containers closed except when removing materials. Do not use equipment or containers containing remains of dissimilar materials. Do not expose foam component containers to direct sunlight. Do not use materials from containers with content temperatures in excess of 80 degrees F.

Containers exposed to long periods of cold may also exhibit separation and poor performance. Do not use materials exposed to temperature ranges outside of manufacturer's instructions for exposure limits.

Mark and remove from job site materials which have been exposed to moisture, that exceed shelf life limits, or that have been exposed to temperature extremes.

#### 1.6.3.1 Venting and Handling of Material Containers

Partially unscrew material container and drum caps to gradually vent the containers prior to opening. Do not inhale vapors. Decontaminate empty component containers by filling with water and allowing to stand for 48 hours with bung caps removed. Do not, under any circumstances seal, stop, or close containers which have been emptied of foam components.

### 1.7 FIELD PEEL ADHESION TEST

Perform a field peel adhesion test on the construction mockup. Test the SPF for adhesion in accordance with ASTM D4541 using a Type II pull tester except use a disk that is 4 inches in diameter and cut through the membrane to separate the material attached to the dish from the surrounding material. Perform test after curing period in accordance with manufacturer's written recommendations. Record mode of failure and area which failed in accordance with ASTM D4541. Compare adhesion values with the manufacturer's established minimum values for the particular combination of material and substrate. Indicate on the inspection report whether the manufacturer's requirement has been met. Where the manufacturer has not declared a minimum adhesion value for their product and substrate combination, the inspector must record actual values.

### 1.8 AIR BARRIER TESTING

Perform air barrier testing in accordance with Section 07 27 10.00 10 BUILDING AIR BARRIER SYSTEM and Section 07 05 23 PRESSURE TESTING AN AIR BARRIER SYSTEM FOR AIR TIGHTNESS.

### 1.9 SAFETY PROVISIONS

#### 1.9.1 Fire Prevention

Provide a written fire prevention plan for the SPF application. Address specific fire hazards such as spontaneous combustion from exothermic heat build-up of SPF components during curing. Provide a continuous fire watch during mixing and spraying of SPF and for a minimum of 30 minutes after

completion of work at the end of each day. Maintain fire watch for additional time as required to ensure no potential ignition conditions exist.

#### 1.9.1.1 Fire Extinguishers

Furnish two fire extinguishers of minimum 15 pounds capacity each, in accordance with NFPA 10, in the immediate vicinity of the work. CAUTION: Do not discharge high pressure carbon dioxide extinguishers where explosive vapors exist since the discharge can cause a spark which will ignite the vapors.

#### 1.9.2 Respirator Plan

Provide a written respirator plan in accordance with OSHA regulations that protects installers during application and addresses separation of the area to prevent other workers from entering the work area during spraying.

#### 1.9.3 Isolation

Isolate the work area as recommended by spray foam manufacturer's written requirements. Prevent workers without respiratory, skin, and eye Personal Protective Equipment (PPE) or training from entering the work area or otherwise being exposed to off-gassing of the insulation in excess of permissible exposure limits.

#### 1.9.4 Respirators and Eye Protection

Respiratory protective devices (respirators) must meet the requirements of ASSP Z88.2. Eye and face protective equipment must meet the requirements of ANSI/ISEA Z87.1. Additionally, sprayers and workers in the immediate vicinity of the spray must wear NIOSH-approved, full-face, supplied air respirators (SAR) operated in positive pressure or continuous flow mode. Workers not in the immediate vicinity of the sprayer must wear air purifying respirators (APR) with an organic gas / P100 particulate cartridge. Instruct personnel in the use of devices. Maintain such equipment and inspect regularly. All workers are required to have undergone pulmonary function testing and fit testing and must provide certification that they have done so. Change APR cartridges in accordance with manufacturer's written recommendations.

#### 1.9.5 Clothing and Gloves

Sprayers and workers must wear protective clothing and gloves in accordance with OSHA requirements during materials application. Disposable coveralls must be worn and must cover all exposed skin. Sprayers and workers must wear fabric gloves coated with nitrile, neoprene, butyl or PVC.

#### 1.9.6 Additional Requirements

Require personnel to review the Health, Safety and Environmental Aspects of Spray Polyurethane Foam and Coverings published by the Spray Polyurethane Foam Alliance (SPFA). Verify compliance prior to allowing personnel on site for installation work. <http://www.sprayfoam.org>.

## 1.10 QUALITY ASSURANCE

### 1.10.1 Qualification of Manufacturer

Submit documentation verifying that the manufacturer of the SPF is currently accredited by the Air Barrier Association of America (ABAA Accreditation <https://www.airbarrier.org/>) and by the Spray Polyurethane Foam Alliance (SPFA).

### 1.10.2 Qualification of Installer

Submit documentation verifying that installers of the spray foam air barrier are currently certified by ABAA/BPQI (Building Performance Quality Institute) [or][and] by the Spray Polyurethane Foam Alliance (SPFA) Professional Certification Program (PCP). Installers must provide photo identification certification cards for inspection upon request.

### 1.10.3 General Quality Requirements

Provide all products and installation in accordance with SPFA TechDocs requirements (<http://www.sprayfoam.org/technical/spfa-technical-documents>) and documented best practices.

## 1.11 PRECONSTRUCTION MEETING

Conduct a preconstruction meeting after approval of submittals and a minimum of two weeks prior to commencing work specified in this Section. Attendance is required by the Contracting Officer's designated personnel, Contractor, and representatives of related trades including covering materials, substrate materials, adjacent materials, and materials and components of the air/vapor/thermal barrier system. Agenda must include, at a minimum, the following items:

- a. Drawings, specifications and submittals related to the SPF work;
- b. Sequence of construction;
- c. Coordination with substrate preparation work and responsibility of repairing defects in substrates. Determine method of ensuring SPF work does not begin until substrates have been inspected and accepted;
- d. Compatibility of materials;
- e. Construction and testing of construction mockup;
- f. Application of self-adhering air barrier transitions strips and primer as required for sealing the spray foam air barrier system at openings including but not limited to windows, doors and louvers;
- g. Spray foam air barrier system installation; including methods to be used to provide a continuous barrier at thru-wall flashing, penetrations, and covering of embed items;
- h. Quality control plan including methods of applying the product so that a consistent thickness across the face of the substrate is achieved.
- i. Procedures for SPF manufacturer's technical representative's onsite inspection and acceptance of substrates, contact info for the representative, frequency of visits, and distribution of copies of

inspection reports. Determine where [core samples](#) will be taken and review procedures for daily documentation of SPF application.

- j. Property protection measures[, including isolation of the work,] and prevention of overspray and clean-up should overspray occur.
- k. Safety requirements, including review of PPE, fire prevention, [safety plan](#), respirator plan, ventilation and separation of the work area, fall protection, and posting of warning signs. Provide a complete schedule and a detailed, written fire protection plan[ including temporary isolation of the product and the work area until permanent isolation or thermal barrier is in place].

## 1.12 ENVIRONMENTAL CONDITIONS

### 1.12.1 Temperature and Weather

Install SPF within the range of ambient and substrate surface temperatures in accordance with manufacturer's written instructions. Do not apply SPF to damp or wet substrates. Do not apply SPF during inclement weather or when ice, frost, surface moisture, or visible dampness is present on surfaces to be covered, or when precipitation is imminent. Do not apply SPF to exterior building surfaces when wind speeds exceed [25 miles](#) per hour. Use moisture measuring methods and equipment to verify that the moisture conditions of substrate surfaces are in accordance with SPF manufacturer requirements prior to application. Substrate temperatures must be within limits recommended by the manufacturer's printed instructions.

### 1.12.2 Conditions for Primers

Follow manufacturer's printed application and curing instructions. Do not apply primer when ambient temperature is below [40 degrees F](#) or when ambient temperature is expected to fall below [35 degrees F](#) for the duration of the drying or curing period.

### 1.12.3 Conditions for Ignition Barriers

Ensure that sprayed surfaces comply with manufacturer's written requirements for application coverage, thickness, and curing prior to application of ignition barrier coatings.

### 1.12.4 Temporary Ventilation

Provide temporary ventilation for work of this section in accordance with manufacturer's written instructions and with OSHA requirements for this type of application.

## 1.13 FOAM SPRAY EQUIPMENT

### 1.13.1 Applicator

Use an air purge foam spray gun.

### 1.13.2 Equipment Calibration

Fully calibrate the foam metering equipment to monitor each liquid component to within 2 percent of the SPF manufacturer's required metering ratio. Calibrate spray equipment each day at the start of operations,

after each restart if spraying operations have been terminated for more than one hour, whenever there is a change in fan pattern or pressure, whenever slow curing areas are noticed, whenever a change is made in hose length or working height, and after changeover between materials. Calibration consists of demonstrating that the equipment is adjusted to deliver components in proper mix and proportion. Conduct calibration tests on cardboard or plywood on a wall adjacent to the area to be sprayed.

#### 1.13.3 Metering Equipment Requirements

Use foam metering equipment capable of developing and maintaining the SPF manufacturer's required liquid component pressures and temperatures. Foam metering equipment must have gages for visual monitoring. Equipment must provide temperature control of foam components to within the temperature ranges recommended by the foam manufacturer's printed instructions.

#### 1.13.4 Moisture Protection

Protect surfaces of supply containers and tanks used to feed foam metering equipment from moisture.

#### 1.13.5 Compressed Air

Supply compressed air that is in contact with SPF during mixing or atomization through moisture traps that are continuously bled.

#### 1.13.6 Dispense Excess Materials

Do not deposit materials used for cleaning of equipment or materials dispensed for calibration purposes and establishment of spray gun pattern onto the ground. Dispense such materials into scrap containers or onto plastic film, or cardboard, and dispose of in accordance with safety requirements and jobsite regulations.

### PART 2 PRODUCTS

#### 2.1 SPRAY FOAM AIR BARRIER

##### 2.1.1 General

Provide a closed cell, sprayed in place, SPF that forms a continuous air/vapor/thermal barrier at the building enclosure. Provide in accordance with [ASTM C1029](#), with the requirements of [UFC 3-600-01](#), [ICC IBC](#) Chapter 26, [ICC-ES AC308](#), and [NFPA 285](#). In the event of a conflict, the most stringent requirement applies. Provide all system components necessary for a complete, code compliant installation, whether indicated or not, including material support components, expansion and contraction joints, [thermal barrier materials](#), and accessories.

##### 2.1.2 Physical Properties

Provide a [closed cell](#) product with the following characteristics:

- a. Density ([ASTM D1622](#)): 2.0 lb per cf, nominal
- b. Thermal Resistance ([ASTM C518](#))

(1) Initial R-value per inch thickness: 7 sf·degrees F h per Btu

(2) Aged R-value per inch thickness (180 days at 76 degrees F): 6.6  
sf·degrees F·h per Btu

c. Air Permeance (ASTM E2178): In accordance with Section 07 27 10.00 10 BUILDING AIR BARRIER SYSTEM.

d. Air Leakage (ASTM E2357, ASTM E283): In accordance with Section 07 27 10.00 10 BUILDING AIR BARRIER SYSTEM and Section 07 05 23 PRESSURE TESTING AN AIR BARRIER SYSTEM FOR AIR TIGHTNESS.

e. Compressive Strength (ASTM D1621): Minimum 28.3 psi

f. Tensile Strength (ASTM D1623)

(1) Medium density: 15 psi

(2) Roofing: 40 psi

g. Water Vapor Permeance (ASTM E96/E96M, water method): less than 1.2 US perms at one inch thickness

h. Vapor Retarder (ICC IBC, ICC IECC) Class III

i. Surface Burning Characteristics (ASTM E84) 3 inch thickness:

(1) Flame Spread (FS) Index Rating less than 75.

(2) Smoke Developed (SD) Index Rating less than 150. SPF with an SD rating greater than 150 but less than 450 may be used when fully encapsulated. Approval of SPF product is contingent upon approval of encapsulation products and assemblies..

j. Closed Cell Content (ASTM D6226): 90 percent

k. Dimensional Stability (Humid Aging) (ASTM D2126): 15 percent at 28 days at 158 degrees F with 97 percent relative humidity.

l. Water Absorption (ASTM D2842): Maximum 1.0 per volume

m. Fungi Resistance (ASTM C1338): Pass, with no growth

n. Recycled Content: Minimum 9 percent (pre- and post-consumer). Provide data identifying percentage of recycled content for closed cell spray foam air barrier.

#### 2.1.3 Expansion and Contraction

Provide an assembly that allows for relative movement due to temperature, moisture, and air pressure changes. Provide expansion and contraction measures as required by the manufacturer's written recommendations.

#### 2.1.4 Fire-ratings, Flame Spread and Smoke Developed Index Ratings

Where fire-rated materials are indicated, provide products with the appropriate markings of a qualified testing agency. Submit fire-rating test reports. Submit flame spread (FS) and smoke developed (SD) index data. Where FS and SD values of foam products do not meet requirements, provide corresponding barrier products or assemblies and verify complete encapsulation of the spray foam air barrier through product data or on

shop drawings. Submit for approval in accordance with Section 01 33 00 SUBMITTAL PROCEDURES.

#### 2.1.5 Prohibited Materials

Products that contain hexabromocyclododecane (HBCD) flame retardants are prohibited. Products that contain hydrochlorofluorocarbons (HCFCs), chlorofluorocarbons (CFCs), or other high ozone depleting blowing agents, are prohibited. For a list of acceptable substitute foam blowing agents see <https://www.epa.gov/snap/foam-blowing-agents>. Provide validation of indoor air quality for spray foam air barrier that no prohibited materials are used.

#### 2.2 TRANSITION MEMBRANE

Provide as specified in Section 07 27 19.01 SELF-ADHERING AIR BARRIERS.

#### 2.3 PRIMERS, ADHESIVES, AND MASTICS

Provide primers, adhesives, mastics and other accessory materials as recommended by spray foam manufacturer's printed literature.

#### 2.4 FLASHING

As specified in Section 07 60 00 FLASHING AND SHEET METAL.

#### 2.5 JOINT SEALANTS

As specified in Section 07 92 00 JOINT SEALANTS. Verify compatibility with other system products.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

Before installing the spray foam air barrier and with the installer present, examine substrates, areas, and conditions under which SPF will be applied, for compliance with requirements. Ensure that surfaces are sound, dry, even, and free of oil, grease, dirt, excess mortar or other contaminants. Ensure that concrete surfaces are cured and dry, smooth without large voids, spalled areas or sharp protrusions. Correct defects that adversely affect the spray foam application or performance. Verify that work by other trades is in place and complete prior to application of spray foam.

#### 3.2 PREPARATION

##### 3.2.1 Substrate Preparation

Clean, prepare, and treat substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for spray foam application.

- a. Prepare surfaces by brushing, scrubbing, scraping, or grinding to remove loose mortar, dust, oil, grease, oxidation, mill scale and other contaminants which will affect adhesion of the SPF.
- b. Wipe down metal surfaces to remove release agents or other non-compatible coatings, using clean sponges or rags soaked in a



solvent compatible with the SPF.

### 3.2.2 Protection

Protect adjacent areas and surfaces from spray applied materials in accordance with the following:

- a. Mask and cover adjacent areas to protect from over spray.
- b. Ensure required foam stops and back up materials are in place to achieve a complete seal.
- c. Seal off ventilation equipment. Install temporary ducting and fans to provide required exhaust of spray fumes. Provide make-up air as required.
- d. Erect barriers, isolate area, and post warning signs to notify non-protected personnel of the requirement to avoid the spray area.

### 3.2.3 Blocking Around Heat Producing Devices

Install non-combustible blocking around heat producing devices to provide the following clearances:

- a. Recessed light fixtures, including wiring compartments, ballasts, and other heat producing devices, unless certified for installation surrounded by insulation: Minimum of 3 inches from outside face of fixtures and devices and in accordance with NFPA 70 and, if insulation is to be placed above fixture or device, 24 inches above fixture.
- b. Vents and vent connectors used for venting products of combustion, flues, and chimneys other than masonry chimneys: Minimum clearances in accordance with NFPA 211.

### 3.2.4 Fire and Explosion Hazards

Prohibit open flames, sparks, welding, and smoking in the application area. Provide and maintain fire extinguishers of appropriate type, size and distance, as required by NFPA, in the application area. Mix batches in small enough quantities to avoid spontaneous combustion from exothermic heat build-up of SPF components during curing.

### 3.2.5 Warning Signs

Post warning signs at ground level adjacent to the work area and a minimum of 150 feet from the application area stating the area is off limits to unauthorized persons and warning of potential hazards. Place clearly visible and legible warning sign at entrance to primary road leading to the project facility warning of presence of flammable materials, irritating fumes, and potential of overspray damage.

### 3.2.6 Prime Substrate

Provide as recommended by the manufacturer for each substrate to be primed. Use primers at full strength. Do not dilute primers unless required and as recommended in writing by the manufacturer. Do not use cleaning solvents for thinning primers or other materials. Ensure that diluted primer(s) meet VOC requirements.

### 3.3 INSTALLATION

#### 3.3.1 Sequencing and Coordination

Sequence the work so as to prevent access to the work area by other trades during foam application and curing. Limit access of non-essential workers during application. Notify the Contracting Officer 24 hours in advance of spraying operations. Sequence spray foam work with other trades to permit continuous self-flashing of the spray foam air barrier. Ensure expansion and control joints are provided as detailed on the manufacturer's shop drawings to accommodate the expansion of each layer of the air/vapor /thermal envelope.

#### 3.3.2 Installation of Transition Membrane

Install transition membrane materials in accordance with the details on the drawings, Section 07 27 19.01 SELF-ADHERING AIR BARRIERS, and the following:

- a. Install transition membrane at all required locations prior to installation of the fluid-applied membrane air barrier.
- b. Verify transition membrane is fully adhered to substrate and that its surface is clean, dry and wrinkle free prior to installation of the fluid-applied membrane air barrier.
- c. Verify transition membrane completely covers all transition areas and will provide continuity of the finished SPF air barrier without gaps or cracks.

#### 3.3.3 Installation of Spray Foam Air Barrier

Install materials in accordance with paragraph SAFETY PROVISIONS, in accordance with manufacturer's recommendations, ULC S705.2 Installation Standard, and in accordance with the following:

- a. Use spray equipment that complies with foam manufacturer's recommendations for the specific type of application, and as specified herein. Record equipment settings on the Daily Work Record. Each proportioned unit can supply only one spray gun.
- b. Apply only when surfaces and environmental conditions are within limits prescribed by the material manufacturer.
- c. Continuously connect the spray foam air barrier between walls, roof, floor, and below grade assemblies to form a continuous integrated air barrier system around the entire building enclosure. Extend the spray foam air barrier into rough openings such as doors, windows, louvers, and other exterior penetrations. Use self-adhering air barrier transition strips if necessary to achieve full extension and continuity of the barrier at these locations. Seal edges of barrier at junctures with rough openings.
- d. Install within manufacturer's tolerances, but not more than minus 1/4 inch or plus 1/2 inch.
- e. Sequence work so as to completely seal all penetrations resulting from pipes, vents, wires, conduit, electrical fixtures, structural members, or other construction. If penetrations through the spray foam air

barrier are made after the initial SPF application, reapply in accordance with manufacturer's written instructions for such remedial work.

- f. Do not install SPF within 3 inches of heat emitting devices such as light fixtures and chimneys.
- g. Finished surface of SPF must be free of voids and embedded foreign objects.
- h. Remove masking materials and over spray from adjacent areas immediately after foam surface has hardened. Ensure cleaning methods do not damage work performed by other sections.
- i. Trim, as required, any excess thickness that would interfere with the application of cladding and covering system by other trades.
- j. Clean and restore surfaces soiled or damaged by work of other trades. Before cleaning and restoring damaged work, consult with other trades for appropriate and approved methods for cleaning and restoration to prevent further damage.
- k. Complete connections to other components and repair any gaps, holes or other damage using material approved by the manufacturer.
- l. Provide expansion joints in the SPF application aligned with expansion joints in the building enclosure, where substrate materials change, and in accordance with manufacturer's recommendations.
- m. Provide a continuous fire watch in accordance with paragraph SAFETY PROVISIONS.

### 3.4 FIELD QUALITY CONTROL

#### 3.4.1 General Site Inspections and Testing

Provide site inspections and testing in accordance with ABAA protocol to verify conformance with the manufacturer's instructions, the ABAA QAP Quality Assurance Program (<https://www.airbarrier.org/qap/>), Section 07 27 10.00 10 BUILDING AIR BARRIER SYSTEM, [ Section 07 05 23 PRESSURE TESTING AN AIR BARRIER SYSTEM FOR AIR TIGHTNESS,] and this section.

- a. Conduct inspections and testing at 5, 50, and 95 percent of completion of this scope of work. Forward written inspection reports to the Contracting Officer within 5 working days of the inspection and test being performed.
- b. If inspections reveal any defects, promptly remove and replace defective work at no additional expense to the Government.

#### 3.4.2 Manufacturer Site Inspections

Manufacturer's technical representative must visit the site during the installation process to ensure the SPF and accessories are being applied in compliance with requirements. At a minimum, manufacturer's technical representative must be present at work startup and perform field inspection of the first day's completed application and at substantial completion, prior to demobilization. After each inspection, submit an inspection report signed by the manufacturer's technical representative,

to the Contracting Officer within five working days. The inspection report must note overall quality of work, deficiencies, and recommended corrective actions in detail. Notify the Contracting Officer a minimum of two working days prior to site visits by manufacturer's technical representative.

#### 3.4.3 Contractor's Site Inspections

Establish and maintain an inspection procedure to ensure compliance of the foam installation with contract requirements. Conduct inspections and testing at 5, 50, and 95 percent completion of application. Forward written inspection reports to the Contracting Officer within five working days of the inspection and test being performed. Work not in compliance must be promptly removed and replaced or corrected, in an approved manner, at no additional cost to the Government. Quality control must include, but is not limited to, the following:

- a. Observation of environmental conditions; number and skill level of insulation workers.
- b. Verification of certification, listing, or label.
- c. Verification of proper storage and handling of materials before, during, and after installation.
- d. Inspection of SPF, support structure, primer, expansion joints, vapor retarder, and accessories.

#### 3.4.4 Field Peel Adhesion Test

Conduct in accordance with test protocol indicated in Part 1 paragraph FIELD PEEL ADHENSION TEST.

#### 3.4.5 Visual Inspection and Thermal Scanning

Following completion of installation, inspect the SPF surface or cavity using infrared (IR) scanning as specified in ASTM C1060. Where the IR inspection indicates construction inconsistencies including wet insulation, remove inconsistent portions of the assembly and replace insulation to correct thermal anomalies. Reinspect and document corrections to the satisfaction of the Contracting Officer.

##### 3.4.5.1 Thermographic Test Report

Include thermographs in color and a color temperature scale to define the temperature indicated by the various colors. Identify the high temperature reading, the outdoor air temperature, the building indoor air temperature, and the wind speed and direction. Note areas of compromise in the building enclosure, and note actions required and taken to correct those areas. Final thermography test report must demonstrate that the problem areas have been corrected. Submit the complete test and analysis.

#### 3.5 CORRECTION OF DEFICIENCIES

Upon completion of inspection, testing, or sample taking, repair damaged construction, restore substrates and finishes, and protect repaired construction. Deficiencies found during inspection must be corrected within 5 working days following notification.

### 3.6 CLEANUP OF SPILLS

Conduct cleanup of uncured product spillage in accordance with paragraph SAFETY PROVISIONS and the manufacturer's written safe handling instructions. In the event of a conflict, the most stringent requirement governs.

### 3.7 PROTECTION AND CLEANING

#### 3.7.1 Protection of Installed Work

Protect SPF installation from damage during application and remainder of construction period in accordance with manufacturer's written instructions. Repair damaged areas to new condition.

#### 3.7.2 Cleaning of Adjacent Surfaces

Clean overspray from adjacent construction using cleaning agents and procedures as recommended in writing by the manufacturer of each type of affected construction and as acceptable to same.

-- End of Section --

## SECTION 07 60 00

## FLASHING AND SHEET METAL

**05/17, CHG 2: 11/18**

## PART 1 GENERAL

## 1.1 REFERENCES

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

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 90.1 - IP (2013) Energy Standard for Buildings  
Except Low-Rise Residential Buildings

AMERICAN WELDING SOCIETY (AWS)

AWS D1.2/D1.2M (2014; Errata 1 2014; Errata 2 2020)  
Structural Welding Code - Aluminum

ASTM INTERNATIONAL (ASTM)

ASTM A308/A308M (2010) Standard Specification for Steel  
Sheet, Terne (Lead-Tin Alloy) Coated by  
the Hot Dip Process

ASTM A480/A480M (2020a) Standard Specification for General  
Requirements for Flat-Rolled Stainless and  
Heat-Resisting Steel Plate, Sheet, and  
Strip

ASTM A653/A653M (2020) Standard Specification for Steel  
Sheet, Zinc-Coated (Galvanized) or  
Zinc-Iron Alloy-Coated (Galvannealed) by  
the Hot-Dip Process

ASTM B32 (2020) Standard Specification for Solder  
Metal

ASTM B69 (2020) Standard Specification for Rolled  
Zinc

ASTM B221 (2014) Standard Specification for Aluminum  
and Aluminum-Alloy Extruded Bars, Rods,  
Wire, Profiles, and Tubes

ASTM C1549 (2016) Standard Test Method for  
Determination of Solar Reflectance Near  
Ambient Temperature Using a Portable Solar  
Reflectometer

ASTM D226/D226M (2017) Standard Specification for  
Asphalt-Saturated Organic Felt Used in  
Roofing and Waterproofing

ASTM D1784	(2020) Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D4586/D4586M	(2007; E 2012; R 2012) Asphalt Roof Cement, Asbestos-Free
ASTM E408	(2013) Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques
ASTM E971	(2011) Standard Practice for Calculation of Photometric Transmittance and Reflectance of Materials to Solar Radiation
ASTM E1918	(2016) Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field
ASTM E1980	(2011) Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1793	(2012) Architectural Sheet Metal Manual, 7th Edition
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SINGLE PLY ROOFING INDUSTRY (SPRI)

ANSI/SPRI RD-1	(2014) Performance Standard for Retrofit Drains
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U.S. DEPARTMENT OF ENERGY (DOE)

Energy Star	(1992; R 2006) Energy Star Energy Efficiency Labeling System (FEMP)
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## 1.2 GENERAL REQUIREMENTS

Finished sheet metal assemblies must form a weathertight enclosure without waves, warps, buckles, fastening stresses or distortion, while allowing for expansion and contraction without damage to the system. The sheet metal installer is responsible for cutting, fitting, drilling, and other operations in connection with sheet metal modifications required to accommodate the work of other trades. Coordinate installation of sheet metal items used in conjunction with roofing with roofing work to permit continuous, uninterrupted roofing operations.

## 1.3 SUBMITTALS

Approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29.05 20 SUSTAINABILITY REPORTING FOR DESIGN-BUILD. Submit the following in accordance with Section

01 33 00.05 20 CONSTRUCTION SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Exposed Sheet Metal Coverings; G

Gutters; G

Downspouts; G

Base Flashing; G

Counterflashing; G

Flashing at Roof Penetrations and Equipment Supports; G

Reglets; G

Copings; G

Drip Edges; G

Open Valley Flashing; G

Eave Flashing; G

Recycled Content; S

SD-03 Product Data

Cool Roof Data; G

SD-04 Samples

Finish Samples; G

SD-08 Manufacturer's Instructions

Instructions for Installation; G

Quality Control Plan; G

SD-10 Operation and Maintenance Data

Cleaning and Maintenance; G

1.4 MISCELLANEOUS REQUIREMENTS

1.4.1 Product Data

Indicate thicknesses, dimensions, fastenings, anchoring methods, expansion joints, and other provisions necessary for thermal expansion and contraction. Scaled manufacturer's catalog data may be submitted for factory fabricated items.

1.4.2 Finish Samples

Submit two color charts and two finish sample chips from manufacturer's standard color and finish options for each type of finish indicated.



#### 1.4.3 Operation and Maintenance Data

Submit detailed [instructions for installation](#) and quality control during installation, [cleaning and maintenance](#), for each type of assembly indicated.

#### 1.5 DELIVERY, HANDLING, AND STORAGE

Package and protect materials during shipment. Uncrate and inspect materials for damage, dampness, and wet-storage stains upon delivery to the job site. Remove from the site and replace damaged materials that cannot be restored to like-new condition. Handle sheet metal items to avoid damage to surfaces, edges, and ends. Store materials in dry, weather-tight, ventilated areas until installation.

### PART 2 PRODUCTS

#### 2.1 [RECYCLED CONTENT](#)

Provide products with recycled content. Provide data for each product with recycled content, identifying percentage of recycled content.

#### 2.2 MATERIALS

Do not use lead, lead-coated metal, or galvanized steel. Use any metal listed by [SMACNA 1793](#) for a particular item, unless otherwise indicated. Provide materials, thicknesses, and configurations in accordance with [SMACNA 1793](#) for each material. Different items need not be of the same metal, except that contact between dissimilar metals must be avoided.

Furnish sheet metal items in [8 to 10 foot](#) lengths. Single pieces less than [8 feet](#) long may be used to connect to factory-fabricated inside and outside corners, and at ends of runs. Factory fabricate corner pieces with minimum [12 inch](#) legs. Provide accessories and other items essential to complete the sheet metal installation. Provide accessories made of the same or compatible materials as the items to which they are applied. Fabricate sheet metal items of the materials specified below and to the gage, thickness, or weight shown in Table I at the end of this section. Provide sheet metal items with mill finish unless specified otherwise. Where more than one material is listed for a particular item in Table I, each is acceptable and may be used, except as follows:

##### 2.2.1 [Exposed Sheet Metal](#) Items

Must be of the same material. Consider the following as exposed sheet metal: gutters, including hangers; downspouts; [gravel stops and fascia](#); cap, valley, steeped, base, and eave flashings and related accessories.

##### 2.2.2 Drainage

Do not use copper for an exposed item if drainage from that item will pass over exposed masonry, stonework or other metal surfaces. In addition to the metals listed in Table I, lead-coated copper may be used for such items.

##### 2.2.3 Steel Sheet, Zinc-Coated (Galvanized)

Provide in accordance with [ASTM A653/A653M](#).

#### 2.2.4 Zinc Sheet and Strip

Provide in accordance with ASTM B69, Type I, a minimum of 0.024 inch thick.

#### 2.2.5 Stainless Steel

Provide in accordance with ASTM A480/A480M, Type 302 or 304, 2D Finish, fully annealed, dead-soft temper.

#### 2.2.6 Terne-Coated Steel

Provide in accordance with ASTM A308/A308M, a minimum of 14 by 20 inch with minimum of 40 pound coating per double base box. ASTM A308/A308M.

#### 2.2.7 Alclad

When fabricated of aluminum, fabricate the following items with Alclad 3003, Alclad 3004, or Alclad 3005, clad on one side unless otherwise indicated.

- a. Gutters, downspouts, and hangers
- b. Gravel stops and fascia
- c. Flashing

#### 2.2.8 Finishes

Provide exposed exterior sheet metal and aluminum with a baked on, factory applied color coating of polyvinylidene fluoride (PVF2) or approved equal fluorocarbon coating. Dry film thickness of coatings must be 0.8 to 1.3 mils. Color to be selected from as indicated on the Drawings. Field applications of color coatings are prohibited and will be rejected.

#### 2.2.9 Cool Roof Finishes

Provide cool roof finish coatings and colors in accordance with one of the following methods of analysis:

##### 2.2.9.1 Energy Star Certification

Provide roof finishes having an initial solar reflectance of 0.25 for steep slope roofs with a greater than 2:12 pitch when tested in accordance with ASTM E971 when tested in accordance with ASTM E408, or as certified by Energy Star for the particular product proposed. Certified Energy Star roof products are listed at <https://www.energystar.gov/productfinder/product/certified-roof-products/results>

##### 2.2.9.2 ASHRAE 90.1 Compliance

Provide roof finishes having a minimum 3-year aged solar reflectance of 0.55 when tested in accordance with ASTM C1549 or ASTM E1918, and a minimum 3-year aged thermal emittance of 0.75 when tested in accordance with ASTM E971 or ASTM E408, or, a minimum 3-year aged Solar Reflectance Index of 64 when determined in accordance with the Solar Reflectance Index method in ASTM E1980 using a convection coefficient of 2.1 BTU per h ft2, to comply with ASHRAE 90.1 - IP.

#### 2.2.10 Aluminum Alloy, Extruded Bars, Rods, Shapes, and Tubes

ASTM B221.

#### 2.2.11 Solder

Provide in accordance with ASTM B32, 95-5 tin-antimony.

#### 2.2.12 Reglets

##### 2.2.12.1 Polyvinyl Chloride Reglets

Provide in accordance with ASTM D1784, Type II, Grade 1, Class 14333-D, 0.075 inch minimum thickness.

##### 2.2.12.2 Metal Reglets

Provide factory fabricated caulked type or friction type reglets with a minimum opening of 1/4 inch and a depth of 1-1/4 inch, as approved.

##### 2.2.12.2.1 Friction Reglets

Provide with flashing receiving slots not less than 5/8 inch deep, one inch jointing tongues, and upper and lower anchoring flanges installed at 24 inch maximum snap-lock type receiver.

#### 2.2.13 Roofing Felt

Provide in accordance with ASTM D226/D226M [Type I] [Type II].

#### 2.2.14 Fasteners

Use the same metal as, or a metal compatible with the item fastened. Use stainless steel fasteners to fasten. Confirm compatibility of fasteners and items to be fastened to avoid galvanic corrosion due to dissimilar materials.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

##### 3.1.1 Workmanship

Make lines and angles sharp and true. Free exposed surfaces from visible wave, warp, buckle, and tool marks. Fold back exposed edges neatly to form a 1/2 inch hem on the concealed side. Make sheet metal exposed to the weather watertight with provisions for expansion and contraction.

Make surfaces to receive sheet metal plumb and true, clean, even, smooth, dry, and free of defects and projections. For installation of items not shown in detail or not covered by specifications conform to the applicable requirements of SMACNA 1793, Architectural Sheet Metal Manual. Provide sheet metal flashing in the angles formed where roof decks abut walls, curbs, ventilators, pipes, or other vertical surfaces and wherever indicated and necessary to make the work watertight. Join sheet metal items together as shown in Table II.

### 3.1.2 Nailing

Confine nailing of sheet metal generally to sheet metal having a maximum width of 18 inches. Confine nailing of flashing to one edge only. Space nails evenly not over 3 inch on center and approximately 1/2 inch from edge unless otherwise specified or indicated. Face nailing will not be permitted. Where sheet metal is applied to other than wood surfaces, include in shop drawings, the locations for sleepers and nailing strips required to secure the work. [ Secure flashing at one-half the normal interval to ensure a wind-resistant installation.]

### 3.1.3 Cleats

Provide cleats for sheet metal 18 inches and over in width. Space cleats evenly not over 12 inches on center unless otherwise specified or indicated. Unless otherwise specified, provide cleats of 2 inches wide by 3 inches long and of the same material and thickness as the sheet metal being installed. Secure one end of the cleat with two nails and the cleat folded back over the nailheads. Lock the other end into the seam. [Where the fastening is to be made to concrete or masonry, use screws and drive in expansion shields set in concrete or masonry. ]Pre-tin cleats for soldered seams.

### 3.1.4 Bolts, Rivets, and Screws

Install bolts, rivets, and screws where indicated or required. Provide compatible washers where required to protect surface of sheet metal and to provide a watertight connection. Provide mechanically formed joints in aluminum sheets 0.040 inches or less in thickness.

### 3.1.5 Seams

Straight and uniform in width and height with no solder showing on the face.

#### 3.1.5.1 Flat-lock Seams

Finish not less than 3/4 inch wide.

#### 3.1.5.2 Lap Seams

Finish soldered seams not less than one inch wide. Overlap seams not soldered, not less than 3 inches.

#### 3.1.5.3 Loose-Lock Expansion Seams

Not less than 3 inches wide; provide minimum one inch movement within the joint. Completely fill the joints with the specified sealant, applied at not less than 1/8 inch thick bed.

#### 3.1.5.4 Standing Seams

Not less than one inch high, double locked without solder.

#### 3.1.5.5 Flat Seams

Make seams in the direction of the flow.

### 3.1.6 Soldering

Where soldering is specified, apply to copper, terne-coated stainless steel, zinc-coated steel, and stainless steel items. Pre-tin edges of sheet metal before soldering is begun. Seal the joints in aluminum sheets of 0.040 inch or less in thickness with specified sealants. Do not solder aluminum.

#### 3.1.6.1 Edges

Scrape or wire-brush the edges of lead-coated material to be soldered to produce a bright surface. Flux brush the seams in before soldering. Treat with soldering acid flux the edges of stainless steel to be pre-tinned. Seal the joints in aluminum sheets of 0.040 inch or less in thickness with specified sealants. Do not solder aluminum.

### 3.1.7 Welding and Mechanical Fastening

Use welding for aluminum of thickness greater than 0.040 inch. Aluminum 0.040 inch or less in thickness must be butted and the space backed with formed flashing plate; or lock joined, mechanically fastened, and filled with sealant as recommended by the aluminum manufacturer.

#### 3.1.7.1 Welding of Aluminum

Use welding of the inert gas, shield-arc type. For procedures, appearance and quality of welds, and the methods used in correcting welding work, conform to AWS D1.2/D1.2M.

#### 3.1.7.2 Mechanical Fastening of Aluminum

Use No. 12, aluminum alloy, sheet metal screws or other suitable aluminum alloy or stainless steel fasteners. Drive fasteners in holes made with a No. 26 drill in securing side laps, end laps, and flashings. Space fasteners 12 inches maximum on center. Where end lap fasteners are required to improve closure, locate the end lap fasteners not more than 2 inches from the end of the overlapping sheet.

### 3.1.8 Protection from Contact with Dissimilar Materials

#### 3.1.8.1 Aluminum

Do not allow aluminum surfaces in direct contact with other metals except stainless steel, zinc, or zinc coating. Where aluminum contacts another metal, paint the dissimilar metal with a primer followed by two coats of aluminum paint. Where drainage from a dissimilar metal passes over aluminum, paint the dissimilar metal with a non-lead pigmented paint.

#### 3.1.8.2 Metal Surfaces

Paint surfaces in contact with mortar, concrete, or other masonry materials with alkali-resistant coatings such as heavy-bodied bituminous paint.

### 3.1.9 Expansion and Contraction

Provide expansion and contraction joints at not more than 32 foot intervals for aluminum and at not more than 40 foot intervals for other metals. Provide an additional joint where the distance between the last

expansion joint and the end of the continuous run is more than half the required interval. Space joints evenly. Join extruded aluminum gravel stops and fascia by expansion and contraction joints spaced not more than 12 feet apart.

#### 3.1.10 Base Flashing

Extend up vertical surfaces of the flashing not less than 8 inches and not less than 4 inches under the roof covering. Where finish wall coverings form a counterflashing, extend the vertical leg of the flashing up behind the applied wall covering not less than 6 inches. Overlap the flashing strips with the previously laid flashing not less than 3 inches. Fasten the strips at their upper edge to the deck. Horizontal flashing at vertical surfaces must extend vertically above the roof surface and fastened at their upper edge to the deck a minimum of 6 inches on center with a minimum of 2 inch lap of any surface. Solder end laps and provide for expansion and contraction. Extend the metal flashing over crickets at the up-slope side of vertical surfaces extending through sloping roofs, the metal flashings. Extend the metal flashings onto the roof covering not less than 4.5 inches at the lower side of vertical surfaces extending through the roof decks. Install and fit the flashings so as to be completely weathertight. Provide factory-fabricated base flashing for interior and exterior corners. Do not use metal base flashing on built-up roofing.

#### 3.1.11 Counterflashing

Except where indicated or specified otherwise, insert counterflashing in reglets located from 9 to 10 inches above roof decks, extend down vertical surfaces over upturned vertical leg of base flashings not less than 3 inches. Fold the exposed edges of counterflashings 1/2 inch. Where stepped counterflashings are required, they may be installed in short lengths a minimum 8 inches by 8 inches or may be of the preformed single piece type. Provide end laps in counterflashings not less than 3 inches and make it weathertight with plastic cement. Do not make lengths of metal counterflashings exceed 10 feet. Form flashings to the required shapes before installation. Factory form corners not less than 12 inches from the angle. Secure the flashings in the reglets with lead wedges and space not more than 18 inches apart; on short runs, place wedges closer together. Fill caulked-type reglets or raked joints which receive counterflashing with caulking compound. Turn up the concealed edge of counterflashings built into masonry or concrete walls not less than 1/4 inch and extend not less than 2 inches into the walls. Install counterflashing to provide a spring action against base flashing.

#### 3.1.12 Metal Reglets

Keep temporary cores in place during installation. Ensure factory fabricated caulked type or friction type, reglets have a minimum opening of 1/4 inch and a minimum depth of 1-1/4 inch, when installed.

##### 3.1.12.1 Caulked Reglets

Wedge flashing in reglets with lead wedges every 18 inches, caulked full and solid with an approved compound.

##### 3.1.12.2 Friction Reglets

Install flashing snap lock receivers at 24 inches on center maximum. When

flashing has been inserted the full depth of the slot, caulk the slot, lock, and fill with sealant.

#### 3.1.13 Polyvinyl Chloride Reglets for Temporary Construction

Rigid polyvinyl chloride reglets may be provided in lieu of metal reglets for temporary construction.

#### 3.1.14 Gravel Stops and fascia

Prefabricate in the shapes and sizes indicated and in lengths not less than 8 feet. Extend flange at least 4 inches onto roofing. Provide prefabricated, mitered corners internal and external corners. Install gravel stops and fascia after all plies of the roofing membrane have been applied, but before the flood coat of bitumen is applied. Prime roof flange of gravel stops and fascia on both sides with an asphalt primer. After primer has dried, set flange on roofing membrane and strip-in. Nail flange securely to wood nailer with large-head, barbed-shank roofing nails 1.5 inch long spaced not more than 3 inches on center, in two staggered rows.

##### 3.1.14.1 Edge Strip

Hook the lower edge of fascia at least 3/4 inch over a continuous strip of the same material bent outward at an angle not more than 45 degrees to form a drip. Nail hook strip to a wood nailer at 6 inches maximum on center. Where fastening is made to concrete or masonry, use screws spaced 12 inches on center driven in expansion shields set in the concrete or masonry. Where horizontal wood nailers are slotted to provide for insulation venting, install strips to prevent obstruction of vent slots. Where necessary, install strips over 1/16 inch thick compatible spacer or washers.

##### 3.1.14.2 Joints

Leave open the section ends of gravel stops and fascia 1/4 inch and backed with a formed flashing plate, mechanically fastened in place and lapping each section end a minimum of 4 inches set laps in plastic cement. Face nailing will not be permitted. Install prefabricated aluminum gravel stops and fascia in accordance with the manufacturer's printed instructions and details.

#### 3.1.15 Metal Drip Edges

Provide a metal drip edge, designed to allow water run-off to drip free of underlying construction, at eaves and rakes prior to the application of roofing shingles. Apply directly on the wood deck at the eaves and over the underlay along the rakes. Extend back from the edge of the deck not more than 3 inches and secure with compatible nails spaced not more than 10 inches on center along upper edge.

#### 3.1.16 Gutters

The hung type of shape indicated and supported on underside by brackets that permit free thermal movement of the gutter. Provide gutters in sizes indicated complete with mitered corners, end caps, outlets, brackets, and other accessories necessary for installation. Bead with hemmed edge or reinforce the outer edge of gutter with a stiffening bar not less than 3/4 by 3/16 inch of material compatible with gutter. Fabricate gutters in

sections not less than 8 feet. Lap the sections a minimum of one inch in the direction of flow or provide with concealed splice plate 6 inches minimum. Join the gutters, other than aluminum, by riveted and soldered joints. Join aluminum gutters with riveted sealed joints. Provide expansion-type slip joints midway between outlets. Install gutters below slope line of the roof so that snow and ice can slide clear. Support gutters on by continuous cleats or by cleats spaced not less than 36 inches apart. Adjust gutters to slope uniformly to outlets, with high points occurring midway between outlets. Fabricate hangers and fastenings from compatible metals.

### 3.1.17 Downspouts

Space supports for downspouts according to the manufacturer's recommendation for the steel substrate. Types, shapes and sizes are indicated. Provide complete including elbows and offsets. Provide downspouts in approximately 10 foot lengths. Provide end joints to telescope not less than 1/2 inch and lock longitudinal joints. Provide gutter outlets with wire ball strainers for each outlet. Provide strainers to fit tightly into outlets and be of the same material used for gutters. Keep downspouts not less than one inch away from walls. Fasten to the walls at top, bottom, and at an intermediate point not to exceed 5 feet on center with leader straps or concealed rack-and-pin type fasteners. Form straps and fasteners of metal compatible with the downspouts.

#### 3.1.17.1 Terminations

Neatly fit into the drainage connection the downspouts terminating in drainage lines and fill the joints with a portland cement mortar cap sloped away from the downspout. Provide downspouts terminating in splash blocks with elbow-type fittings. Provide splash pans as specified.

### 3.1.18 Flashing for Roof Drains

Provide a 30 inches square sheet indicated. Taper insulation to drain from 24 inches out. Set flashing on finished felts in a full bed of asphalt roof cement, ASTM D4586/D4586M. Heavily coat the drain flashing ring with asphalt roof cement. Clamp the roof membrane, flashing sheet, and stripping felt in the drain clamping ring. Secure clamps so that felts and drain flashing are free of wrinkles and folds. Retrofit roof drains must conform to ANSI/SPRI RD-1.

### 3.1.19 Open Valley Flashing

Provide valley flashing free of longitudinal seams, of width sufficient to extend not less than 6 inches under the roof covering on each side. Provide a 1/2 inch fold on each side of the valley flashing. Lap the sheets not less than 6 inches in the direction of flow and secure to roofing construction with cleats attached to the fold on each side. Nail the tops of sheets to roof sheathing. Space the cleats not more than 12 inches on center. Provide exposed flashing not less than 4 inches in width at the top and increase one inch in width for each additional 8 feet in length. Where the slope of the valley is 4.5 inches or less per foot, or the intersecting roofs are on different slopes, provide an inverted V-joint, one inch high, along the centerline of the valley; and extend the edge of the valley sheets 8 inches under the roof covering on each side.



### 3.1.20 Eave Flashing

One piece in width, applied in 8 to 10 foot lengths with expansion joints spaced as specified in paragraph EXPANSION AND CONTRACTION. Provide a 3/4 inch continuous fold in the upper edge of the sheet to engage cleats spaced not more than 10 inches on center. Locate the upper edge of flashing not less than 18 inches from the outside face of the building, measured along the roof slope. Fold lower edge of the flashing over and loose-lock into a continuous edge strip on the fascia. Where eave flashing intersects metal valley flashing, secure with one inch flat locked joints with cleats that are 10 inches on center.

### 3.1.21 Sheet Metal Covering on Flat, Sloped, or Curved Surfaces

Except as specified or indicated otherwise, cover and flash all minor flat, sloped, or curved surfaces such as crickets, bulkheads, dormers and small decks with metal sheets of the material used for flashing; maximum size of sheets, 16 by 18 inches. Fasten sheets to sheathing with metal cleats. Lock seams and solder. Lock aluminum seams as recommended by aluminum manufacturer. Provide an underlayment of roofing felt for all sheet metal covering.

### 3.1.22 Flashing at Roof Penetrations and Equipment Supports

Provide metal flashing for all pipes, ducts, and conduits projecting through the roof surface and for equipment supports, guy wire anchors, and similar items supported by or attached to the roof deck. Goose-necks, rain hoods, and power roof ventilators.

### 3.1.23 Single Pipe Vents

See Table I, footnote (d). Set flange of sleeve in bituminous plastic cement and nail 3 inches on center. Bend the top of sleeve over and extend down into the vent pipe a minimum of 2 inches. For long runs or long rises above the deck, where it is impractical to cover the vent pipe with lead, use a two-piece formed metal housing. Set metal housing with a metal sleeve having a 4 inches roof flange in bituminous plastic cement and nailed 3 inches on center. Extend sleeve a minimum of 8 inches above the roof deck and lapped a minimum of 3 inches by a metal hood secured to the vent pipe by a draw band. Seal the area of hood in contact with vent pipe with an approved sealant.

### 3.1.24 Stepped Flashing

Provide stepped flashing where sloping roofs surfaced with shingles abut vertical surfaces. Place separate pieces of base flashing in alternate shingle courses.

### 3.1.25 Copings

Provide coping with locked and soldered seam. Terminate outer edges in edge strips. Install with sealed lap joints as indicated.

## 3.2 PAINTING

Touch ups in the field may be applied only after metal substrates have been cleaned and pretreated in accordance with manufacturer's written instructions and products.

Field-paint sheet metal for separation of dissimilar materials.

### 3.3 CLEANING

Clean exposed sheet metal work at completion of installation. Remove grease and oil films, handling marks, contamination from steel wool, fittings and drilling debris, and scrub-clean. Free the exposed metal surfaces of dents, creases, waves, scratch marks, and solder or weld marks.

### 3.4 REPAIRS TO FINISH

Scratches, abrasions, and minor surface defects of finish may be repaired in accordance with the manufacturer's printed instructions and as approved. Repair damaged surfaces caused by scratches, blemishes, and variations of color and surface texture. Replace items which cannot be repaired.

### 3.5 FIELD QUALITY CONTROL

Establish and maintain a [Quality Control Plan](#) for sheet metal used in conjunction with roofing to assure compliance of the installed sheet metalwork with the contract requirements. Remove work that is not in compliance with the contract and replace or correct. Include quality control, but not be limited to, the following:

- a. Observation of environmental conditions; number and skill level of sheet metal workers; condition of substrate.
- b. Verification that specified material is provided and installed.
- c. Inspection of sheet metalwork, for proper size(s) and thickness(es), fastening and joining, and proper installation.

#### 3.5.1 Procedure

Submit for approval prior to start of roofing work. Include a checklist of points to be observed. Document the actual quality control observations and inspections. Furnish a copy of the documentation to the Contracting Officer at the end of each day.

TABLE I. SHEET METAL WEIGHTS, THICKNESSES, AND GAGES					
Sheet Metal Items	[Copper kilograms per square foot]	[Aluminum, inch]	[Stainless Steel, inch]	[Terne-Coated Stainless Steel, inch]	[Zinc-Coated Steel, U.S. Std. Gage]
[Building Expansion Joints]					
[Cover]	16	.032	.015	.015	24

TABLE I. SHEET METAL WEIGHTS, THICKNESSES, AND GAGES					
Sheet Metal Items	[Copper kilograms per square foot]	[Aluminum, inch]	[Stainless Steel, inch]	[Terne-Coated Stainless Steel, inch]	[Zinc-Coated Steel, U.S. Std. Gage]
[Waterstop-bellows or flanged, U-type.]	16	-	.015	.015	-
[Covering on minor flat, pitched or curved surfaces]	20	.040	.018	.018	-
[Downspouts and leaders]	16	.032	.015	.015	24
[Downspout clips and anchors]	-	.040 clip .125 anchor	-	-	-
[Downspout straps, 2-inch]	48 (a)	.060	.050	-	-
[Conductor heads]	16	.032	.015	.015	-
[Scupper lining]	20	.032	.015	.015	-
[Strainers, wire diameter or gage]	No. 9 gage	.144 diameter	.109 diameter	-	
[Flashings:]					
[Base]	20	.040	.018	.018	24
[Cap (Counter-flashing)]	16	.032	.015	.015	26
[Eave]	16	-	.015	.015	24
[Spandrel beam]	10	-	.010	.010	-
[Bond barrier]	16	-	.015	.015	-
[Stepped]	16	.032	.015	.015	-
[Valley]	16	.032	.015	.015	-
[Roof drain]	16 (b)				
[Pipe vent sleeve (d)]					
[Coping]	16	-	-	-	-

TABLE I. SHEET METAL WEIGHTS, THICKNESSES, AND GAGES					
Sheet Metal Items	[Copper kilograms per square foot]	[Aluminum, inch]	[Stainless Steel, inch]	[Terne-Coated Stainless Steel, inch]	[Zinc-Coated Steel, U.S. Std. Gage]
[Gravel stops and fascia:]					
[Extrusions]	-	.075	-	-	-
[Sheets, corrugated]	16	.032	.015	.015	-
[Sheets, smooth]	20	.050	.018	.018	24
[Edge strip]	24	.050	.025	-	-
[Gutters:]					
[Gutter section]	16	.032	.015	.015	24
[Continuous cleat]	16	.032	.015	.015	24
[Hangers, dimensions]	1 inch by 1/8 inch (a)	1 inch by .1 inch (c)	1 inch by .01 inch	-	-
[Joint Cover plates (See Table II)]	16	.032	.015	.015	24
[Reglets (c)]	10	-	.010	.010	-
[Splash pans]	16	.040	.018	.018	-
(a) Brass.					
(b) May be lead weighing 4 pounds per square foot.					
(c) May be polyvinyl chloride.					
(d) 2.5 pound minimum lead sleeve with 4 inch flange. Where lead sleeve is impractical, refer to paragraph SINGLE PIPE VENTS for optional material.					

TABLE II. SHEET METAL JOINTS			
TYPE OF JOINT			
Item Designation	Copper, Terne-Coated Stainless Steel, Zinc-Coated Steel and Stainless Steel	Aluminum	Remarks
Joint cap for building expansion seam, cleated joint at roof	1.25 inch single lock, standing seam, cleated	1.25 inch single lock, standing	--
Flashings			
Base	One inch 3 inch lap for expansion joint	One inch flat locked, soldered; sealed; 3 inch lap for expansion joint	Aluminum manufacturer's recommended hard setting sealant for locked aluminum joints. Fill each metal expansion joint with a joint sealing compound.
Cap-in reglet	3 inch lap	3 inch lap	Seal groove with joint sealing compound.
Reglets	Butt joint	--	Seal reglet groove with joint sealing compound.
Eave	One inch flat locked, cleated. One inch loose locked, sealed expansion joint, cleated.	One inch flat locked, locked, cleated one inch loose locked, sealed expansion joints, cleated	Same as base flashing.
Stepped	3 inch lap	3 inch lap	--
Valley	6 inch lap cleated	6 inch lap cleated	--
Edge strip	Butt	Butt	--
Gravel stops:			

TABLE II. SHEET METAL JOINTS			
TYPE OF JOINT			
Item Designation	Copper, Terne-Coated Stainless Steel, Zinc-Coated Steel and Stainless Steel	Aluminum	Remarks
Extrusions	--	Butt with 1/2 inch space	Use sheet flashing beneath and a cover plate
Sheet, smooth	Butt with 1/4 inch space	Butt with 1/4 inch space	Use sheet flashing backup plate.
Sheet, corrugated	Butt with 1/4 inch space	Butt with 1/4 inch space	Use sheet flashing beneath and a cover plate or a combination unit
Gutters	1.5 inch lap, riveted and soldered	One inch flat locked riveted and sealed	Aluminum producers recommended hard setting sealant for locked aluminum joints.
(a) Provide a 3 inch lap elastomeric flashing with manufacturer's recommended sealant.			
(b) Seal Polyvinyl chloride reglet with manufacturer's recommended sealant.			

-- End of Section --

## SECTION 07 61 14.00 20

## STEEL STANDING SEAM ROOFING

**08/16, CHG 1: 08/18**

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI SG03-3 (2002; Suppl 2001-2004; R 2008)  
Cold-Formed Steel Design Manual Set

## ASTM INTERNATIONAL (ASTM)

ASTM A653/A653M (2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A792/A792M (2010; R 2015) Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process

ASTM A1008/A1008M (2020) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable

ASTM A1011/A1011M (2018a) Standard Specification for Steel Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength

ASTM B117 (2019) Standard Practice for Operating Salt Spray (Fog) Apparatus

ASTM D522/D522M (2017) Mandrel Bend Test of Attached Organic Coatings

ASTM D523 (2014; R 2018) Standard Test Method for Specular Gloss

ASTM D714 (2002; R 2017) Standard Test Method for Evaluating Degree of Blistering of Paints

ASTM D968 (2017) Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive

ASTM D1654 (2008; R 2016; E 2017) Standard Test

Method for Evaluation of Painted or Coated  
Specimens Subjected to Corrosive  
Environments

ASTM D2244

(2016) Standard Practice for Calculation  
of Color Tolerances and Color Differences  
from Instrumentally Measured Color  
Coordinates

ASTM D2247

(2015) Testing Water Resistance of  
Coatings in 100% Relative Humidity

ASTM D4214

(2007; R 2015) Standard Test Method for  
Evaluating the Degree of Chalking of  
Exterior Paint Films

ASTM E84

(2020) Standard Test Method for Surface  
Burning Characteristics of Building  
Materials

ASTM E1592

(2017) Standard Test Method for Structural  
Performance of Sheet Metal Roof and Siding  
Systems by Uniform Static Air Pressure  
Difference

ASTM G152

(2013) Operating Open Flame Carbon Arc  
Light Apparatus for Exposure of  
Nonmetallic Materials

ASTM G153

(2013) Operating Enclosed Carbon Arc Light  
Apparatus for Exposure of Nonmetallic  
Materials

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION  
(SMACNA)

SMACNA 1793

(2012) Architectural Sheet Metal Manual,  
7th Edition

U.S. DEPARTMENT OF ENERGY (DOE)

Energy Star

(1992; R 2006) Energy Star Energy  
Efficiency Labeling System (FEMP)

## 1.2 DEFINITIONS

### 1.2.1 Field-Formed Seam

Seams of panels so configured that when adjacent sheets are installed the seam is sealed utilizing mechanical or hand seamers. Crimped (45 degree bend), roll formed (180 degree bend), double roll formed (2 - 180 degree bends), and roll and lock systems are types of field-formed seam systems.

### 1.2.2 Snap Together Seam

Panels so configured that the male and female portions of the seam interlock through the application of foot pressure or tamping with a mallet. Snap-on cap configurations are a type of snap together system.



### 1.2.3 Pre-Formed

Formed to the final, less field-formed seam, profile and configuration in the factory.

### 1.2.4 Field-Formed

Formed to the final, less field-formed seam, profile and configuration at the site of work prior to installation.

### 1.2.5 Roofing System

The roofing system is defined as the assembly of roofing components, including roofing panels, flashing, fasteners, and accessories which, when assembled properly result in a watertight installation.

### 1.2.6 SSMRS

Standing Seam Metal Roof System (SSMRS) is abbreviation of the entire roof system specified herein with all components and parts coming from a single manufacturer's system.

## 1.3 SYSTEM DESCRIPTION

### 1.3.1 Design Requirements

- a. Panels must be 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. Individual panels of snap together type systems must be removable for replacement of damaged material.
- b. There must be no 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. There must be a minimum of two fasteners per clip. Single fasteners will be allowed when supporting structural members are prepunched or predrilled.
- c. Snap together type systems must have a capillary break and a positive side lap locking device. Field-formed seam type systems must be mechanically locked closed by the manufacturer's locking tool. The seam must include a continuous factory applied sealant when required by the manufacturer to withstand the wind loads specified.
- 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.

### 1.3.2 Design Conditions

Design the system to resist positive and negative loads specified herein in accordance with the AISI SG03-3. Panels must support walking loads without permanent distortion or telegraphing of the structural supports.

## 1.3.2.1 Wind Uplift

Compute and apply the design uplift pressures for the roof system using a basic wind speed of [\_\_\_\_\_] miles per hour (mph). Roof system and attachments must resist the following wind loads, in pounds per square foot (psf):

	<u>Negative</u>
a. At eaves	[_____]
b. At rakes	[_____]
c. At ridge	[_____]
d. At building corners	[_____]
e. At central areas	[_____]

The design uplift force for each connection assembly must be that pressure given for the area under consideration, multiplied by the tributary load area of the connection assembly, and multiplied by the appropriate factor of safety, as follows:

- a. Single fastener in a connection: 3.0
- b. Two or more fasteners in each connection: 2.25

## 1.3.2.2 Roof Live Loads

Loads must be applied on the horizontal projection of the roof structure. The minimum roof design live load must be 20 psf.

## 1.3.2.3 Thermal Movement

System must be capable of withstanding thermal movement based on a temperature range of 10 degrees F below [\_\_\_\_\_] degrees F and [140 degrees F.] [180 degrees F.]

## 1.3.2.4 Deflection

Panels must be capable of supporting design loads between unsupported spans with deflection of not greater than L/180 of the span.

## 1.3.3 Structural Performance

The structural performance test methods and requirements of the Standing Seam Roofing Systems (SSRS) must be in accordance with ASTM E1592.

## 1.4 SUBMITTALS

Approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29.05 20 SUSTAINABILITY REPORTING FOR DESIGN-BUILD. Submit the following in accordance with Section 01 33 00.05 20 CONSTRUCTION SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

Roofing; G

## SD-03 Product Data

Roofing Panels; G

Energy Star Label for Steel Roofing Product; S

Recycled Content for Steel Roofing Product; S

Heat Island Reduction; S

Attachment Clips

Closures

Accessories

Fasteners

Sealants

Insulation, including Joint Sealing Measures for Vapor Barrier Facing

Sample Warranty Certificate; G

Submit for materials to be provided. Submit data sufficient to indicate conformance to specified requirements.

## SD-04 Samples

Roofing Panel

Submit a 12 inch long by full width section of typical panel.

For color selection, submit 2 by 4 inch metal samples in color, finish and texture specified.

Accessories

Submit each type of accessory item used in the project including, but not limited to each type of anchor clip, closure, fastener, and leg clamp.

Sealants

Intermediate Support Section

Submit full size samples of each intermediate support section, 12 inches long.

## SD-05 Design Data

Design Calculations

## SD-06 Test Reports

#### Field Inspection; G

Submit manufacturer's technical representative's field inspection reports as specified in paragraph MANUFACTURER'S FIELD INSPECTION.

#### Structural Performance Tests

#### Finish Tests

### SD-07 Certificates

#### Manufacturer's Technical Representative's Qualifications

#### Statement of Installer's Qualifications

Submit documentation from roofing manufacturer proving the manufacturer's technical representative meets below specified requirements. Include name, address, telephone number, and experience record.

Submit documentation proving the installer is factory-trained, has the specified experience, and authorized by the manufacturer to install the products specified.

#### Coil Stock Compatibility; G

Provide certification of coil compatibility with roll forming machinery to be used for forming panels without warping, waviness, and rippling not part of panel profile; to be done without damage, abrasion or marking of finish coating.

### SD-08 Manufacturer's Instructions

#### Installation Manual; G

Submit manufacturers printed installation manual, instructions, and standard details.

### SD-11 Closeout Submittals

#### Information Card

For each roofing installation, submit a typewritten card or photoengraved aluminum card containing the information listed on Form 1 located at the end of this section.

#### Warranty

## 1.5 DESIGN CALCULATIONS

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:

Wind load uplift design pressure at roof locations specified in paragraph WIND UPLIFT.

Clip spacing and allowable load per clip.

Fastening of clips to structure or intermediate supports.

Intermediate support spacing and framing and fastening to structure when required.

Allowable panel span at anchorage spacing indicated.

Safety factor used in design loading.

Governing code requirements or criteria.

Edge and termination details.

## 1.6 QUALITY ASSURANCE

### 1.6.1 Preroofing Conference

After submittals are received and approved but before roofing and insulation work, including associated work, is preformed, the Contractor must hold a preroofing conference to review the following:

- a. The drawings and specifications
- b. Procedure for on site inspection and acceptance of the roofing substrate and pertinent structural details relating to the roofing system
- c. Contractor's plan for coordination of the work of the various trades involved in providing the roofing system and other components secured to the roofing
- d. Safety requirements

The preroofing conference must be attended by the Contractor and personnel directly responsible for the roofing and insulation installation, and the roofing manufacturer's technical representative. Conflicts among those attending the preroofing conference must be resolved and confirmed in writing before roofing work, including associated work, is begun.

### 1.6.2 Manufacturer

The SSMRS must be the product of a metal roofing industry - recognized manufacturer who has been in the practice of manufacturing SSMRS for a period of not less than 5 years and who has been involved in at least 5 projects similar in size and complexity to this project.

### 1.6.3 Manufacturer's Technical Representative

The representative must have authorization from manufacturer to approve field changes and be thoroughly familiar with the products and with installations in the geographical area where construction will take place. The manufacturer's representative must be an employee of the manufacturer with at least 5 years experience in installing the roof system. The representative must be available to perform field inspections and attend meetings as required herein, and as requested by the Contracting Officer.

#### 1.6.4 Installer's Qualifications

The roofing system installer must be factory-trained, approved by the steel roofing system manufacturer to install the system, and must have 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.

#### 1.6.5 Single Source

Roofing panels, clips, closures, and other accessories must be standard products of the same manufacturer; must be the latest design by the manufacturer; and must have been designed by the manufacturer to operate as a complete system for the intended use.

#### 1.6.6 Laboratory Tests For Panel Finish

The term "appearance of base metal" refers to the metal coating on steel. Panels must meet the following test requirements:

- a. Formability Test: When subjected to a 180 degree bend over a 1/8 inch diameter mandrel in accordance with ASTM D522/D522M, exterior coating film may show only slight microchecking and no loss of adhesion.
- b. Accelerated Weathering Test: Withstand a weathering test for a minimum of 2000 hours in accordance with ASTM G152 and ASTM G153, Method 1 without cracking, peeling, blistering, loss of adhesion of the protective coating, or corrosion of the base metal. Protective coating that can be readily removed from the base metal with a penknife blade or similar instrument will be considered to indicate loss of adhesion.
- c. Chalking Resistance: After the 2000-hour weatherometer test, exterior coating may not chalk greater than No. 8 rating when measured in accordance with ASTM D4214 test procedures.
- d. Color Change Test:  
  
After the 2000-hour weatherometer test, exterior coating color change must not exceed 2 NBS units when measured in accordance with ASTM D2244 test procedure.
- e. Salt Spray Test: Withstand a salt spray test for a minimum of 1000 hours in accordance with ASTM B117, including the scribe requirement in the test. Immediately upon removal of the panel from the test, the coating must receive a rating of 8, few blisters in field as determined by ASTM D714; and an average rating of 6, 1/8 inch failure at scribe, as determined by ASTM D1654. Rating Schedule No. 1.
- f. Abrasion Resistance Test for Color Coating: When subjected to the falling sand test in accordance with ASTM D968, coating system must withstand a minimum of 50 liters of sand per mil thickness before appearance of base metal.
- g. Humidity Test: When subjected to a humidity cabinet test in accordance with ASTM D2247 for 1000 hours, a scored panel must show no signs of blistering, cracking, creepage, or corrosion.

- h. Gloss Test: The gloss of the finish must be 30 plus or minus 5 at an angle of 60 degrees, when measured in accordance with ASTM D523.

- [ i. Glare Resistance Test:

Surfaces of panels that will be exposed to the exterior must have a specular reflectance of not more than 10 when measured in accordance with ASTM D523 at an angle of 85 degrees. Specular reflectance may be obtained with striations or embossing. Requirements specified under FORMABILITY TEST will be waived if necessary to conform to this requirement.

#### ]1.6.7 Shop Drawing Requirements

Submit roofing drawings to supplement the instructions and diagrams. Include design and erection drawings containing an isometric view of the roof showing the design uplift pressures and dimensions of edge, ridge and corner zones; and show typical and special conditions including flashings, materials and thickness, dimensions, fixing lines, anchoring methods, sealant locations, sealant tape locations, fastener layout, sizes, and spacing, terminations, penetrations, attachments, and provisions for thermal movement. Details of installation must be in accordance with the manufacturer's Standard Instructions and details or the SMACNA 1793. Prior to submitting shop drawings, have drawings reviewed and approved by the manufacturer's technical engineering department.

#### 1.7 WARRANTY

Furnish manufacturer's no-dollar-limit materials and workmanship warranty for the roofing system. The warranty period must be not less than 20 years from the date of Government acceptance of the work. The warranty must be issued directly to the Government. The warranty must provide that if within the warranty period the metal roofing system becomes non-watertight or shows evidence of corrosion, perforation, rupture or excess weathering due to deterioration of the roofing system resulting from defective materials or installed workmanship the repair or replacement of the defective materials and correction of the defective workmanship must be the responsibility of the roofing system manufacturer. Repairs that become necessary because of defective materials and workmanship while roofing is under warranty must be performed within 7 days after notification, unless additional time is approved by the Contracting Officer. Failure to perform repairs within the specified period of time will constitute grounds for having the repairs performed by others and the cost billed to the manufacturer. In addition, provide a 2 year contractor installation warranty.

#### 1.8 DELIVERY, STORAGE AND HANDLING

Deliver, store, and handle preformed panels, bulk roofing products and other manufactured items in a manner to prevent damage or deformation.

##### 1.8.1 Delivery

Provide adequate packaging to protect materials during shipment. Crated materials must not be uncrated until ready for use, except for inspection. Immediately upon arrival of materials at the jobsite, inspect materials for damage, dampness, and staining. Replace damaged or permanently stained materials that cannot be restored to like-new condition with satisfactory material. If materials are wet, remove the moisture and

re-stack and protect the panels until used.

#### 1.8.2 Storage

Stack materials on platforms or pallets and cover with tarpaulins or other suitable weathertight covering which prevents water trapping or condensation. Store materials so that water which might have accumulated during transit or storage will drain off. Do not store the panels in contact with materials that might cause staining, such as mud, lime, cement, fresh concrete or chemicals. Protect stored panels from wind damage.

#### 1.8.3 Handling

Handle material carefully to avoid damage to surfaces, edges and ends.

### PART 2 PRODUCTS

#### 2.1 ROOFING PANELS

Provide panels with interlocking ribs for securing adjacent sheets and with concealed clip fastening system for securing the roof covering to structural framing members. Fasteners must not penetrate the panels except at the ridge, eave, rakes, penetrations, and end laps. Backing plates and ends of panels at end laps must be predrilled or prepunched. Factory prepare ends of panels to be lapped by trimming part of seam, die-setting, or swaging ends of panels. Individual sheets must be sufficiently long to cover the entire length of any unbroken roof slope when such slope is 30 feet or less. Provide panels that extend over two or more spans when length of run exceeds 30 feet. Obtain Contracting Officer (KO) approval for sheets longer than 30 feet before submitting shop drawings. Sheets must provide not less than 12 inches of coverage (width) in place. Provide panels with a minimum corrugation height of 1.75 inches (nominal). Make provisions for expansion and contraction at either ridge or eave, consistent with the type of system to be used. Form panels from coil stock without warping, waviness or ripples not part of the panel profile, and free of damage to the finish coating system.

Provide steel roofing product that is Energy Star labeled. Provide data identifying Energy Star label for steel roofing product. Provide solar reflectance product with an initial solar reflectance greater than or equal to 0.25 and a solar reflectance greater than or equal to 0.15 three years after installation under normal conditions. Provide emittance and reflectance percentages, solar reflectance index values, and slopes to meet sustainable third party certification requirements for Heat Island Reduction.

##### 2.1.1 Material

Zinc-coated steel conforming to ASTM A653/A653M, G90 coating designation or aluminum-zinc alloy coated steel conforming to ASTM A792/A792M, AZ 55 coating. Provide material with a minimum thickness of 0.023 inch thick (24 gage) minimum except when mid field of roof is subject to design wind uplift pressures of 60 psf or greater, entire roof system must have a minimum thickness of 0.030 inch (22 gage). Steel roofing materials must contain a minimum of 30 percent total recycled content. Provide data identifying percentage of recycled content for steel roofing product. Prior to shipment, treat mill finish panels with a passivating chemical and oil to inhibit the formation of oxide corrosion products. Dry,



retreat, and re-oil panels that have become wet during shipment or storage but have not started to oxidize.

#### 2.1.2 Texture

Smooth with raised intermediate ribs for added stiffness.

#### 2.1.3 Finish

Factory color finish.

##### 2.1.3.1 Factory Color Finish

Provide factory applied, thermally cured coating to exterior and interior of metal roof and wall panels and metal accessories. Provide exterior finish top coat of 70 percent resin polyvinylidene fluoride with not less than 0.8 mil dry film thickness. Provide exterior primer [standard with panel manufacturer][\_\_\_\_\_] with not less than [0.2 mil][0.8 mil] dry film thickness. Interior finish must consist of 0.5 mil dry film thickness backer coat. Provide exterior and interior coating meeting test requirements specified below. Tests must have been performed on the same factory finish and thickness provided. Provide clear factory edge coating on all factory cut or unfinished edges.

#### 2.2 ATTACHMENT CLIPS

Fabricate clips from ASTM A1011/A1011M, or ASTM A1008/A1008M steel hot-dip galvanized in accordance with ASTM A653/A653M, G 90, or Series 300 stainless steel. Size, shape, thickness and capacity as required to meet the load, insulation thickness and deflection criteria specified.

#### 2.3 ACCESSORIES

Sheet metal flashings, gutters, downspouts, trim, moldings, closure strips, pre-formed crickets, caps, equipment curbs, and other similar sheet metal accessories used in conjunction with preformed metal panels must be of the same material as used for the panels. Provide metal accessories with a factory color finish to match the roofing panels, except that such items which will be concealed after installation may be provided without the finish if they are stainless steel. Metal must be of a thickness not less than that used for the panels. Thermal spacer blocks and other thermal barriers at concealed clip fasteners must be as recommended by the manufacturer except that wood spacer blocks are not allowed.

##### 2.3.1 Closures

###### 2.3.1.1 Rib Closures

Corrosion resisting steel, closed-cell or solid-cell synthetic rubber, neoprene or polyvinyl chloride pre-molded to match configuration of rib opening. Material for closures must not absorb water.

###### 2.3.1.2 Ridge Closures

Metal-clad foam or metal closure with foam secondary closure matching panel configuration for installation on surface of roof panel between panel ribs at ridge and headwall roof panel flashing conditions and terminations. Foam material must not absorb water.

### 2.3.2 Fasteners

Zinc-coated steel, corrosion resisting steel, zinc cast head, or nylon capped steel, type and size specified below or as otherwise approved for the applicable requirements. Design the fastening system to withstand the design loads specified. Exposed fasteners must be gasketed or have gasketed washers on the exterior side of the covering to waterproof the penetration. Washer material must be compatible with the covering; have a minimum diameter of 3/8 inch for structural connections; and gasketed portion of fasteners or washers must be neoprene or other equally durable elastomeric material approximately 1/8 inch thick.

#### 2.3.2.1 Screws

Not smaller than No. 14 diameter if self-tapping type and not smaller than No. 12 diameter if self-drilling and self-tapping.

#### 2.3.2.2 Bolts

Not smaller than 1/4 inch diameter, shouldered or plain shank as required, with proper nuts.

#### 2.3.2.3 Automatic End-Welded Studs

Automatic end-welded studs must be shouldered type with a shank diameter of not smaller than 3/16 inch and cap or nut for holding covering against the shoulder.

#### 2.3.2.4 Explosive Driven Fasteners

Fasteners for use with explosive actuated tools must have a shank diameter of not smaller than 0.145 inch with a shank length of not smaller than 1/2 inch for fastening to steel and not smaller than 1 inch for fastening to concrete.

#### 2.3.2.5 Rivets

Blind rivets must be stainless steel with 1/8 inch nominal diameter shank. Rivets must be threaded stem type if used for other than the fastening of trim. Rivets with hollow stems must have closed ends.

### 2.3.3 Sealants

Elastomeric type containing no oil or asphalt. Exposed sealant must cure to a rubberlike consistency. Concealed sealant must be the non-hardening type. Seam sealant must be factory-applied, non-skinning, non-drying, and must conform to the roofing manufacturer's recommendations. Silicone-based sealants must not be used in contact with finished metal panels and components unless approved otherwise by the Contracting Officer.

### 2.3.4 GASKETS AND INSULATING COMPOUNDS

Nonabsorptive and suitable for insulating contact points of incompatible materials. Insulating compounds must be nonrunning after drying.

## 2.4 THERMAL INSULATION

Flexible blanket, rigid, or semi-rigid faced with a flexible vapor

retarder. Insulation and facing must have a flame-spread rating of 50 or less in accordance with [ASTM E84](#). Vapor retarder facing must have a permeance rating of 0.05 perm or less. Provide a thermal resistance "R" value of 30 or more. Facings must be factory-applied.

## 2.5 LINER PANELS

Fabricate liner panels of the same material as roof panels, and formed or patterned to prevent waviness and distortion. Liner panels must have a factory applied, one mil thick minimum painted coating on the inside face and a prime coat on the liner side.

## PART 3 EXECUTION

Do not install building construction materials that show visible evidence of biological growth.

### 3.1 EXAMINATION

Examine surfaces to receive standing seam metal roofing and flashing. Ensure that surfaces are plumb and true, clean, even, smooth, as dry and free from defects and projections which might affect the installation.

### 3.2 PROTECTION FROM CONTACT WITH DISSIMILAR MATERIALS

#### 3.2.1 Cementitious Materials

Paint metal surfaces which will be in contact with mortar, concrete, or other masonry materials with one coat of alkali-resistant coating such as heavy-bodied bituminous paint.

#### 3.2.2 Contact with Wood

Where metal will be in contact with wood or other absorbent material subject to wetting, seal joints with sealing compound and apply one coat of heavy-bodied bituminous paint.

### 3.3 [INSTALLATION](#)

Install in accordance with the approved manufacturer's erection instructions, shop drawings, and diagrams. Panels must be in full and firm contact with attachment clips. Where prefinished panels are cut in the field, or where any of the factory applied coverings or coatings are abraded or damaged in handling or installation, they must, after necessary repairs have been made with material of the same color as the weather coating, be approved before being installed. Seal completely openings through panels. Correct defects or errors in the materials. Replace materials which cannot be corrected in an approved manner with nondefective materials. Provide molded closure strips where indicated and where necessary to provide weathertight construction. Use shims as required to ensure attachment clip line is true. Use a spacing gage at each row of panels to ensure that panel width is not stretched or shortened.

#### 3.3.1 Roof Panels

Apply roofing panels with the standing seams parallel to the slope of the roof. Provide roofing panels in longest practical lengths from ridge to eaves (top to eaves on shed roofs), with no transverse joints except at

the junction of ventilators, curbs, skylights, chimneys, and similar openings. Install flashing to assure positive water drainage away from roof penetrations. Locate panel end laps such that fasteners do not engage supports or otherwise restrain the longitudinal thermal movement of panels. Form field-formed seam type system seams in the field with an automatic mechanical seamer approved by the manufacturer. Attach panels to the structure with concealed clips incorporated into panel seams. Clip attachment must allow roof to move independently of the structure, except at fixed points as indicated.

### 3.3.2 Insulation Installation

Install between covering and supporting members to present a neat appearance. Fold and staple and tape seams unless approved otherwise by the Contracting Officer.

#### 3.3.2.1 Rigid or Semi-Rigid Insulation

Install in areas where insulation is exposed to view. Fasten securely without loose joints or unsightly sags.

### 3.3.3 Flashings

Provide flashing, related closures and accessories as indicated and as necessary to provide a weathertight installation. Install flashing to ensure positive water drainage away from roof penetrations. Flash and seal the roof at the ridge, eaves and rakes, and projections through the roof. Place closure strips, flashing, and sealing material in an approved manner that will assure complete weathertightness. Details of installation which are not indicated must be in accordance with the [SMACNA 1793](#), panel manufacturer's approved printed instructions and details, or the approved shop drawings. Allow for expansion and contraction of flashing.

#### 3.3.4 Flashing Fasteners

Fastener spacings must be in accordance with the panel manufacturer's recommendations and as necessary to withstand the design loads indicated. Install fasteners in roof valleys as recommended by the manufacturer of the panels. Install fasteners in straight lines within a tolerance of  $1/2$  inch in the length of a bay. Drive exposed penetrating type fasteners normal to the surface and to a uniform depth to seat gasketed washers properly and drive so as not to damage factory applied coating. Exercise extreme care in drilling pilot holes for fastenings to keep drills perpendicular and centered. Do not drill through sealant tape. After drilling, remove metal filings and burrs from holes prior to installing fasteners and washers. Torque used in applying fasteners must not exceed that recommended by the manufacturer. Remove panels deformed or otherwise damaged by over-torqued fastenings, and provide new panels.

#### 3.3.5 Rib and Ridge Closure/Closure Strips

Set closure/closure strips in joint sealant material and apply sealant to mating surfaces prior to adding panel.

### 3.4 PROTECTION OF APPLIED ROOFING

Do not permit storing, walking, wheeling, and trucking directly on applied roofing materials. Provide temporary walkways, runways, and platforms of

smooth clean boards or planks as necessary to avoid damage to applied roofing materials, and to distribute weight to conform to indicated live load limits of roof construction.

### 3.5 CLEANING

Clean exposed sheet metal work at completion of installation. Remove metal shavings, filings, nails, bolts, and wires from roofs. Remove grease and oil films, excess sealants, handling marks, contamination from steel wool, fittings and drilling debris and scrub the work clean. Exposed metal surfaces must be free of dents, creases, waves, scratch marks, solder or weld marks and damage to the finish coating.

### 3.6 MANUFACTURER'S FIELD INSPECTION

Manufacturer's technical representative must visit the site as necessary during the installation process to assure panels, flashings, and other components are being installed in a satisfactory manner. Manufacturer's technical representative must perform a field inspection during the first 20 squares of roof panel installation and at substantial completion prior to issuance of warranty, as a minimum, and as otherwise requested by the Contracting Officer. Additional inspections must not exceed one for 100 squares of total roof area with the exception that follow-up inspections of previously noted deficiencies or application errors must be performed as requested by the Contracting Officer. Each inspection visit must include a review of the entire installation to date. After each inspection, submit a report, signed by the manufacturer's technical representative, to the Contracting Officer noting the overall quality of work, deficiencies and any other concerns, and recommended corrective actions in detail. Notify Contracting Officer a minimum of 2 working days prior to site visit by manufacturer's technical representative.

### 3.7 COMPLETED WORK

Completed work must be plumb and true without oil canning, dents, ripples, abrasion, rust, staining, or other damage detrimental to the performance or aesthetics of the completed roof assembly.

### 3.8 INFORMATION CARD

For each roof, provide a typewritten card, laminated in plastic and framed for interior display or a photoengraved 0.032 inch thick aluminum card for exterior display. Card to be 8 1/2 by 11 inches minimum and contain the information listed on Form 1 at end of this section. Install card near point of access to roof, or where indicated. Send a photostatic paper copy to SOUTHNAVFACENGCOM, Code 0535, P.O. Box 190010, North Charleston, SC 29419-9010.

### 3.9 FORM ONE

FORM 1 - PREFORMED STEEL STANDING SEAM ROOFING SYSTEM COMPONENTS

1. Contract Number:
2. Building Number & Location:
3. NAVFAC Specification Number:
4. Deck/Substrate Type:
5. Slopes of Deck/Roof Structure:
6. Insulation Type & Thickness:
7. Insulation Manufacturer:
8. Vapor Retarder: ( ) Yes ( ) No
9. Vapor Retarder Type:
10. Preformed Steel Standing Seam Roofing Description:
  - a. Manufacturer (Name, Address, & Phone No.):
  - b. Product Name:
  - c. Width:
  - d. Gage:
  - e. Base Metal:
  - f. Method of Attachment:
11. Repair of Color Coating:
  - a. Coating Manufacturer (Name, Address & Phone No.):
  - b. Product Name:
  - c. Surface Preparation:
  - d. Recoating Formula:
  - e. Application Method:
12. Statement of Compliance or Exception: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
13. Date Roof Completed:
14. Warranty Period: From \_\_\_\_\_ To \_\_\_\_\_
15. Roofing Contractor (Name & Address):
16. Prime Contractor (Name & Address):

Contractor's Signature \_\_\_\_\_ Date:

Inspector's Signature \_\_\_\_\_ Date:

-- End of Section --

## SECTION 07 84 00

## FIRESTOPPING

05/10, CHG 1: 08/13

## PART 1 GENERAL

## 1.1 SUMMARY

Furnish and install 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.

- a. Through-penetrations include the annular space around pipes, tubes, conduit, wires, cables and vents.
- b. Construction joints include those used to accommodate expansion, contraction, wind, or seismic movement; firestopping material shall not interfere with the required movement of the joint.

Gaps requiring firestopping include gaps between the curtain wall and the floor slab and 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.

## 1.2 REFERENCES

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

## ASTM INTERNATIONAL (ASTM)

ASTM E84	(2020) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E119	(2020) Standard Test Methods for Fire Tests of Building Construction and Materials
ASTM E699	(2009) Standard Practice for Evaluation of Agencies Involved in Testing, Quality Assurance, and Evaluating of Building Components
ASTM E814	(2013a; R 2017) Standard Test Method for Fire Tests of Penetration Firestop Systems
ASTM E1399/E1399M	(1997; R 2017) Standard Test Method for Cyclic Movement and Measuring the Minimum and Maximum Joint Widths of Architectural Joint Systems
ASTM E1966	(2015; R 2019) Standard Test Method for

## Fire-Resistive Joint Systems

ASTM E2174	(2020a) Standard Practice for On-Site Inspection of Installed Firestop Systems
ASTM E2307	(2020) Standard Test Method for Determining Fire Resistance of Perimeter Fire Barrier Systems Using Intermediate-Scale, Multi-story Test Apparatus
ASTM E2393	(2020a) Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers

## FM GLOBAL (FM)

FM 4991	(2013) Approval of Firestop Contractors
FM APP GUIDE	(updated on-line) Approval Guide <a href="http://www.approvalguide.com/">http://www.approvalguide.com/</a>

## UNDERWRITERS LABORATORIES (UL)

UL 723	(2018) UL Standard for Safety Test for Surface Burning Characteristics of Building Materials
UL 1479	(2015) Fire Tests of Through-Penetration Firestops
UL 2079	(2015; Reprint Jul 2020) Tests for Fire Resistance of Building Joint Systems
UL Fire Resistance	(2014) Fire Resistance Directory

## 1.3 SEQUENCING

Coordinate the specified work with other trades. Apply firestopping materials, at penetrations of pipes and ducts, prior to insulating, unless insulation meets requirements specified for firestopping. Apply firestopping materials, at building joints and construction gaps, prior to completion of enclosing walls or assemblies. Cast-in-place firestop devices shall be located and installed in place before concrete placement. Pipe, conduit or cable bundles shall be installed through cast-in-place device after concrete placement but before area is concealed or made inaccessible. Firestop material shall be inspected and approved prior to final completion and enclosing of any assemblies that may conceal installed firestop.

## 1.4 SUBMITTALS

Approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29.05 20 SUSTAINABILITY REPORTING FOR DESIGN-BUILD. Submit the following in accordance with Section 01 33 00.05 20 CONSTRUCTION SUBMITTAL PROCEDURES:



## SD-02 Shop Drawings

Firestopping System; G

## SD-03 Product Data

Firestopping Materials; G

## SD-06 Test Reports

Inspection; G

## SD-07 Certificates

Inspector Qualifications

Firestopping Materials

Installer Qualifications; G

## 1.5 QUALITY ASSURANCE

## 1.5.1 Installer

Engage an experienced Installer who is:

- a. FM Research approved in accordance with FM 4991, operating as a UL Certified Firestop Contractor, or
- b. Certified, licensed, or otherwise qualified by the firestopping manufacturer as having the necessary staff, training, and a minimum of 3 years experience in the installation of manufacturer's products in accordance with specified requirements. Submit documentation of this experience. A manufacturer's willingness to sell its firestopping products to the Contractor or to an installer engaged by the Contractor does not in itself confer installer qualifications on the buyer. The Installer shall have been trained by a direct representative of the manufacturer (not distributor or agent) in the proper selection and installation procedures. The installer shall obtain from the manufacturer and submit written certification of training, and retain proof of certification for duration of firestop installation.

## 1.5.2 Inspector Qualifications

The inspector shall[ meet the criteria contained in ASTM E699 for agencies involved in quality assurance and shall] have a minimum of two years experience in construction field inspections of firestopping systems, products, and assemblies. The inspector shall be completely independent of, and divested from, the installer, the manufacturer, and the supplier of any material or item being inspected. The inspector shall not be a competitor of the installer, the contractor, the manufacturer, or supplier of any material or item being inspected. Include in the qualifications submittal a notarized statement assuring compliance with the requirements stated herein.

## 1.6 DELIVERY, STORAGE, AND HANDLING

Deliver materials in the original unopened packages or containers showing

name of the manufacturer and the brand name. Store materials off the ground, protected from damage and exposure to elements and temperatures in accordance with manufacturer requirements. Remove damaged or deteriorated materials from the site. Use materials within their indicated shelf life.

## PART 2 PRODUCTS

### 2.1 FIRESTOPPING SYSTEM

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 in lieu of fire-test data or report. For those firestop applications for which no UL tested system is available through a manufacturer, a manufacturer's engineering judgment, derived from similar UL system designs or other tests, shall be submitted 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.

Also, submit a written report indicating locations of and types of penetrations and types of firestopping used at each location; record type by UL list printed numbers.

### 2.2 FIRESTOPPING MATERIALS

Provide firestopping materials, supplied from a single domestic manufacturer, consisting of commercially manufactured, asbestos-free, nontoxic products [FM APP GUIDE](#) approved, or UL listed, for use with applicable construction and penetrating items, complying with the following minimum requirements:

#### 2.2.1 Fire Hazard Classification

Material shall have a flame spread of 25 or less, and a smoke developed rating of 50 or less, when tested in accordance with [ASTM E84](#) or [UL 723](#). Material shall be an approved firestopping material as listed in [UL Fire Resistance](#) or by a nationally recognized testing laboratory.

#### 2.2.2 Toxicity

Material shall be nontoxic and carcinogen free to humans at all stages of application or during fire conditions and shall not contain hazardous chemicals or require harmful chemicals to clean material or equipment.

#### 2.2.3 Fire Resistance Rating

Firestop systems shall be [UL Fire Resistance](#) listed or [FM APP GUIDE](#) approved with "F" rating at least equal to fire-rating of fire wall or floor in which penetrated openings are to be protected. Where required, firestop systems shall also have "T" rating at least equal to the fire-rated floor in which the openings are to be protected.

##### 2.2.3.1 Through-Penetrations

Firestopping materials for through-penetrations, as described in paragraph SUMMARY, shall provide "F", "T" and "L" fire resistance ratings in

accordance with ASTM E814 or UL 1479. Fire resistance ratings shall be as follows:

#### 2.2.3.1.1 Penetrations of Fire Resistance Rated Walls and Partitions

F Rating = Rating of wall or partition being penetrated.

#### 2.2.3.1.2 Penetrations of Fire and Smoke Resistance Rated Walls, Floors, Floor-Ceiling Assemblies, and the ceiling membrane of Roof-Ceiling Assemblies

F Rating = 1/2 hour, T Rating = 1/2 hour and L Rating = <10 cfm/sf.

#### 2.2.3.2 Construction Joints and Gaps

Fire resistance ratings of construction joints, as described in paragraph SUMMARY, and gaps such as those between floor slabs and curtain walls shall be the same as the construction in which they occur. Construction joints and gaps shall be provided with firestopping materials and systems that have been tested in accordance with ASTM E119, ASTM E1966 or UL 2079 to meet the required fire resistance rating. Curtain wall joints shall be provided with firestopping materials and systems that have been tested in accordance with ASTM E2307 to meet the required fire resistance rating. Systems installed at construction joints shall meet the cycling requirements of ASTM E1399/E1399M or UL 2079. All joints at the intersection of the top of a fire resistance rated wall and the underside of a fire-rated floor, floor ceiling, or roof ceiling assembly shall provide a minimum class II movement capability.

#### 2.2.4 Material Certification

Submit certificates attesting that firestopping material complies with the specified requirements. For all intumescent firestop materials used in through penetration systems, manufacturer shall provide certification of compliance with UL 1479.

### PART 3 EXECUTION

#### 3.1 PREPARATION

Areas to receive firestopping must be free of dirt, grease, oil, or loose materials which may affect the fitting or fire resistance of the firestopping system. For cast-in-place firestop devices, formwork or metal deck to receive device prior to concrete placement must be sound and capable of supporting device. Prepare surfaces as recommended by the manufacturer.

#### 3.2 INSTALLATION

Completely fill void spaces with firestopping material regardless of geometric configuration, subject to tolerance established by the manufacturer. Firestopping systems for filling floor voids 4 inches or more in any direction must be capable of supporting the same load as the floor is designed to support or be protected by a permanent barrier to prevent loading or traffic in the firestopped area. Install firestopping in accordance with manufacturer's written instructions. Provide tested and listed firestop systems in the following locations, except in floor slabs on grade:

- a. Penetrations of duct, conduit, tubing, cable and pipe through floors

and through fire-resistance rated walls, partitions, and ceiling-floor assemblies.

- b. Penetrations of vertical shafts such as pipe chases, elevator shafts, and utility chutes.
- c. Gaps at the intersection of floor slabs and curtain walls, including inside of hollow curtain walls at the floor slab.
- d. Gaps at perimeter of fire-resistance rated walls and partitions, such as between the top of the walls and the bottom of roof decks.
- e. Construction joints in floors and fire rated walls and partitions.
- f. Other locations where required to maintain fire resistance rating of the construction.

### 3.2.1 Insulated Pipes and Ducts

Thermal insulation shall be cut and removed where pipes or ducts pass through firestopping, unless insulation meets requirements specified for firestopping. Replace thermal insulation with a material having equal thermal insulating and firestopping characteristics.

### 3.2.2 Fire Dampers

Install and firestop fire dampers in accordance with Section 23 30 00 HVAC AIR DISTRIBUTION. Firestop installed with fire damper must be tested and approved for use in fire damper system. Firestop installed with fire damper must be tested and approved for use in fire damper system.

### 3.2.3 Data and Communication Cabling

Cabling for data and communication applications shall be sealed with re-enterable firestopping products and devices as indicated.

#### 3.2.3.1 Re-Enterable Devices

Firestopping devices shall be pre-manufactured modular devices, containing built-in self-sealing intumescent inserts. Firestopping devices shall allow for cable moves, additions or changes without the need to remove or replace any firestop materials. Devices must be capable of maintaining the fire resistance rating of the penetrated membrane at 0 percent to 100 percent visual fill of penetrants; while maintaining "L" rating of <10 cfm/sf [measured at ambient temperature and 400 degrees F] at 0 percent to 100 percent visual fill.

#### 3.2.3.2 Re-Sealable Products

Provide firestopping pre-manufactured modular products, containing self-sealing intumescent inserts. Firestopping products shall allow for cable moves, additions or changes. Devices shall be capable of maintaining the fire resistance rating of the penetrated membrane at 0 percent to 100 percent visual fill of penetrants.

### 3.3 INSPECTION

For all projects, the firestopped areas shall not be covered or enclosed until inspection is complete and approved by the Contracting Officer. The

inspector must inspect the applications initially to ensure adequate preparations (clean surfaces suitable for application, etc.) and periodically during the work to assure that the completed work has been accomplished according to the manufacturer's written instructions and the specified requirements. Submit written reports indicating locations of and types of penetrations and types of firestopping used at each location; type shall be recorded by UL listed printed numbers.

### 3.3.1 Inspection Standards

Inspect all firestopping in accordance with [ASTM E2393](#) and [ASTM E2174](#) for firestop inspection, and document inspection results to be submitted.

### 3.3.2 Inspection Reports

Submit inspection report stating that firestopping work has been inspected and found to be applied according to the manufacturer's recommendations and the specified requirements.

-- End of Section --

## SECTION 07 92 00

## JOINT SEALANTS

**08/16, CHG 3: 11/18**

## PART 1 GENERAL

## 1.1 REFERENCES

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

## ASTM INTERNATIONAL (ASTM)

ASTM C509	(2006; R 2015) Elastomeric Cellular Preformed Gasket and Sealing Material
ASTM C734	(2015; R 2019) Low-Temperature Flexibility of Latex Sealants After Artificial Weathering
ASTM C919	(2012; R 2017) Standard Practice for Use of Sealants in Acoustical Applications
ASTM C920	(2018) Standard Specification for Elastomeric Joint Sealants
ASTM C1193	(2013) Standard Guide for Use of Joint Sealants
ASTM C1311	(2014) Standard Specification for Solvent Release Agents
ASTM C1521	(2013) Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints
ASTM D217	(2019b) Standard Test Methods for Cone Penetration of Lubricating Grease
ASTM D1056	(2014) Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D1667	(2017) Standard Specification for Flexible Cellular Materials - Poly (Vinyl Chloride) Foam (Closed-Cell)
ASTM D2452	(2015; R 2019) Standard Test Method for Extrudability of Oil- and Resin-Base Caulking Compounds
ASTM D2453	(2015; R 2020; E 2020) Standard Test Method for Shrinkage and Tenacity of Oil- and Resin-Base Caulking Compounds
ASTM E84	(2020) Standard Test Method for Surface

Burning Characteristics of Building  
Materials

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

CDPH SECTION 01350 (2010; Version 1.1) Standard Method for  
the Testing and Evaluation of Volatile  
Organic Chemical Emissions from Indoor  
Sources using Environmental Chambers

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS SCS Global Services (SCS) Indoor Advantage

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule 1168 (2017) Adhesive and Sealant Applications

UNDERWRITERS LABORATORIES (UL)

UL 2818 (2013) GREENGUARD Certification Program  
For Chemical Emissions For Building  
Materials, Finishes And Furnishings

1.2 SUBMITTALS

Approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29.05 20 SUSTAINABILITY REPORTING FOR DESIGN-BUILD. Submit the following in accordance with Section 01 33 00.05 20 CONSTRUCTION SUBMITTAL PROCEDURES:

SD-03 Product Data

Sealants; G

Primers; G

Bond Breakers; G

Backstops; G

SD-06 Test Reports

Field Adhesion; G

SD-07 Certificates

Indoor Air Quality For Interior Sealants; S

Indoor Air Quality For Interior Floor Joint Sealants; S

Indoor Air Quality For Interior Acoustical Sealants; S

Indoor Air Quality For Interior Caulking; S

### 1.3 PRODUCT DATA

Include storage requirements, shelf life, curing time, instructions for mixing and application, and accessories. Provide manufacturer's Safety Data Sheets (SDS) for each solvent, primer and sealant material proposed.

### 1.4 CERTIFICATIONS

#### 1.4.1 Indoor Air Quality Certifications

Submit required indoor air quality certifications in one submittal package.

##### 1.4.1.1 Adhesives and Sealants

Provide products certified to meet indoor air quality requirements by [UL 2818](#) (Greenguard) Gold, [SCS](#) Global Services Indoor Advantage Gold or provide certification or validation by other third-party program that products meet the requirements of this Section. Provide current product certification documentation from certification body.. When product does not have certification, provide validation that product meets the indoor air quality product requirements cited herein.

### 1.5 ENVIRONMENTAL CONDITIONS

Apply sealant when the ambient temperature is between [40 and 90 degrees F](#).

### 1.6 DELIVERY AND STORAGE

Deliver materials to the jobsite in unopened manufacturers' sealed shipping containers, with brand name, date of manufacture, color, and material designation clearly marked thereon. Label elastomeric sealant containers to identify type, class, grade, and use. Handle and store materials in accordance with manufacturer's printed instructions. Prevent exposure to foreign materials or subjection to sustained temperatures exceeding [90 degrees F](#) or lower than [0 degrees F](#). Keep materials and containers closed and separated from absorptive materials such as wood and insulation.

### 1.7 QUALITY ASSURANCE

#### 1.7.1 Compatibility with Substrate

Verify that each sealant is compatible for use with each joint substrate in accordance with sealant manufacturer's printed recommendations for each application.

#### 1.7.2 Joint Tolerance

Provide joint tolerances in accordance with manufacturer's printed instructions.

#### 1.7.3 Adhesion

Provide in accordance with [ASTM C1193](#) or [ASTM C1521](#).



## PART 2 PRODUCTS

## 2.1 SEALANTS

Provide sealant products that have been tested, found suitable, and documented as such by the manufacturer for the particular substrates to which they will be applied.

## 2.1.1 Interior Sealants

Provide [ASTM C920](#), Type S or M, Grade NS, Class 12.5, Use NT. Provide sealant products used on the interior of the building (defined as inside of the weatherproofing system) meeting either emissions requirements of [CDPH SECTION 01350](#) (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of [SCAQMD Rule 1168](#). Provide certification or validation of [indoor air quality for interior sealants](#). Location(s) and color(s) of sealant for the following. Note, color "as selected" refers to manufacturer's full range of color options

LOCATION	COLOR
a. Small voids between walls or partitions and adjacent lockers, casework, shelving, door frames, built-in or surface mounted equipment and fixtures, and similar items.	As selected
b. Perimeter of frames at doors, windows, and access panels which adjoin exposed interior concrete and masonry surfaces.	As selected
c. Joints of interior masonry walls and partitions which adjoin columns, pilasters, concrete walls, and exterior walls unless otherwise detailed.	As selected
d. Joints between edge members for acoustical tile and adjoining vertical surfaces.	As selected
e. Interior locations, not otherwise indicated or specified, where small voids exist between materials specified to be painted.	As selected
f. Joints between bathtubs and ceramic tile; joints between shower receptors and ceramic tile; joints formed where non-planar tile surfaces meet.	As selected
g. Joints formed between tile floors and tile base cove; joints between tile and dissimilar materials; joints occurring where substrates change.	As selected
h. Behind escutcheon plates at valve pipe penetrations and showerheads in showers.	As selected

## 2.1.2 Exterior Sealants

For joints in vertical surfaces, provide [ASTM C920](#), Type S or M, Grade NS, Class 25, Use NT. For joints in horizontal surfaces, provide [ASTM C920](#), Type S or M, Grade P, Class 25, Use T. Provide location(s) and color(s) of sealant as follows. Note, color "as selected" refers to manufacturer's

full range of color options:

LOCATION	COLOR
a. Joints and recesses formed where frames and subsills of windows, doors, louvers, and vents adjoin masonry, concrete, or metal frames. Use sealant at both exterior and interior surfaces of exterior wall penetrations.	Match adjacent surface color
b. Joints between new and existing exterior masonry walls.	Match adjacent surface color
c. Masonry joints where shelf angles occur.	Match adjacent surface color
d. Joints in wash surfaces of stonework.	Match adjacent surface color
e. Expansion and control joints.	Match adjacent surface color
f. Interior face of expansion joints in exterior concrete or masonry walls where metal expansion joint covers are not required.	Match adjacent surface color
g. Voids where items pass through exterior walls.	Match adjacent surface color
h. Metal reglets, where flashing is inserted into masonry joints, and where flashing is penetrated by coping dowels.	Match adjacent surface color
i. Metal-to-metal joints where sealant is indicated or specified.	Match adjacent surface color
j. Joints between ends of gravel stops, fascia, copings, and adjacent walls.	Match adjacent surface color

### 2.1.3 Floor Joint Sealants

ASTM C920, Type S or M, Grade P, Class 25, Use T. Provide sealant products used on the interior of the building (defined as inside of the weatherproofing system) meeting either emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of SCAQMD Rule 1168. Provide certification or validation of indoor air quality for interior floor joint sealants. Provide location(s) and color(s) of sealant as follows. Note, color "as selected" refers to manufacturer's full range of color options:

LOCATION	COLOR
a. Seats of metal thresholds for exterior doors.	As selected
b. Control and expansion joints in floors, slabs, ceramic tile, and walkways.	As selected

#### 2.1.4 Acoustical Sealants

Rubber or polymer based acoustical sealant in accordance with [ASTM C919](#) to have a flame spread of 25 or less and a smoke developed rating of 50 or less when tested in accordance with [ASTM E84](#). Provide non-staining acoustical sealant with a consistency of 250 to 310 when tested in accordance with [ASTM D217](#). Acoustical sealant must remain flexible and adhesive after 500 hours of accelerated weathering as specified in [ASTM C734](#). Provide sealant products used on the interior of the building (defined as inside of the weatherproofing system) meeting either emissions requirements of [CDPH SECTION 01350](#) (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of [SCAQMD Rule 1168](#). Provide certification or validation of [indoor air quality for interior acoustical sealants](#).

#### 2.1.5 Preformed Sealants

Provide preformed sealants of polybutylene or isoprene-butylene based pressure sensitive weather resistant tape or bead sealants capable of sealing out moisture, air and dust when installed as recommended by the manufacturer. At temperatures from minus [30 to plus 160 degrees F](#), sealants must be non-bleeding and have no loss of adhesion.

##### 2.1.5.1 Tape

Tape sealant: Provide cross section dimensions of [\_\_\_\_\_].

##### 2.1.5.2 Bead

Bead sealant: Provide cross section dimensions of [\_\_\_\_\_].

##### 2.1.5.3 Foam Strip

Provide foam strip of polyurethane foam. Provide foam strip capable of sealing out moisture, air, and dust when installed and compressed in accordance with manufacturer's printed instructions. Service temperature must be [minus 40 to plus 275 degrees F](#). Furnish untreated strips with adhesive to hold them in place. Do not allow adhesive to stain or bleed onto adjacent finishes. Saturate treated strips with butylene waterproofing or impregnate with asphalt.

#### 2.2 PRIMERS

Non-staining, quick drying type and consistency as recommended by the sealant manufacturer for the particular application. Provide primers for interior applications that meet the indoor air quality requirements of the paragraph SEALANTS above.

## 2.3 BOND BREAKERS

Type and consistency as recommended by the sealant manufacturer to prevent adhesion of the sealant to the backing or to the bottom of the joint. Provide bond breakers for interior applications that meet the indoor air quality requirements of the paragraph SEALANTS above.

## 2.4 BACKSTOPS

Provide glass fiber roving, neoprene, butyl, polyurethane, or polyethylene foams free from oil or other staining elements as recommended by sealant manufacturer. Provide 25 to 33 percent oversized backing for closed cell and 40 to 50 percent oversized backing for open cell material, unless otherwise indicated. Provide backstop material that is compatible with sealant. Do not use oakum or other types of absorptive materials as backstops.

### 2.4.1 Rubber

Provide in accordance with ASTM D1056, [Type 1, open cell,] [or] [Type 2, closed cell,] Class [A] [B] [D], Grade [\_\_\_\_], [round] [\_\_\_\_] cross section for [\_\_\_\_] cellular rubber sponge backing.

### 2.4.2 PVC

Provide in accordance with ASTM D1667, Grade [VO 12] [\_\_\_\_], open-cell foam, [round] [\_\_\_\_] cross section for [\_\_\_\_] polyvinyl chloride (PVC) backing.

### 2.4.3 Synthetic Rubber

Provide in accordance with ASTM C509, Option [I] [II], Type [I] [II] preformed [rods] [or] [tubes] for [\_\_\_\_] synthetic rubber backing.

### 2.4.4 Neoprene

Provide in accordance with ASTM D1056, [closed cell expanded neoprene cord Type 2, Class C, Grade [2C2] [\_\_\_\_]] [open cell neoprene sponge Type 1, Class C, Grade [1C3] [\_\_\_\_]] for [\_\_\_\_] neoprene backing.

### 2.4.5 Butyl Rubber Based

Provide in accordance with ASTM C1311, from a single component, with solvent release. color [as selected from manufacturer's full range of color choices] [\_\_\_\_].

### 2.4.6 Silicone Rubber Base

Provide in accordance with ASTM C920, from a single component, with solvent release, Non-sag, Type [\_\_\_\_], Grade [\_\_\_\_], Class [25] [\_\_\_\_]. Color [as selected from manufacturer's full range of color choices] [\_\_\_\_].

## 2.5 CAULKING

For interior use and only where there is little or no anticipated joint movement. Provide in accordance with ASTM D2452 and ASTM D2453, Type [\_\_\_\_], for [\_\_\_\_] oil and resin-based caulking. Provide products used on the interior of the building (defined as inside of the weatherproofing

system) meeting either emissions requirements of [CDPH SECTION 01350](#) (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of [SCAQMD Rule 1168](#). Provide certification or validation of [indoor air quality for interior caulking](#).

## 2.6 CLEANING SOLVENTS

Provide type(s) recommended by the sealant manufacturer and in accordance with environmental requirements herein. Protect adjacent aluminum and bronze surfaces from solvents. Provide solvents for interior applications that meet the indoor air quality requirements of the paragraph SEALANTS above.

## PART 3 EXECUTION

### 3.1 FIELD QUALITY CONTROL

Perform a field adhesion test in accordance with manufacturer's instructions and [ASTM C1193](#), Method A or ASTM C1521, Method A, Tail Procedure. Remove sealants that fail adhesion testing; clean substrates, reapply sealants, and re-test. Test sealants adjacent to failed sealants. Submit [field adhesion](#) test report indicating tests, locations, dates, results, and remedial actions taken.

### 3.2 SURFACE PREPARATION

Prepare surfaces according to manufacturer's printed installation instructions. Clean surfaces from dirt, frost, moisture, grease, oil, wax, lacquer, paint, or other foreign matter that would destroy or impair adhesion. Remove oil and grease with solvent; thoroughly remove solvents prior to sealant installation. Wipe surfaces dry with clean cloths. When resealing an existing joint, remove existing caulk or sealant prior to applying new sealant. For surface types not listed below, provide in accordance with sealant manufacturer's printed instructions for each specific surface.

#### 3.2.1 Steel Surfaces

Remove loose mill scale by sandblasting or, if sandblasting is impractical or would damage finished work, scraping and wire brushing. Remove protective coatings by sandblasting or using a residue free solvent. Remove resulting debris and solvent residue prior to sealant installation.

#### 3.2.2 Aluminum or Bronze Surfaces

Remove temporary protective coatings from surfaces that will be in contact with sealant. When masking tape is used as a protective coating, remove tape and any residual adhesive prior to sealant application. For removing protective coatings and final cleaning, use non-staining solvents recommended by the manufacturer of the item(s) containing aluminum or bronze surfaces.

#### 3.2.3 Concrete and Masonry Surfaces

Where surfaces have been treated with curing compounds, oil, or other such materials, remove materials by sandblasting or wire brushing. Remove laitance, efflorescence and loose mortar from the joint cavity. Remove resulting debris prior to sealant installation.

### 3.3 SEALANT PREPARATION

Do not add liquids, solvents, or powders to sealants. Mix multicomponent elastomeric sealants in accordance with manufacturer's printed instructions.

### 3.4 APPLICATION

#### 3.4.1 Joint Width-To-Depth Ratios

Acceptable Ratios:

<u>JOINT WIDTH</u>	<u>JOINT DEPTH</u>	
	Minimum	Maximum
For metal, glass, or other nonporous surfaces:		
1/4 inch (minimum)	1/4 inch	1/4 inch
over 1/4 inch	1/2 of width	Equal to width
For wood, concrete, masonry, stone:		
1/4 inch (minimum)	1/4 inch	1/4 inch
over 1/4 inch to 1/2 inch	1/4 inch	Equal to width
over 1/2 inch to 1 inch	1/2 inch	5/8 inch
Over 1 inch	prohibited	

Unacceptable Ratios: Where joints of acceptable width-to-depth ratios have not been provided, clean out joints to acceptable depths and grind or cut to acceptable widths without damage to the adjoining work. Grinding is prohibited at metal surfaces.

#### 3.4.2 Unacceptable Sealant Use

Do not install sealants in lieu of other required building enclosure weatherproofing components such as flashing, drainage components, and joint closure accessories, or to close gaps between walls, floors, roofs, windows, and doors, that exceed acceptable installation tolerances. Remove sealants that have been used in an unacceptable manner and correct building enclosure deficiencies to comply with contract documents requirements.

#### 3.4.3 Masking Tape

Place masking tape on the finished surface on one or both sides of joint cavities to protect adjacent finished surfaces from primer or sealant smears. Remove masking tape within 10 minutes of joint filling and tooling.

#### 3.4.4 Backstops

Provide backstops dry and free of tears or holes. Tightly pack the back

or bottom of joint cavities with backstop material to provide joints in specified depths. Provide backstops where indicated and where backstops are not indicated but joint cavities exceed the acceptable maximum depths specified in JOINT WIDTH-TO-DEPTH RATIOS Table.

#### 3.4.5 Primer

Clean out loose particles from joints immediately prior to application of. Apply primer to joints in concrete masonry units, wood, and other porous surfaces in accordance with sealant manufacturer's printed instructions. Do not apply primer to exposed finished surfaces.

#### 3.4.6 Bond Breaker

Provide bond breakers to surfaces not intended to bond in accordance with, sealant manufacturer's printed instructions for each type of surface and sealant combination specified.

#### 3.4.7 Sealants

Provide sealants compatible with the material(s) to which they are applied. Do not use a sealant that has exceeded its shelf life or has jelled and cannot be discharged in a continuous flow from the sealant gun. Apply sealants in accordance with the manufacturer's printed instructions with a gun having a nozzle that fits the joint width. Work sealant into joints so as to fill the joints solidly without air pockets. Tool sealant after application to ensure adhesion. Apply sealant uniformly smooth and free of wrinkles. Upon completion of sealant application, roughen partially filled or unfilled joints, apply additional sealant, and tool smooth as specified. Apply sealer over sealants in accordance with the sealant manufacturer's printed instructions.

### 3.5 PROTECTION AND CLEANING

#### 3.5.1 Protection

Protect areas adjacent to joints from sealant smears. Masking tape may be used for this purpose if removed 5 to 10 minutes after the joint is filled and no residual tape marks remain.

#### 3.5.2 Final Cleaning

Upon completion of sealant application, remove remaining smears and stains and leave the work in a clean and neat condition.

- a. Masonry and Other Porous Surfaces: Immediately remove fresh sealant that has been smeared on adjacent masonry, rub clean with a solvent, and remove solvent residue, in accordance with sealant manufacturer's printed instructions. Allow excess sealant to cure for 24 hour then remove by wire brushing or sanding. Remove resulting debris.
- b. Metal and Other Non-Porous Surfaces: Remove excess sealant with a solvent moistened cloth. Remove solvent residue in accordance with solvent manufacturer's printed instructions.

-- End of Section --

## SECTION 08 11 13

## STEEL DOORS AND FRAMES

**02/10**

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2020) Structural Welding Code - Steel

## ASTM INTERNATIONAL (ASTM)

ASTM A653/A653M (2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A924/A924M (2020) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

ASTM C578 (2019) Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation

ASTM C591 (2020) Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation

ASTM C612 (2014; R 2019) Standard Specification for Mineral Fiber Block and Board Thermal Insulation

ASTM D2863 (2017a) Standard Test Method for Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)

ASTM E1300 (2016) Standard Practice for Determining Load Resistance of Glass in Buildings

ASTM F2248 (2012) Standard Practice for Specifying an Equivalent 3-Second Duration Design Loading for Blast Resistant Glazing Fabricated with Laminated Glass

## BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

ANSI/BHMA A156.115 (2016) Hardware Preparation in Steel Doors and Steel Frames



NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM HMMA 810 (2009) Hollow Metal Doors

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80 (2019) Standard for Fire Doors and Other Opening Protectives

NFPA 105 (2019) Standard for Smoke Door Assemblies and Other Opening Protectives

NFPA 252 (2017) Standard Methods of Fire Tests of Door Assemblies

STEEL DOOR INSTITUTE (SDI/DOOR)

SDI/DOOR 111 (2009) Recommended Selection and Usage Guide for Standard Steel Doors, Frames and Accessories

SDI/DOOR 113 (2001; R2006) Standard Practice for Determining the Steady State Thermal Transmittance of Steel Door and Frame Assemblies

SDI/DOOR A250.4 (2011) Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors and Hardware Reinforcing

SDI/DOOR A250.6 (2003; R2009) Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames

SDI/DOOR A250.8 (2003; R2008) Recommended Specifications for Standard Steel Doors and Frames

SDI/DOOR A250.11 (2001) Recommended Erection Instructions for Steel Frames

UNDERWRITERS LABORATORIES (UL)

UL 10C (2016) UL Standard for Safety Positive Pressure Fire Tests of Door Assemblies

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance with Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Doors; G

Recycled Content for Steel Door Product; S

Frames; G

Recycled Content for Steel Frame Product; S

Accessories

Show elevations, construction details, metal gages, hardware provisions, method of glazing, and installation details.

Schedule of Doors; G

Schedule of Frames; G

Submit door and frame locations.

#### SD-03 Product Data

Doors; G

Frames; G

Accessories

Submit manufacturer's descriptive literature for doors, frames, and accessories. Include data and details on door construction, panel (internal) reinforcement, insulation, and door edge construction. When "custom hollow metal doors" are provided in lieu of "standard steel doors," provide additional details and data sufficient for comparison to [SDI/DOOR A250.8](#) requirements.

### 1.3 DELIVERY, STORAGE, AND HANDLING

Deliver doors, frames, and accessories undamaged and with protective wrappings or packaging. Provide temporary steel spreaders securely fastened to the bottom of each welded frame. Store doors and frames on platforms under cover in clean, dry, ventilated, and accessible locations, with [1/4 inch](#) airspace between doors. Remove damp or wet packaging immediately and wipe affected surfaces dry. Replace damaged materials with new.

## PART 2 PRODUCTS

### 2.1 STANDARD STEEL DOORS

[SDI/DOOR A250.8](#), except as specified otherwise. Prepare doors to receive door hardware as specified in Section [08 71 00](#). Undercut where indicated. Provide exterior doors with top edge closed flush and sealed to prevent water intrusion. Provide doors at [1-3/4 inch](#) thick, unless otherwise indicated. Provide door material that uses a minimum of 25 percent recycled content. Provide data indicating percentage of [recycled content for steel door product](#). Provide exterior glazing in accordance with [ASTM F2248](#) and [ASTM E1300](#).

#### 2.1.1 Classification - Level, Performance, Model

##### 2.1.1.1 Heavy Duty Doors

[SDI/DOOR A250.8](#), Level 2, physical performance Level B, Model 2, with core construction as required by the manufacturer for interior doors, of

size(s) and design(s) indicated. Where vertical stiffener cores are required, the space between the stiffeners must be filled with mineral board insulation.

#### 2.1.1.2 Extra Heavy Duty Doors

SDI/DOOR A250.8, Level 3, physical performance Level A, Model 2 with core construction as required by the manufacturer for indicated exterior doors, of size(s) and design(s) indicated. Where vertical stiffener cores are required, the space between the stiffeners must be filled with mineral board insulation.

#### 2.1.1.3 Maximum Duty Doors

SDI/DOOR A250.8, Level 4, physical performance Level A, Model 2 with core construction as required by the manufacturer for indicated exterior doors, of size(s) and design(s) indicated. Where vertical stiffener cores are required, the space between the stiffeners must be filled with mineral board insulation.

### 2.2 CUSTOM HOLLOW METAL DOORS

Provide custom hollow metal doors where nonstandard steel doors are indicated. At the Contractor's option, custom hollow metal doors may be provided in lieu of standard steel doors. Provide standard steel doors in the door size(s), design(s), materials, construction, gages, and finish as specified for standard steel doors and complying with the requirements of NAAMM HMMA 810. Fill all spaces in doors with insulation. Close top and bottom edges with steel channels not lighter than 16 gage. Close tops of exterior doors flush with an additional channel and seal to prevent water intrusion. Prepare doors to receive hardware specified in Section 08 71 00 DOOR HARDWARE. Undercut doors where indicated. Provide doors at 1-3/4 inch thick, unless otherwise indicated.

### 2.3 INSULATED STEEL DOOR SYSTEMS

At the option of the Contractor, insulated steel doors and frames may be provided in lieu of Level 1 standard steel doors and frames. Provide insulated steel doors in the door size(s), design, and material as specified for standard steel doors. Provide insulated steel doors with a core of polyurethane foam; face sheets, edges, and frames of galvanized steel not lighter than 23 gage, 16 gage, and 16 gage respectively; magnetic weatherstripping; nonremovable-pin hinges; thermal-break aluminum threshold; and vinyl door bottom. Provide to doors and frames a phosphate treatment, rust-inhibitive primer, and baked acrylic enamel finish. Test doors in accordance with SDI/DOOR A250.4 and meet the requirements for Level C. Prepare doors to receive specified hardware. Provide doors 1-3/4 inch thick.

### 2.4 SOUND RATED STEEL DOORS

Provide sound rated doors with a Sound Transmission Class (STC) as indicated on the drawings.

### 2.5 ACCESSORIES

#### 2.5.1 Astragals

For pairs of exterior steel doors which will not have aluminum astragals

or removable mullions, as specified in Section 08 71 00 DOOR HARDWARE provide overlapping steel astragals with the doors. For interior pairs of fire rated and smoke control doors, provide stainless steel astragals complying with NFPA 80 for fire rated assemblies and NFPA 105 for smoke control assemblies.

## 2.6 INSULATION CORES

Provide insulating cores of the type specified, and provide an apparent U-factor of .48 in accordance with SDI/DOOR 113 and conforming to:

- a. Rigid Cellular Polyisocyanurate Foam: ASTM C591, Type I or II, foamed-in-place or in board form, with oxygen index of not less than 22 percent when tested in accordance with ASTM D2863; or
- b. Rigid Polystyrene Foam Board: ASTM C578, Type I or II; or
- c. Mineral board: ASTM C612, Type I.

## 2.7 STANDARD STEEL FRAMES

SDI/DOOR A250.8, Level 2, except as otherwise specified. Form frames to sizes and shapes indicated, with welded corners. Provide steel frames for doors, transoms, sidelights, mullions, cased openings, and interior glazed panels, unless otherwise indicated. Provide frame product that uses a minimum of 25 percent recycled content. Provide data indicating percentage of recycled content for steel frame product.

### 2.7.1 Welded Frames

Continuously weld frame faces at corner joints. Mechanically interlock or continuously weld stops and rabbets. Grind welds smooth.

Weld frames in accordance with the recommended practice of the Structural Welding Code Sections 1 through 6, AWS D1.1/D1.1M and in accordance with the practice specified by the producer of the metal being welded.

### 2.7.2 Knock-Down Frames

Design corners for simple field assembly by concealed tenons, splice plates, or interlocking joints that produce square, rigid corners and a tight fit and maintain the alignment of adjoining members. Provide locknuts for bolted connections.

### 2.7.3 Mullions and Transom Bars

Provide mullions and transom bars of closed or tubular construction with heads and jambs butt-welded together or knock-down for field assembly. Bottom of door mullions must have adjustable floor anchors and spreader connections.

### 2.7.4 Stops and Beads

Form stops and beads from 20 gage steel. Provide for glazed and other openings in standard steel frames. Secure beads to frames with oval-head, countersunk Phillips self-tapping sheet metal screws or concealed clips and fasteners. Space fasteners approximately 12 to 16 inch on center. Miter molded shapes at corners. Butt or miter square or rectangular beads at corners.

### 2.7.5 Terminated Stops

Where indicated, terminate interior door frame stops 6 inch above floor. Do not terminate stops of frames for lightproof, soundproof, doors.

### 2.7.6 Cased Openings

Fabricate frames for cased openings of same material, gage, and assembly as specified for metal door frames, except omit door stops and preparation for hardware.

### 2.7.7 Anchors

Provide anchors to secure the frame to adjoining construction. Provide steel anchors, zinc-coated or painted with rust-inhibitive paint, not lighter than 18 gage.

#### 2.7.7.1 Wall Anchors

Provide at least three anchors for each jamb. For frames which are more than 7.5 feet in height, provide one additional anchor for each jamb for each additional 2.5 feet or fraction thereof.

- a. Masonry: Provide anchors of corrugated or perforated steel straps or 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;
- c. Completed openings: Secure frames to previously placed concrete or masonry with expansion bolts in accordance with SDI/DOOR 111; and
- d. Solid plaster partitions: Secure anchors solidly to back of frames and tie into the lath. Provide adjustable top strut anchors on each side of frame for fastening to structural members or ceiling construction above. Provide size and type of strut anchors as recommended by the frame manufacturer.

#### 2.7.7.2 Floor Anchors

Provide floor anchors drilled for 3/8 inch anchor bolts at bottom of each jamb member. Where floor fill occurs, terminate bottom of frames at the indicated finished floor levels and support by adjustable extension clips resting on and anchored to the structural slabs.

## 2.8 FIRE AND SMOKE DOORS AND FRAMES

NFPA 80 and NFPA 105 and this specification. The requirements of NFPA 80 and NFPA 105 takes precedence over details indicated or specified.

### 2.8.1 Labels

Provide fire doors and frames bearing the label of Underwriters Laboratories (UL), Factory Mutual Engineering and Research (FM), or Warnock Hersey International (WHI) attesting to the rating required.

Testing must be in accordance with NFPA 252 or UL 10C. Provide labels that are metal with raised letters, bearing the name or file number of the door and frame manufacturer. Labels must be permanently affixed at the factory to frames and to the hinge edge of the door. Do not paint door and labels.

#### 2.8.2 Oversized Doors

For fire doors and frames which exceed the size for which testing and labeling are available, furnish certificates stating that the doors and frames are identical in design, materials, and construction to a door which has been tested and meets the requirements for the class indicated.

#### 2.8.3 Astragal on Fire and Smoke Doors

On pairs of labeled fire doors, conform to NFPA 80 and UL requirements. On smoke control doors, conform to NFPA 105.

#### 2.9 WEATHERSTRIPPING

As specified in Section 08 71 00 DOOR HARDWARE.

#### 2.10 HARDWARE PREPARATION

Provide minimum hardware reinforcing gages as specified in SDI/DOOR A250.6. Drill and tap doors and frames to receive finish hardware. Prepare doors and frames for hardware in accordance with the applicable requirements of SDI/DOOR A250.8 and SDI/DOOR A250.6. For additional requirements refer to ANSI/BHMA A156.115. Drill and tap for surface-applied hardware at the project site. Build additional reinforcing for surface-applied hardware into the door at the factory. Locate hardware in accordance with the requirements of SDI/DOOR A250.8, as applicable. Punch door frames, with the exception of frames that will have weatherstripping or lightproof or soundproof 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.

#### 2.11 FINISHES

##### 2.11.1 Hot-Dip Zinc-Coated and Factory-Primed Finish

Fabricate scheduled doors and frames from hot dipped zinc coated steel, alloyed type, that complies with ASTM A924/A924M and ASTM A653/A653M. The coating weight must meet or exceed the minimum requirements for coatings having 0.4 ounces per square foot, total both sides, i.e., A40. Repair damaged zinc-coated surfaces by the application of zinc dust paint. Thoroughly clean and chemically treat to insure maximum paint adhesion. Factory prime as specified in SDI/DOOR A250.8..

#### 2.12 FABRICATION AND WORKMANSHIP

Provide finished doors and frames that are strong and rigid, neat in appearance, and free from defects, waves, scratches, cuts, dents, ridges, holes, warp, and buckle. Provide molded members that are clean cut, straight, and true, with joints coped or mitered, well formed, and in true alignment. Dress exposed welded and soldered joints smooth. Design door frame sections for use with the wall construction indicated. Corner joints must be well formed and in true alignment. Conceal fastenings

where practicable. Frames for use in solid plaster partitions must be welded construction. On wraparound frames for masonry partitions, provide a throat opening 1/8 inch larger than the actual masonry thickness.

#### 2.12.1 Grouted Frames

For frames to be installed in exterior walls and to be filled with mortar or grout, fill the stops with strips of rigid insulation to keep the grout out of the stops and to facilitate installation of stop-applied head and jamb seals.

#### 2.13 PROVISIONS FOR GLAZING

Materials are specified in Section 08 81 00, GLAZING.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

##### 3.1.1 Frames

Set frames in accordance with SDI/DOOR A250.11. Plumb, align, and brace securely until permanent anchors are set. Anchor bottoms of frames with expansion bolts or powder-actuated fasteners. Build in or secure wall anchors to adjoining construction. Where frames require ceiling struts or overhead bracing, anchor frames to the struts or bracing.

##### 3.1.2 Doors

Hang doors in accordance with clearances specified in SDI/DOOR A250.8. After erection and glazing, clean and adjust hardware.

##### 3.1.3 Fire and Smoke Doors and Frames

Install fire doors and frames, including hardware, in accordance with NFPA 80. Install fire rated smoke doors and frames in accordance with NFPA 80 and NFPA 105.

#### 3.2 PROTECTION

Protect doors and frames from damage. Repair damaged doors and frames prior to completion and acceptance of the project or replace with new, as directed. Wire brush rusted frames until rust is removed. Clean thoroughly. Apply an all-over coat of rust-inhibitive paint of the same type used for shop coat.

#### 3.3 CLEANING

Upon completion, clean exposed surfaces of doors and frames thoroughly. Remove mastic smears and other unsightly marks.

-- End of Section --

SECTION 08 11 16

ALUMINUM DOORS AND FRAMES

**05/17, CHG 2: 11/18**

PART 1 GENERAL

1.1 REFERENCES

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

ALUMINUM ASSOCIATION (AA)

AA DAF45 (2003; Reaffirmed 2009) Designation System for Aluminum Finishes

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 2603 (2020) Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels

AAMA 2604 (2017a) Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 90.1 - IP (2013) Energy Standard for Buildings Except Low-Rise Residential Buildings

ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M (2019) Standard Specification for Carbon Structural Steel

ASTM B209 (2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

ASTM B209M (2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric)

ASTM B221 (2014) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

ASTM B221M (2013) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)

ASTM E283 (2019) Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls,



and Doors Under Specified Pressure  
Differences Across the Specimen

ASTM E331	(2000; R 2016) Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E1886	(2019) Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials
ASTM E1996	(2017) Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes
ASTM F1642/F1642M	(2017) Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loadings
ASTM F1643	(2012) Standard Test Methods for Detention Sliding Door Locking Device Assembly
ASTM F2247	(2018) Standard Test Method for Metal Doors Used in Blast Resistant Applications (Equivalent Static Load Method)
ASTM F2927	(2012) Standard Test Method for Door Systems Subject to Airblast Loadings

#### NATIONAL FENESTRATION RATING COUNCIL (NFRC)

NFRC 100	(2017) Procedure for Determining Fenestration Product U-Factors
NFRC 200	(2017) Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence

## 1.2 PERFORMANCE REQUIREMENTS

### 1.2.1 Structural Calculations

#### 1.2.1.1 Minimum Antiterrorism Performance

Provide doors meeting the minimum antiterrorism performance as specified in the paragraphs below.

#### [ a. Dynamic Design Analysis Method

As an alternative to the static equivalent load design approach described above, glazed opening framing members, anchors, and glazing may be designed using a dynamic analysis to prove the glazed opening system will provide performance equivalent to or better than a very

low hazard rating in accordance with ASTM F1642/F1642M associated with the applicable low level of protection for the project.

#### 1.1.2.1 Standard Airblast Test Method

Testing in accordance with ASTM F2927 may be by shock tube or arena test. Perform the test on the entire proposed door assembly, which must include, but not be limited to, the glazing, its framing/support system, operating devices, and all anchorage devices. Install door system anchorage that replicates the method of installation to be used for the project. Utilize the fasteners and anchorage methods used to attach the tested door assembly that are representative of the actual door installation. Demonstrate by calculation any deviations in actual installation of the connections or the connected elements from those tested to provide the damage level as indicated below.

The minimum airblast loading parameters for the test must be as follows: peak positive pressure of [ ] pounds per square inch (psi); and peak positive phase impulse of [ ] pounds per square inch - millisecond (psi-msec).

The acceptance criteria for the proposed door systems, as determined by the damage level/door response damage criteria of [ASTM F2247][ASTM F2927], will provide a performance equivalent to or better than a category [IV]; [III]; [ ] door damage level rating. [ Door glazing performance must be equivalent to or better than [H3- Very Low][H4-Low] hazard rating in accordance with ASTM F1642/F1642M.]

#### 1.1.2.2 Wind Borne Debris

Provide impact resistant door [ ] assemblies meeting the Windborne-Debris-Impact Resistant Performance requirements of ASTM E1996 and ASTM E1886 as follows:

- (1) Pass missile-impact tests when tested according to ASTM E1886 and meeting performance requirements according to ASTM E1996 for missiles A and D in Table 2.

#### 1.1.2.3 Air Infiltration

When tested in accordance with ASTM E283, air infiltration per door leaf cannot exceed 0.6 cubic feet per minute per square foot of fixed area at a test pressure of 6.24 pounds per square foot.

#### 1.1.2.4 Water Penetration

When tested in accordance with ASTM E331, there can be no water penetration at a pressure of 2.86 pounds per square foot of fixed area.

#### 1.1.2.5 Thermal Transmittance, Solar Heat Gain, Visible Light Transmittance

Provide products bearing NFRC Project Label Certificates for Fenestration verifying compliance with requirements for each assembly indicated. An NFRC Bid Report, or approved equal, for field assembled exterior doors may be submitted in lieu of Project Label Certificates for Fenestration if such reports are created in accordance with NFRC CAMP procedures and are provided by the manufacturer. Such alternate reports may be submitted with shop drawings, however, NFRC validated Project Label Certificates for Fenestration are required as a Closeout Submittal. Contact NFRC for

information on **NFRC 100** and **NFRC 200** Compliance and Monitoring Program (CAMP) rating requirements:

<http://www.nfrc.org/industry/certification/compliance-and-monitoring-program-camp/>

#### 1.2.5.1 U-Factor

Provide exterior glazed assemblies, including aluminum entrances doors with greater than 50 percent glazed area, certified by the NFRC as having a whole window U-factor of [\_\_\_\_\_] or less as determined in accordance with **ASHRAE 90.1 - IP** and as verified in accordance with **NFRC 100**.

#### 1.2.5.2 Solar Heat Gain Coefficient (SHGC)

Provide exterior glazed assemblies, including aluminum entrances doors with greater than 50 percent glazed area, certified by the National Fenestration Rating Council with a whole window SHGC of [\_\_\_\_\_] or less as determined in accordance with **ASHRAE 90.1 - IP** and as verified in accordance with **NFRC 200**.

#### 1.2.5.3 Visible Light Transmittance (VLT)

Provide exterior glazed assemblies, including aluminum entrances doors with greater than 50 percent glazed area, certified by the NFRC with a whole window VLT of [\_\_\_\_\_] or greater as determined in accordance with **ASHRAE 90.1 - IP** and as verified in accordance with **NFRC 200**.

#### [1.2.5.4 Doors with Less than 50 Percent Glazed Area

For exterior aluminum entrances doors with less than 50 percent glazed area, the glazed area is considered the fenestration area and must be certified by the National Fenestration Rating Council with a whole window U-Factor, SHGC and VLT as required above.

### ]1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section **01 33 00** SUBMITTAL PROCEDURES:

#### SD-02 Shop Drawings

For Each Type of Door and Frame Assembly; G[, [\_\_\_\_\_] ]

#### SD-03 Product Data

For Each Type of Door and Frame Assembly; G[, [\_\_\_\_\_] ]

Recycled Content of Aluminum Material; S

#### SD-04 Samples

Finish Samples; G[, [\_\_\_\_\_] ]

#### SD-05 Design Data

[ Design Analysis; G[, [\_\_\_\_\_] ]

] Structural Calculations for Deflection and Antiterrorism; G[, [\_\_\_\_]]

SD-06 Test Reports

Air Infiltration; G[, [\_\_\_\_]]

Water Penetration; G[, [\_\_\_\_]]

[ Standard Airblast; G[, [\_\_\_\_]]

] SD-07 Certificates

NFRC Project Label Certificates for Fenestration; G[, [\_\_\_\_]]

SD-08 Manufacturer's Instructions

Installation of Each Type of Door and Frame Assembly; G[, [\_\_\_\_]]

SD-10 Operation and Maintenance Data

Adjustments, Cleaning, and Maintenance; G[, [\_\_\_\_]]

SD-11 Closeout Submittals

NFRC Project Label Certificates for Fenestration; G[, [\_\_\_\_]]

#### 1.4 DELIVERY, STORAGE, AND HANDLING

Inspect materials delivered to the site for damage. Unload and store with minimum handling. Provide storage space in dry location with adequate ventilation, free from dust or water, and easily accessible for inspection and handling. Stack materials on non-absorptive strips or wood platforms. Do not cover doors and frames with tarps, polyethylene film, or similar coverings. Protect finished surfaces during shipping and handling using manufacturer's standard method. Do not apply coatings or lacquers to surfaces to which caulking and glazing compounds must adhere.

#### 1.5 QUALITY CONTROL

##### 1.5.1 Shop Drawing

Indicate elevations and sections for each type of door and frame assembly. Show sizes and details of each assembly, frame construction, [subframe attachment,] thickness and gages of metal, details of door and frame construction, proposed method(s) of anchorage, glazing details, provisions for an location of hardware, [mullion details,] method and materials for flashing and weatherstripping, miscellaneous trim, installation details, and other related items necessary for a complete representation of all components. A qualified blast engineer must perform testing or calculations for door system design resistance to specified blast loads.

##### 1.5.2 Finish Samples

Submit two color charts and two finish sample chips from manufacturer's standard color and finish options for each type of finish indicated.

### [1.5.3 Design Analysis

Submit design analysis with calculations showing that the design of each different size and type of door unit [\_\_\_\_\_] and its anchorage to the structure meets the minimum antiterrorism standards required by paragraph MINIMUM ANTITERRORISM PERFORMANCE[, unless conformance is demonstrated by standard blast test results]. Calculations verifying the performance of each door [\_\_\_\_\_] proposed for use, under the given loads, must be prepared and signed by a registered Professional Engineer. The door [\_\_\_\_\_] components and anchorage devices to the structure, as determined by the design analysis, must be reflected in the shop drawings.

### ]1.5.4 Test Reports

Test door assembly [including glazing ]for evaluation of hazards generated from airblast loading in accordance with [ASTM F2247][ASTM F2927] by an independent testing agency regularly engaged in blast testing. This test method and the resulting data are valid for the door size tested and smaller doors of identical construction.

[ Design Door assembly (including glazing) using a dynamic analysis to prove the performance equivalent to or better than a category [IV];[III];[\_\_\_\_\_] door damage level in accordance with ASTM F2927 for the peak positive pressure of [\_\_\_\_\_] pounds per square inch (psi); and peak positive phase impulse of [\_\_\_\_\_] pounds per square inch - millisecond (psi-msec). Use a triangular blast load using the applicable pressure and impulse identified above.

] [For minimum Antiterrorism doors [\_\_\_\_\_] , in lieu of a Design Analysis, submit results of standard blast testing, included in a test report, providing information in accordance with [ASTM F2247][ASTM F2927], as prepared by the independent testing agency performing the test. The test results must demonstrate the ability of each door [\_\_\_\_\_] proposed for use to withstand the blast loading parameters and achieve the damage [hazard] level rating specified in paragraph TESTING.

] [Testing in accordance with ASTM F2927 may be by shock tube or arena test. Perform the test on the entire proposed door assembly, which must include, but not be limited to, the glazing, its framing/support system, operating devices, and all anchorage devices. Install door system anchorage that replicates the method of installation to be used for the project. Utilize the fasteners and anchorage methods used to attach the tested door assembly that are representative of the actual door installation. Demonstrate by calculation any deviations in actual installation of the connections or the connected elements from those tested to provide the damage level as indicated below.

The minimum airblast loading parameters for the test must be as follows: peak positive pressure of [\_\_\_\_\_] pounds per square inch (psi); and peak positive phase impulse of [\_\_\_\_\_] pounds per square inch - millisecond (psi-msec).

] The acceptance criteria for the proposed door systems, as determined by the damage level/door response damage criterial of [ASTM F2247][ASTM F2927], will provide a performance equivalent to or better than a category [IV]; [III]; [\_\_\_\_\_] door damage level rating.[ Door glazing performance must be equivalent to or better than [H3 - Very low][H4 - Low] hazard rating in accordance with ASTM F1643.]

### 1.5.5 Operation and Maintenance Data

Submit detailed instructions for installation, adjustments, cleaning, and maintenance of each type of assembly indicated.

## 1.6 QUALITY ASSURANCE

### 1.6.1 Engineer Qualifications for Blast Design

All blast design calculations must be performed by or under the direct supervision of a registered engineer with a minimum of 5 years' experience performing blast design. The engineering firm performing the blast design must be able to demonstrate experience on similar size projects using similar design methods to meet the requirements outlined in this specification.

## PART 2 PRODUCTS

### 2.1 DOORS AND FRAMES

Provide swing-type aluminum doors and frames of size, design, and location indicated. Provide doors complete with frames, framing members[, subframes][, transoms][, adjoining side lites] , trim, and accessories.[ Coordinate side lites, window walls, adjacent curtainwall with Section 08 41 13 ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS][ and Section 08 44 00 CURTAIN WALL AND GLAZED ASSEMBLIES.]

### 2.2 MATERIALS

#### 2.2.1 Anchors

Stainless steel [or steel with hot-dipped galvanized finish].

#### 2.2.2 Weatherstripping

Continuous wool pile, silicone treated, or type recommended by door manufacturer.

#### 2.2.3 Aluminum Alloy for Doors and Frames

ASTM B221M, ASTM B221, Alloy 6063-T5 for extrusions. ASTM B209M, ASTM B209, alloy and temper best suited for aluminum sheets and strips. Provide aluminum materials that include a minimum of 30 percent recycled content. Provide data indicating percentage of recycled content of aluminum material.

#### 2.2.4 Fasteners

Hard aluminum or stainless steel.

#### 2.2.5 Structural Steel

ASTM A36/A36M.

#### 2.2.6 Aluminum Paint

Aluminum door manufacturer's standard aluminum paint.

## 2.3 FABRICATION

### 2.3.1 Aluminum Frames

Extruded aluminum shapes with contours approximately as indicated. Provide removable glass stops and glazing beads for frames accommodating fixed glass. Use countersunk stainless steel Phillips screws for exposed fastenings, and space not more than 12 inches on center. Mill joints in frame members to a hairline fit, reinforce, and secure mechanically.

### 2.3.2 Aluminum Doors

Of type, size, and design indicated and minimum 1-3/4 inch thick. minimum wall thickness, 0.125 inch, except beads and trim, 0.050 inch. Door sizes shown are nominal; include standard clearances as follows: 0.093 inch at hinge and lock stiles, 0.125 inch between meeting stiles, 0.125 inch at top rails, 0.187 inch between bottom and threshold, and 0.687 inch between bottom and floor.[ Provide bevel single-acting doors 0.063 or 0.125 inch at lock, hinge, and meeting stile edges.][ Provide double-acting doors rounded edges at hinge stile, lock stile, and meeting stile edges.]

#### 2.3.2.1 Full Glazed Stile and Rail Doors

Provide doors with [narrow][medium][wide] stiles and rails as indicated. Fabricate from extruded aluminum hollow seamless tubes or from a combination of open-shaped members interlocked or welded together. Fasten top and bottom rail together by means of welding or by 3/8 or 1/2 inch diameter cadmium-plated tensioned steel tie rods. Provide an adjustable mechanism of jack screws or other methods in the top rail to allow for minor clearance adjustments after installation.

#### 2.3.2.2 Flush Doors

Use facing sheets with[ a vertical ribbed][ an embossed][ or][ a plain smooth] surface. Use one of the following constructions:

- a. A phenolic resin-impregnated kraft paper honeycomb core, surrounded at edges and around glass and louvered areas with extruded aluminum shapes. Provide cores with a minimum impregnation of 18 percent resin content. Provide sheet aluminum door facings minimum 0.032 inch thick laminated to a 0.10 inch thick tempered hardboard backing, with the backing bonded to the honeycomb core. Bond facing sheets to cores under heat and pressure with thermosetting adhesive and mechanically lock to extruded edge members.
- b. A phenolic resin-impregnated kraft paper honeycomb core. Use aluminum facing sheets minimum 0.050 inch thick and form into two pans to eliminate seams on faces. Bond honeycomb core to face sheets using epoxy resin or contact cement-type adhesive.
- c. A solid fibrous core, surrounded at edges and around glass and louvered areas and cross braced at intermediate points with extruded aluminum shapes. Use aluminum facing sheets of minimum 0.050 inch thickness. Bond facing sheets to core under heat and pressure with a thermosetting adhesive, and mechanically lock to the extruded edge members.
- d. Form from extruded tubular stiles and rails mitered at corners, reinforce, and continuously weld at miters. Provide facing sheets of

minimum 0.032 inch thick sheet aluminum internally reinforced with aluminum channels or Z-bars placed horizontally not more than 16 inch apart and extending the full width of panels. Fit spaces between reinforcing with sound-deadening insulation. Weld facing sheets to reinforcing bars or channels and to stiles and rails. Finish facing sheets flush with faces of stiles and rails.

- e. Form from an internal grid composed of extruded aluminum tubular sections. Provide tubular sections at all sides and perimeter of louver and glass openings. Provide three extruded aluminum tubular sections at top and bottom of each door. Provide wall thickness of tubular sections minimum 0.09 inch except at lock rails which must be minimum 0.125 inch thick, hinge lock rails which must be minimum 0.125 inch thick, and hinge rail edges which must be minimum 0.19 inch thick. Fill spaces in door with mineral insulation. Provide facing sheets of aluminum minimum 0.09 inch thick.
- f. Form from extruded aluminum members at top and bottom, both sides, and at perimeters of louver and glass openings. Provide wall sections of extruded aluminum members minimum 0.09 inch thick and reinforce for application of hardware. Cover framing members on both sides with aluminum facing sheets minimum 0.064 inch thick. Fill door panels with [25 pounds per square inch density polystyrene] [2.5 pound per cubic foot density, chlorofluorocarbon (CFC) free, foamed urethane] with a flame spread rating of no more than 25.

#### 2.3.3 Welding and Fastening

Where possible, locate welds on unexposed surfaces. Dress welds on exposed surfaces smoothly. Select welding rods, filler wire, and flux to produce a uniform texture and color in finished work. Remove flux and spatter from surfaces immediately after welding. Exposed screws or bolts will be permitted only in inconspicuous locations, and must have countersunk heads. Weld concealed reinforcements for hardware in place.

#### 2.3.4 Weatherstripping

Provide on stiles and rails of exterior doors. Fit into slots which are integral with doors or frames. Weatherstripping must be replaceable without special tools, and adjustable at meeting rails of pairs of doors. During installation, verify doors swing freely and close positively. Refer to paragraph AIR INFILTRATION for air leakage requirements and testing.

#### 2.3.5 Anchors

On the backs of subframes, provide anchors of the sizes and shapes indicated for securing subframes to adjacent construction. Anchor transom bars at ends and mullions at head and sill.[ Where indicated, reinforce vertical mullions with structural steel members of sufficient length to extend up to the overhead structural slab or framing and secure thereto.][ Reinforce and anchor freestanding door frames to floor construction as indicated on approved shop drawings and in accordance with manufacturer's recommendation.] Place anchors [as indicated][near top and bottom of each jamb and at intermediate points not more than 25 inch apart].



### 2.3.6 Provisions for Hardware

Coordinate with Section 08 71 00 DOOR HARDWARE. Deliver hardware templates and hardware (except field-applied hardware) to the door manufacturer for use in fabrication of aluminum doors and frames. Cut, reinforce, drill, and tap doors and frames at the factory to receive template hardware. Provide doors to receive surface-applied hardware, except push plates, kick plates, and mop plates, with reinforcing only; drill and tap in the field. Provide hardware reinforcements of stainless steel or steel with hot-dipped galvanized finish, and secure with stainless steel screws. [ Provide reinforcement in core of flush doors as required to receive locks, door closers, and other hardware.]

### 2.3.7 Provisions for Glazing

[Provide extruded aluminum snap-in glazing beads on interior side of doors.][Provide extruded aluminum, theft-proof, snap-in glazing beads or fixed glazing beads on exterior or security side of doors.][ Provide glazing beads with vinyl insert glazing gaskets.][ Design glazing beads to receive thickness indicated for each glazed assembly.] Coordinate requirements with Section 08 81 00 GLAZING.

### 2.3.8 Finishes

Provide exposed aluminum surfaces with [mill finish] [factory finish of anodic coating or organic coating].

#### 2.3.8.1 Anodic Coating

Clean exposed aluminum surfaces and provide an anodized finish conforming to AA DAF45. Provide [clear (natural), designation AA-M10-C22-A31, Architectural Class II 0.4 mil to 0.7 mil][clear (natural), designation AA-M10-C22-A41, Architectural Class I 0.7 mil or thicker)][integral color-anodized, designation AA-M10-C22-A32, Architectural Class II 0.4 mil to 0.7 mil][integral color-anodized, designation AA-M10-C22-A42, Architectural Class I 0.7 mil or thicker][ electrolytically deposited color-anodized, designation AA-M10-C22-A34, Architectural Class II 0.4 mil to 0.7 mil][electrolytically deposited color-anodized, designation AA-M10-C22-A44, Architectural Class I 0.7 mil or thicker] finish. [ Provide material(s) in color(s) [\_\_\_\_\_] [as indicated][as selected from manufacturer's [standard][complete] range of color options]].

#### 2.3.8.2 Organic Coating

Clean and prime exposed aluminum surfaces. Provide [a baked enamel finish in accordance with AAMA 2603 with total dry film thickness minimum 0.8 mil ][a high-performance finish in accordance with AAMA 2604 with total dry film thickness of minimum 1.2 mils]. Finish color to be [\_\_\_\_\_] [as indicated] [as selected from manufacturer's [standard][complete] range of color options].

## PART 3 EXECUTION

### 3.1 INSTALLATION

Plumb, square, level, and align frames and framing members to receive doors[, transoms][, adjoining side lites][, and][, adjoining window walls]. Anchor frames to adjacent construction as indicated and in accordance with manufacturer's printed instructions and the approved shop

drawings. Install anchorage that complies with applicable structural requirements. Anchor bottom of each frame to rough floor construction with 3/32 inch thick minimum stainless steel angle clips secured to back of each jamb and to floor construction; use stainless steel bolts and expansion rivets for fastening clip anchors. Hang doors to produce clearances specified in paragraph ALUMINUM DOORS. After erection and glazing, adjust doors and hardware to operate properly.

### 3.2 PROTECTION FROM DISSIMILAR MATERIALS

#### 3.2.1 Dissimilar Metals

Where aluminum surfaces come in contact with metals other than stainless steel, zinc, or small areas of white bronze, protect from direct contact to dissimilar metals.

##### 3.2.1.1 Protection

Provide one of the following systems to protect surfaces in contact with dissimilar metals:

- a. Paint the dissimilar metal with one coat of heavy-bodied bituminous paint.
- b. Apply elastomeric sealant between aluminum and dissimilar metals in accordance with Section 07 92 00 JOINT SEALANTS.
- c. Paint dissimilar metals with one coat of primer and one coat of aluminum paint.
- d. Use a non-absorptive tape or gasket in permanently dry locations.

#### 3.2.2 Drainage from Dissimilar Metals

In locations where drainage from dissimilar metals has direct contact with aluminum, provide protective paint to prevent aluminum discoloration.

#### 3.2.3 Masonry and Concrete

Provide aluminum surfaces in contact with mortar, concrete, or other masonry materials with one coat of heavy-bodied bituminous paint.

#### 3.2.4 Wood or Other Absorptive Materials

Provide aluminum surfaces in contact with absorptive materials subject to frequent moisture, and aluminum surfaces in contact with treated wood, with two coats of aluminum paint or one coat of heavy-bodied bituminous paint. In lieu of painting aluminum, paint the wood or other absorptive surface with two coats of aluminum paint and seal joints with elastomeric sealant.

### 3.3 SEALING AROUND ASSEMBLIES

Seal all penetrations of the air barrier by sealing around door openings as necessary to achieve compliance with air leakage requirements indicated in [the air barrier sections of the specifications][, the requirements of Section 07 27 10.00 10 BUILDING AIR BARRIER SYSTEM][, and Section 07 05 23 PRESSURE TESTING AN AIR BARRIER SYSTEM FOR AIR TIGHTNESS]. Flash all doors with corrosion resistant flashing to prevent water intrusion.

#### 3.4 CLEANING

Upon completion of installation, clean door and frame surfaces in accordance with door manufacturer's written recommended procedure. Do not use abrasive, caustic, or acid cleaning agents.

#### 3.5 PROTECTION

Protect doors and frames from damage and from contamination by other materials such as cement mortar. Prior to completion and acceptance of the work, restore damaged doors and frames to original condition, or replace with new ones.

-- End of Section --

SECTION 08 14 00

WOOD DOORS

**08/16, CHG 1: 08/18**

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN FOREST FOUNDATION (AFF)

ATFS STANDARDS (2015) American Tree Farm System Standards of Sustainability 2015-2020

ASTM INTERNATIONAL (ASTM)

ASTM E90 (2009; R2016) Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

ASTM E283 (2019) Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

ASTM E2226 (2015; R 2019b) Standard Practice for Application of Hose Stream

CALIFORNIA AIR RESOURCES BOARD (CARB)

CARB 93120 (2007) Airborne Toxic Control Measure (ATCM) to Reduce Formaldehyde Emissions from Composite Wood Products

CSA GROUP (CSA)

CSA Z809-08 (R2013) Sustainable Forest Management

FOREST STEWARDSHIP COUNCIL (FSC)

FSC STD 01 001 (2015) Principles and Criteria for Forest Stewardship

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI/NEMA LD 3 (2005) Standard for High-Pressure Decorative Laminates

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80 (2019) Standard for Fire Doors and Other

## Opening Protectives

NFPA 105 (2019) Standard for Smoke Door Assemblies and Other Opening Protectives

NFPA 252 (2017) Standard Methods of Fire Tests of Door Assemblies

## PROGRAMME FOR ENDORSEMENT OF FOREST CERTIFICATION (PEFC)

PEFC ST 2002:2013 (2015) PEFC International Standard Chain of Custody of Forest Based Products Requirements

## SUSTAINABLE FOREST INITIATIVE (SFI)

SFI 2015-2019 (2015) Standards, Rules for Label Use, Procedures and Guidance

## U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 770 Formaldehyde Standards for Composite Wood Products

## UNDERWRITERS LABORATORIES (UL)

UL 10B (2008; Reprint May 2020) Fire Tests of Door Assemblies

## WINDOW AND DOOR MANUFACTURERS ASSOCIATION (WDMA)

ANSI/WDMA I.S.1A (2013) Interior Architectural Wood Flush Doors

ANSI/WDMA I.S.6A (2013) Interior Architectural Stile and Rail Doors

## WOODWORK INSTITUTE (WI)

NAAWS 3.1 (2017; 2018 Errata Edition) North American Architectural Woodwork Standards

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

### SD-02 Shop Drawings

Doors; G[, [\_\_\_\_]]

Submit drawings or catalog data showing each type of door unit [; include descriptive data of head and jamb weatherstripping with installation instructions]. Indicate within drawings and data the door types and construction, sizes, thickness, [methods of

assembly,] [door louvers,] and [glazing,].

#### SD-03 Product Data

Doors; G[, [\_\_\_\_\_]]

[ Recycled Content for Door Cores; S

] Accessories

Water-resistant Sealer

Sample Warranty

[ Sound Transmission Class Rating; G[, [\_\_\_\_\_]]

][ Fire Resistance Rating; G[, [\_\_\_\_\_]]

] SD-04 Samples

Doors

Prior to the delivery of wood doors, submit a sample section of each type of door which shows the stile, rail, veneer, finish, and core construction.

Door Finish Colors; G[, [\_\_\_\_\_]]

Submit a minimum of three color selection samples [, minimum 3 by 5 inches in size representing wood stain] [for selection by the Contracting Officer].

#### SD-06 Test Reports

Cycle-Slam

Hinge Loading Resistance

Submit cycle-slam test report for doors tested in accordance with ANSI/WDMA I.S.1A, and hinge loading resistance test report for doors tested in accordance with ANSI/WDMA I.S.6A.

#### SD-07 Certificates

Certificates of Grade

[ Certified Sustainably Harvested Stile and Rail Wood Doors; S

][ Certified Sustainably Harvested Flush Wood Doors; S

][ Indoor Air Quality for Particleboard and Agrifiber Door Cores: S

] SD-11 Closeout Submittals

Warranty

### 1.3 CERTIFICATIONS

#### 1.3.1 Certified Wood Grades

Provide [certificates of grade](#) from the grading agency on [x-ray resistant doors], [acoustical doors], and [fire doors].

#### [1.3.2 Certified Sustainably Harvested Wood

Provide wood certified as sustainably harvested by [FSC STD 01 001](#)[, [ATFS STANDARDS](#), [CSA Z809-08](#), [SFI 2015-2019](#), or other third party program certified by [PEFC ST 2002:2013](#)]. Provide a letter of Certification of Sustainably Harvested Wood signed by the wood supplier. Identify certifying organization and their third party program name and indicate compliance with chain-of-custody program requirements. Submit sustainable wood certification data; identify each certified product on a line item basis. Submit copies of invoices bearing certification numbers.

#### ]1.3.3 Indoor Air Quality Certification

##### [1.3.3.1 Composite Wood, Wood Structural Panel and Agrifiber Products

For purposes of this specification, composite wood and agrifiber products include particleboard, medium density fiberboard (MDF), wheatboard, strawboard, panel substrates, and door cores. Provide products certified to meet requirements of both [40 CFR 770](#) and [CARB 93120](#). Provide current product certification documentation from certification body.

#### ]1.4 DELIVERY, STORAGE, AND HANDLING

Deliver doors to the site in an undamaged condition and protect against damage and dampness. Stack doors flat under cover. Support on blocking, a minimum of [4 inch](#) thick, located at each end and at the midpoint of the door. Store doors in a well-ventilated building so that they will not be exposed to excessive moisture, heat, dryness, direct sunlight, or extreme changes of temperature and humidity.[ Do not store in a building under construction until concrete, masonry work, and plaster are dry.] Replace defective or damaged doors with new ones.

### 1.5 WARRANTY

Warrant doors free of defects as set forth in the door manufacturer's standard door warranty.

## PART 2 PRODUCTS

### 2.1 DOORS

Provide doors of the types, sizes, and designs [indicated] [specified] free of urea-formaldehyde resins.

#### 2.1.1 Stile and Rail Doors

[Premium][Standard] grade Ponderosa Pine doors or [premium or select][standard] stile and rail doors conforming to [ANSI/WDMA I.S.6A](#). Furnish laminate panels in not less than three ply thickness. Provide flat panels with a minimum finished panel thickness of [1/2 inch](#) and [3/4 inch](#) thickness for raised panels.[ Provide [certified sustainably harvested stile and rail wood doors](#).]

### 2.1.2 Flush Doors

Conform to ANSI/WDMA I.S.1A for flush doors. Provide hollow core doors with lock blocks and 1 inch minimum thickness hinge stile. Hardwood stile edge bands of doors receives a natural finish, compatible with face veneer. Provide mill option for stile edge of doors scheduled to be painted. No visible finger joints will be accepted in stile edge bands. When used, locate finger-joints under hardware. Provide [certified sustainably harvested flush wood doors.](#)

#### [2.1.2.1 Exterior Flush Doors

Solid wood core, Type I conforming to ANSI/WDMA I.S.1A. Provide doors with [tempered hardboard] [medium density overlayed hardwood veneer] faces. Provide wood edge bands. Install in exterior flush doors with [aluminum] [bronze] [copper] flashings at the bottom of the openings.

#### ]2.1.2.2 Interior Flush Doors

Provide [staved lumber] [particleboard] [agrifiber] [hollow] core, Type II flush doors conforming to ANSI/WDMA I.S.1A with faces of [sound grade hardwood or hardboard for painted finish] [ [premium] [good] grade natural birch] [select [premium white] [red] birch] [[premium] [good] grade [red] [white] oak] [[premium] [good] grade walnut] [plastic laminate]. [Hardwood veneers must be [rotary cut] [plain sliced] [quarter sliced]] [[random] [slip] [book] matched]]. [Finish plastic laminate faced doors on both vertical edges with [wood] [laminated plastic] of color matching faces.] [Door cores must have a minimum recycled content of 45 percent. Provide data identifying percentage of [recycled content for door cores.](#)] [Products must contain no added urea-formaldehyde resins. Provide certification of [indoor air quality for particleboard and agrifiber door cores.](#)]

### 2.1.3 Bi-Fold Closet Doors

Provide [hardboard grade flush doors conforming to ANSI/WDMA I.S.1A.] [paneled] [louvered] doors [premium or select] [standard] grade, conforming to ANSI/WDMA I.S.6A with [1-1/8] [1-3/8] inch thickness. Equip doors with the manufacturer's standard hardware, including tracks, hinges, guides, and pulls.

### 2.1.4 Sliding Closet Doors

Provide flush wood doors to conform to ANSI/WDMA I.S.1A. Provide [paneled] [and] [louvered] doors to conform to ANSI/WDMA I.S.6A [premium or select] [standard] grade with 1-3/8 inch thickness. Equip doors with the manufacturer's standard hardware.

### 2.1.5 X-Ray Resistant Doors

ANSI/WDMA I.S.1A solid core flush doors, hardwood veneered, minimum [13/4] [2] [2 1/4] [2 1/2] inch thick, of sizes and construction indicated. Provide lead sheets with 99.9 percent pure lead, [\_\_\_\_\_] inch thickness, free from dross, oxide, inclusions, laminations, scale, blisters, and cracks. Locate lead sheets in accordance with manufacturer's standard, to extend fully from edge to edge, from top to bottom, and to be an integral part of the door. Provide wood edge strips compatible with face veneers.



#### 2.1.6 Acoustical Doors

ANSI/WDMA I.S.1A, solid core, constructed to provide Sound Transmission Class rating of [35] [\_\_\_\_\_] when tested in accordance with ASTM E90.

#### 2.1.7 [Composite-Type] Fire Doors

Provide doors specified or indicated to have a fire resistance rating conforming to the requirements of UL 10B, ASTM E2226, or NFPA 252 for the class of door indicated. Affix a permanent metal label with raised or incised markings indicating testing agency's name and approved hourly fire rating to hinge edge of each door.

#### 2.1.8 Prehung Doors

Frames for prehung interior doors to be for [painted] [clear] finish, with [3 piece adjustable jamb units] [3 piece adjustable jamb units with pins]. Provide doors complete with frame, hinges, and prepared to receive finish hardware.

### 2.2 ACCESSORIES

#### 2.2.1 Door Louvers

Fabricate from wood and of sizes indicated. Provide louvers with a minimum of 35 percent free air. Equip louvers with [slat] [sightproof inverted vee slat] type. [Block hollow core doors to provide solid anchorage for the louvers.] Mount louvers in the door with [flush wood moldings.] [wood lip moldings.]

#### 2.2.2 Door Light Openings

Provide glazed openings with the manufacturer's standard wood moldings. [Provide moldings for doors to receive natural finish of the same wood species and color as the wood face veneers.] Provide moldings on the exterior doors with sloped surfaces. [Lip type moldings for flush doors.]

#### 2.2.3 Weatherstripping

Provide weatherstripping that is a standard cataloged product of a manufacturer regularly engaged in the manufacture of this specialized item. Provide weatherstripping [tempered spring bronze] [or] [looped neoprene or vinyl held in an extruded non-ferrous metal housing]. Install [bronze weatherstripping with a minimum thickness of 0.0089 inch for sills, and a minimum thickness of 0.0063 inch elsewhere.] Air leakage of weatherstripped doors not to exceed [0.5] [1.25] cubic feet per minute of air per square foot of door area when tested in accordance with ASTM E283.

#### 2.2.4 Additional Hardware Reinforcement

Provide the minimum lock blocks to secure the specified hardware. The measurement of top, bottom, and intermediate rail blocks are a minimum 125 mm 5 inch by full core width. Comply with the manufacturer's labeling requirements for reinforcement blocking, but not mineral material similar to the core.

## 2.3 FABRICATION

### 2.3.1 Marking

Stamp each door with a brand, stamp, or other identifying mark indicating quality and construction of the door.

### 2.3.2 Quality and Construction

Identify the standard on which the construction of the door was based [, identify the standard under which preservative treatment was made,] and identify doors having a Type I glue bond.

### 2.3.3 Preservative Treatment

Treat doors scheduled for restrooms, janitor closets and other possible wet locations including exterior doors with a water-repellent preservative treatment and so marketed at the manufacturer's plant.

### 2.3.4 Adhesives and Bonds

ANSI/WDMA I.S.1A. Use Type I bond for exterior doors and Type II bond for interior doors. Provide a nonstaining adhesive on doors with a natural finish.

### 2.3.5 Prefitting

Provide factory [prefinished] [finished] [and] factory prefitted doors for the specified hardware, door frame and door-swing indicated. Machine and size doors at the factory by the door manufacturer in accordance with the standards under which the doors are produced and manufactured. The work includes sizing, beveling edges, mortising, and drilling for hardware and providing necessary beaded openings for glass and louvers. Provide the door manufacturer with the necessary hardware samples, and frame and hardware schedules to coordinate the work.

### 2.3.6 Finishes

#### 2.3.6.1 Field Painting

Factory prime or seal doors, and field paint.

#### 2.3.6.2 Factory Finish

Provide doors finished at the factory by the door manufacturer as follows: [ NAAWS 3.1 Section 1500, specification for System No. 4 Conversion varnish alkyd urea or System No. 5 Vinyl catalyzed.][ WDMA System TR-8 (UV cured acrylated polyester/urethane) or TR-2 (catalyzed lacquer) or TR-4 (conversion varnish) factory finish systems that utilize water-based stains and finishes with ultraviolet UV protection.] The coating is NAAWS 3.1 premium, medium rubbed sheen, [open] [closed] grain effect. Use stain when required to produce the finish specified for color. Seal edges, cutouts, trim, and wood accessories, and apply two coats of finish compatible with the door face finish. Touch-up finishes that are scratched or marred, or where exposed fastener holes are filled, in accordance with the door manufacturer's instructions. Match color and sheen of factory finish using materials compatible for field application.

## 2.3.6.3 Plastic Laminate Finish

Factory applied, ANSI/NEMA LD 3, General or Specific purpose type, 0.050 inch minimum thickness. Glue laminated plastic for hollow core doors to wood veneer, plywood, or hardboard backing to form door panel. Provide a combined thickness of laminate sheet and backing of 0.10 inch minimum.

## 2.3.6.4 Color

Provide door finish colors in accordance with Section 09 06 00 SCHEDULES FOR FINISHES.

## 2.3.7 Water-Resistant Sealer

Provide manufacturer's standard water-resistant sealer compatible with the specified finish[es].

## 2.4 SOURCE QUALITY CONTROL

Meet or exceed the following minimum performance criteria of stiles of "B" and "C" label fire doors utilizing standard mortise leaf hinges:

- a. **Cycle-slam:** [Standard Duty Doors: 250,000 cycles with no loose hinge screws or other visible signs of failure when tested in accordance with the requirements of ANSI/WDMA I.S.1A] [Heavy Duty Doors: 500,000 cycles with no loose hinge screws or other visible signs of failure when tested in accordance with the requirements of ANSI/WDMA I.S.1A] [Extra Heavy Duty Doors: 1,000,000 cycles with no loose hinge screws or other visible signs of failure when tested in accordance with the requirements of ANSI/WDMA I.S.1A].
- b. **Hinge loading resistance:** Averages of ten test samples not less than [Standard Duty doors: 400 pounds force] [Heavy Duty doors: 475 pounds force] [Extra Heavy Duty doors: 550 pounds force] when tested for direct screw withdrawal in accordance with ANSI/WDMA I.S.6A using a No. 12, 1-1/4 inch long, steel, fully threaded wood screw. Drill 5/32 inch pilot hole, use 1-1/2 inch opening around screw for bearing surface, and engage screw full, except for last 1/8 inch. Do not use a steel plate to reinforce screw area.

## PART 3 EXECUTION

## 3.1 INSTALLATION

Do not install building construction materials that show visual evidence of biological growth.

Before installation, seal top and bottom edges of doors with the approved water-resistant sealer. Seal cuts made on the job immediately after cutting using approved water-resistant sealer. Fit, trim, and hang doors with a 1/16 inch minimum, 1/8 inch maximum clearance at sides and top, and a 3/16 inch minimum, 1/4 inch maximum clearance over thresholds. Provide 3/8 inch minimum, 7/16 inch maximum clearance at bottom where no threshold occurs. Bevel edges of doors at the rate of 1/8 inch in 2 inch. Door warp must not exceed 1/4 inch when measured in accordance with ANSI/WDMA I.S.1A.

## 3.1.1 Fire[ and Smoke] Doors

Install fire doors in accordance with NFPA 80. [Install smoke doors in accordance with NFPA 105. ]Do not paint over labels.

## 3.1.2 Prehung Doors

Install doors in accordance with the manufacturer's instructions and details. Provide fasteners for [stops] [and] [casing trim] within 3 inch of each end and spaced 11 inch on center maximum. Provide side and head jambs joined together with a dado or notch of 3/16 inch minimum depth.

## [3.1.3 Weatherstripping

Install doors in strict accordance with the door manufacturer's printed installation instructions and details. Weatherstrip exterior swing-type doors at sills, heads and jambs to provide weathertight installation. Apply weatherstripping at sills to bottom rails of doors and hold in place with a brass or bronze plate. Apply weatherstripping to door frames at jambs and head. Shape weatherstripping at sills to suit the threshold. [Meeting stiles of exterior double-doors must be made weathertight by means of [a looped vinyl or neoprene strip in an extruded nonferrous metal housing applied to the edge of one door leaf] [a neoprene, vinyl or spring-bronze weatherstripped astragal secured to the inactive door leaf].]

] -- End of Section --

## SECTION 08 31 00

## ACCESS DOORS AND PANELS

**05/17, CHG 1: 08/18**

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2020) Structural Welding Code - Steel

## ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M (2019) Standard Specification for Carbon Structural Steel

ASTM A653/A653M (2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A666 (2015) Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar

ASTM A1008/A1008M (2020) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable

ASTM E90 (2009; R2016) Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

ASTM E119 (2020) Standard Test Methods for Fire Tests of Building Construction and Materials

ASTM E413 (2016) Classification for Rating Sound Insulation

ASTM E1332 (2016) Standard Classification for Rating Outdoor-Indoor Sound Attenuation

## MASTER PAINTERS INSTITUTE (MPI)

MPI 79 (2016) Primer, Alkyd, Anti-Corrosive for Metal

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80	(2019) Standard for Fire Doors and Other Opening Protectives
NFPA 252	(2017) Standard Methods of Fire Tests of Door Assemblies
NFPA 288	(2017) Standard Methods of Fire Tests of Horizontal Fire Door Assemblies Installed in Horizontal Fire Resistance-Rated Assemblies

## UNDERWRITERS LABORATORIES (UL)

UL 10B	(2008; Reprint May 2020) Fire Tests of Door Assemblies
UL 263	(2011; Reprint Sep 2020) UL Standard for Safety Fire Tests of Building Construction and Materials

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

Access Doors And Panels; G[, [\_\_\_\_\_]]

## SD-03 Product Data

Access Doors And Panels; G[, [\_\_\_\_\_]]

Hardware Including Locks and Keys; G[, [\_\_\_\_\_]]

Accessories; G[, [\_\_\_\_\_]]

[ Power Transfer Components; G[, [\_\_\_\_\_]]

] Recycled Content; S

## SD-04 Samples

Finishes; G[, [\_\_\_\_\_]]

[ SD-06 Test Reports

Fire-rating(s) of Assemblies; G[, [\_\_\_\_\_]]

Acoustical Ratings of Assemblies; G[, [\_\_\_\_\_]]

## ]1.3 MISCELLANEOUS REQUIREMENTS

For access doors and panels provide the following:

## 1.3.1 Shop Drawings

For field assembled access doors and panels, provide plans, elevations, sections, and details for each type of access door and panel assembly. Indicate frame, surface and edge construction, materials, and accessories. Indicate types of finished surfaces and details for panel edge conditions. Provide a door schedule with a unique number for each access door and panel, specific location in the project, location of hinges and hardware for each door.[ Indicate [acoustical ratings of assemblies as sound transmission class (STC) ratings][,][ and][ fire-rating(s) of assemblies][ and][locations and power transfer components for electrified locks and alarms].]

## 1.3.2 Product Data

For shop assembled access doors and panels, provide literature indicating sizes, types, frame and edge construction, finishes, hardware, accessories such as gaskets, seals and weatherstripping, and location of each door and panel in the project. Indicate[ acoustical ratings of assemblies,][ fire-ratings of assemblies,][ and][ locations and power transfer components for electrified locks and alarms.]. Provide details of adjoining work for each condition indicated.

## 1.3.3 Finish Samples

Submit two color charts from manufacturer's standard color and finish options for each type of frame and panel assembly finish indicated.

## [1.3.4 Test Reports

[Provide test reports for acoustical assemblies when tested in accordance with ASTM E90 and classified in accordance with ASTM E413 and ASTM E1332.][ Provide test reports for fire-rated assemblies when tested in accordance with NFPA 252 or UL 10B for fire-rated access door assemblies installed vertically and NFPA 288 for fire-rated access door assemblies installed horizontally.]

## ]1.4 PERFORMANCE REQUIREMENTS

## 1.4.1 Structural Requirements

Provide floor access assemblies to support live loads indicated for floors. Deflection must not exceed 1/180 of span.

## [1.4.2 Acoustical Requirements

Provide access panels with a minimum sound transmission class (STC) of [\_\_\_\_\_] [as indicated on the Drawings]. Provide gasketing in accordance with manufacturer's written recommendations.

## ][1.4.3 Fire-Rating Requirements

Provide access panels with a minimum fire-rating of [[\_\_\_\_\_] -Hour] [as indicated on the Drawings].

## ][1.4.4 Insulated Access Panels

Provide panels in a thickness as necessary to achieve a minimum R-value of [\_\_\_\_\_] [as indicated on the Drawings]. Provide gasketing as necessary for an airtight installation.

## ][1.4.5 Access Panels for Wet Areas

Provide panel assemblies that will be located in wet areas with corrosion resistant finishes and hardware and water resistant gasketing.

## ]1.5 DELIVERY, STORAGE, AND PROTECTION

Protect from corrosion, deformation, and other types of damage. Store items in an enclosed area free from contact with soil and weather. Remove and replace damaged items with new items.

## PART 2 PRODUCTS

## 2.1 RECYCLED CONTENT

Provide products with recycled content. Provide data for each product with recycled content, identifying percentage of recycled content.

## 2.2 MATERIALS

## 2.2.1 Steel Plates, Shapes, and Bars

Provide in accordance with ASTM A36/A36M.

## 2.2.2 Sheet Steel

Provide cold rolled steel sheet substrate in accordance with ASTM A1008/A1008M, Commercial Steel (CS), exposed.

## 2.2.3 Stainless Steel

Provide in accordance with ASTM A666, type 302 or 304.

## 2.2.4 Metallic Coated Steel Sheet

Provide in accordance with ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

## 2.2.5 Hardware

Provide automatic closing devices. Provide latch releases operable from insides of doors. [ Provide anchors in accordance with applicable fire test parameters.]

## 2.2.6 Hinges

Provide concealed spring hinges, 175 degrees of opening, with [non-]removable hinge pins[ to allow removal of door panel from frame]. Provide hinges of same steel as door and frame or in accordance with manufacturer's written recommendations. If providing non-continuous hinges, provide in numbers required to maintain alignment of door panel with frame. Provide coatings as necessary to permanently protect dissimilar metals from contact with one another; see Part 3 herein for



more information.

#### 2.2.7 Locks

Unless otherwise indicated, provide flush [screwdriver operated cam lock. Provide plastic sleeve or stainless steel bushings to protect holes in surface finishes for screwdriver to access lock.][keyed lock][tamper proof screws (spanner head locks) for access panels in locations requiring such security.][ Lock cylinders are specified in Section 08 71 00 DOOR HARDWARE.]

#### 2.2.8 Accessories

Provide anchors in size, number and location on four sides to secure access door to substrate. Provide anchors in types as recommended by manufacturer's written installation instructions for each substrate indicated. Provide shims, bushings, clips, gaskets, and other devices as necessary for a complete installation.

### 2.3 FABRICATION

#### 2.3.1 Thickness, Size, Edges

Fabricate frames for access doors of steel not lighter than 16 gage with welded joints and anchorage for securing to adjacent construction. Provide doors a minimum of 24 by 24 inches and of not lighter than 16 gage steel, with stiffened edges and welded attachments. Provide with eased (lightly rounded) edges, without burrs, snags or sharpness and exposed welds ground smooth.

#### 2.3.2 Welding

Provide in accordance with AWS D1.1/D1.1M.

### 2.4 ACCESS ASSEMBLY TYPES

Unless indicated otherwise, provide flush-face steel access doors and panels with steel frames and flanges.

#### [2.4.1 Recessed Doors

Provide recessed access doors[ with gypsum wallboard bead flanges]. Depth of door panel recess must accommodate the installed thickness of the finish material of the wall assembly for a flush finished condition of the wall and the access panel face. Reinforce panel and frame to prevent sagging.

#### ] [2.4.2 Fire-rated Doors

##### 2.4.2.1 Door Construction

Provide ceiling access door construction in accordance with ASTM E119 or UL 263. Provide wall access doors in accordance with NFPA 252 or UL 10B.

##### 2.4.2.2 Labels

Provide class B opening according to UL 10B or test by another nationally recognized laboratory, approved by the Contracting Officer. Provide fire-rating as indicated herein, with a maximum temperature rise of 216

degrees F.

#### 2.4.2.3 Door Panel and Frame

[Steel][Stainless steel] sheet, with mineral fiber insulation core, insulated sandwich type construction.

#### ]2.4.3 Acoustical Doors

Manufacturer's standard assembly rated in accordance with STC requirements indicated herein. Acoustical insulating materials must have a flame spread rating of no more than 25.

#### ]2.4.4 Insulated Doors

Provide access door panels with [25 pounds per square inch density polystyrene][5 pound per cubic foot density, chlorofluorocarbon (CFC) free, foamed urethane] with a flame spread rating of no more than 25.

[Provide ceiling access panels for terminal air blenders as indicated. Provide pin-tumbler cylinder locks with appropriate cams in lieu of screwdriver-operated latches.]

### ]2.5 FINISHES

[Provide steel frames and panel surfaces with a [baked enamel][powder coated finish. ]Provide manufacturer's standard two coat finish system consisting of one coat primer and one thermoset topcoat. Provide dry film thickness in 2 mils minimum.][ Provide steel frame and panel surfaces with a shop applied prime coat. [Field paint frames and panels to match wall and ceiling surfaces in which they occur.]] [ Provide stainless steel frames and panels.][ Provide brushed aluminum frames and panels.] Provide exposed fastenings that approximately match the color and finish of the each material to which fastenings are applied.

## PART 3 EXECUTION

### 3.1 PREPARATION

Field verify all measurements prior to fabrication. Verify access door locations and sizes provide required maintenance access to installed building services components. Protect existing construction and completed work from damage during installation.

### 3.2 GENERAL INSTALLATION REQUIREMENTS

Install items at locations indicated, in accordance with manufacturer's written instructions. Include materials and parts as necessary for a complete installation of each item. Conceal fastenings where practicable. Poor matching of holes to fasteners is cause for rejection of the work.

### 3.3 ACCESS LOCATIONS

Install removable access panels directly below each valve, flow indicator, damper, air splitter or other utility requiring access that is located above ceilings, other than at acoustical panel ceilings, and that would otherwise not be accessible. Install access doors and panels permitting access to service valves, traps, dampers, cleanouts, and other mechanical,

electrical and conveyor control items concealed in walls and partitions.

#### 3.4 ACCESS LOCATIONS IN WET AREAS

When possible, avoid locating access panels in wet areas. When such locations cannot be avoided, provide moisture resistant assemblies as indicated in Part I herein.

#### [3.5 RECESSED ACCESS DOORS

Install fire-rated access doors in fire-rated partitions and ceilings in accordance with NFPA 80.

#### ]3.6 FIELD PAINTING

Field painting primed access doors in accordance with the requirements of Section 09 90 00 PAINTS AND COATINGS.

#### 3.7 DISSIMILAR MATERIALS

Where dissimilar metals are in contact, protect surfaces with a coating in accordance with MPI 79 to prevent galvanic or corrosive action.

#### 3.8 ADJUSTMENT

Adjust hardware so that door panel opens freely. Adjust door when closed center door panel in frame.

#### 3.9 ENVIRONMENTAL CONDITIONS

Do not paint surfaces when damp or exposed to weather, when surface temperature is below 45 degrees F or over 95 degrees F, unless approved by the Contracting Officer.

-- End of Section --

## SECTION 08 34 73

## SOUND CONTROL DOOR ASSEMBLIES

**11/19, CHG 1: 02/21**

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AMERICAN WELDING SOCIETY (AWS)

AWS D1.3/D1.3M (2018) Structural Welding Code - Sheet Steel

## ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M (2019) Standard Specification for Carbon Structural Steel

ASTM A108 (2013) Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished

ASTM A568/A568M (2019a) Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for

ASTM A1008/A1008M (2020) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable

ASTM A1011/A1011M (2018a) Standard Specification for Steel Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength

ASTM C143/C143M (2020) Standard Test Method for Slump of Hydraulic-Cement Concrete

ASTM C476 (2020) Standard Specification for Grout for Masonry

ASTM C1036 (2016) Standard Specification for Flat Glass

ASTM D1056 (2014) Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber

ASTM D4689 (2012) Standard Specification for Adhesive, Casein-Type

ASTM D6386 (2016a) Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting

ASTM E90 (2009; R2016) Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

ASTM E336 (2020) Standard Test Method for Measurement of Airborne Sound Attenuation between Rooms in Buildings

ASTM E413 (2016) Classification for Rating Sound Insulation

ASTM E1289 (2008; R 2016) Standard Specification for Reference Specimen for Sound Transmission Loss

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80 (2019) Standard for Fire Doors and Other Opening Protectives

NFPA 101 (2021) Life Safety Code

NFPA 252 (2017) Standard Methods of Fire Tests of Door Assemblies

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

36 CFR 1191 Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines

UNDERWRITERS LABORATORIES (UL)

UL 10C (2016) UL Standard for Safety Positive Pressure Fire Tests of Door Assemblies

WOODWORK INSTITUTE (WI)

NAAWS 3.1 (2017; 2018 Errata Edition) North American Architectural Woodwork Standards

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

## Fabrication Drawings

## SD-03 Product Data

Hollow Metal Sound Retardant Doors[; G[, [\_\_\_\_]]]

Wood Sound Retardant Doors[; G[, [\_\_\_\_]]]

Door Frames[; G[, [\_\_\_\_]]]

Door Hardware[; G[, [\_\_\_\_]]]

Door Frame Sound Infill[; G[, [\_\_\_\_]]]

[ Vision Panels[; G[, [\_\_\_\_]]]

][ Intumescent Seals and Gasketing[; G[, [\_\_\_\_]]]

] Thresholds[; G[, [\_\_\_\_]]]

[ Astragals[; G[, [\_\_\_\_]]]

## ] SD-06 Test Reports

Wind Loading Tests[; G[, [\_\_\_\_]]]

Water Leakage Tests[; G[, [\_\_\_\_]]]

Acoustical Tests[; G[, [\_\_\_\_]]]

Air Infiltration Tests[; G[, [\_\_\_\_]]]

Positive Pressure Tests[; G[, [\_\_\_\_]]]

## SD-07 Certificates

Hollow Metal Sound Retardant Doors[; G[, [\_\_\_\_]]]

Wood Sound Retardant Doors[; G[, [\_\_\_\_]]]

Door Frames[; G[, [\_\_\_\_]]]

Door Hardware[; G[, [\_\_\_\_]]]

[ Vision Panels[; G[, [\_\_\_\_]]]

][ Intumescent Seals,Gasketing [and Door Bottoms][; G[, [\_\_\_\_]]]

] Thresholds[; G[, [\_\_\_\_]]]

[ Astragals[; G[, [\_\_\_\_]]]

] Assembly Test Reports

## 1.3 QUALITY CONTROL

Ensure work within this section is designed and furnished by one manufacturer, who has been engaged in the manufacture of Sound Retardant

[Wood Swinging Door] [Hollow Metal Door] [\_\_\_\_\_] systems for at least five years prior to the start of this work.

Provide acoustic assemblies manufactured by a single source specializing in the production of this type work for a minimum of five years.

### 1.3.1 Compliance and Labeling

#### 1.3.1.1 Compliance with Accessibility Requirements

Americans with Disabilities Act/Architectural Barriers Act (ADA/ABA)  
36 CFR 1191

Accessibility Guidelines for Buildings and Facilities (ADAAG) 36 CFR 1191

[\_\_\_\_\_] (Insert appropriate accessibility standard)

#### 1.3.1.2 Category A Positive Pressure Fire Door Construction

Where requirements for positive pressure are met, include for doors all requirements as part of the door construction per Category A guidelines as published by ITS/Warnock-Hersey. Intumescent is not allowed on the frame. Applying smoke gasketing around the perimeter of the frame to meet the "S" smoke rating is permissible in instances where smoke control is required.

#### 1.3.1.3 Category B Positive Pressure Fire Door Construction

Conform all door openings to the applicable portions of NFPA 101 and NFPA 252. Incorporate field applied intumescent materials, applied by a licensed installer according to the manufacturers' instructions. Keep instructions on file. Additional gasketing may be required to meet the 'S' smoke rating. Submit Certificate for intumescent seals, gasketing[ and door bottoms].

#### 1.3.1.4 Labeling

Ensure all positive pressure door assemblies carry the fire label for the complete opening, clearly identifying the:

- a. Manufacturer
- b. Third party testing and certification agency
- c. Fire door rating
- d. Installation limitations
- e. Compatible frame, hardware component ratings
- f. Compatible lite or vision panel component ratings
- g. Required building code information, including temperature and smoke rating
- g. STC rating if required.

Indicate fire-ratings of applicable components. Provide documentation of ABA/ADA accessibility compliance of applicable components, as required by

36 CFR 1191 Appendix D - Technical.

1.4 DELIVERY, STORAGE, AND HANDLING

Ship all doors in the manufacturer's undamaged individual cartons, securely bundled and wrapped with moisture-resistant covers and stored in accordance with the manufacturer's printed instructions in a dry, clean, and ventilated area.

Deliver and store wood doors in the building following the installation of concrete, terrazzo, plaster, or other wet materials, and only after the building has dried out and has a roof.

Store all materials on planks in a dry location. Store doors and frames vertically with minimum [\_\_\_\_\_] airspace between. Store doors on the edge to eliminate any potential damage to the door bottom seal. Cover all material to protect from damage but in a manner to allow proper circulation.

Maintain relative humidity in the building between 30 and 65 percent. Maintain the ambient temperature at 60 degrees F minimum at the time of installation of wood doors.

Perform final adjustment of seals when temperatures and humidity conditions replicate the interior conditions that will exist when the building is occupied.

1.5 WARRANTY

Manufacturer's warranty for [\_\_\_\_\_] [5] years from date of supply, covering material and workmanship. Failures include, but are not limited to, the following:

- a. Failure to meet sound rating requirements
- b. Faulty operation of sound seals
- c. Deterioration of metals, metal finishes, and other materials beyond normal use or weathering.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Provide sound retardant door assemblies of the thickness, width, and height indicated, complete with perimeter seals, seal housings, gasketing, [automatic door bottoms,] thresholds, door frames, and astragals as required to conform to the specified STC per ASTM E90 and ASTM E1289.

Submit fabrication drawings for [Hollow Metal Sound Retardant Doors,] [Wood Sound Retardant Doors,] Door Frames and Door Frame Sound Infill.

Submit certificates showing conformance with the referenced standards in this section, and manufacturer's catalog data including STC ratings and UL fire rating, where applicable, for the following items: Hollow metal sound retardant doors; wood sound retardant doors; door frames; door hardware; [vision panels]; [intumescent seals and gasketing]; thresholds; [and] [astragals].



Provide assemblies that are complete with metal frame, wood door(s), sealing system, and Cam-lift hinges (when required). [ If vision lights are specified for doors, provide metal loose stops and field install glass and glazing when shipped separately.]

#### 2.1.1.1 Design Requirements

##### 2.1.1.1.1 Door Design

Provide sound Retardant Wood Swinging Doors that are a 1-3/4-inch thickness construction with sizes as indicated on drawings. No visible seams are permitted on door faces. Provide face gauges, internal sound retardant core and perimeter door edge construction per manufacturer's standard for the specified STC rating. No lead or asbestos is permitted in door construction to achieve STC performance. Provide face veneer species cut and color as selected from manufacturer's full range of available colors and patterns. No lead or asbestos is permitted in door construction to achieve performance requirements.

##### 2.1.1.1.2 Frame Design

Provide sound Retardant Metal Frames conforming to ASTM A1008/A1008M, not less than 0.0747-inch thick, and free from pitting, scale, stretcher strains, fluting, and surface defects with integral trim and shipped with temporary spreader. Knockdown frames are not acceptable.

Provide frames with 2 inch faces, profiles and dimensions as indicated, with mitered reinforced corners, welded the full depth of frame and trim, with exposed surfaces ground smooth and flush. Close contact edges to hairline joints.

#### 2.1.2 Performance Requirements

##### 2.1.2.1 STC (Sound Transmission Classification) Rating

Provide doors with an STC [of at least [25] [30] [35] [40] [45]][per the door schedule].

#### 2.2 FABRICATION

Provide doors that are minimum 16 gauge, 1 3/4 inch thick with welded, seamless construction. No visible joints are permitted on the exposed faces or edges. Join door skins at vertical edges by continuous welds, ground and dressed smooth to provide a flush finish. Reinforce top and bottom with 16 gauge continuous inverted steel channels spot welded to both faces. Finish both top and bottom to provide a smooth flush condition. Bevel both vertical edges 1/8 inch in 2 inches.

Clean and sand to smooth finish all doors to remove handling and storage marks, raised grain, minor surface marks and abrasions which are to receive a job site finish.

##### 2.2.1 Hollow Metal Sound Retardant Doors

###### 2.2.1.1 Construction

Conform to ASTM A1008/A1008M for door construction utilizing steel facing sheets. Conform stretcher level flatness to ASTM A568/A568M; not less than 0.0598 inch thick; free from pitting, scale, and surface defects;

separated by a core construction designed to meet the required STC; and tested and rated in accordance with [ASTM E90](#).

Provide doors that have flush seamless face sheets and vertical edges, with continuous welded and smooth joints. Provide edges that are flush or rabbeted as required for perimeter seals.

Provide door surfaces that are visually flat and free from warp, waviness, and other surface irregularities and defects. Maximum allowable warp or twist-can not exceed [1/8 inch](#) when measured with a [7 foot](#) straightedge along the diagonal and not exceed [1/16 inch](#) when measured with a [7 foot](#) straightedge in the width or in any position along the length of the door.

Provide hardware reinforcement that is steel drilled, tapped to template requirements and welded in place. Provide minimum thicknesses as follows:

- a. Butts, [0.1494 inch](#)
- b. Lock strike, [0.1196 inch](#)
- c. Surface applied hardware [0.0747 inch](#)

Provide doors, including sound retardant type, to bear the UL [3-hour A] [1-1/2-hour B] [3/4-hour C] [1-1/2-hour D] label fire rating and the specified STC.

#### 2.2.1.2 Coating

Thoroughly clean all mill scale, rust, oil, grease, dirt, and other foreign materials from surfaces before the application of the shop coat of paint.

After cleaning, provide galvanized surfaces free of paint in accordance with [ASTM D6386](#), Method A, B, C, or D.

Apply to clean prepared dry surfaces one shop coat of rust inhibitive metallic oxide or synthetic resin primer by brush, dipping, or other approved method to provide a continuous minimum dry film thickness (dft) of [0.9 mil](#).

Shop paint the exposed door surfaces, including surfaces that are galvanized.

Shop paint the concealed exterior door surfaces except galvanized surfaces.

#### 2.2.2 Wood Sound Retardant Doors

Construct doors with wood veneer facings separated by a core construction designed to meet the required STC. Test, rate, and label in accordance with [ASTM E90](#).

Comply with the [NAAWS 3.1](#), "Guide Specifications and Quality Certification Program," for [premium] [custom] [economy] grade constructions and to the requirements specified.

Perform beveling, prefabricating, machining, mortising, and routing for hardware, perimeter seals, and door bottom cutouts at the mill.

[ Furnish [premium] [custom] [economy] grade door facings with standard

thickness face veneers conforming to **NAAWS 3.1**, Type 1 for stain and transparent job site-applied finish.

] [Apply medium density overlay door facings over a good grade of hardwood conforming to **NAAWS 3.1**, Type 3 for job site-applied paint finish.

] [Furnish plastic laminate door facings, 1/16 inch thick, in decorator color and patterns as selected, conforming to **NAAWS 3.1**, Type 4.

#### ]2.2.2.1 Faces

Single-ply wood veneer not less than 1/50 inch thick.

- a. Species: [Anigre] [Select white ash] [Figured select white ash] [Select white birch] [Select red birch] [Cherry] [Select red gum] [Figured select red gum] [Select white maple] [Red oak] [White oak] [Persimmon] [Sapele] [Sycamore] [Walnut] [\_\_\_\_\_].
- b. Cut: [Rotary cut] [Plain sliced (flat sliced)] [Quarter sliced] [Rift cut].
- c. Match between Veneer Leaves: [Book] [Slip] [Random] match.
- d. Assembly of Veneer Leaves on Door Faces: [Center-balance] [Balance] [Running] match.
- e. Pair and Set Match: Provide for doors hung in same opening[ or separated only by mullions].
- f. Room Match: Match door faces within each separate room or area of building. Corridor-door faces do not need to match where they are separated by [10 feet] [20 feet] [\_\_\_\_\_] or more.
- g. Room Match: Provide door faces of compatible color and grain within each separate room or area of building.
- h. Transom Match: [Continuous match] [End match] [As indicated].
- i. Blueprint Match: Where indicated, provide doors with faces produced from same flitches as adjacent wood paneling and arranged to provide blueprint match with wood paneling.

#### 2.2.3 Door Finishing

Conform factory finishing of Sound Retardant Wood Swinging Doors in accordance with AWI Quality Standards. Provide factory finish of a water-base stain and ultraviolet (UV) cured polyurethane sealer to comply with EPA Title 5 guidelines for Volatile Organic Compound (VOC) emissions limitations. Conform finish to meet or exceed performance standards of **NAAWS 3.1** catalyzed polyurethane.

### 2.3 COMPONENTS

#### 2.3.1 Frames

Construct frames for Sound Retardant Wood Swinging Doors from formed sheet steel or structural shapes and bars. Provide sheet steel that is commercial quality, level, cold rolled steel conforming to **ASTM A1008/A1008M** or hot rolled, pickled and oiled steel conforming to

ASTM A1011/A1011M. Comply steel shapes with ASTM A36/A36M and steel bars with ASTM A108, Grade 1018.

### 2.3.2 Door Frame Sound Infill

[ Grout: Comply with ASTM C476, with a slump of not more than 4 inches as measured according to ASTM C143/C143M.

] [Corrosion-Resistant 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.

] Select the appropriate infill material [\_\_\_\_\_].

### 2.3.3 Hardware Reinforcements

Factory mortise, reinforce, drill and tap frames for all mortise hardware as required by hardware manufacturer's template. Provide necessary reinforcement plates as required for surface mounted hardware; installer to perform all field drilling and tapping. Provide dust cover boxes on all frame mortises. Provide minimum thicknesses as follows:

- a. Butts, 3/16 inch
- b. Lock strike, 0.1196 inch
- c. Surface applied hardware 0.0747 inch

### 2.3.4 Jamb Anchors

Provide number and spacing of anchors as follows:

#### 2.3.4.1 Masonry Type

Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

- a) Two anchors per jamb up to 60 inches in height.
- b) Three anchors per jamb from 60 to 90 inches in height.
- c) Four anchors per jamb from 90 to 96 inches in height.
- d) Four anchors per jamb plus one additional anchor per jamb for each 24 inches, or fraction thereof, more than 96 inches in height.

#### 2.3.4.2 Stud-Wall Type

Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

- a) Three anchors per jamb up to 60 inches in height.
- b) Four anchors per jamb from 60 to 90 inches in height.
- c) Five anchors per jamb from 90 to 96 inches in height.
- d) Five anchors per jamb plus one additional anchor per jamb for each 24

inches, or fraction thereof, more than 96 inches in height.

- e) Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.

#### 2.3.4.3 Post-installed Expansion Type

Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.

#### 2.3.5 Door Hardware

Provide the following STC related hardware with the door; [cam-lift hinges][, perimeter seals][, astragals][, door bottoms][, thresholds][, hardware standoff brackets] and [\_\_\_\_\_].

Include on Fabrication drawings a finish hardware schedule for each door and a hollow metal door frame schedule for each door indicating profile, dimensions, hardware reinforcement, and frame anchorage. Also indicate perimeter seals, door-bottom devices and other hardware items that are assembled in the shop.

Refer to Section 08 71 00 DOOR HARDWARE for remaining hardware requirements.

#### [2.3.6 Vision Panels

Furnish doors with vision panels complete with glazing. Provide 0.0747 inch steel or wood frames, moldings, and stop to match the door finish, with profile indicated. Assemble with mitered corners and flush joints, and secured with countersunk phillips-head screws.

Provide either a single thickness of acoustical plate glass laminated to an inner face of water-clear plastic or multiple thicknesses of 1/4 inch plate glass, clear or patterned as indicated, and set in glazing gaskets and frames as required to meet the specified STC.

Provide glass to conform to ASTM C1036, Type I, Class 1. Provide acoustical plate glass that has been tested and rated in accordance with ASTM E90, with an STC of not less than 36 and a minimum thickness of 9/32 inch.

#### ]2.3.7 Head and Jamb Seals

[ Provide a closed-cell, expanded cellular rubber Seal material conforming to ASTM D1056, Type S, Grade SBE-42 or SCE-42 for heads, jambs[, and door bottoms].

] Install seals in formed steel or extruded aluminum shapes designed to receive and hold seals and to provide concealed adjustable attachment to door frames. Provide concealed adjustment screws that are not more than 12 inches on center and provide at least 3/8 inch adjustment.

#### ]2.3.8 Door Bottoms

Neoprene or silicone gasket held in place by metal housing; mortised into bottom edge of door.

## 2.3.8.1 Automatic Door Bottoms

Neoprene or silicone gasket, held in place by metal housing, that automatically drops to form seal when door is closed; mounted to bottom edge of door with screws.

Mounting: [Mortised or semimortised into bottom of door] [or] [surface mounted on face of door] as required by testing to achieve STC rating indicated.

## 2.3.9 Thresholds

Provide metal thresholds where indicated. Provide thresholds that are extruded aluminum, 6063-T5 alloy, mill finish, not less than 1/8 inch thick, with integral seal grooves formed to the indicated section.

Provide flat, smooth, unfluted thresholds as recommended by manufacturer; fabricated from [aluminum][stainless steel][solid wood matching wood door faces].

a. Finish: [Clear][Color] anodic finish.

b. Color: [Light bronze][Medium bronze][Dark bronze][Black][Match Architect's sample][As selected by Architect from full range of industry colors and color densities].

Provide hardwood thresholds where indicated made of clear, all-heartwood, free of streaks, pin or worm holes, uniform in color, free of defects, finish sanded, and ready for job site, transparent or paint finish.

## [2.3.10 Astragals

[ Provide steel astragals for the inactive leaf of each pair of doors, as indicated. Surface mount to the door by welded connections or by countersunk, flat-head screws, within integral groove to receive perimeter seal material.

][Provide wood astragals for the inactive leaf of each pair of doors. Provide astragals that are solid hardwood. Match the veneer and finish of doors. Surface mount to doors by screw fasteners or with waterproof and mold-resistant adhesive conforming to ASTM D4689, Type II.

## ]]2.4 TESTS, INSPECTIONS, AND VERIFICATIONS

## 2.4.1 Sound Transmission Classification

Provide test reports prepared by a nationally recognized, independent laboratory for Acoustical Tests, Air Infiltration Tests, Wind Loading Tests, and Water Leakage Tests indicating that the sound transmission classification (STC) of the proposed door, based on tests at 16 third-octave band frequencies from 125 to 4,000 hertz, is no less than the specified STC when tested in accordance with ASTM E90, and that the door tested is hung in substantially the type of wall and frame as indicated and is fully operable with hardware and perimeter seals installed.

## 2.4.2 Positive Pressure

Provide test reports, prepared by a nationally recognized, independent laboratory for Positive Pressure Tests, for all fire rated door

assemblies, including Intumescent Seals,Gasketing[, and Door Bottoms].

#### 2.4.3 Cam Lift Hinges

When required to achieve STC, manufacturer to furnish laboratory test data certifying hinges have been cycled a minimum of 1,000,000 while supporting a minimum door weight of 350 pounds.

Full-mortise template type that raises the door 1/2 inch when door is fully open; with hardened pin; fabricated from stainless steel.

#### 2.4.4 Guarantee

Provide written guarantee that each door delivered to the project is equal in construction, sound transmission classification (STC), and positive pressure test rating where applicable, with appropriate labeling and markings, to that of the sample door tested. Clearly state in written guarantee that each door assembly, when installed in accordance with the manufacturer's printed instructions, has an in-place STC within 3 decibels of the specimen tested. Submit the following test data and Certificates with the written Guarantee:

- a. Wind Loading Tests
- b. Water Leakage Tests
- c. Acoustical Tests
- d. Air Infiltration Tests
- e. Positive Pressure Tests

### PART 3 EXECUTION

#### 3.1 PREPARATION

Upon receipt of material, thoroughly inspect all frames, doors and accessories. Verify quantities and tag numbers according to the packing list provided. Report all discrepancies, deficiencies and/or damages immediately to Contracting Officer.

Prior to installation check all doors and frames for correct size and swing. Verify that frames are plumb, square and aligned without twist in accordance with tolerances published by NAAMM/HMMA and SDI.

##### 3.1.1 Frame Painting and Cleaning

Clean thoroughly all surfaces of all mill scale, rust, oil, grease, dirt, and other foreign materials before the application of the shop coat of paint.

Apply one shop coat of rust inhibitive metallic oxide or synthetic resin primer applied to clean, dry, and prepared surfaces by brush, dipping, or other approved method to provide a continuous minimum dry film thickness of 0.9 mil.

### 3.2 INSTALLATION

#### 3.2.1 Frame

Install frames plumb and true with not more than 1/32 inch deviation in vertical alignment in 8 feet. Anchor to the wall in accordance with the manufacturer's instructions. Grout frames solid with mortar in masonry, concrete, and plaster wall construction. Spot grout frames in dry wall partitions with mortar at the jamb anchor clips; fill the space between metal frame and stud partition solidly with fiberglass or mineral wool insulation.

Field splices may be required after installation because of shipping limitations. Field weld splices by certified welders per manufacturer's instructions and in accordance with AWS D1.3/D1.3M.

#### 3.2.2 Door

Install and adjust all doors, hardware, and seals in accordance with the approved drawings, hardware schedules, and the printed instructions of the door manufacturer.

Install and adjust perimeter seals [and automatic door bottom seals] to provide positive compression contact with the entire sealing surface with no gaps, openings, or breaks. Hinges or hardware which distort or pinch the perimeter seal during operation of the door will be rejected.

Install door bottom devices to seal the space between the door bottoms and the finished floor and the space between the seal and seal housing.

Field apply perimeter seal housings with mitered corners and with flush, aligned hairline joints.

[ Install wood doors and frames in accordance with [NFPA 80][UL 10C].

] Install components to manufacturer's written instructions. Coordinate with [masonry][gypsum board][concrete][\_\_\_\_\_] wall construction for anchor placement. Set frames plumb, square, level and at correct elevation. Adjust operable parts for correct clearances and function. Install and adjust perimeter and bottom acoustic seals.

### [3.3 FIELD QUALITY CONTROL

Provide third party testing in accordance with ASTM E336. Verify in writing that installed product performs no less than five (5) ASTC or NIC rating points below the specified laboratory STC rating. Examine, adjust, and retest any installation not meeting that criteria until compliance is obtained.

#### 3.3.1 Testing and Performance

Provide assemblies that are identical to those tested at an independent acoustical laboratory qualified under the National Voluntary Laboratory Accreditation Program (NVLAP) by the National Institute for Science and Technology (NIST) in accordance with ASTM E90 and ASTM E413. For the assembly test reports include the laboratory name, test report number and date of test.

] -- End of Section --





## SECTION 08 41 13

## ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

**08/18, CHG 1: 08/18**

## PART 1 GENERAL

## 1.1 REFERENCES

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

## ALUMINUM ASSOCIATION (AA)

AA DAF45 (2003; Reaffirmed 2009) Designation System for Aluminum Finishes

## AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 501 (2015) Methods of Test for Exterior Walls

AAMA 611 (2014) Voluntary Specification for Anodized Architectural Aluminum

AAMA 800 (2016) Voluntary Specifications and Test Methods for Sealants

AAMA 1503 (2009) Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections

AAMA 2605 (2020) Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels

## AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7-16 (2017; Errata 2018; Supp 1 2018) Minimum Design Loads and Associated Criteria for Buildings and Other Structures

## ASTM INTERNATIONAL (ASTM)

ASTM B221 (2014) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

ASTM E283 (2019) Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

ASTM E330/E330M (2014) Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure

# Difference

ASTM E331	(2000; R 2016) Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E783	(2002; R 2018) Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors
ASTM E1105	(2015) Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference
ASTM E1424	(1991; R 2016) Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure and Temperature Differences Across the Specimen
ASTM E1886	(2019) Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials
ASTM E1996	(2017) Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes
ASTM F1642/F1642M	(2017) Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loadings

## BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

ANSI/BHMA A156.4	(2013) Door Controls - Closers
ANSI/BHMA A156.10	(2017) Power Operated Pedestrian Doors

## INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC	(2018) International Building Code
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## U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS TT-P-645	(Rev C) Primer, Paint, Zinc-Molybdate, Alkyd Type
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## UNDERWRITERS LABORATORIES (UL)

UL 325	(2017; Reprint Feb 2020) UL Standard for Safety Door, Drapery, Gate, Louver, and Window Operators and Systems
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## 1.2 ADMINISTRATIVE REQUIREMENTS

### 1.2.1 Pre-Installation Meetings

Conduct a meeting before installation begins to verify the project requirements, substrate conditions, manufacturer's installation instructions, and manufacturer's warranty requirements.

Within [30] [\_\_\_\_] days of the Contract Award, submit the following for review and approval by the Contracting Officer:

- a. List of product installations
- b. Sample warranty
- c. Finish and color samples
- d. Manufacturer's catalog data

Concurrently submit **certified test reports** showing compliance with specified performance characteristics and **UL 325** for the following:

- a. Wind Load (Resistance) in accordance with **AAMA 501**
- b. Deflection in accordance with **ASTM F1642/F1642M**
- c. Condensation Resistance and Thermal Transmittance Performance Requirements in accordance with **AAMA 1503**
- d. Water Infiltration in accordance with **ASTM E331**
- e. Structural Requirements in accordance with **ASTM F1642/F1642M**

## 1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section **01 33 00 SUBMITTAL PROCEDURES**:

### SD-01 Preconstruction Submittals

Sample Warranty; G[, [\_\_\_\_]]

List of Product Installations; G[, [\_\_\_\_]]

### SD-02 Shop Drawings

Installation Drawings; G[, [\_\_\_\_]]

[ Fabrication Drawings; G[, [\_\_\_\_]] ]

### SD-03 Product Data

Manufacturer's Catalog Data; G[, [\_\_\_\_]]

Finish; G[, [\_\_\_\_]]

Recycled Content of Aluminum Material; S

#### SD-04 Samples

Finish and Color Samples; G[, [\_\_\_\_]]

#### SD-06 Test Reports

Certified Test Reports; G[, [\_\_\_\_]]

Deflection

Air Infiltration

Condensation Resistance and Thermal Transmittance

Water Infiltration

#### SD-08 Manufacturer's Instructions

Manufacturer's Instructions

#### SD-11 Closeout Submittals

Manufacturer's Product Warranty

### 1.4 QUALITY CONTROL

#### 1.4.1 Qualifications

##### 1.4.1.1 Installer Qualifications

Provide documentation of the installer's experience [as determined by the Contractor] in performing the work specified in this section.

Ensure that the installers are specialized in work similar to that required for this project, and that they are acceptable to product manufacturer.

##### 1.4.1.2 Manufacturer Qualifications

Ensure that manufacturers meet the requirements specified in this section and project drawings.

Ensure that the manufacturer is capable of providing field service representation during construction, approving acceptable installers and approving application methods.

#### 1.4.2 Single-Source Responsibility

When aluminum entrances are part of a building enclosure system, that includes storefront framing, windows, a curtain wall system, and related products, provide building enclosure system products from a single-source manufacturer.

Use a single source manufacturer with sole responsibility for providing design, structural engineering, and custom fabrication for door portal

systems and for supplying components, materials, and products. Do not use products provided from numerous sources for assembly at the site. Ensure that the following work items and components are fabricated or supplied by a single source are:

- a. Door assemblies to be installed in door portals as specified in [Section 08 11 16 ALUMINUM DOORS AND FRAMES][\_\_\_\_\_].
- b. Glazed walls to be constructed around door portals as specified in [this Section][\_\_\_\_\_].
- c. Door operating hardware to be installed on or within door portals as specified in Section 08 71 00 DOOR HARDWARE.
- d. Glass as specified in [Section 08 81 00 GLAZING][\_\_\_\_\_].

## 1.5 DELIVERY, STORAGE, AND HANDLING

### 1.5.1 Ordering

To avoid construction delays, comply with the manufacturer's lead-time requirements and instructions for ordering.

### 1.5.2 Packing, Shipping, Handling and Unloading

Deliver materials in the manufacturer's original, unopened, undamaged containers with identification labels intact.

### 1.5.3 Storage and Protection

Store materials in a way that protects them from exposure to harmful weather conditions. Avoid damaging the storefront material and components during handling. Protect storefront material against damage from elements, construction activities, and other hazards before, during, and after storefront installation.

Do not use adhesive papers or sprayed coatings that become firmly bonded when exposed to sunlight. Do not leave coating residue on surfaces.

## 1.6 PROJECT / SITE CONDITIONS

### 1.6.1 Field Measurements

Verify actual measurements or openings by taking field measurements before fabrication; record these measurements on shop drawings. To avoid construction delays, coordinate field measurements, and fabrication schedule with construction progress.

## 1.7 WARRANTY

Provide a written manufacturer's warranty, executed by a company official, warranting against defects in materials and products for [\_\_\_\_\_] [2] years from the date of shipment. Warrant that the door corner construction is for the life of the project. [Provide a written installer's warranty, warranting work to be watertight and free from defective materials, defective workmanship, and glass breakage as a result of defective design, and agreeing to replace components that fail within [\_\_] [2] years.]

The warranty states the following:

- a. Watertight and airtight system installation is completed within specified tolerances.
- b. The completed installation remains free of rattles, wind whistles and noise caused by thermal movement and wind pressure.
- c. System is structurally sound and free from distortion.
- d. Glass and glazing gaskets will not break or "pop" from frames as a result of design, wind load pressure, movement caused by expansion or contraction, or structural loading.
- e. Glazing sealants and gaskets remain free of abnormal deterioration or dislocation as a result of sunlight, weather, or oxidation.

[ Provide written warranty stating that the organic coating finish will not fade more than 10 percent or show chalking, yellowing, peeling, cracking, pitting, corroding or variations in color, or gloss deterioration beyond the manufacturer's descriptive standards for [\_\_\_\_\_] years from the shipment date and agreeing to promptly correct defects.

] Provide a written thermal integrity warranty for [\_\_\_\_\_] years from ship date against thermal barrier system failure resulting from the following:

- a. Longitudinal and transverse thermal barrier shrinkage.
- b. Thermal barrier cracking.
- c. Structural failure of the thermal barrier material.
- d. Loss of adhesion or loss of prescribed edge pressure on glazing material, resulting in excessive air and water infiltration.

]

## PART 2 PRODUCTS

### 2.1 SYSTEM DESCRIPTION

Provide aluminum entrances, with glass and glazing, door hardware, and components.

Aluminum entrances include impact resistance entrances; [medium stile, 3 1/2 inch][\_\_\_\_\_] vertical face dimension, [1 3/4 inch][\_\_\_\_\_] depth, for interior structural silicone glaze, for high-traffic/impact-resistant applications.:

#### 2.1.1 Design Requirements for Aluminum (Entrances and Components)

Provide a door portal system designed to withstand the following loads without breakage, loss, failure of seals, product deterioration, or other defects.

- a. Dead and Live Loads: Determined by ASCE 7-16 and calculated in accordance with applicable codes.
- b. Seismic Loads: Design and install the system to comply with the seismic requirements for the project location in accordance with Section 1613 of the International Building Code, ICC IBC.

- c. Wind Loads: Design and install the system so that the effects of wind load acting inward and outward normal to the plane of the wall are in accordance with [ASTM E330/E330M](#).
- d. Thermal Loads And Movement:
  - (1) Ambient Temperature Range: [120][\_\_\_\_\_] degrees F
  - (2) Material Surfaces Range: [180][\_\_\_\_\_] degrees F
- e. Water and Air Resistance: Provide weatherstripping, exterior gaskets, sealants, and other accessories to resist water and air penetration.
- f. Impact-Protective Systems Provide an impact-protective system in accordance with [[ASTM E1886](#)][[ASTM E1996](#)].

#### 2.1.1.1 Material Standard

[ASTM B221](#); 6063-T5 alloy and tempered.

Provide door stile and rail face dimensions of the entrance doors as follows:

Vertical Stile	Top Rail	Bottom Rail
3-1/2 inches	3-1/2 inches	6-1/2 inches

Provide major portions of the door members at 0.125 inches nominal in thickness and glazing molding at 0.050 inches thick.

#### 2.1.1.2 Recycled Content

Provide aluminum framed entrances and storefronts that have a minimum of 20 percent recycled content based upon the aluminum billet used in the original material. Provide data indicating percentage of [recycled content of aluminum material](#).

#### 2.1.1.3 Sealants

Provide either ethylene propylene diene monomer (EPDM) elastomeric extrusions or thermoplastic elastomer glazing gaskets. Structural silicone sealant is required.

Internal Sealants: Provide sealants that according to the manufacturer will remain permanently elastic, tacky, non-drying, non-migrating, and weather tight.

#### 2.1.1.4 Thermal Barrier

Use a rigid, structural thermal barrier to separate all exterior aluminum from interior aluminum. For purposes of this specification, a structural thermal barrier is defined as a system that transfers shear during bending and, therefore, promotes composite action between the exterior and interior extrusions. Do not use a nonstructural thermal barrier. Ensure that the thermal barrier provides a structural connection between the two sides of the door.



## 2.2 FABRICATION

Provide the following information when submitting fabrication drawings for custom fabrications:

- a. Indicate elevations, detailed design, dimensions, member profiles, joint locations, arrangement of units, and member connections.
- b. Show the following items:
  - (1) Details of special shapes.
  - (2) Reinforcing.
  - (3) Anchorage system.
  - (4) Interfacing with building construction.
  - (5) Provisions for expansion and contraction.
  - (6) Thermal breaks.
- c. Indicate typical glazing details, [locations of various types and thickness of glass][, emergency breakout locations,] and internal sealant requirements as recommended by the sealant manufacturer.
- d. Clearly indicate locations of exposed fasteners and joints.
- e. Clearly show where and how the manufacturer's system deviates from Contract drawings and these specifications.

### 2.2.1 Entrance System Fabrication

Provide door corner construction consisting of mechanical clip fastening, SIGMA deep penetration plug welds and 1 1/8 inch long fillet welds inside and outside all four corners. Provide a hook-in type exterior glazing stop with EPDM glazing gaskets reinforced with non-stretchable cord. Provide an interior glazing stop that is mechanically fastened to the door member and that incorporates a silicone-compatible spacer used with silicone sealant.

Accurately fit and secure joints and corners. Make joints hairline in appearance. Remove burrs and smooth edges. Prepare components with internal reinforcement for door hardware. Arrange fasteners and attachments so that they are concealed from view.

Separate dissimilar metals with protective coating or pre-formed separators to prevent contact and corrosion.

### 2.2.2 Shop Assembly

Fabricate and assemble units with joints only at the intersection of aluminum members with hairline joints; rigidly secure these units, and seal them in accordance with the manufacturer's recommendations.

#### 2.2.2.1 Welding

Conceal welds on aluminum members in accordance with AWS recommendations or methods recommended by the manufacturer. Members showing welding bloom

or discoloration on finish or material distortion will be rejected by the Contacting Officer.

### 2.2.3 Finish

Before fabrication, clean the units and give them a [AA-M-10-C22-A31 clear (natural) anodized finish] [AA-M-10-C22-A41 clear (natural) anodized finish] [AA-M-10-C22-A32 [\_\_\_\_\_] (color) anodized finish] [AA-M-10-C22-A42 [\_\_\_\_\_] (color) anodized finish] in accordance with the requirements of the AA DAF45. The finish thickness is [A41, 0.4 mil or greater.] [A42, 0.7 mil or greater.]

#### a. Organic Coating (high-performance exterior coating):

- (1) Comply with requirements of AAMA 2605.
- (2) Clean surfaces and pretreat them with a conversion coating before applying 0.3 mil dry-film thickness of epoxy or acrylic primer according to the recommendations of the finish coat manufacturer.
- (3) Apply a finish coat of [70 percent][\_\_\_\_\_] minimum fluoropolymer resin fused to primed surfaces at the temperature recommended by the manufacturer and at a minimum dry film thickness of 1.0 mil.
- (4) Use a 2-, 3-, or 4-coat system as required for the color selected.

#### [ b. Clear Anodized; Conforming to [AA-M12C22A31][\_\_\_\_\_] and AAMA 611.

Select and edit the following items for the appropriate finish; delete types that do not apply.

- (1) Architectural Class II[\_\_\_\_\_]
- (2) Etched, medium matte[\_\_\_\_\_]
- (3) Clear anodic coating, 0.4 minimum thickness[\_\_\_\_\_]

]

#### [ c. Color Anodized: Conforming to [AA-M12C22A [34] [44]][\_\_\_\_\_] and AAMA 611

Select and edit the following items for appropriate finish; delete types that do not apply.

- (1) Architectural Class [II] [I]
- (2) Etched, medium matte
- (3) [Black] [dark bronze][medium bronze] [light bronze] anodic coating, [ 0.4 mil][ 0.7 mil] minimum thickness

### ]2.2.4 Fabrication Tolerance

Fabricate and assemble units with joints only at intersection of aluminum members with hairline joints; rigidly secure these units, and seal them in accordance with the manufacturer's recommendations.

Fabricate aluminum entrances in accordance with the entrance manufacturer's prescribed tolerances.

#### 2.2.4.1 Material Cuts

Square to  $1/32$  inch off square, over largest dimension; proportionate amount of  $1/32$  inch on the two dimensions.

#### [2.2.4.2 Maximum Offset at Consecutive Members

$1/64$  inch in alignment between two consecutive members in line, end to end.

#### ]2.2.4.3 Maximum Offset at Glazing Pocket Corners

$1/64$  inch between framing members at glazing pocket corners.

#### ]2.2.4.4 Joints

Between adjacent members in same assembly: Joints are hairline and square to the adjacent member.

#### 2.2.4.5 Variation

In squaring diagonals for doors and fabricated assemblies:  $1/16$  inch.

#### 2.2.4.6 Flatness

For doors and fabricated assemblies: plus/minus  $1/16$  inch of neutral plane.

### 2.3 MATERIALS

#### 2.3.1 Sealants

[ Refer to Section 07 92 00 JOINT SEALANTS. ]Ensure that all sealants conform to AAMA 800.

#### 2.3.2 Glass

Refer to Section 08 81 00 GLAZING.

### 2.4 ACCESSORIES

#### 2.4.1 Fasteners

Provide stainless steel fasteners in areas where the fasteners are exposed.

Use non-corrosive and compatible fasteners with components being fastened. Do not use exposed fasteners, except where unavoidable for application of hardware.

In areas where fasteners are not exposed, use aluminum, non-magnetic stainless steel, or other materials warranted by the manufacturer.

For exposed locations, provide countersunk Phillips head screws when items with a matching finish are fastened. For concealed locations, provide the manufacturer's standard fasteners.

Provide nuts or washers that have been designed with a means to prevent disengagement; do not deform fastener threads.

#### 2.4.2 Perimeter Anchors

When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.

##### 2.4.2.1 Inserts and Anchorage Devices

Provide manufacturer's standard formed or fabricated assemblies, steel or aluminum, of shapes, plates, bars, or tubes. Shop-coat steel assemblies after fabrication with an alkyd zinc chromate primer complying with FS TT-P-645.

#### 2.4.3 Standard Entrance Hardware

##### 2.4.3.1 Weatherstripping

Equip meeting stiles on pairs of doors with an adjustable astragal using wool pile with a polymeric fin.

Provide door weatherstripping on a single-acting offset pivot or butt-hung door and frame (single or pairs) consisting of a thermoplastic elastomer weatherstripping on a tubular shape with a semi-rigid polymeric backing.

Provide sill-sweep strips: Provide an EPDM blade gasket sweep strip in an aluminum extrusion applied to the interior exposed surface of the bottom rail with concealed fasteners. (Provide as necessary to meet specified performance tests.)

##### 2.4.3.2 Threshold

Provide an extruded aluminum threshold, one piece per door opening, with ribbed surface.

##### 2.4.3.3 Offset Pivots

Provide the manufacturer's standard top and bottom pivots with one intermediate offset pivot.

##### 2.4.3.4 Panic Device

Provide the manufacturer's recommended standard panic hardware.

##### 2.4.3.5 Closer

Provide a surface closer in accordance with ANSI/BHMA A156.4.

##### 2.4.3.6 Security Lock or Dead Lock

Provide [A/R MS 1850A lock with two A/R 1871 cylinder operated flush bolts][\_\_\_\_\_].

##### 2.4.3.7 Cylinder(s)/Thumb-turn

Provide the manufacturer's recommended standard.

##### 2.4.3.8 Cylinder Guard

Provide the manufacturer's recommended standard.

## PART 3 EXECUTION

### 3.1 EXAMINATION

#### 3.1.1 Site Verification of Conditions

Verify that the condition of substrate previously installed under other sections is acceptable for product installation in accordance with the manufacturer's instructions.

Verify that openings are sized to receive the storefront system and that the sill plate is level in accordance with the manufacturer's acceptable tolerances.

### 3.2 PREPARATION

Field-verify dimensions before fabricating components for the door portal assembly.

Coordinate requirements for locations of blockouts for anchorage of door portal columns and other embedded components with Section 03 30 00 CAST-IN-PLACE CONCRETE.

Coordinate the erection of door portal with installation of surrounding glass wall and door assemblies. Ensure that the door portals can provide support and anchorage for assembly components.

Coordinate electrical requirements for [automatic door assemblies][electrified door hardware] to ensure proper power source, conduit, wiring, and boxes.

#### 3.2.1 Adjacent Surfaces Protection

Protect adjacent work areas and finish surfaces from damage during product installation.

#### 3.2.2 Aluminum Surface Protection

Protect aluminum surfaces from contact with lime, mortar, cement, acids, and other harmful contaminants.

### 3.3 INSTALLATION

Submit [installation drawings](#) for review and approval.

Install the entrance system in accordance with the [manufacturer's instructions](#) and the AAMA storefront and entrance guide specifications manual. Attach the entrance system to the structure, allowing it to be adjusted to accommodate construction tolerances and other irregularities. Provide alignment attachments and shims to permanently fasten the system to the building structure. Align the assembly so that it is plumb and level, and free of warp and twist. Maintain assembly dimensional tolerances aligning with adjacent work.

Set thresholds in a bed of mastic and secure the thresholds. Protect aluminum members in contact with masonry, steel, concrete, or dissimilar materials using nylon pads or a bituminous coating. Shim and brace the aluminum system before anchoring the system to the structure. Verify that weep holes are open, and the metal joints are sealed in accordance with

the manufacturer's installation instructions. Seal metal-to-metal joints using a sealant recommended by the system manufacturer.

### 3.3.1 Tolerances

Ensure that tolerances for wall thickness and other cross-sectional dimensions of entrance members are nominal and in compliance with Aluminum Standards and Data, published by the Aluminum Association.

### 3.3.2 Adjusting

Adjust operating hardware for smooth operation, and as recommended by the manufacturer.

### 3.3.3 Related Products Installation Requirements

#### 3.3.3.1 Sealants (Perimeter)

Refer to Section 07 92 00 JOINT SEALANTS.

#### 3.3.3.2 Glass

Refer to Section 08 81 00 GLAZING.

## 3.4 FIELD QUALITY CONTROL

### 3.4.1 Air Infiltration

Test air infiltration in accordance with ASTM E783

Submit certified test reports showing compliance with specified performance characteristics as follows:

- a. For single-acting offset pivot, butt hung, or continuous geared hinge entrances in the closed and locked position, test the specimen in accordance with ANSI/BHMA A156.10, and ASTM E283 at a pressure differential of 1.57 psf for pairs of doors; ensure that maximum infiltration for a pair of 7 foot by 8 foot entrance doors and frame is 1.2 cfm/square foot.
- b. Ensure the maximum allowable infiltration for a completed storefront system does not exceed 0.06 cfm/square foot when tested in accordance with ASTM E1424 at a differential static pressure of 6.24 psf.

### 3.4.2 Wind Loads

Provide a completed storefront system capable of withstanding wind pressure loads, normal to the wall plane indicated, as follows:

#### a. Exterior Walls

(1) Positive Pressure: [\_\_\_\_\_] psf

(2) Negative Pressure: [\_\_\_\_\_] psf

#### b. Interior Walls: (pressure acting in either direction) [\_\_\_\_\_] psf

### 3.4.3 Deflection

Submit certified test reports showing that the maximum allowable deflection in a member when tested in accordance with **ASTM E330/E330M** with allowable stress is L/175 or 3/4 inches maximum.

### 3.4.4 Condensation Resistance and Thermal Transmittance

Submit certified test reports showing compliance with specified performance characteristics as follows:

#### a. U-Value Requirements:

- (1) Perform test in accordance with the **AAMA 1503** procedure and on the configuration specified therein.
- (2) Thermal Transmittance ("U" Value) maximum [\_\_\_\_\_] [0.65 (6250) BTU/hr/sf/deg F] at [15] [\_\_\_\_\_] mph exterior wind.

#### b. CRF Class Requirements:

- (1) Perform a test in accordance with **AAMA 1503**.
- (2) Condensation Resistance Factor Requirements (CRF) minimum [\_\_\_\_\_] .

### 3.4.5 Water Infiltration

Submit certified test reports showing that the system is designed to provide no uncontrolled water when tested in accordance with **ASTM E1105** at a static pressure of 8 psf.

## 3.5 ADJUSTING AND CLEANING

### 3.5.1 Protection

Protect the installed product's finish surfaces from damage during construction. Protect the aluminum storefront system from damage from grinding and polishing compounds, plaster, lime, acid, cement, or other harmful contaminants.

### 3.5.2 Cleaning

Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions before acceptance remove excess mastic, mastic smears, and other foreign materials. Remove construction debris from the project site and legally dispose of this debris.

## 3.6 WARRANTY

Submit [three] [\_\_\_\_\_] signed copies of the **manufacturer's product warranty** for the entrance system as follows:

- a. Warranty Period: [Five] [\_\_\_\_\_] years from Date of Substantial Completion of the project, provided that the Limited Warranty begins no later than [six] [\_\_\_\_\_] months from the date of shipment by the manufacturer. In addition, support welded door corner construction with a limited lifetime warranty for the life of the door under normal use.

Ensure that the Warranty's language is identical to the "As Approved" version of the sample warranty submitted to and returned from the Contracting Officer.

-- End of Section --



## SECTION 08 51 13

## ALUMINUM WINDOWS

**05/19**

## PART 1 GENERAL

## 1.1 REFERENCES

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

## ALUMINUM ASSOCIATION (AA)

AA DAF45 (2003; Reaffirmed 2009) Designation System for Aluminum Finishes

## AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 611 (2014) Voluntary Specification for Anodized Architectural Aluminum

AAMA 701/702 (2011) Voluntary Specification for Pile Weatherstripping and Replaceable Fenestration Weatherseals

AAMA 901 (2016) Voluntary Specification for Rotary & Linear Operators in Window Applications

AAMA 902 (2016) Voluntary Specification for Sash Balances

AAMA 907 (2015) Voluntary Specification for Corrosion Resistant Coatings on Carbon Steel Components Used in Windows, Doors and Skylights

AAMA 1302.4 (1973) Specifications for Forced-Entry Resistant Aluminum Prime Windows

AAMA 1503 (2009) Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections

AAMA 2603 (2020) Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels

AAMA 2604 (2017a) Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels

AAMA 2605 (2020) Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic

	Coatings on Aluminum Extrusions and Panels
AAMA WSG.1	(1995) Window Selection Guide
AAMA/WDMA/CSA 101/I.S.2/A440	(2017) North American Fenestration Standard/Specification for Windows, Doors, and Skylights
AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)	
ASHRAE 169	(2013) Climate Data for Building Design Standards
ASTM INTERNATIONAL (ASTM)	
ASTM A276/A276M	(2017) Standard Specification for Stainless Steel Bars and Shapes
ASTM D3656/D3656M	(2013) Standard Specification for Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns
ASTM E90	(2009; R2016) Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
ASTM E413	(2016) Classification for Rating Sound Insulation
ASTM E1300	(2016) Standard Practice for Determining Load Resistance of Glass in Buildings
ASTM E1332	(2016) Standard Classification for Rating Outdoor-Indoor Sound Attenuation
ASTM E1886	(2019) Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials
ASTM E1996	(2017) Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes
ASTM F1642/F1642M	(2017) Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loadings
ASTM F2248	(2012) Standard Practice for Specifying an Equivalent 3-Second Duration Design Loading for Blast Resistant Glazing Fabricated with Laminated Glass
ASTM F2912	(2017) Standard Specification for Glazing

and Glazing Systems Subject to Airblast Loadings

INTERNATIONAL WINDOW CLEANING ASSOCIATION (IWCA)

IWCA I-14.1 (2001) Window Cleaning Safety Standard

NATIONAL FENESTRATION RATING COUNCIL (NFRC)

NFRC 100 (2017) Procedure for Determining Fenestration Product U-Factors

NFRC 200 (2017) Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101 (2021) Life Safety Code

PASSIVE HOUSE INSTITUTE - US (PHIUS)

PHIUS Certified Certified Data Program for Window Performance

PASSIVE HOUSE INSTITUTE INTERNATIONAL (PHI)

Passivhaus Certified (2012) Certification of Passive House Suitable Components

Passivhaus Criteria (2012) Certification Criteria for Certified Passive House Glazings and Transparent Components

SCREEN MANUFACTURERS ASSOCIATION (SMA)

SMA 1004 (1987; R 1998) Aluminum Tubular Frame Screens for Windows

SMA 1201 (R 2013) Specifications for Insect Screens for Windows, Sliding Doors and Swinging Doors

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 4-010-01 (2018;with Change 1, 2020) DoD Minimum Antiterrorism Standards for Buildings

U.S. DEPARTMENT OF ENERGY (DOE)

Energy Star (1992; R 2006) Energy Star Energy Efficiency Labeling System (FEMP)

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When

used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-02 Shop Drawings

Windows; G[, [\_\_\_\_\_]]

Fabrication Drawings

#### SD-03 Product Data

Windows; G[, [\_\_\_\_\_]]

[ Recycled Content of Aluminum Windows; S

] Hardware; G[, [\_\_\_\_\_]]

Fasteners; G[, [\_\_\_\_\_]]

Window Performance; G[, [\_\_\_\_\_]]

Thermal-Barrier Windows; G[, [\_\_\_\_\_]]

Mullions; G[, [\_\_\_\_\_]]

Window Cleaners' Bolts; G[, [\_\_\_\_\_]]

Screens; G[, [\_\_\_\_\_]]

Weatherstripping; G[, [\_\_\_\_\_]]

Accessories; G[, [\_\_\_\_\_]]

Adhesives

Thermal Performance; G[, [\_\_\_\_\_]]

Energy Star Label For Residential Aluminum Window Products; S

#### SD-04 Samples

Finish Sample

Window Sample

[ Window Mock-Ups; G[, [\_\_\_\_\_]]

#### ] SD-05 Design Data

Structural Calculations for Deflection; G[, [\_\_\_\_\_]]

Design Analysis; G[, [\_\_\_\_\_]]

#### SD-06 Test Reports

Minimum Condensation Resistance Factor

[ Resistance to Forced Entry

] [ Standard Airblast Test; G[, [\_\_\_\_]]

] [ Windborne-Debris-Impact Performance

] SD-07 Certificates

[ Engineer's Qualifications

] SD-10 Operation and Maintenance Data

Windows, Data Package 1; G[, [\_\_\_\_]]

Submit in accordance with Section 01 78 23 OPERATION AND  
MAINTENANCE DATA.

Plastic Identification

### 1.3 QUALITY ASSURANCE

#### 1.3.1 Qualification of Manufacturer

Window manufacturer must specialize in designing and manufacturing the type of aluminum windows specified in this section, and have a minimum of [\_\_\_\_] years of documented successful experience. Manufacturer must have the facilities capable of meeting contract requirements, single-source responsibility and warranty.

#### 1.3.2 Shop Drawing Requirements

Take field measurements prior to preparation of drawings and fabrications. Provide drawings that indicate elevations of windows, full-size sections, thickness and gages of metal, fastenings, proposed method of anchoring, size and spacing of anchors, details of construction, method of glazing, details of operating hardware, [mullion details,] [method and materials for weatherstripping,] [method of attaching screens,] [material and method of attaching subframes,] [stools,] [casings,] [sills,] [trim,] [window cleaner anchors,] installation details, and other related items.

#### [1.3.3 Engineer's Qualifications for Blast Design

All blast design calculations must be performed by or under the direct supervision of a registered engineer with a minimum of 5 years experience performing blast design. The engineer performing the blast design must be able to demonstrate experience on similar size projects using similar design methods to meet the requirements outlined in this specification.

#### ]1.3.4 Sample Requirements

##### 1.3.4.1 Finish Sample Requirements

Submit color chart of standard factory color coatings when factory-finish color coating is to be provided.

##### 1.3.4.2 Window Sample Requirements

[ Submit one full-size window of each type proposed for use, complete with AAMA Label, glazing, hardware, anchors, and other accessories. Where

screens or weatherstripping is required, fit sample windows with such items that are to be used. After approval, install each sample in work, clearly identified, and record its location.

] [Submit one full-size corner of each window type proposed for use. Where screens or weatherstripping is required, fit sample with such items that are to be used.

#### ] [1.3.4.3 Mock-Ups

Before fabrication, full-size mock-up of [each type of aluminum window] [one window unit] [\_\_\_\_\_] complete with glass and AAMA certification label for structural purposes and NFRC Temporary and Permanent Label for certification of thermal performance rating will be required for review of window construction and quality of hardware operation.

#### ] 1.3.5 Design Data Requirements

Submit calculations to substantiate compliance with deflection requirements[ and Antiterrorism Performance Requirements]. A registered Professional Engineer must provide calculations.

Submit [design analysis](#) with calculations showing that the design of each different size and type of aluminum window unit and its anchorage to the structure[.] [meets the requirements of paragraph ANTITERRORISM PERFORMANCE REQUIREMENTS.] Calculations verifying the structural performance of each window proposed for use, under the given loads, must be prepared and signed by a registered professional engineer. Reflect the window components and anchorage devices to the structure, as determined by the design analysis, in the shop drawings.

#### 1.3.6 Test Report Requirements

Submit test reports for each type of window attesting that identical windows have been tested and meet the requirements specified herein for conformance to [AAMA/WDMA/CSA 101/I.S.2/A440](#) including test size, [and] [minimum condensation resistance factor](#) (CRF)[, and [resistance to forced entry](#)][, and, for Antiterrorism windows, in lieu of a Design Analysis, results of a Standard Airblast Test]. [ For Antiterrorism windows, in lieu of a Design Analysis, results of airblast testing, whether by arena test or shock tube, must be included in a test report, providing information in accordance with [ASTM F1642/F1642M](#), as prepared by the independent testing agency performing the test. The test results must demonstrate the ability of each window proposed for use to withstand the airblast loading parameters and achieve the hazard level rating specified in paragraph STANDARD AIRBLAST TEST METHOD.]

#### 1.3.7 Certification

Ensure that construction is performed with products that meet or exceed [ [Energy Star](#) criteria,] [FEMP Designated criteria,] [and [Passivhaus Criteria](#) ] [[Passivhaus Certified](#)] [and be current in their certification]. [ Provide [PHIUS Certified](#) window performance.]

Each prime window unit must bear the AAMA Label warranting that the product complies with [AAMA/WDMA/CSA 101/I.S.2/A440](#). Certified test reports attesting that the prime window units meet the requirements of [AAMA/WDMA/CSA 101/I.S.2/A440](#), including test size, will be acceptable in lieu of product labeling.

#### 1.4 DELIVERY AND STORAGE

Deliver windows to project site in an undamaged condition. Use care in handling and hoisting windows during transportation and at the jobsite. Store windows and components out of contact with the ground, under a weathertight covering, so as to prevent bending, warping, or otherwise damaging the windows. Repair damaged windows to an "as new" condition as approved. If windows can not be repaired, provide a new unit.

#### 1.5 PLASTIC IDENTIFICATION

Label plastic products provided to indicate their polymeric composition according to the following list. Where products are not labeled, provide product data indicating polymeric information in Operation and Maintenance Manual.

- a. Type 1: Polyethylene Terephthalate (PET, PETE).
- b. Type 2: High Density Polyethylene (HDPE).
- c. Type 3: Vinyl (Polyvinyl Chloride or PVC).
- d. Type 4: Low Density Polyethylene (LDPE).
- e. Type 5: Polypropylene (PP).
- f. Type 6: Polystyrene (PS).
- g. Type 7: Other. Use of this code indicates that the package in question is made with a resin other than the six listed above, or is made of more than one resin listed above, and used in a multi-layer combination.

#### 1.6 PERFORMANCE REQUIREMENTS

##### 1.6.1 Wind Loading Design Pressure

Design window components, including mullions, hardware, and anchors, to withstand a wind-loading design pressure of at least [\_\_\_\_\_] pounds per square foot (psf).

##### [1.6.2 Tests

Test windows proposed for use in accordance with AAMA/WDMA/CSA 101/I.S.2/A440 for the particular type and quality window specified.

Perform tests by a nationally recognized independent testing laboratory equipped and capable of performing the required tests. Submit the results of the tests as certified laboratory reports required herein.

Minimum design load for a uniform-load structural test must be 50 psf.

[ Test projected windows in accordance with the applicable portions of the AAMA WSG.1 for air infiltration, water resistance, uniform-load deflection, and uniform-load structural test.

] [Test double-hung windows in accordance with the applicable portions of the

AAMA WSG.1 for air infiltration, water resistance, uniform-load deflection, and uniform-load structural test.

## ]1.7 DRAWINGS

Submit the Fabrication Drawings for aluminum window units showing complete window assembly including hardware, weatherstripping, and subframe assembly details.

## 1.8 WINDOW PERFORMANCE

Aluminum windows must meet the following performance requirements. Perform testing requirements by an independent testing laboratory or agency.

### 1.8.1 Structural Performance

Structural test pressures on window units must be for positive load (inward) and negative load (outward). After testing, there will be no glass breakage, permanent damage to fasteners, hardware parts, support arms or actuating mechanisms or any other damage which could cause window to be inoperable. There must be no permanent deformation of any main frame, sash or ventilator member in excess of the requirements established by AAMA/WDMA/CSA 101/I.S.2/A440 for the window types and classification specified in this section.

### [1.8.2 Antiterrorism Performance Requirements

Windows must meet the antiterrorism performance criteria as specified in the paragraphs below in accordance with UFC 4-010-01. Conformance to the performance requirements must be validated by one of the following methods.

#### 1.8.2.1 Computational Design Analysis Method

Design window assembly to the criteria listed herein. Include computational design analysis calculations verifying the structural performance of each window assembly proposed for use, under the given static equivalent loads.

Design window frames, mullions, sashes, and glazing to the criteria listed herein. Include computational design analysis calculations verifying the structural performance of each window system proposed for use, under the given static equivalent loads.

Glazing resistance must be greater than equivalent 3-second duration loading of [\_\_\_\_\_] pounds per square foot (psf) for type [\_\_\_\_\_] window[ and [\_\_\_\_\_] psf for the remaining window types]. The glazing frame bite for the window frames must be in accordance with ASTM F2248.

Design Aluminum/Steel window framing members to restrict deflections of the edges of glazing they support to L/60 under two times (2X) the glazing resistance per the requirements of ASTM F2248 and ASTM E1300.

[ Anchor window frames to the supporting structure with anchors designed to resist [two times (2X)][one time (1X)] the glazing resistance in accordance with ASTM F2248 and ASTM E1300.



## ]1.8.2.2 Dynamic Design Analysis Method

Design window assembly using a dynamic analysis to prove the system will provide performance equivalent to or better than a [low];[very low]; [\_\_\_\_\_] hazard rating in accordance with ASTM F2912 for the peak positive pressure of [\_\_\_\_\_] pounds per square inch (psi) and peak positive phase impulse of [\_\_\_\_\_] pounds per square inch - millisecond (psi-msec). Use a triangular blast load using the applicable pressure and impulse indicated above. The allowable response limits of [aluminum] [steel] frame elements are as follows: Maximum ductility ratio of [\_\_\_\_\_] and maximum support rotation of [\_\_\_\_\_] degrees.

## 1.8.2.3 Standard Airblast Test Method

As an alternative to the 'Computational Design Analysis Method' and 'Dynamic Design Analysis Method' indicated above, window [\_\_\_\_\_] assembly may be tested for evaluation of hazards generated from airblast loading in accordance with ASTM F1642/F1642M by an independent testing agency regularly engaged in blast testing. For proposed window systems that are of the same type as the tested system but of different size, the test results may be accepted provided the proposed window size is within the range from 25 percent smaller to 10 percent larger in area and aspect ratio of the original qualified tested glazing systems in accordance with ASTM F2912. Proposed window system/assembly of a size outside this range will require testing to evaluate their hazard rating or are certified by the 'Dynamic Design Analysis Method' indicated above. Testing may be by shock tube or arena test. Perform the test on the entire proposed window system/assembly, including, the glazing, its framing/support system, operating devices, and all anchorage devices. Window support system replicate anchorage of the window support system with the method of installation to be used for the project. The minimum airblast loading parameters for the test will be as follows: peak positive pressure of [\_\_\_\_\_] pounds per square inch (psi) and peak positive phase impulse of [\_\_\_\_\_] pounds per square inch - millisecond (psi-msec). The hazard rating for the proposed window systems, as determined by the rating criteria of ASTM F2912, to provide performance equivalent to or better than a [low];[very low]; [\_\_\_\_\_] hazard rating (i.e. the "No Break", "No Hazard", "Minimal Hazard", "Very Low Hazard" and "Low Hazard" ratings are acceptable. "High Hazard" ratings are unacceptable. Results of window systems previously tested by test protocols other than ASTM F1642/F1642M may be accepted provided the required loading, hazard level rating, and size limitations stated herein are met.

## ]1.8.3 Air Infiltration

Air infiltration must not exceed the amount established by AAMA/WDMA/CSA 101/I.S.2/A440 for each window type.

## 1.8.4 Water Penetration

Water penetration must not exceed the amount established by AAMA/WDMA/CSA 101/I.S.2/A440 for each window type.

## 1.8.5 Thermal Performance

Windows (including frames and glass) will be independently tested and certified with a Solar Heat Gain Coefficient (SHGC) determined according to NFRC 200 procedures and a whole window U-factor determined in accordance with NFRC 100 within the ranges as indicated below according to

the [ASHRAE 169](#) Climate Zone of the project location.[ Windows used solely within the interior of a conditioned envelope are exempted from meeting U-Factor and SHGC requirements, unless otherwise noted.] Provide visual Transmittance (VT) of 0.5 or greater. Submit documentation supporting compliance with Energy Star, FEMP designated, and Passive House qualifications as applicable. Provide proof of [Energy Star label for residential aluminum window products](#).

#### [1.8.5.1 Southern Climate

Windows installed in Climate Zone [1] [2] will have a U-Factor of [0.40] [\_\_\_\_\_] BTU/h·ft<sup>2</sup>·degrees F or less and a SHGC of [0.25] [\_\_\_\_\_] or less.

#### ] [1.8.5.2 South-Central Climate

Windows installed within Climate Zone 3 will have a U-Factor of [0.30] [\_\_\_\_\_] BTU/h·ft<sup>2</sup>·degrees F or less and a SHGC of [0.25] [\_\_\_\_\_] or less.

#### ] [1.8.5.3 North-Central Climate

Windows installed within Climate Zone 4 will have a U-Factor of [0.30] [\_\_\_\_\_] BTU/h·ft<sup>2</sup>·degrees F or less and a SHGC of [0.36] [\_\_\_\_\_] or less.

#### ] [1.8.5.4 Northern Climate

Windows installed within Climate Zone [5] [6] [7] will have a U-Factor of [0.27] [\_\_\_\_\_] BTU/h·ft<sup>2</sup>·degrees F or less and a SHGC of [0.36] [0.41] [\_\_\_\_\_] or less.

#### ] [1.8.5.5 Subarctic Climate

Windows installed within Climate Zone 8 will have a U-Factor of [0.08] [0.22] [\_\_\_\_\_] BTU/h·ft<sup>2</sup>·degrees F or less. There is no SHGC limit for this climate zone.

#### ] [1.8.6 Life Safety Criteria

Provide windows that conform to [NFPA 101](#) Life Safety Code when rescue and/or second means of escape are indicated.

#### ] [1.8.7 Sound Attenuation

When tested in accordance with [AAMA/WDMA/CSA 101/I.S.2/A440](#) or the following below, provide a minimum Sound Transmission Class (STC) of 35 in accordance with [ASTM E90](#) and as determined by [ASTM E413](#) or Outside-Indoor Transmission Class (OITC) of 25 in accordance with [ASTM E1332](#) and as determined by [ASTM E413](#) with the window glazed with 1/2 inch air space between two pieces of 1/4 inch.

#### ] [1.8.8 Windborne-Debris-Impact Performance

Exterior window system including glazing must comply with indicated basis or enhanced protection testing requirements in [ASTM E1996](#) for [Wind Zone 1] [Wind Zone 2] [Wind Zone 3] [Wind Zone 4] when tested according to [ASTM E1886](#). Test specimens must be no smaller in width and length than glazing indicated for use on Project and must be installed in same manner

as glazing indicated for use on Project.

- a. Refer to drawings for classification of window requiring basic or enhanced protection.

[ b. Large-Missile Test: For glazing located within 30 feet of grade.

]c. Small-Missile Test: For glazing located more than 30 feet above grade.

#### ]1.9 WARRANTY

Provide Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period.

## PART 2 PRODUCTS

### 2.1 WINDOWS

Provide prime windows that comply with AAMA/WDMA/CSA 101/I.S.2/A440 and the requirements specified herein. In addition to compliance with AAMA/WDMA/CSA 101/I.S.2/A440, window framing members for each individual light of glass must not deflect to the extent that deflection perpendicular to the glass light exceeds L/175 of the glass edge length when subjected to uniform loads at specified design pressures. Provide Structural calculations for deflection to substantiate compliance with deflection requirements. Provide windows of types, performance classes, performance grades, combinations, and sizes indicated or specified. Provide aluminum window frames with a minimum recycled content of 20 percent. Provide data identifying percentage of recycled content of aluminum windows.] Design windows to accommodate hardware, glass, weatherstripping, screens, and accessories to be furnished. Each window must be a complete factory assembled unit with or without glass installed. Dimensions shown are minimum. Provide windows with insulating glass and thermal break necessary to achieve a minimum Condensation Resistance Factor (CRF) of [\_\_\_\_\_] when tested in accordance with AAMA 1503. Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with adjacent materials; designed to smoothly operate, tightly close, and securely lock windows, and sized to accommodate sash weight and dimensions.

#### 2.1.1 Awning Windows (AP)

Type AP-[R15] [LC25] [CW30] [AW40] [ [R] [LC] [CW] [AW]- [\_\_\_\_\_] (Optional Performance Grade)]. Conceal operating mechanism within the frame members or enclose within a metal casing not less than 0.0625 inch thick sheet aluminum.

#### 2.1.2 Casement Windows (C)

Type C-[R15] [LC25] [CW30] [AW40] [ [R] [LC] [CW] [AW]- [\_\_\_\_\_] (Optional Performance Grade)]. Ventilators must be[ rotary crank][ handle] operated. Provide ventilators over 65 inches high with two separate locking devices or a two-point locking device operated by rods from a single lever handle. Conceal rods where possible.[ Provide casement windows in combination with [fixed][projected] windows specified below.]

## 2.1.1.3 Hung Windows (H)

[Double][\_\_\_\_\_] Hung, Type H-[R15] [LC25] [CW30] [AW40] [ [R] [LC] [CW] [AW]- [\_\_\_\_\_] (Optional Performance Grade)]. Test and rate sash balance to conform with AAMA 902.

Design windows, mullions, hardware, and anchors to withstand the wind loading specified.

## 2.1.1.4 Horizontal Sliding Windows (HS)

Type HS-[R15] [LC25] [CW30] [AW40] [ [R] [LC] [CW] [AW]- [\_\_\_\_\_] (Optional Performance Grade)].

## 2.1.1.5 Projected Windows (AP)

Type AP-[R15] [LC25] [CW30] [AW40] [ [R] [LC] [CW] [AW]- [\_\_\_\_\_] (Optional Performance Grade)]. Provide projected windows with concealed four bar friction hinges only. Gear-type rotary hardware to comply with AAMA 901. Provide operators that function without requiring the removal of interior screens.

## 2.1.1.6 Top-Hinged Windows (TH)

Type TH-[CW30] [AW40] [ [CW] [AW]- [\_\_\_\_\_] (Optional Performance Grade)]. Top-hinged windows must be [inswinging][outswinging].

## 2.1.1.7 Vertically Pivoted Windows (VP)

Type VP-[R15] [LC25] [CW30] [AW40] [ [R] [LC] [CW] [AW]-[\_\_\_\_\_] (Optional Performance Grade)]. [ Provide window with remotely operated venetian blind mounted between an access sash and the main sash.]

## 2.1.1.8 Fixed Windows (F)

Type F-[R15] [LC25] [CW30] [AW40] [ [R] [LC] [CW] [AW]- [\_\_\_\_\_] (Optional Performance Grade)].

## 2.1.1.9 Forced Entry Resistant Windows

In addition to meeting the requirements of AAMA/WDMA/CSA 101/I.S.2/A440, windows designated for resistance to forced entry must conform to the requirements of AAMA 1302.4.

## 2.1.1.10 Glass and Glazing

Materials are specified in Section 08 81 00 GLAZING.

## 2.1.1.11 Caulking and Sealing

Are specified in Section 07 92 00 JOINT SEALANTS.

## 2.1.1.12 Weatherstripping

AAMA/WDMA/CSA 101/I.S.2/A440. Provide for all ventilating (operable) sash for all windows. Provide woven wool pile weatherstripping 0.210 inch thick, conforming to AAMA 701/702, or polypropylene multifilament fiber weatherstripping installed in an integral weatherstripping groove in the sash or frame, and flexible polyvinylchloride weatherstripping installed

in the sill member.

#### 2.1.13 Sash Poles

Seamless aluminum tube, 0.0625 inch minimum wall thickness, one inch diameter, [\_\_\_\_\_] feet long, with cast aluminum hook and protective cover or tip on the lower end. Finish must match windows.

### 2.2 FABRICATION

Fabrication of window units must comply with AAMA/WDMA/CSA 101/I.S.2/A440.

#### 2.2.1 Provisions for Glazing

Design windows and rabbets suitable for glass thickness shown [or specified]. [ For minimum antiterrorism windows, attach glazing to its supporting frame using structural silicone sealant or adhesive glazing tape in accordance with ASTM F2248.] Design sash for [ inside ] [ outside ] [ single ] [ double ] glazing and for securing glass with [ metal beads, ] [ glazing clips, ] [ glazing channels, ] or glazing compound.

#### 2.2.2 Fasteners

Use window manufacturer's standard for windows, trim, and accessories. Self-tapping sheet-metal screws are not acceptable for material more than 1/16 inch thick.

#### 2.2.3 Adhesives

Provide joint sealants as specified in Section 07 92 00 JOINT SEALANTS. For interior application of joint sealants, comply with applicable regulations regarding reduced VOC's, and as specified in Section 07 92 00 JOINT SEALANTS.

#### 2.2.4 Drips and Weep Holes

Provide continuous drips over heads of top ventilators. Where fixed windows adjoin ventilators, drips must be continuous across tops of fixed windows. Provide drips and weep holes as required to return water to the outside.

#### 2.2.5 Combination Windows

Windows used in combination must be factory assembled of the same class and grade. Where factory assembly of individual windows into larger units is limited by transportation considerations, prefabricate, match mark, transport, and field assemble.

#### 2.2.6 Mullions and Transom Bars

[Provide mullions between multiple window units to resist two times (2X) glazing resistance in accordance with ASTM F2248 and ASTM E1300. ] Provide mullions with a thermal break. Secure mullions and transom bars to adjoining construction and window units in such a manner as to permit expansion and contraction and to form a weathertight joint. [ Where window cleaner anchors are required, reinforce mullions and anchor to adjoining construction so as to provide safe and adequate support. ] Provide mullion covers on the interior and exterior to completely close exposed joints and recesses between window units and to present a neat appearance. [ Provide

special covers over structural support at mullions as indicated.]

#### 2.2.7 Accessories

Provide windows complete with necessary hardware, fastenings, clips, fins, anchors, glazing beads, and other appurtenances necessary for complete installation and proper operation.[ Furnish extruded aluminum subframe receptors[ and subsill] with each window unit.]

##### 2.2.7.1 Hardware

AAMA/WDMA/CSA 101/I.S.2/A440. The item, type, and functional characteristics must be the manufacturer's standard for the particular window type. Provide [stainless steel ]hardware of suitable design and of sufficient strength to perform the function for which it is used. Equip all operating ventilators with a lock or latching device which can be secured from the inside.

##### 2.2.7.2 Fasteners

Provide concealed anchors of the type recommended by the window manufacturer for the specific type of construction. Anchors and fasteners must be compatible with the window and the adjoining construction. Provide a minimum of three anchors for each jamb located approximately 6 inches from each end and at midpoint.

##### 2.2.7.3 Window-Cleaner Anchors

Provide double head anchors for windows[ indicated][ specified]. Anchors must be stainless steel of size and design required for the window type and application, conforming to ASTM A276/A276M. Provide two anchors for each single window[ and each adjacent fixed glass window unit]. Fasten anchors 44 inches above the window sill utilizing appropriate methods for the window type and application in accordance with industry safety standards.

##### 2.2.7.4 Window Anchors

Anchoring devices for installing windows must be made of aluminum, cadmium-plated steel, stainless steel, or zinc-plated steel conforming to AAMA/WDMA/CSA 101/I.S.2/A440.

#### 2.2.8 Finishes

Comply with NAAMM's "Metal Finishes Manual" for applying and designating finishes. Exposed aluminum surfaces must be factory finished with an[ anodic coating][ or][ organic coating].[ Color must be [\_\_\_\_\_] [ as indicated].] All windows[ for each building] must have the same finish.

##### 2.2.8.1 Anodic Coating

Clean exposed aluminum surfaces and provide an anodized finish conforming to AA DAF45 and AAMA 611. Finish must be:

- [ a. Architectural Class II ( 0.4 mil to 0.7 mil), designation AA-M10-C22-[A31, clear (natural)] [A32, integral color] [A34, electrolytically deposited color] anodized.
- ] [b. Architectural Class I ( 0.7 mil or thicker), designation

AA-M10-C22-[A41, clear (natural)] [A42, integral color] [A44, electrolytically deposited color] anodized.

#### 2.2.8.2 Organic Coating

Clean and prime exposed aluminum surfaces. Provide a[ baked enamel finish in accordance with AAMA 2603 with total dry film thickness not less than 0.8 mil][ high-performance finish in accordance with [AAMA 2604][AAMA 2605 ] with total dry film thickness of not less than 1.2 mils].

#### 2.2.9 Screens

AAMA/WDMA/CSA 101/I.S.2/A440. Provide one insect screen for each operable exterior sash or ventilator. Design screens to be rewirable, easily removable from inside the building, and to permit easy access to operating hardware. Manufacturers standard aluminum frame complying with SMA 1004 or SMA 1201. Fabricate frames with mitered or coped joints or corner extrusion, concealed fasteners and removable PVC spline/anchors concealing edge of frame.

##### 2.2.9.1 Insect Screen

Insect screen mesh to be[ Glass-fiber mesh, 18x16 of PVC-coated glass-fiber threads; woven and fused to form a fabric mesh in accordance with ASTM D3656/D3656M][ Aluminum wire fabric, 18x16 mesh of 0.011 inch diameter coated aluminum wire].

#### 2.3 SPECIAL OPERATORS

For windows having operating hardware or locking or latching devices located more than 6 feet above the floor, provide suitably designed operators or locking or latching devices necessary for convenient and proper window operation.

##### 2.3.1 Pole Operators

Poles must be of proper length to permit window operation from 5 feet above the floor. Provide one pole operator for each room, and one pole hanger for each pole. Locate hangers where directed.

##### 2.3.2 Extension Crank Operators

Provide removable handles for crank-operated rotary-type operators located more than 6 feet above the floor. Provide one removable handle for each room.

##### 2.3.3 Mechanical Operators

Provide [manual] [electric motor driven] operators for group operation of continuous rows of windows [located [\_\_\_\_\_] feet above the floor]. Operators must be capable of opening and closing windows without appreciable deflection, vibration or rattle. Provide means of adjustment for transmission lines. Provide operators to control window units in groups [as recommended by the window manufacturer] [or] [as indicated].

#### 2.4 THERMAL-BARRIER WINDOWS

Provide thermal-barrier windows, complete with accessories and fittings, where indicated.

Specify material and construction except as follows:

- a. Aluminum alloy must be 6063-T6.
- b. Frame construction, including operable sash, must be factory-assembled and factory-sealed inner and outer aluminum completely separated from metal-to-metal contact. Join assembly by a continuous, concealed, low conductance divider housed in an interlocking extrusion of the inner frame. Metal fasteners, straps, or anchors must not bridge the connection between the inner and outer frame.
- c. Operating hardware for each sash must consist of spring-loaded nylon cushion blocks and pin locks designed to lock in predetermined locations.
- d. Sash must be completely separated from metal-to-metal contact by means of woven-pile weatherstripping, plastic, or elastomeric separation members.
- e. Operating and storm sash must be factory-glazed with the type of glass indicated and of the quality specified in Section 08 81 00 GLAZING.

## 2.5 MULLIONS

Provide mullions between multiple-window units where indicated.

Provide profiles for mullions and mullion covers, reinforced as required for the specified wind loading, and securely anchored to the adjoining construction. Mullion extrusion will include serrations or pockets to receive weatherstripping, sealant, or tape at the point of contact with each window flange.

Mullion assembly must include aluminum window clamps or brackets screwed or bolted to the mullion and the mullion cover.

Mullion cover must be screw-fastened to the mullion unless otherwise indicated.

Mullion reinforcing members must be fabricated of the materials specified in AAMA/WDMA/CSA 101/I.S.2/A440 and meet the specified design loading.

## 2.6 WINDOW CLEANERS' BOLTS

Provide window cleaners' bolts for all windows 7 feet or higher above finished grade, except for windows that can be removed and cleaned from the ground or from a lower roof level without the use of an extension ladder. Provide two bolts for each single window unit and each fixed glass unit. Locate bolts 44 inches above the window sill.

Window cleaners' bolts must be double-head type, AISI Series 300 corrosion-resistant steel, size and design complying with IWCA I-14.1. Contact side of the bolts must be ground to fit flat against window jambs. Bolts must be factory- or field-attached before windows are set. Reinforce backs of frames to receive bolts with 1/4 by 6-inch corrosion-resistant steel or aluminum plates bolted or welded to the frames at the factory. Special wall anchors must be provided on frames at the point of bolt attachment.



## PART 3 EXECUTION

### 3.1 INSTALLATION

#### 3.1.1 Method of Installation

Install in accordance with the window manufacturer's printed instructions and details. Build in windows as the work progresses or install without forcing into prepared window openings. Set windows at proper elevation, location, and reveal; plumb, square, level, and in alignment; and brace, strut, and stay properly to prevent distortion and misalignment. Protect ventilators and operating parts against accumulation of dirt and building materials by keeping ventilators tightly closed and locked to frame. Bed screws or bolts in sill members, joints at mullions, contacts of windows with sills, built-in fins, and subframes in mastic sealant of a type recommended by the window manufacturer. Install and caulk windows in a manner that will prevent entrance of water and wind. Fasten insect screens securely in place.

Any materials that show visual evidence of biological growth due to the presence of moisture must not be installed on the building project.

#### 3.1.2 Dissimilar Materials

Where aluminum surfaces are in contact with, or fastened to masonry, concrete, wood, or dissimilar metals, except stainless steel or zinc, protect the aluminum surface from dissimilar materials as recommended in the Appendix to [AAMA/WDMA/CSA 101/I.S.2/A440](#). Do not coat surfaces in contact with sealants after installation with any type of protective material. Do not apply coatings or lacquers to surfaces to which caulking and glazing components must adhere.

#### 3.1.3 Anchors and Fastenings

Make provision for securing units to each other, to masonry, and to other adjoining construction. Windows installed in masonry walls must have head and jamb members designed to recess into masonry wall not less than  $\frac{7}{16}$  inch.

#### 3.1.4 Adjustments After Installation

After installation of windows and completion of glazing and field painting, adjust all ventilators and hardware to operate smoothly and to provide weathertight sealing when ventilators are closed and locked. Lubricate hardware and operating parts as necessary. [ Adjust double hung windows to operate with maximum applied force of 25 pounds in either direction, not including breakaway friction force.] Verify that products are properly installed, connected, and adjusted.

### 3.2 CLEANING

Clean interior and exterior surfaces of window units of mortar, plaster,

paint spattering spots, and other foreign matter to present a neat appearance, to prevent fouling of weathering surfaces and weather-stripping, and to prevent interference with the operation of hardware. Replace all stained, discolored, or abraded windows that cannot be restored to their original condition with new windows.

-- End of Section --

## SECTION 08 71 00

DOOR HARDWARE  
**02/16**

## PART 1 GENERAL

## 1.1 REFERENCES

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

## ASTM INTERNATIONAL (ASTM)

ASTM E283	(2019) Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
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## BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

ANSI/BHMA A156.1	(2016) Butts and Hinges
ANSI/BHMA A156.3	(2014) Exit Devices
ANSI/BHMA A156.4	(2013) Door Controls - Closers
ANSI/BHMA A156.5	(2014) Cylinder and Input Devices for Locks
ANSI/BHMA A156.6	(2015) Architectural Door Trim
ANSI/BHMA A156.7	(2016) Template Hinge Dimensions
ANSI/BHMA A156.8	(2015) Door Controls - Overhead Stops and Holders
ANSI/BHMA A156.13	(2017) Mortise Locks & Latches Series 1000
ANSI/BHMA A156.14	(2013) Sliding and Folding Door Hardware
ANSI/BHMA A156.15	(2015) Release Devices Closer Holder, Electromagnetic and Electromechanical
ANSI/BHMA A156.16	(2018) Auxiliary Hardware
ANSI/BHMA A156.18	(2016) Materials and Finishes
ANSI/BHMA A156.19	(2013) Power Assist & Low Energy Power Operated Doors
ANSI/BHMA A156.21	(2014) Thresholds
ANSI/BHMA A156.22	(2017) Door Gasketing and Edge Seal Systems
ANSI/BHMA A156.23	(2010) Electromagnetic Locks

ANSI/BHMA A156.25	(2013) Electrified Locking Devices
ANSI/BHMA A156.26	(2012) Continuous Hinges
ANSI/BHMA A156.31	(2013) Electric Strikes and Frame Mounted Actuators
ANSI/BHMA A156.36	(2010) Auxiliary Locks

#### NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code
NFPA 72	(2019; TIA 19-1; ERTA 1 2019) National Fire Alarm and Signaling Code
NFPA 80	(2019) Standard for Fire Doors and Other Opening Protectives
NFPA 101	(2021) Life Safety Code
NFPA 252	(2017) Standard Methods of Fire Tests of Door Assemblies

#### STEEL DOOR INSTITUTE (SDI/DOOR)

SDI/DOOR A250.8	(2003; R2008) Recommended Specifications for Standard Steel Doors and Frames
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#### U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

36 CFR 1191	Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines
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#### UNDERWRITERS LABORATORIES (UL)

UL Bld Mat Dir	(updated continuously online) Building Materials Directory
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### 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance with Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Manufacturer's Detail Drawings; G

Verification of Existing Conditions; G

Hardware Schedule; G

Keying System; G

SD-03 Product Data

Hardware Items; G

SD-08 Manufacturer's Instructions

Installation

SD-10 Operation and Maintenance Data

Hardware Schedule Items, Data Package 1; G

SD-11 Closeout Submittals

Key Bitting

### 1.3 SHOP DRAWINGS

Submit [manufacturer's detail drawings](#) indicating all hardware assembly components and interface with adjacent construction. Indicate power components and wiring coordination for electrified hardware. Base shop drawings on verified field measurements and include [verification of existing conditions](#).

### 1.4 PRODUCT DATA

Indicate fire-ratings at applicable components. Provide documentation of ABA/ADA accessibility compliance of applicable components, as required by [36 CFR 1191](#) Appendix D - Technical.

### 1.5 HARDWARE SCHEDULE

Prepare and submit hardware schedule in the following form:

Hardware Item	Quantity	Size	Reference Publication Type No.	Finish	Mfr Name and Catalog No.	Key Control Symbols	UL Mark (If fire-rated and listed)	BHMA Finish Designation

In addition, submit hardware schedule data package 1 in accordance with Section [01 78 23](#) OPERATION AND MAINTENANCE DATA.

### 1.6 KEY BITTING CHART REQUIREMENTS

#### 1.6.1 Requirements

Submit [key bitting](#) charts to the Contracting Officer prior to completion of the work. Include:

- a. Complete listing of all keys (e.g. AA1 and AA2).

- b. Complete listing of all key cuts (AA1-123456, AA2-123458).
- c. Tabulation showing which key fits which door.
- d. Copy of floor plan showing doors and door numbers.
- e. Listing of 20 percent more key cuts than are presently required in each master system.

## 1.7 QUALITY ASSURANCE

### 1.7.1 Hardware Manufacturers and Modifications

Provide, as far as feasible, locks, hinges, and closers of one lock, hinge, or closer manufacturer's make. Modify hardware as necessary to provide features indicated or specified.

### 1.7.2 Key Shop Drawings Coordination Meeting

Prior to the submission of the key shop drawing, the Contracting Officer, Contractor, Door Hardware Subcontractor, using Activity and Base Locksmith must meet to discuss and coordinate key requirements for the facility.

## 1.8 DELIVERY, STORAGE, AND HANDLING

Deliver hardware in original individual containers, complete with necessary appurtenances including fasteners and instructions. Mark each individual container with item number as shown on hardware schedule. Deliver permanent keys and removable cores to the Contracting Officer, either directly or by certified mail. Deliver construction master keys with the locks.

## PART 2 PRODUCTS

### 2.1 TEMPLATE HARDWARE

Hardware applied to metal or to prefinished doors must be manufactured using a template. Provide templates to door and frame manufacturers in accordance with ANSI/BHMA A156.7 for template hinges. Coordinate hardware items to prevent interference with other hardware.

### 2.2 HARDWARE FOR FIRE DOORS AND EXIT DOORS

Provide all hardware necessary to meet the requirements of NFPA 72 for door alarms, NFPA 80 for fire doors, NFPA 101 for exit doors, NFPA 252 for fire tests of door assemblies, ABA/ADA accessibility requirements, and all other requirements indicated, even if such hardware is not specifically mentioned in paragraph HARDWARE SCHEDULE. Provide Underwriters Laboratories, Inc. labels for such hardware in accordance with UL Bld Mat Dir or equivalent labels in accordance with another testing laboratory approved in writing by the Contracting Officer.

### 2.3 HARDWARE ITEMS

Clearly and permanently mark with the manufacturer's name or trademark, hinges, pivots, locks, latches, exit devices, bolts and closers where the identifying mark is visible after the item is installed. For closers with covers, the name or trademark may be beneath the cover. Coordinate

electrified door hardware components with corresponding components specified in Division 28 ELECTRONIC SECURITY SYSTEMS (ESS).

#### 2.3.1 Hinges

Provide in accordance with ANSI/BHMA A156.1. Provide hinges that are 4-1/2 by 4-1/2 inch unless otherwise indicated. Construct loose pin hinges for interior doors and reverse-bevel exterior doors so that pins are non-removable when door is closed. Other anti-friction bearing hinges may be provided in lieu of ball bearing hinges.

#### 2.3.2 Continuous Hinges

Where continuous hinges are required, provide in accordance with ANSI/BHMA A156.26.

#### 2.3.3 Locks and Latches

##### 2.3.3.1 Mortise Locks and Latches

Provide in accordance with ANSI/BHMA A156.13, Series 1000, Operational Grade 1, Security Grade 2. Provide knobs and roses of mortise locks with screwless shanks and no exposed screws.

##### 2.3.3.2 Auxiliary Locks

Provide in accordance with ANSI/BHMA A156.36, Grade 1.

##### 2.3.3.3 Combination Locks

Heavy-duty, mechanical combination lockset with five push buttons, standard sized knobs, 3/4 inch deadlocking latch, 2-3/4 inch backset. Locks to operate by pressing two or more of the buttons in unison or individually in the proper sequence. Inside knob operates the latch. Provide a keyed cylinder on the interior to permit setting the combination.

Provide a keyed removable core cylinder on the exterior to permit bypassing the combination.

##### 2.3.4 Exit Devices

Provide in accordance with ANSI/BHMA A156.3, Grade 1. Provide adjustable strikes for rim type and vertical rod devices. Provide open back strikes for pairs of doors with mortise and vertical rod devices. Provide touch bars in lieu of conventional crossbars and arms.

#### 2.3.5 Cylinders and Cores

Provide cylinders and cores for new locks, including locks provided under other sections of this specification. Provide cylinders and cores with six pin tumblers. Provide cylinders from the products of one manufacturer, and provide cores from the products of one manufacturer. Rim cylinders, mortise cylinders, and knobs of bored locksets have interchangeable cores which are removable by special control keys. Stamp each interchangeable core with a key control symbol in a concealed place on the core.

#### 2.3.6 Electrified Hardware

Comply with the requirements of NFPA 70 for wiring of electrified hardware.

#### 2.3.6.1 Electric Strikes and Frame Mounted Actuators

Provide in accordance with ANSI/BHMA A156.31, Grade 1. Provide electric strikes and actuators as required to meet operational requirements. Provide electric strikes that remain secure during power failure. Provide a separate power supply for electric strikes, other locking devices and ancillary parts. Provide strikes and actuators with a minimum opening force of 2300 pounds.

Provide facility interface devices that use direct current (dc) power to energize the solenoids. Provide electric strikes and actuators that incorporate end-of-line resistors to facilitate line supervision by the system. If not incorporated into the electric strike or local controller, provide metal oxide resistors (MOVs) to protect the controller from reverse current surges.

##### 2.3.6.1.1 Solenoid

Provide actuating solenoid for strikes and actuators that are rated for continuous duty, cannot dissipate more than 12 Watts and must operate on 12 or 24 Volts dc. Inrush current cannot exceed 1 ampere and the holding current cannot be greater than 500 milliamperes. Actuating solenoid must move from fully secure to fully open positions in less than 500 milliseconds.

##### 2.3.6.1.2 Signal Switches

Provide strikes and actuators with signal switches to indicate to the system when the bolt is not engaged or the strike mechanism is unlocked. Signal switches must report a forced entry to the system.

##### 2.3.6.1.3 Tamper Resistance

Provide strike guards that prevent tampering with the latch bolt of the locking hardware or the latch bolt keeper of the electric strike. Strike guards to bolt through the door using tamper resistant screws. Provide strike guards made of 1/8 inch thick brass and that are 11-1/14 inch high by 1-5/8 inch wide, with a minimum 5/32 inch wide offset.

##### 2.3.6.1.4 Coordination

Provide electric strikes and actuators of a size, weight and profile compatible with each specified door frame. Field verify installation clearances prior to procurement.

##### 2.3.6.1.5 Mounting Method

Provide electric strikes and actuators suitable for use with single and double doors, with mortise or rim type hardware specified, and for right or left hand mounting as specified. In double door installations, locate the lock in the active leaf and monitor the fixed leaf.

#### 2.3.6.2 Electrified Mortise Locks

Provide in accordance with ANSI/BHMA A156.25, Grade 1. Provide electrified mortise locks that remain secure during power failure. Provide facility interface devices that use dc power to energize solenoids. Provide solenoids, resistors, and signal switches in accordance with paragraph ELECTRIC STRIKES AND FRAME MOUNTED ACTUATORS.



#### 2.3.6.2.1 Power Transfer Hinges

Provide power transfer hinges with each electrified lock that route power and monitoring signals from the lockset to the door frame. Coordinate power transfer hinges with door frames.

#### 2.3.6.3 Card Readers and Keypad Access Control Hardware

Coordinate access control hardware with corresponding devices and systems specified in Division 28 ELECTRONIC SECURITY SYSTEMS (ESS).

#### 2.3.6.4 Release Devices

In accordance with ANSI/BHMA A156.15, Grade 1.

##### 2.3.6.4.1 Release Devices

Provide wall mounted Electromagnetic release devices connected to fire smoke detecting devices.

#### 2.3.6.5 Power Assist and Low Energy Power Operated Doors

Provide in accordance with ANSI/BHMA A156.19, Grade 1.

#### 2.3.6.6 Electromagnetic Locks

Provide in accordance with ANSI/BHMA A156.23, Grade 1. Provide electromagnetic locks that do not contain any moving parts and depend solely upon electromagnetism to secure a portal by generating at least 1200 pounds of holding force. The lock must interface with the local processors without external, internal or functional alteration of the local processor. The electromagnetic lock must incorporate an end of line resistor to facilitate line supervision by the system. Provide metal-oxide resistors (MOVs) to protect controllers from reverse current surges, if not incorporated into the electromagnetic lock or local controller.

##### 2.3.6.6.1 Armature

Provide electromagnetic locks with internal circuitry to eliminate residual magnetism and inductive kickback. Provide actuating armature that operates on 12 or 24 Volts dc and cannot dissipate more than 12 Watts. Holding current must be less than 500 milliamperes. Actuating armature must take less than 300 milliseconds to change the status of the lock from fully secure to fully open or fully open to fully secure.

##### 2.3.6.6.2 Tamper Resistance

Provide lock mechanism encased in hardened guard barriers to deter forced entry.

##### 2.3.6.6.3 Mounting Method

Provide electromagnetic lock suitable for use with single and double door with mortise or rim type hardware and compatible with right or left hand mounting.

### 2.3.7 Keying System

Provide an extension of the existing keying system. Existing locks were manufactured by **Yale** and have interchangeable cores.

### 2.3.8 Lock Trim

Provide cast, forged, or heavy wrought construction and commercial plain design for lock trim.

#### 2.3.8.1 Lever Handles

Provide lever handles where indicated in the Hardware Schedule. Provide in accordance with **ANSI/BHMA A156.3** for mortise locks of lever handles for exit devices. Provide lever handle locks with a breakaway feature (such as a weakened spindle or a shear key) to prevent irreparable damage to the lock when force in excess of that specified in **ANSI/BHMA A156.13** is applied to the lever handle. Provide lever handles return to within 1/2 inch of the door face.

#### 2.3.8.2 Texture

Provide knurled or abrasive coated knobs or lever handles for doors which are accessible to blind persons and which lead to dangerous areas.

### 2.3.9 Keys

Furnish one file key, one duplicate key, and one working key for each key change and for each master and grand master keying system. Furnish one additional working key for each lock of each keyed-alike group. Stamp each key with appropriate key control symbol and "U.S. property - do not duplicate." Do not place room number on keys.

### 2.3.10 Door Bolts

Provide in accordance with **ANSI/BHMA A156.16**. Provide dustproof strikes for bottom bolts, except at doors having metal thresholds. Provide automatic latching flush bolts in accordance with **ANSI/BHMA A156.3**, Type 25.

### 2.3.11 Closers

Provide in accordance with **ANSI/BHMA A156.4**, Series C02000, Grade 1, with PT 4C. Provide with brackets, arms, mounting devices, fasteners, and other features necessary for the particular application. Size closers in accordance with manufacturer's printed recommendations, or provide multi-size closers, Sizes 1 through 6, and list sizes in the Hardware Schedule. Provide manufacturer's 10 year warranty.

#### 2.3.11.1 Identification Marking

Engrave each closer with manufacturer's name or trademark, date of manufacture, and manufacturer's size designation in locations that will be visible after installation.

### 2.3.12 Overhead Holders

Provide in accordance with ANSI/BHMA A156.8.

### 2.3.13 Door Protection Plates

Provide in accordance with ANSI/BHMA A156.6.

#### 2.3.13.1 Sizes of Armor Mop and Kick Plates

2 inch less than door width for single doors; 1 inch less than door width for pairs of doors. Provide 10 inch kick plates for flush doors . Provide a minimum 36 inch armor plates for flush doors and completely cover lower panels of panel doors, except 16 inch high armor plates on fire doors. Provide 6 inch mop plates.

### 2.3.14 Door Stops and Silencers

Provide in accordance with ANSI/BHMA A156.16. Silencers Type L03011. Provide three silencers for each single door, two for each pair.

### 2.3.15 Thresholds

Provide in accordance with ANSI/BHMA A156.21. Use J35100, with vinyl or silicone rubber insert in face of stop, for exterior doors opening out, unless specified otherwise.

### 2.3.16 Weatherstripping Gasketing

Provide in accordance with ANSI/BHMA A156.22. Provide the type and function designation where specified in paragraph HARDWARE SCHEDULE. Provide a set to include head and jamb seals, sweep strips, and, for pairs of doors, astragals. Air leakage of weatherstripped doors not to exceed 0.5 cubic feet per minute of air per square foot of door area when tested in accordance with ASTM E283. Provide weatherstripping with one of the following:

#### 2.3.16.1 Extruded Aluminum Retainers

Extruded aluminum retainers not less than 0.050 inch wall thickness with vinyl, neoprene, silicone rubber, or polyurethane inserts. Provide clear (natural) anodized aluminum.

#### 2.3.16.2 Interlocking Type

Zinc or bronze not less than 0.018 inch thick.

#### 2.3.16.3 Spring Tension Type

Spring bronze or stainless steel not less than 0.008 inch thick.

### 2.3.17 Lightproofing and Soundproofing Gasketing

Provide in accordance with ANSI/BHMA A156.22. Provide adjustable doorstops at heads, jams and automatic door bottoms in accordance with the hardware set, of extruded aluminum, clear (natural) anodized, surface applied, with vinyl fin seals between plunger and housing. Provide doorstops with solid neoprene tube, silicone rubber, or closed cell sponge gasket. Provide door bottoms with adjustable operating rod and silicone

rubber or closed cell sponge neoprene gasket. Provide doorstops that are mitered at corners. Provide type and function designation where specified in paragraph HARDWARE SETS.

#### 2.3.18 Rain Drips

Provide in accordance with ANSI/BHMA A156.22. Provide extruded aluminum rain drips, not less than 0.08 inch thick, clear anodized finish. Provide the manufacturer's full range of color choices to the Contracting Officer for color selection. Provide rain drips with a 4 inch overlap on each side of each exterior door that is not protected by an awning, roof, eave or other horizontal projection. Set drips in sealant and fasten with stainless steel screws.

##### 2.3.18.1 Door Rain Drips

Approximately 1-1/2 inch high by 5/8 inch projection. Align bottom with bottom edge of door.

##### 2.3.18.2 Overhead Rain Drips

Approximately 1-1/2 inch high by 2-1/2 inch projection. Align bottom with door frame rabbet.

#### 2.3.19 Auxiliary Hardware (Other than locks)

Provide in accordance with ANSI/BHMA A156.16, Grade 1.

#### 2.3.20 Sliding and Folding Door Hardware

Provide in accordance with ANSI/BHMA A156.14, Grade 1. Finishes to match other hardware specified herein.

#### 2.3.21 Special Tools

Provide special tools, such as spanner and socket wrenches and dogging keys, as required to service and adjust hardware items.

### 2.4 FASTENERS

Provide fasteners of type, quality, size, and quantity appropriate to the specific application. Fastener finish to match hardware. Provide stainless steel or nonferrous metal fasteners in locations exposed to weather. Verify metals in contact with one another are compatible and will avoid galvanic corrosion when exposed to weather.

### 2.5 FINISHES

Provide in accordance with ANSI/BHMA A156.18. Provide hardware in BHMA 630 finish (satin stainless steel), unless specified otherwise. Provide items not manufactured in stainless steel in BHMA 626 finish (satin chromium plated) over brass or bronze, except aluminum paint finish for surface door closers, and except BHMA 652 finish (satin chromium plated) for steel hinges. Provide hinges for exterior doors in stainless steel with BHMA 630 finish or chromium plated brass or bronze with BHMA 626 finish. Furnish exit devices in BHMA 626 finish in lieu of BHMA 630 finish except where BHMA 630 is specified under paragraph HARDWARE SETS. Match exposed parts of concealed closers to lock and door trim. Match hardware finish for aluminum doors to the doors.

## 2.6 KEY CABINET AND CONTROL SYSTEM

Provide in accordance with ANSI/BHMA A156.5, Type required to yield a capacity (number of hooks) 50 percent greater than the number of key changes used for door locks.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Provide hardware in accordance with manufacturers' printed installation instructions. Fasten hardware to wood surfaces with full-threaded wood screws or sheet metal screws. Provide machine screws set in expansion shields for fastening hardware to solid concrete and masonry surfaces. Provide toggle bolts where required for fastening to hollow core construction. Provide through bolts where necessary for satisfactory installation.

#### 3.1.1 Weatherstripping Installation

Provide full contact, weathertight seals that allow operation of doors without binding the weatherstripping.

##### 3.1.1.1 Stop Applied Weatherstripping

Fasten in place with color matched sheet metal screws not more than 9 inch on center after doors and frames have been finish painted.

##### 3.1.1.2 Interlocking Type Weatherstripping

Provide interlocking, self adjusting type on heads and jambs and flexible hook type at sills. Nail weatherstripping to door 1 inch on center and to heads and jambs at 4 inch on center.

##### 3.1.1.3 Spring Tension Type Weatherstripping

Provide spring tension type on heads and jambs. Provide bronze nails with bronze. Provide stainless steel nails with stainless steel. Space nails not more than 1-1/2 inch on center.

#### 3.1.2 Lightproofing and Soundproofing Installation

Provide as specified for stop applied weatherstripping.

#### 3.1.3 Threshold Installation

Extend thresholds the full width of the opening and notch end for jamb stops. Set thresholds in a full bed of sealant and anchor to floor with cadmium-plated, countersunk, steel screws in expansion sleeves. For aluminum thresholds placed on top of concrete surfaces, coat the underside surfaces that are in contact with the concrete with fluid applied waterproofing as a separation measure prior to placement.

### 3.2 FIRE DOORS AND EXIT DOORS

Provide hardware in accordance with NFPA 72 for door alarms, NFPA 80 for fire doors, NFPA 101 for exit doors, and NFPA 252 for fire tests of door assemblies. .

### 3.3 HARDWARE LOCATIONS

Provide in accordance with SDI/DOOR A250.8, unless indicated or specified otherwise.

- a. Kick and Armor Plates: Push side of single-acting doors. Both sides of double-acting doors.
- b. Mop Plates: Bottom flush with bottom of door.

### 3.4 KEY CABINET AND CONTROL SYSTEM

Locate where directed. Tag one set of file keys and one set of duplicate keys. Place other keys in appropriately marked envelopes, or tag each key. Provide complete instructions for setup and use of key control system. On tags and envelopes, indicate door and room numbers or master or grand master key.

### 3.5 FIELD QUALITY CONTROL

After installation, protect hardware from paint, stains, blemishes, and other damage until acceptance of work. Submit notice of testing 15 days before scheduled, so that testing can be witnessed by the Contracting Officer. Adjust hinges, locks, latches, bolts, holders, closers, and other items to operate properly. Demonstrate that permanent keys operate respective locks, and give keys to the Contracting Officer. Correct, repair, and finish, errors in cutting and fitting and damage to adjoining work.

### 3.6 HARDWARE SETS

Provide hardware for aluminum doors under this section. Deliver Hardware templates and hardware, except field applied hardware, to the aluminum door and frame manufacturer for use in fabricating doors and frames.

1. MK - McKinney
2. MR - Markar
3. PE - Pemko
4. SU - Securitron
5. RF - Rixson
6. RO - Rockwood
7. RU - Corbin Russwin
8. YA - Yale
9. SA - SARGENT
10. AD - Adams Rite
11. HS - HES
12. NO - Norton

#### Hardware Sets

Set: 1.0

Doors: C014, C032, L010

2	Continuous Hinge (A51331B)*	FM300 (height)	CTP	630	MR
1	Blast Resistant Mullion*	BY DOOR SUPPLIER			
1	Exit Device (Type 1, 01)	7150 WS EO	630	YA	
1	Exit Device (Type 1, 03)	7150 WS 121NL Temp Core	630	YA	
1	Interchangeable Core (E09241)	A600 626	YA		
2	Door Pull (J402)	BF158 US32D	RO		
2	Surface Closer (C02021-PT4G)	3531 689	YA		
2	Kick Plate (J102)	K1050 10" CSK	US32D	RO	
1	Threshold (J36100)	2009APK	PE		
1	Rain Guard (R0Y976)	346C	PE		
1	Gasketing (R3E164)	303AS (HEAD/JAMBS)	PE		
2	Sweep (R3D534)	345AV	PE		
2	Astragal (R3E734)	29310CS	PE		
2	Position Switch (E08)	DPS-M-BK	SU		

#### Notes:

\*Waiver may be required to comply with Trade Agreement Act.

o Coordinate hardware with blast resistant door/frame supplier.

o All exterior doors on this project shall meet Building Code Standards for windstorm. The door hardware specified is listed as a basis of design. If alternate hardware is proposed, please provide third-party test results and compliance information to architect.

Set: 2.0

Doors: 403

2	Continuous Hinge (A51331B)*	FM300 (height)	CTP	630	MR
1	Blast Resistant Mullion*	BY DOOR SUPPLIER			
1	Exit Device (Type 1, 01)	7150 WS EO	630	YA	
1	Exit Device (Type 1, 03)	7150 WS AU627F Temp Core	630	YA	
1	Interchangeable Core (E09241)	A600 626	YA		
2	Surface Closer (C02021-PT4G)	3531 689	YA		
2	Kick Plate (J102)	K1050 10" CSK	US32D	RO	
1	Threshold (J36100)	2009APK	PE		

1	Rain Guard (R0Y976)	346C	PE	
1	Gasketing (R3E164)	303AS (HEAD/JAMBS)	PE	
2	Sweep (R3D534)	345AV	PE	
1	Astragal (R3E734)	29310CS	PE	
2	Position Switch (E08)	DPS-M-BK	SU	

## Notes:

\*Waiver may be required to comply with Trade Agreement Act.

- o Coordinate hardware with blast resistant door/frame supplier.
- o All exterior doors on this project shall meet Building Code Standards for windstorm. The door hardware specified is listed as a basis of design. If alternate hardware is proposed, please provide third-party test results and compliance information to architect.

Set: 3.0

Doors: C023

1	Continuous Hinge (A51031B)*	FM300 (height)	630	MR	
1	Exit Device (Type 1, 03)	7150 WS 121NL Temp Core	630	YA	
1	Interchangeable Core (E09241)	A600	626	YA	
1	Door Pull (J402)	BF158 US32D	RO		
1	Surface Closer (C02021-PT4G)	3531	689	YA	
1	Windstorm Kick Plate (J102)	K1050 WS 10" CSK	US32D	RO	
1	Threshold (J36100)	2009APK	PE		
1	Rain Guard (R0Y976)	346C	PE		
1	Gasketing (R3E164)	303AS (HEAD/JAMBS)	PE		
1	Sweep (R3D534)	345AV	PE		

## Notes:

\*Waiver may be required to comply with Trade Agreement Act.

- o Coordinate hardware with blast resistant door/frame supplier.
- o All exterior doors on this project shall meet Building Code Standards for windstorm. The door hardware specified is listed as a basis of design. If alternate hardware is proposed, please provide third-party test results and compliance information to architect.

Set: 4.0

Doors: 400A, 401A, 402A

1	Continuous Hinge (A51031B)*	FM300 (height)	630	MR	
1	Storeroom Deadbolt Lock	AUR 8840FL Temp Core	626	YA	
1	Interchangeable Core (E09241)	A600	626	YA	
1	Surface Closer (C02021-PT4G)	3531	689	YA	
1	Windstorm Kick Plate (J102)	K1050 WS 10" CSK	US32D	RO	
1	Threshold (J36100)	2009APK	PE		
1	Gasketing (R3E164)	303AS (HEAD/JAMBS)	PE		
1	Sweep (R3D534)	345AV	PE		

## Notes:

\*Waiver may be required to comply with Trade Agreement Act.

- o Coordinate hardware with blast resistant door/frame supplier.
- o All exterior doors on this project shall meet Building Code Standards for windstorm. The door hardware specified is listed as a basis of design. If alternate hardware is proposed, please provide third-party test results and compliance information to architect.

Set: 5.0

Doors: 300AA, 300AB, 300BA, 300BB, 300CA, 300CB, 300XB, 300YA, 300YB, 300ZA, 300ZB, 301AA, 301AB, 301BA, 301BB



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1 Continuous Hinge (A31031G) CFM (height) HD1 PT PE
1 Electric Power Transfer EL-CEPT SU
1 High Security Lock Exit Device* LKM10K (TO SUIT)
1 Interchangeable Core (E09241) A600 626 YA
1 Surface Closer (C02011 / C02021) R/PR3501 (TO SUIT) 689 YA
1 Kick Plate (J102) K1050 10" CSK US32D RO
1 Door Stop (L02251 / L02121) 403/470 (TO SUIT) US26D RO
1 Frame Harness QC-C1500P MK
1 Door Harness QC-C_____ MK
1 Position Switch (E08) DPS-M-BK SU
1 Card Reader BY SECURITY INTEGRATOR
1 Power Supply* AQDxx (TO SUIT) SU

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Notes: \*Waiver may be required to comply with Trade Agreement Act.

- o STC seals by door supplier.
- o Electronic Operation: Valid code unlocks X-10 prior to valid card unlocks outside lever or key retracts latchbolt. Request to exit shows authorized egress. Free egress at all times. In case of power loss, door remains locked and latched.

Set: 6.0  
Doors: 300XA

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1 Continuous Hinge (A31031G) CFM (height) HD1 PT PE
1 Electric Power Transfer EL-CEPT SU
1 High Security Lock Exit Device* LKM10K (TO SUIT)
1 Interchangeable Core (E09241) A600 626 YA
1 Surface Closer (C02021-PT4G) 3531 689 YA
1 Kick Plate (J102) K1050 10" CSK US32D RO
1 Frame Harness QC-C1500P MK
1 Door Harness QC-C_____ MK
1 Position Switch (E08) DPS-M-BK SU
1 Card Reader BY SECURITY INTEGRATOR
1 Power Supply* AQDxx (TO SUIT) SU

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Notes: \*Waiver may be required to comply with Trade Agreement Act.

- o STC seals by door supplier.
- o Electronic Operation: Valid code unlocks X-10 prior to valid card unlocks outside lever or key retracts latchbolt. Request to exit shows authorized egress. Free egress at all times. In case of power loss, door remains locked and latched.

Set: 7.0  
Doors: 116

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1 Continuous Hinge (A31031G) CFM (height) HD1 PE
1 Exit Device (Type 1, 03) 7100 AU627F Temp Core 630 YA
1 Interchangeable Core (E09241) A600 626 YA
1 Surface Closer (C02021-PT4G) 3531 689 YA
1 Kick Plate (J102) K1050 10" CSK US32D RO
3 Silencer (L03011) 608 RO

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Notes:

\*Waiver may be required to comply with Trade Agreement Act.

Set: 8.0  
Doors: C020A, C020B

6 Hinge (A8111) T4A3786 US26D MK  
 2 Exit Device (Type 2, 08) 7170 LBR AU626F Temp Core 630 YA  
 2 Interchangeable Core (E09241) A600 626 YA  
 2 Surface Closer (C02021-PT4G) 3531 689 YA  
 2 Kick Plate (J102) K1050 10" CSK US32D RO  
 2 Silencer (L03011) 608 RO

Notes: \*Waiver may be required to comply with Trade Agreement Act.

Set: 9.0  
 Doors: 200AA

1 Continuous Hinge (A31031G) CFM (height) HD1 PE  
 1 Exit Device (Type 1, 08) 7100 AU626F Temp Core 630 YA  
 1 Interchangeable Core (E09241) A600 626 YA  
 1 Surface Closer (C02011 / C02021) R/PR3501 (TO SUIT) 689 YA  
 1 Kick Plate (J102) K1050 10" CSK US32D RO  
 1 Door Stop (L02251 / L02121) 403/470 (TO SUIT) US26D RO  
 3 Silencer (L03011) 608 RO

Notes: \*Waiver may be required to comply with Trade Agreement Act.

Set: 10.0  
 Doors: 200AB, 200BA, 200BB, 200CA, 200CB, 202A

1 Continuous Hinge (A31031G) CFM (height) HD1 PE  
 1 Exit Device (Type 1, 08) 7100 AU626F Temp Core 630 YA  
 1 Interchangeable Core (E09241) A600 626 YA  
 1 Surface Closer (C02011 / C02021) R/PR3501 (TO SUIT) 689 YA  
 1 Kick Plate (J102) K1050 10" CSK US32D RO  
 1 Door Stop (L02251 / L02121) 403/470 (TO SUIT) US26D RO

Notes: \*Waiver may be required to comply with Trade Agreement Act.  
 o STC seals by door supplier.

Set: 11.0  
 Doors: 201A, 201B

3 Hinge (A8111) T4A3786 US26D MK  
 1 Exit Device (Type 1, 08) 7100 AU626F Temp Core 630 YA  
 1 Interchangeable Core (E09241) A600 626 YA  
 1 Surface Closer (C02011 / C02021) R/PR3501 (TO SUIT) 689 YA  
 1 Kick Plate (J102) K1050 10" CSK US32D RO  
 1 Door Stop (L02251 / L02121) 403/470 (TO SUIT) US26D RO

Notes: \*Waiver may be required to comply with Trade Agreement Act.  
 o STC seals by door supplier.

Set: 12.0  
 Doors: 202B

1 Continuous Hinge (A31031G) CFM (height) HD1 PE  
 1 Exit Device (Type 1, 08) 7100 AU626F Temp Core 630 YA  
 1 Interchangeable Core (E09241) A600 626 YA  
 1 Surface Closer (C02021-PT4G) 3531 689 YA  
 1 Kick Plate (J102) K1050 10" CSK US32D RO

Notes: \*Waiver may be required to comply with Trade Agreement Act.  
 o STC seals by door supplier.

Set: 13.0  
 Doors: C010, C022

1	Continuous Hinge (A31031G)	CFM (height)	HD1	PE	
1	Exit Device (Type 1, 14)	7100 AU628F	630	YA	
1	Surface Closer (C02011 / C02021)	R/PR3501 (TO SUIT)	689	YA	
1	Kick Plate (J102)	K1050 10" CSK	US32D	RO	
1	Door Stop (L02251 / L02121)	403/470 (TO SUIT)	US26D	RO	
3	Silencer (L03011)	608	RO		

Notes: \*Waiver may be required to comply with Trade Agreement Act.

Set: 14.0  
 Doors: C020, C034

1	Continuous Hinge (A31031G)	CFM (height)	HD1	PE	
1	Exit Device (Type 1, 03)	7100 AU627F Temp Core	630	YA	
1	Interchangeable Core (E09241)	A600 626	YA		
1	SMART Pac Bridge Rectifier*	2005M3	HS		
1	Electric Strike (E09371)	9500 630	HS		
1	Surface Closer (C02011 / C02021)	R/PR3501 (TO SUIT)	689	YA	
1	Kick Plate (J102)	K1050 10" CSK	US32D	RO	
1	Door Stop (L02251 / L02121)	403/470 (TO SUIT)	US26D	RO	
3	Silencer (L03011)	608	RO		
1	Position Switch (E08)	DPS-M-BK	SU		
1	Card Reader	BY SECURITY INTEGRATOR			
1	Motion Sensor	XMS	SU		
1	Power Supply*	AQDxx (TO SUIT)	SU		

Notes:  
 \*Waiver may be required to comply with Trade Agreement Act.  
 o Electronic Operation: Valid card releases electric strike or key retracts latchbolt. Request to exit shows authorized egress. Free egress at all times. In case of power loss, door remains locked and latched.

Set: 15.0  
 Doors: 302, 303A

1	Continuous Hinge (A31031G)	CFM (height)	HD1 PT	PE	
1	Electric Power Transfer	EL-CEPT	SU		
1	High Security Lock*	LKM10K (TO SUIT)			
1	Interchangeable Core (E09241)	A600 626	YA		
1	Surface Closer (C02011 / C02021)	R/PR3501 (TO SUIT)	689	YA	
1	Kick Plate (J102)	K1050 10" CSK	US32D	RO	
1	Door Stop (L02251 / L02121)	403/470 (TO SUIT)	US26D	RO	
1	Frame Harness	QC-C1500P	MK		
1	Door Harness	QC-C	MK		
1	Position Switch (E08)	DPS-M-BK	SU		
1	Card Reader	BY SECURITY INTEGRATOR			
1	Power Supply*	AQDxx (TO SUIT)	SU		

Notes: \*Waiver may be required to comply with Trade Agreement Act.  
 o STC seals by door supplier.  
 o Electronic Operation: Valid code unlocks X-10 prior to valid card unlocks

outside lever or key retracts latchbolt. Request to exit shows authorized egress. Free egress at all times. In case of power loss, door remains locked and latched.

Set: 16.0

Doors: 103A, 203A, 203B

6	Hinge (A8112)	TA2714	US26D	MK		
2	Flush Bolt (L04251/L04261)	555/557	(TO SUIT)	US26D	RO	
1	Dust Proof Strike (L04021)	570	US26D	RO		
1	Storeroom Lock (F07)	AUR 8805FL	Temp Core	626	YA	
1	Interchangeable Core (E09241)	A600	626	YA		
1	Surface Closer (C02011 / C02021)	R/PR3501	(TO SUIT)	689	YA	
2	Kick Plate (J102)	K1050 10"	CSK US32D	RO		
2	Door Stop (L02251 / L02121)	403/470	(TO SUIT)	US26D	RO	
2	Silencer (L03011)	608	RO			

Notes:

\*Waiver may be required to comply with Trade Agreement Act.

Set: 17.0

Doors: 118, 204, 208, 402C

3	Hinge (A8112)	TA2714	US26D	MK		
1	Storeroom Lock (F07)	AUR 8805FL	Temp Core	626	YA	
1	Interchangeable Core (E09241)	A600	626	YA		
1	Surface Closer (C02011 / C02021)	R/PR3501	(TO SUIT)	689	YA	
1	Kick Plate (J102)	K1050 10"	CSK US32D	RO		
1	Door Stop (L02251 / L02121)	403/470	(TO SUIT)	US26D	RO	
3	Silencer (L03011)	608	RO			

Notes:

\*Waiver may be required to comply with Trade Agreement Act.

Set: 18.0

Doors: 110A, 305, 306

1	Continuous Hinge (A31031G)	CFM (height)	HD1	PE		
1	Storeroom Lock (F07)	AUR 8805FL	Temp Core	626	YA	
1	Interchangeable Core (E09241)	A600	626	YA		
1	Surface Closer (C02011 / C02021)	R/PR3501	(TO SUIT)	689	YA	
1	Kick Plate (J102)	K1050 10"	CSK US32D	RO		
1	Door Stop (L02251 / L02121)	403/470	(TO SUIT)	US26D	RO	
3	Silencer (L03011)	608	RO			

Notes:

\*Waiver may be required to comply with Trade Agreement Act.

Set: 19.0

Doors: 115

1	Continuous Hinge (A31031G)	CFM (height)	HD1	PE		
1	Storeroom Lock (F07)	AUR 8805FL	Temp Core	626	YA	
1	Interchangeable Core (E09241)	A600	626	YA		
1	Surface Closer (C02021-PT4G)	3531	689	YA		
1	Kick Plate (J102)	K1050 10"	CSK US32D	RO		
3	Silencer (L03011)	608	RO			

Notes:

\*Waiver may be required to comply with Trade Agreement Act.

Set: 20.0

Doors: 106, 111, 112, 113, 114

3	Hinge (A8112)	TA2714	US26D	MK		
1	Office Lock (F04)	AUR 8807FL	Temp Core	626	YA	
1	Interchangeable Core (E09241)	A600	626	YA		
1	Door Stop (L02251 / L02121)	403/470	(TO SUIT)	US26D	RO	
3	Silencer (L03011)	608	RO			

Notes:

\*Waiver may be required to comply with Trade Agreement Act.

Set: 21.0

Doors: 100

3	Hinge (A8112)	TA2714	US26D	MK		
1	Office Lock (F04)	AUR 8807FL	Temp Core	626	YA	
1	Interchangeable Core (E09241)	A600	626	YA		
1	Surface Closer (C02011 / C02021)	R/PR3501	(TO SUIT)	689	YA	
1	Kick Plate (J102)	K1050 10"	CSK US32D	RO		
1	Door Stop (L02251 / L02121)	403/470	(TO SUIT)	US26D	RO	
3	Silencer (L03011)	608	RO			

Notes:

\*Waiver may be required to comply with Trade Agreement Act.

Set: 22.0

Doors: 205, 400C

6	Hinge (A8112)	TA2714	US26D	MK		
2	Flush Bolt (L04251/L04261)	555/557	(TO SUIT)	US26D	RO	
1	Dust Proof Strike (L04021)	570	US26D	RO		
1	Classroom Lock (F05)	AUR 8808FL	Temp Core	626	YA	
1	Interchangeable Core (E09241)	A600	626	YA		
1	Surface Closer (C02011 / C02021)	R/PR3501	(TO SUIT)	689	YA	
2	Kick Plate (J102)	K1050 10"	CSK US32D	RO		
2	Door Stop (L02251 / L02121)	403/470	(TO SUIT)	US26D	RO	
2	Silencer (L03011)	608	RO			

Notes:

\*Waiver may be required to comply with Trade Agreement Act.

Set: 23.0

Doors: 105, 207, 303B

3	Hinge (A8112)	TA2714	US26D	MK		
1	Classroom Lock (F05)	AUR 8808FL	Temp Core	626	YA	
1	Interchangeable Core (E09241)	A600	626	YA		
1	Surface Closer (C02011 / C02021)	R/PR3501	(TO SUIT)	689	YA	
1	Kick Plate (J102)	K1050 10"	CSK US32D	RO		
1	Door Stop (L02251 / L02121)	403/470	(TO SUIT)	US26D	RO	
3	Silencer (L03011)	608	RO			

Notes:

\*Waiver may be required to comply with Trade Agreement Act.

Set: 24.0

Doors: 101, 102, 209

3	Hinge (A8112)	TA2714	US26D	MK		
1	Classroom Lock (F05)	AUR 8808FL	Temp Core	626	YA	
1	Interchangeable Core (E09241)	A600	626	YA		
1	Surface Closer (C02011 / C02021)	R/PR3501	(TO SUIT)	689	YA	
1	Kick Plate (J102)	K1050 10"	CSK US32D	RO		
1	Door Stop (L02251 / L02121)	403/470	(TO SUIT)	US26D	RO	

Notes:

\*Waiver may be required to comply with Trade Agreement Act.  
o STC seals by door supplier.

Set: 25.0

Doors: 107, 109, 304A, 304B

1	Continuous Hinge (A31031G)	CFM (height)	HD1	PE		
1	Classroom Lock (F05)	AUR 8808FL	Temp Core	626	YA	
1	Interchangeable Core (E09241)	A600	626	YA		
1	Surface Closer (C02011 / C02021)	R/PR3501	(TO SUIT)	689	YA	
1	Kick Plate (J102)	K1050 10"	CSK US32D	RO		
1	Door Stop (L02251 / L02121)	403/470	(TO SUIT)	US26D	RO	
3	Silencer (L03011)	608	RO			

Notes:

\*Waiver may be required to comply with Trade Agreement Act.

Set: 26.0

Doors: 104A, 104B, 104C

1	Continuous Hinge (A31031G)	CFM (height)	HD1	PE		
1	Classroom Lock (F05)	AUR 8808FL	Temp Core	626	YA	
1	Interchangeable Core (E09241)	A600	626	YA		
1	Surface Closer (C02011 / C02021)	R/PR3501	(TO SUIT)	689	YA	
1	Kick Plate (J102)	K1050 10"	CSK US32D	RO		
1	Door Stop (L02251 / L02121)	403/470	(TO SUIT)	US26D	RO	

Notes:

\*Waiver may be required to comply with Trade Agreement Act.  
o STC seals by door supplier.

Set: 27.0

Doors: 110, G012, G020

3	Hinge (A8112)	TA2714	US26D	MK		
1	Privacy Lock	AUR 8802FL	IND	626	YA	
1	Surface Closer (C02011 / C02021)	R/PR3501	(TO SUIT)	689	YA	
1	Kick Plate (J102)	K1050 10"	CSK US32D	RO		
1	Mop Plate (J103)	K1050 6"	CSK US32D	RO		
1	Door Stop (L02251 / L02121)	403/470	(TO SUIT)	US26D	RO	
3	Silencer (L03011)	608	RO			

Notes:

\*Waiver may be required to comply with Trade Agreement Act.  
o Mop plate at inswinging doors only.

Set: 28.0

Doors: 108

3 Hinge (A8112) TA2714 US26D MK  
 1 Passage Latch (F01) AUR 8801FL 626 YA  
 1 Door Stop (L02251 / L02121) 403/470 (TO SUIT) US26D RO  
 3 Silencer (L03011) 608 RO

## Notes:

\*Waiver may be required to comply with Trade Agreement Act.

Set: 29.0

Doors: C011

1 Continuous Hinge (A31031G) CFM (height) HD1 PE  
 1 Passage Latch (F01) AUR 8801FL 626 YA  
 1 Surface Closer (C02011 / C02021) R/PR3501 (TO SUIT) 689 YA  
 1 Kick Plate (J102) K1050 10" CSK US32D RO  
 1 Electromagnetic Holder (C00011)\* 998M 689 RF  
 1 Adhesive Gasketing (R0Y154) S88BL PE

## Notes:

\*Waiver may be required to comply with Trade Agreement Act.

o Connect holder to fire alarm system to release upon fire alarm.

Set: 30.0

Doors: G010, G011, G021, G022, G023, G024, G025

3 Hinge (A8111) T4A3786 US26D MK  
 1 Push Plate (J301) 70C-RKW US32D RO  
 1 Door Pull w/ Plate (J405) BF 110x70C US32D RO  
 1 Surface Closer (C02011 / C02021) R/PR3501 (TO SUIT) 689 YA  
 1 Kick Plate (J102) K1050 10" CSK US32D RO  
 1 Mop Plate (J103) K1050 6" CSK US32D RO  
 1 Door Stop (L02251 / L02121) 403/470 (TO SUIT) US26D RO  
 3 Silencer (L03011) 608 RO

## Notes:

\*Waiver may be required to comply with Trade Agreement Act.

o Mop plate at inswinging doors only.

Set: 31.0

Doors: C012, C016

1 Continuous Hinge (A31031G) CFM (height) HD1 PE  
 1 Storeroom Lock (F07) AUR 8805FL Temp Core 626 YA  
 1 Interchangeable Core (E09241) A600 626 YA  
 1 Electric Strike (E09391) 1600 630 HS  
 1 SMART Pac Bridge Rectifier\* 2005M3 HS  
 1 Surface Closer (C02011 / C02021) R/PR3501 (TO SUIT) 689 YA  
 1 Kick Plate (J102) K1050 10" CSK US32D RO  
 1 Door Stop (L02251 / L02121) 403/470 (TO SUIT) US26D RO  
 1 Position Switch (E08) DPS-M-BK SU  
 1 Card Reader BY SECURITY INTEGRATOR  
 1 Motion Sensor XMS SU  
 1 Power Supply\* AQDxx (TO SUIT) SU

## Notes:

\*Waiver may be required to comply with Trade Agreement Act.

o STC seals by door supplier.

o Electronic Operation: Valid card releases electric strike or key retracts latchbolt. Request to exit shows authorized egress. Free egress at all

times. In case of power loss, door remains locked and latched.

Set: 32.0

Doors: 400B, 401B, 402B

0 All Hardware BY DOOR SUPPLIER

Notes:

-- End of Section --



## SECTION 08 81 00

## GLAZING

**05/19**

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

- |             |   |
|-------------|---|
| AAMA 800    | (2016) Voluntary Specifications and Test Methods for Sealants |
| AAMA GDSG-1 | (1987) Glass Design for Sloped Glazing                        |
| AAMA TIR A7 | (2011) Sloped Glazing Guidelines                              |

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- |            |   |
|------------|---|
| ANSI Z97.1 | (2015) Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test |
|------------|---|

## ASTM INTERNATIONAL (ASTM)

- |            |  |
|------------|--|
| ASTM C509  | (2006; R 2015) Elastomeric Cellular Preformed Gasket and Sealing Material  |
| ASTM C864  | (2005; R 2015) Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers   |
| ASTM C920  | (2018) Standard Specification for Elastomeric Joint Sealants   |
| ASTM C1021 | (2008; R 2014) Standard Practice for Laboratories Engaged in Testing of Building Sealants  |
| ASTM C1036 | (2016) Standard Specification for Flat Glass   |
| ASTM C1048 | (2018) Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass  |
| ASTM C1087 | (2016) Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems |
| ASTM C1172 | (2019) Standard Specification for Laminated Architectural Flat Glass   |

ASTM C1184	(2014) Standard Specification for Structural Silicone Sealants
ASTM C1281	(2016) Standard Specification for Preformed Tape Sealants for Glazing Applications
ASTM C1376	(2015) Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass
ASTM D395	(2016; E 2017) Standard Test Methods for Rubber Property - Compression Set
ASTM D2287	(2019) Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds
ASTM D4802	(2016) Standard Specification for Poly(Methyl Methacrylate) Acrylic Plastic Sheet
ASTM E90	(2009; R2016) Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
ASTM E119	(2020) Standard Test Methods for Fire Tests of Building Construction and Materials
ASTM E413	(2016) Classification for Rating Sound Insulation
ASTM E1300	(2016) Standard Practice for Determining Load Resistance of Glass in Buildings
ASTM E2190	(2010) Standard Specification for Insulating Glass Unit Performance and Evaluation
ASTM E2226	(2015; R 2019b) Standard Practice for Application of Hose Stream
ASTM F1642/F1642M	(2017) Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loadings
ASTM F2912	(2017) Standard Specification for Glazing and Glazing Systems Subject to Airblast Loadings

GLASS ASSOCIATION OF NORTH AMERICA (GANA)

GANA Glazing Manual	(2008) Glazing Manual
GANA Sealant Manual	(2008) Sealant Manual
GANA Standards Manual	(2008) Engineering Standards Manual

INSULATING GLASS MANUFACTURERS ALLIANCE (IGMA)

IGMA TB-1200	(1983; R 2016) Guidelines for Insulating Glass Dimensional Tolerances
IGMA TB-3001	(2001) Guidelines for Sloped Glazing
IGMA TM-3000	(1990; R 2016) North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use

NATIONAL FENESTRATION RATING COUNCIL (NFRC)

NFRC 100	(2017) Procedure for Determining Fenestration Product U-Factors
NFRC 200	(2017) Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80	(2019) Standard for Fire Doors and Other Opening Protectives
NFPA 251	(2006) Standard Methods of Tests of Fire Resistance of Building Construction and Materials
NFPA 252	(2017) Standard Methods of Fire Tests of Door Assemblies
NFPA 257	(2012; ERTA 2017) Standard on Fire Test for Window and Glass Block Assemblies

U.S. DEPARTMENT OF ENERGY (DOE)

Energy Star	(1992; R 2006) Energy Star Energy Efficiency Labeling System (FEMP)
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U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

16 CFR 1201	Safety Standard for Architectural Glazing Materials
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UNDERWRITERS LABORATORIES (UL)

UL 752	(2005; Reprint Dec 2015) Standard for Bullet-Resisting Equipment
UL MEAPD	(2011) Mechanical Equipment and Associated Products Directory (online version is listed under Certifications at <a href="http://www.ul.com">www.ul.com</a> )

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S"

classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Insulating Glass

Plastic Glazing

Glazing Accessories

Sealants

Joint Backer

SD-04 Samples

Insulating Glass

Plastic Sheet

Glazing Compound

Glazing Tape

Sealing Tapes

[ SD-07 Certificates

Insulating Glass

Plastic Glazing

] SD-08 Manufacturer's Instructions

Setting and Sealing Materials

Glass Setting

SD-11 Closeout Submittals

Warranty for Insulated Glass Units

[ Warranty for Polycarbonate Sheet

] [ Warranty for Monolithic Reflective Glass

] [ Warranty for Monolithic Opacified Spandrel

]

[ Energy Efficient Equipment for Residential Windows; S

] [1.3 SYSTEM DESCRIPTION

Fabricate and install watertight and airtight glazing systems to withstand

thermal movement and wind loading without glass breakage, gasket failure, deterioration of [glazing accessories](#), or defects in the work. Glazed panels must comply with the safety standards, in accordance with [ANSI Z97.1](#), and comply with indicated wind/snow loading in accordance with [ASTM E1300](#). [Sloped glazing must comply with [AAMA GDSG-1](#) and [AAMA TIR A7](#), and [IGMA TB-3001](#).]

#### [1.3.1 Glazing for Passive Solar and Dynamic Control Fenestration

Identify glazing for Passive Solar and Dynamic Control Fenestration noted as part of a passive solar heating system and/or chromogenic fenestration and evaluate separately from other fenestration. Glazing for use in Passive Solar systems are exempt from SHGC requirements. Area-weighted averaging of chromogenic fenestration with other non-chromogenic fenestration is not permitted. For chromogenic fenestration systems, the lower-rated labeled SHGC must be used with automatic controls to modulate the amount of heat flow into the space in multiple steps in response to daylight levels or solar intensity.

#### ]1.4 QUALITY CONTROL

Submit two [8 by 10 inch](#) samples of each of the following: tinted glass, patterned glass, heat-absorbing glass, [\_\_\_\_\_] and insulating glass units.

Submit three samples of each other material. Samples of plastic sheets must be minimum [5 by 7 inches](#).

#### 1.5 DELIVERY, STORAGE, AND HANDLING

Deliver products to the site in unopened containers, labeled plainly with manufacturers' names and brands. Store glass and setting materials in safe, enclosed dry locations and do not unpack until needed for installation. Handle and install materials in a manner that will protect them from damage.

#### 1.6 ENVIRONMENTAL REQUIREMENTS

Do not start glazing work until the outdoor temperature is above [40 degrees F](#) and rising, unless procedures recommended by the glass manufacturer and approved by the Contracting Officer are made to warm the glass and rabbet surfaces. Provide ventilation to prevent condensation of moisture on glazing work during installation. Do not perform glazing work during damp or rainy weather.

#### 1.7 WARRANTY

##### 1.7.1 Warranty for [Insulated Glass Units](#)

Warranty insulating glass units against development of material obstruction to vision (such as dust, fogging, or film formation on the inner glass surfaces) caused by failure of the hermetic seal, other than through glass breakage, for a 10-year period following acceptance of the work. Provide new units for any units failing to comply with terms of this warranty within 45 working days after receipt of notice from the Government.

##### 1.7.2 [Warranty for Polycarbonate Sheet](#)

For a 5-year period following acceptance of the work:

- a. Warranty Type I, Class A (UV stabilized) sheets against breakage;
- b. Warranty Type III (coated, mar-resistant) sheets against breakage and against coating delamination;
- c. Warranty Type IV (coated sheet) against breakage and against yellowing;
- d. Warranty extruded polycarbonate profile sheet against breakage.

For a 10-year period following acceptance of the work, warranty Type IV against yellowing and loss of light transmission.

#### [1.7.3 Monolithic Reflective Glass

Manufacturer must warrant the monolithic reflective glass to be free of peeling or deteriorating of coating for a period of 10 years after Date of Substantial Completion. Warranty must be signed by manufacturer.

#### ] [1.7.4 Monolithic Opacified Spandrel

Manufacturer must warrant the opacifier film on the spandrel to be free of peeling for a period of five years after Date of Substantial Completion. Warranty must be signed by manufacturer.

### ]PART 2 PRODUCTS

#### 2.1 PRODUCT SUSTAINABILITY CRITERIA

##### [2.1.1 Energy Efficient Equipment for Residential Windows

Provide **Energy Star** residential windows in accordance with Section 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING paragraph ENERGY EFFICIENT PRODUCTS.

#### ]2.2 GLASS

**ASTM C1036**, unless specified otherwise. In doors and sidelights, provide safety glazing material conforming to **16 CFR 1201**.

##### 2.2.1 Clear Glass

[ For interior glazing (i.e., pass and observation windows), **1/4 inch** thick glass should be used.

] Type I, Class 1 (clear), Quality [q4 (A)] [q5 (B)]. Provide for glazing openings not indicated or specified otherwise. Use double-strength sheet glass or **1/8 inch** float glass for openings up to and including **15 square feet**, **3/16 inch** for glazing openings over **15 square feet** but not over **30 square feet**, and **1/4 inch** for glazing openings over **30 square feet** but not over **45 square feet**.

##### 2.2.2 Annealed Glass

Annealed glass must be Type I transparent flat type, [Class 1 - clear, ] Quality q3 - glazing select, [\_\_\_\_\_] percent light transmittance, [\_\_\_\_\_] percent shading coefficient, conforming to **ASTM C1036**.

## 2.2.3 Heat-Absorbing Glass

Type I, Class 2 (tinted), Quality [q3 (select)] [q4 (A)], [\_\_\_\_\_] inch thick, [blue][green] in color, [\_\_\_\_\_] percent light transmittance, [\_\_\_\_\_] percent shading coefficient, conforming to ASTM C1036.

## 2.2.4 Reflective Coating Vision Glass

ASTM C1376

## 2.2.5 Wired Glass

Provide UL listed glass for fire-rated windows rated for [45] [20] minutes when tested in accordance with ASTM E2226. Wired glass must be Type II flat type, Class [1 - translucent] [2 - tinted, heat-absorbing] [3 - tinted, light-reducing], Quality [q7 - decorative] [q8 - glazing], Form [1 - wired and polished both sides] [2 - patterned and wired], [\_\_\_\_\_] percent light transmittance, [\_\_\_\_\_] percent shading coefficient, conforming to ASTM C1036. Wire mesh must be polished stainless steel Mesh [1 - diamond] [2 - square] [3 - parallel]. Wired glass for fire-rated windows must bear an identifying UL label or the label of a nationally recognized testing agency, and be rated for [20] [45] minutes when tested in accordance with NFPA 257. Wired glass for fire-rated doors must be tested as part of a door assembly in accordance with NFPA 252.

## 2.2.6 Patterned Glass

Type II, Class 1 (translucent), Form 3 (patterned), Quality q5 or q6 (decorative), Finish [F1 (patterned one side)] [F2 (patterned two sides)], Pattern [P1 (linear)] [P2 (geometric)] [P3 (random)] [P4 (special)], [\_\_\_\_\_] percent light transmittance, [\_\_\_\_\_] percent shading coefficient.] [1/8] [7/32] inch thick. [ Provide [\_\_\_\_\_] ].

## 2.2.7 Laminated Glass

[ASTM C1172, Laminated glass fabricated from two nominal [1/8] [\_\_\_\_\_] inch pieces of Type I, Class 1, [Class \_\_\_\_\_], Quality Q3, flat annealed [ultraclear]; [clear] [\_\_\_\_\_] glass conforming to ASTM C1036.] [ASTM C1172, Laminated glass fabricated from two nominal [1/8] [\_\_\_\_\_] inch pieces of Type I, Kind [HS] [FT], Condition [A] [B] [C], Class 1, Class [\_\_\_\_\_] , Quality Q3, flat [heat strengthened] [fully tempered] [clear] [\_\_\_\_\_] glass conforming to ASTM C1048.] Flat glass to be laminated together with a minimum of 0.030 inch thick, clear [polyvinyl butyral] [ionoplast] [cast-in-place liquid resin] laminate, conforming to requirements of 16 CFR 1201 and ASTM C1172. The total thickness of nominally 1/4 [\_\_\_\_\_] inches. Color to be [clear] [gray] [bronze] [\_\_\_\_\_] . The total thickness of nominally [\_\_\_\_\_] inch.

[ Design window glazing using a dynamic analysis[ testing from airblast loading in accordance with ASTM F1642/F1642M by an independent testing agency regularly engaged in blast testing] to prove the glazing will provide performance equivalent to or better than a [low] [very low] [\_\_\_\_\_] hazard rating in accordance with ASTM F2912 for the peak positive pressure of [\_\_\_\_\_] pounds per square inch (psi) and peak positive phase impulse of [\_\_\_\_\_] pounds per square inch - millisecond (psi-msec) .

## ]2.2.8 Bullet-Resisting Glass

Fabricated from Type I, Class 1, Quality q3 glass with polyvinyl butyral

plastic interlayers between the layers of glass and listed by UL MEAPD as bullet resisting, with a rating Level of [Level 1] [Level 2] [Level 3] [Level 4] [Level 5] [\_\_\_\_\_] in accordance with UL 752. Provide [\_\_\_\_\_] [where indicated].

#### [2.2.9 Mirrors

##### 2.2.9.1 Glass Mirrors

Glass for mirrors must be Type I transparent flat type, Class 1-clear, Glazing Quality q1 1/4 inch thick conforming to ASTM C1036. Glass must be coated on one surface with silver coating, copper protective coating, and mirror backing paint. Silver coating must be highly adhesive pure silver coating of a thickness which must provide reflectivity of 83 percent or more of incident light when viewed through 1/4 inch thick glass, and must be free of pinholes or other defects. Copper protective coating must be pure bright reflective copper, homogeneous without sludge, pinholes or other defects, and must be of proper thickness to prevent "adhesion pull" by mirror backing paint. Mirror backing paint must consist of two coats of special scratch and abrasion-resistant paint, and must be baked in uniform thickness to provide a protection for silver and copper coatings which will permit normal cutting and edge fabrication.

##### ]2.2.10 One-Way Vision Glass (Transparent Mirrors)

Type I, Class 1, Quality q1, 1/4 inch thick, coated on one face with a hard, adherent film of chromium or other approved coating of equal durability. Glass must transmit not less than 5 percent or more than 11 percent of total incident visible light and must reflect from the front surface of the coating not less than 45 percent of the total incident visible light. [Provide [\_\_\_\_\_] .]

##### 2.2.11 Tempered Glass

ASTM C1048, Kind FT (fully tempered), Condition A (uncoated), Type I, Class [1 (transparent)] [2 (tinted heat absorbing)], Quality q3, [\_\_\_\_\_] inch thick, [\_\_\_\_\_] percent light transmittance, [\_\_\_\_\_] percent shading coefficient conforming to ASTM C1048 and GANA Standards Manual. Color must be [[clear] [bronze] [gray] [\_\_\_\_\_] ]. [Provide [\_\_\_\_\_] ] [and wherever safety glazing material is indicated or specified].

##### 2.2.12 Heat-Strengthened Glass

ASTM C1048, Kind HS (heat strengthened), Condition A (uncoated), Type I, Class [1 (clear)] [2 (tinted heat absorbing)], Quality q3, [\_\_\_\_\_] inch thick. [Provide [\_\_\_\_\_] .]

##### 2.2.13 Spandrel Glass

##### 2.2.13.1 Ceramic-Opacified Spandrel Glass

Ceramic-opacified spandrel glass must be Kind HS heat-strengthened transparent flat type, Condition B, coated with a colored ceramic material on No. 2 surface, Quality q3 - glazing select, [\_\_\_\_\_] inch thick, conforming to ASTM C1048. Glass performance must be R-Value/Winter Nighttime [\_\_\_\_\_] , shading coefficient [\_\_\_\_\_] . Color must be [\_\_\_\_\_] .



## 2.2.13.2 Film-Opacified Spandrel Glass

Film-opacified spandrel glass must be Kind HS heat-strengthened transparent flat type, Quality q3 - glazing select, Condition C glass with a polyester or polyethylene film 2 mils to 5 mils thick attached to No. 2 surface of a sputtered solar-reflective film, conforming to ASTM C1048. Film opacification must be compatible to and specifically developed for application to solar reflective films. Glass performance must be R-Value/Winter Nighttime [\_\_\_\_], shading coefficient [\_\_\_\_]. Color must be [\_\_\_\_].

## 2.2.13.3 Spandrel Glass With Adhered Backing

ASTM C1048, Kind HS or FT, Condition B (ceramic coated), Type I, Quality q5, [\_\_\_\_] inch thick and must pass the fallout resistance test specified in ASTM C1048. [Provide [\_\_\_\_].]

## [2.2.14 Fire/Safety Rated Glass

## [2.2.14.1 Fire Protection Rated Glass

Clear tempered and meet 16 CFR 1201 Category I (under 9 square feet) or II (over 9 square feet) impact safety standard. Glass to make [20] [45] minute rating when tested in accordance with NFPA 257 and NFPA 252. Glass to be permanently labeled with appropriate markings.

## ][2.2.14.2 Fire Resistive Rated Glazing

Fire resistive glass must be laminated, with intumescent interlayer, Type I transparent flat type, Class 1-clear and meet 16 CFR 1201 Category I (under 9 square feet) or II (over 9 square feet). Glass must have a [60] [90] [120] minute rating when tested in accordance with ASTM E119 and NFPA 251. Glass must be permanently labeled with appropriate markings.

## ]]2.3 INSULATING GLASS UNITS

[Two][Three] panes of glass separated by a dehydrated airspace[, filled with argon gas][, filled with krypton gas,][, filled with aerogel] and hermetically sealed, conforming to ASTM E2190. Submit performance and compliance documentation for each type of insulating glass.

[ Insulated glass units must have a Solar Heat Gain Coefficient (SHGC) maximum of [\_\_\_\_] determined according to NFRC 200 and a U-factor maximum of [\_\_\_\_] Btu per square foot by hr by degree F in accordance with NFRC 100.

] [See section[s][\_\_\_\_] for energy performance requirements for glazed systems (glazing and frames).] [Glazed panels must be rated for not less than [26] [30] [35] [\_\_\_\_] Sound Transmission Class (STC) when tested for laboratory sound transmission loss according to ASTM E90 and determined by ASTM E413.]

Dimensional tolerances must be as specified in IGMA TB-1200. Spacer must be black, roll-formed, [thin-gauge, C-section steel] [steel-reinforced butyl rubber] [thermally broken aluminum] [polyurethane and silicon foams], with bent or tightly welded or keyed and sealed joints to completely seal the spacer periphery and eliminate moisture and hydrocarbon vapor transmission into airspace through the corners. Primary seal must be compressed polyisobutylene and the secondary seal must be a

specially formulated silicone.

The inner light must be [ASTM C1172, clear annealed flat glass Type I, Class I, Quality q3] [ASTM C1036, Type I, Class 1, Quality q4, [\_\_\_\_\_] inch thick] [ASTM C1048, Grade B (fully tempered), Style I (uncoated), Type I, Class 1 (transparent), Quality q4, [\_\_\_\_\_] inch thick]. [The intermediate light must be [ASTM C1172, clear annealed flat glass Type I, Class I, Quality q3] [ASTM C1036, Type I, Class 1, Quality q4, [\_\_\_\_\_] inch thick] [ASTM C1048, Grade B (fully tempered), Style I (uncoated), Type I, Class 1 (transparent), Quality q4, [\_\_\_\_\_] inch thick].] The outer light must be [ASTM C1036, Type I, Class 1 (transparent)] [2 (tinted heat absorbing)], [2 (solar-reflective)], Quality q4, [\_\_\_\_\_] inch thick] [ASTM C1048, Grade B (fully tempered), Style I (uncoated), Type I, Class 1 (clear)] [2 (tinted heat absorbing)] [solar-reflective], Quality q4, [\_\_\_\_\_] inch thick].

#### 2.3.1 Low Emissivity Coatings

Interior and exterior glass panes for Low-E insulating units must be Type I annealed flat glass, Class [1-clear] [2-tinted] with anti-reflective low-emissivity coating or heat-strengthened or fully tempered glass complying with ASTM C1048, Condition C on [No. 2 surface (inside surface of exterior pane)] [No. 3 surface (inside surface of interior pane)], Quality q3 - glazing select, conforming to ASTM C1036. Glass performance must be U value maximum of [\_\_\_\_\_] [Btu/hr-ft<sup>2</sup>-F], Solar Heat Gain Coefficient (SHGC) maximum of [\_\_\_\_\_] . Color must be [green] [gray] [bronze] [blue] [\_\_\_\_\_] .

#### 2.4 PLASTIC GLAZING

Plastic glazing must have a U-factor maximum of [\_\_\_\_\_] Btu per square foot by hr by degree F. [Plastic glazing must include a [0.63][1.26][\_\_\_\_\_] inch layer of aerogel between panels.]

Certificates stating that the plastic glazing meets the specified requirements. Labels or manufacturers marking affixed to the glass will be accepted in lieu of certificates.

##### 2.4.1 Acrylic Sheet

ASTM D4802, [Type I, regular] [Type II, heat resistant,] [clear and smooth on both sides] [translucent, textured on both sides,] [gray tint,] [bronze tint,] ultraviolet stabilized, [scratch resistant,] [\_\_\_\_\_] [0.236] [\_\_\_\_\_] in. thick.

##### 2.4.2 Polycarbonate Sheet

ANSI Z97.1, [Clear and smooth both sides] [Translucent, textured both sides] [Gray tint] [Bronze tint] [mar-resistant] [high abrasion resistant], ultraviolet stabilized, [\_\_\_\_\_] inch thick and listed in UL MEAPD as burglar resisting.

##### 2.4.3 Extruded Polycarbonate Profiled Sheet

Provide [double] [triple] walled, surface treated for improved UV resistance, offering thermal efficiency and impact strength.

#### 2.4.4 Bullet-Resistant Plastic Sheet

Cast acrylic sheet or mar-resistant polycarbonate sheet laminated with a special interlayer, and listed in [UL 752](#) as bullet resisting, Class [I] [II] [III], [clear] [\_\_\_\_\_] in color.[ Provide [\_\_\_\_\_] .]

### 2.5 SETTING AND SEALING MATERIALS

Provide as specified in the [GANA Glazing Manual](#), [IGMA TM-3000](#), [IGMA TB-3001](#), and manufacturer's recommendations, unless specified otherwise herein. Do not use metal sash putty, nonskinning compounds, nonresilient preformed sealers, or impregnated preformed gaskets. Materials exposed to view and unpainted must be gray or neutral color. Sealant testing must be performed by a testing agency qualified according to [ASTM C1021](#).

Submit glass manufacturer's recommendations for setting and sealing materials and for installation of each type of glazing material specified.[ Include cleaning instructions for plastic sheets.]

#### 2.5.1 Putty and Glazing Compound

Provide glazing compound as recommended by manufacturer for face-glazing metal sash. Putty must be linseed oil type. Do not use putty and glazing compounds with insulating glass or laminated glass.

#### 2.5.2 Glazing Compound

Use for face glazing metal sash. Do not use with insulating glass units or laminated glass.

#### 2.5.3 Sealants

Provide elastomeric [and structural] sealants.

##### 2.5.3.1 Elastomeric Sealant

[ASTM C920](#), Type S, Grade NS, Class 12.5, Use G. Use for channel or stop glazing [wood] [and] [metal] sash. [Sealants](#) must be chemically compatible with setting blocks, edge blocks, and sealing tapes[, with sealants used in manufacture of insulating glass units] [, and with plastic sheet]. Color of sealant must be white.

##### 2.5.3.2 Structural Sealant

[ASTM C1184](#), Type S.

#### 2.5.4 Joint Backer

Joint backer must have a diameter size at least 25 percent larger than joint width; type and material as recommended in writing by glass and sealant manufacturer.

#### 2.5.5 Glazing Tapes

##### 2.5.5.1 Back-Bedding Mastic Glazing Tapes

Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for

application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:

- a. AAMA 804.3 tape, where indicated.
- b. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
- c. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

#### 2.5.5.2 Expanded Cellular Glazing Tapes

Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

- a. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
- b. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

#### 2.5.6 Sealing Tapes

Preformed, semisolid, PVC-based material of proper size and compressibility for the particular condition, complying with ASTM D2287. Use only where glazing rabbet is designed for tape and tape is recommended by the glass or sealant manufacturer. Provide spacer shims for use with compressible tapes. Tapes must be chemically compatible with the product being set.

#### 2.5.7 Setting Blocks and Edge Blocks

Closed-cell neoprene setting blocks must be dense extruded type conforming to ASTM C509 and ASTM D395, Method B, Shore A durometer between 70 and 90. Edge blocking must be Shore A durometer of 50 (plus or minus 5). Provide silicone setting blocks when blocks are in contact with silicone sealant. Profiles, lengths and locations must be as required and recommended in writing by glass manufacturer. Block color must be [black][\_\_\_\_\_].

#### 2.5.8 Glazing Gaskets

Glazing gaskets must be extruded with continuous integral locking projection designed to engage into metal glass holding members to provide a watertight seal during dynamic loading, building movements and thermal movements. Glazing gaskets for a single glazed opening must be continuous one-piece units with factory-fabricated injection-molded corners free of flashing and burrs. Glazing gaskets must be in lengths or units recommended by manufacturer to ensure against pull-back at corners. Provide glazing gasket profiles as recommended by the manufacturer for the intended application.

##### 2.5.8.1 Fixed Glazing Gaskets

Fixed glazing gaskets must be closed-cell (sponge) smooth extruded compression gaskets of cured elastomeric virgin neoprene compounds conforming to ASTM C509, Type 2, Option 1.

#### 2.5.8.2 Wedge Glazing Gaskets

Wedge glazing gaskets must be high-quality extrusions of cured elastomeric virgin neoprene compounds, ozone resistant, conforming to [ASTM C864](#), Option 1, Shore A durometer between 65 and 75.

#### 2.5.8.3 Aluminum Framing Glazing Gaskets

Glazing gaskets for aluminum framing must be permanent, elastic, non-shrinking, non-migrating, watertight and weathertight.

#### 2.5.9 Accessories

Provide as required for a complete installation, including glazing points, clips, shims, angles, beads, and spacer strips. Provide noncorroding metal accessories. Provide primer-sealers and cleaners as recommended by the glass and sealant manufacturers. Use [ASTM C1087](#) to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to surface.

### [2.6 MIRROR ACCESSORIES

#### 2.6.1 Mastic

Mastic for setting mirrors must be a [polymer] [\_\_\_\_\_] type mirror mastic resistant to water, shock, cracking, vibration and thermal expansion. Provide mastic compatible with mirror backing paint, and as approved by mirror manufacturer.

#### 2.6.2 Mirror Frames

Provide mirrors with mirror frames (J-mold channels) fabricated of one-piece roll-formed Type 304 stainless steel with No. 4 brushed satin finish and concealed fasteners which will keep mirrors snug to wall. Frames must be 1-1/4 by 1/4 by 1/4 inch continuous at top and bottom of mirrors. Concealed fasteners of type to suit wall construction material must be provided with mirror frames.

#### 2.6.3 Mirror Clips

Provide clips with concealed fasteners of type to suit wall construction material.

### ]PART 3 EXECUTION

Any materials that show visual evidence of biological growth due to the presence of moisture must not be installed on the building project.

#### 3.1 PREPARATION

Preparation, unless otherwise specified or approved, must conform to applicable recommendations in the [GANA Glazing Manual](#), [GANA Sealant Manual](#), [IGMA TB-3001](#), [IGMA TM-3000](#), and manufacturer's recommendations. Determine the sizes to provide the required edge clearances by measuring the actual opening to receive the glass. Grind smooth in the shop glass edges that will be exposed in finish work. Leave labels in place until the installation is approved, except remove applied labels on heat-absorbing glass and on insulating glass units as soon as glass is installed. Securely fix movable items or keep in a closed and locked position until

glazing compound has thoroughly set.

### 3.2 GLASS SETTING

Shop glaze or field glaze items to be glazed using glass of the quality and thickness specified or indicated. Glazing, unless otherwise specified or approved, must conform to applicable recommendations in the [GANA Glazing Manual](#), [GANA Sealant Manual](#), [IGMA TB-3001](#), [IGMA TM-3000](#), and manufacturer's recommendations. Aluminum windows, wood doors, and wood windows may be glazed in conformance with one of the glazing methods described in the standards under which they are produced, except that face puttying with no bedding will not be permitted. Handle and install glazing materials in accordance with manufacturer's instructions. Use beads or stops which are furnished with items to be glazed to secure the glass in place. Verify products are properly installed, connected, and adjusted.

#### 3.2.1 Sheet Glass

Cut and set with the visible lines or waves horizontal.

#### 3.2.2 Patterned Glass

Set glass with one patterned surface with smooth surface on the weather side. When used for interior partitions, place the patterned surface in same direction in all openings.

#### 3.2.3 Insulating Glass Units

Do not grind, nip, or cut edges or corners of units after the units have left the factory. Springing, forcing, or twisting of units during setting will not be permitted. Handle units so as not to strike frames or other objects. Installation must conform to applicable recommendations of [IGMA TB-3001](#) and [IGMA TM-3000](#).

#### 3.2.4 Installation of Wire Glass

Install glass for fire doors in accordance with installation requirements of [NFPA 80](#).

#### 3.2.5 Installation of Heat-Absorbing Glass

Provide glass with clean-cut, factory-fabricated edges. Field cutting will not be permitted.

#### 3.2.6 Installation of Laminated Glass

Sashes which are to receive laminated glass must be weeped to the outside to allow water drainage into the channel.

#### 3.2.7 Plastic Sheet

Conform to manufacturer's recommendations for edge clearance, type of sealant and tape, and method of installation.

### 3.3 CLEANING

Clean glass surfaces and remove labels, paint spots, putty, and other defacement as required to prevent staining. Glass must be clean at the

time the work is accepted.[ Clean plastic sheet in accordance with manufacturer's instructions.]

#### 3.4 PROTECTION

Protect glass work immediately after installation. Identify glazed openings with suitable warning tapes, cloth or paper flags, attached with non-staining adhesives. Protect reflective glass with a protective material to eliminate any contamination of the reflective coating. Place protective material far enough away from the coated glass to allow air to circulate to reduce heat buildup and moisture accumulation on the glass. Upon removal, separate protective materials for reuse or recycling. Remove and replace glass units which are broken, chipped, cracked, abraded, or otherwise damaged during construction activities with new units.

-- End of Section --

SECTION 08 91 00

METAL WALL LOUVERS

05/11

PART 1 GENERAL

1.1 REFERENCES

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

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL, INC. (AMCA)

AMCA 500-L (2015) Laboratory Methods of Testing  
Louvers for Rating

AMCA 511 (2010) Certified Ratings Program for Air  
Control Devices

ALUMINUM ASSOCIATION (AA)

AA DAF45 (2003; Reaffirmed 2009) Designation System  
for Aluminum Finishes

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 611 (2014) Voluntary Specification for  
Anodized Architectural Aluminum

AAMA 2605 (2020) Voluntary Specification,  
Performance Requirements and Test  
Procedures for Superior Performing Organic  
Coatings on Aluminum Extrusions and Panels

ASTM INTERNATIONAL (ASTM)

ASTM B221 (2014) Standard Specification for Aluminum  
and Aluminum-Alloy Extruded Bars, Rods,  
Wire, Profiles, and Tubes

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Wall louvers

SD-03 Product Data

Metal Wall Louvers



## SD-04 Samples

## Wall louvers

## 1.3 DELIVERY, STORAGE, AND PROTECTION

Deliver materials to the site in an undamaged condition. Carefully store materials off the ground to provide proper ventilation, drainage, and protection against dampness. Louvers shall be free from nicks, scratches, and blemishes. Replace defective or damaged materials with new.

## 1.4 DETAIL DRAWINGS

Show all information necessary for fabrication and installation of wall louvers. Indicate materials, sizes, thicknesses, fastenings, and profiles.

## 1.5 COLOR SAMPLES

Colors of finishes for wall louvers shall closely approximate colors indicated. Where color is not indicated, submit the manufacturer's standard colors to the Contracting Officer for selection.

## PART 2 PRODUCTS

## 2.1 MATERIALS

## 2.1.1 Extruded Aluminum

ASTM B221, alloy 6063-T5 or -T52.

## 2.2 METAL WALL LOUVERS

Weather resistant type, with bird screens. Miami-Dade County Protocols Compliance: TAS-201 Large and Small Missile Impact Test. TAS-202 Uniform Static Air Pressure Test. TAS-203 Cyclic Wind Pressure Test - Maximum Design Pressure Rating +/- 120 psf (5.75 kPa). Wall louvers must bear the AMCA certified ratings program seal for air performance and water penetration in accordance with AMCA 500-L and AMCA 511. The rating must show a water penetration of 0.10 or less ounce per square foot of free area at a free velocity of 1200 feet per minute.

## 2.2.1 Extruded Aluminum Louvers

Fabricated of extruded 6063-T5 or -T52 aluminum with a wall thickness of not less than 0.081 inch. Blades shall be Drainable and horizontally mounted.

## 2.2.2 Mullions and Mullion Covers

Same material and finish as louvers. Provide mullions where indicated for all louvers more than 5 feet in width at not more than 5 feet on centers. Provide mullions covers on both faces of joints between louvers.

## 2.2.3 Screens and Frames

For aluminum louvers, provide 1/2 inch square mesh, 14 or 16 gage aluminum or 1/4 inch square mesh, 16 gage aluminum bird screening. For steel louvers, provide 1/2 inch square mesh, 12 or 16 gage zinc-coated steel;

1/2 inch square mesh, 16 gage copper; or 1/4 inch square mesh, 16 gage zinc-coated steel or copper bird screening. Mount screens in removable, rewirable frames of same material and finish as the louvers.

#### 2.2.4 Seismic Loads

Louvers shall be factory engineered to withstand the specified seismic loads. Minimum design loads shall be calculated to comply with ASCE - 7, or 1.

### 2.3 FASTENERS AND ACCESSORIES

Provide stainless steel screws and fasteners for aluminum louvers and zinc-coated or stainless steel screws and fasteners for steel louvers. Provide other accessories as required for complete and proper installation.

### 2.4 FINISHES

#### 2.4.1 Aluminum

Exposed aluminum surfaces shall be factory finished with an anodic coating. Color shall be as indicated. Louvers for each building shall have the same finish.

##### 2.4.1.1 Anodic Coating

Clean exposed aluminum surfaces and provide an anodized finish conforming to AA DAF45 and AAMA 611. Finish shall be:

- b. Architectural Class I ( 0.7 mil or thicker), designation AA-M10-C22-A44, electrolytically deposited color anodized.

##### 2.4.1.2 Organic Coating

Clean and prime exposed aluminum surfaces. Provide a high-performance finish in accordance with AAMA 2605 with total dry film thickness of not less than 1.2 mil, color As Selected.

## PART 3 EXECUTION

### 3.1 INSTALLATION

#### 3.1.1 Wall Louvers

Install using stops or moldings, flanges, strap anchors, or jamb fasteners as appropriate for the wall construction and in accordance with manufacturer's recommendations.

#### 3.1.2 Screens and Frames

Attach frames to louvers with screws or bolts.

### 3.2 PROTECTION FROM CONTACT OF DISSIMILAR MATERIALS

#### 3.2.1 Copper or Copper-Bearing Alloys

Paint copper or copper-bearing alloys in contact with dissimilar metal with heavy-bodied bituminous paint or separate with inert membrane.

3.2.2 Aluminum

Where aluminum contacts metal other than zinc, paint the dissimilar metal with a primer and two coats of aluminum paint.

3.2.3 Metal

Paint metal in contact with mortar, concrete, or other masonry materials with alkali-resistant coatings such as heavy-bodied bituminous paint.

-- End of Section --

## SECTION 09 22 00

## SUPPORTS FOR PLASTER AND GYPSUM BOARD

**02/10, CHG 2: 08/18**

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 341 (2016) Seismic Provisions for Structural Steel Buildings

## ASTM INTERNATIONAL (ASTM)

ASTM A463/A463M (2015; R 2020; E 2020) Standard Specification for Steel Sheet, Aluminum-Coated, by the Hot-Dip Process

ASTM A653/A653M (2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM C645 (2014; E 2015) Nonstructural Steel Framing Members

ASTM C754 (2020) Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products

ASTM C841 (2003; R 2013) Installation of Interior Lathing and Furring

ASTM C847 (2014a) Standard Specification for Metal Lath

## NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM EMLA 920 (2009) Guide Specifications for Metal Lathing and Furring

## UNDERWRITERS LABORATORIES (UL)

UL Fire Resistance (2014) Fire Resistance Directory

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that

will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-02 Shop Drawings

Metal Support Systems; G[, [\_\_\_\_\_]]

Submit for the erection of metal[ framing,][ furring,][ and][ ceiling suspension systems]. Indicate materials, sizes, thicknesses, and fastenings.

#### SD-03 Product Data

Metal Support Systems

Recycled Content for Metal Support Systems; S

### 1.3 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the job site and store in ventilated dry locations permitting easy access for inspection and handling. If materials are stored outdoors, stack materials off the ground, supported on a level platform, and fully protected from the weather. Handle materials carefully to prevent damage. Remove damaged items and provide new items.

## PART 2 PRODUCTS

### 2.1 MATERIALS

Provide steel materials for metal support systems with galvanized coating ASTM A653/A653M, G-60; aluminum coating ASTM A463/A463M, T1-25; or a 55-percent aluminum-zinc coating.[ Provide support systems and attachments per [AISC 341][\_\_\_\_\_] [UFC 3-301-01, "Structural Engineering"] in seismic zones.]

Provide metal support systems containing a minimum of 20 percent recycled content. Provide data identifying percentage of recycled content for metal support systems.

#### 2.1.1 Materials for Attachment of Lath

##### 2.1.1.1 Suspended and Furred Ceiling Systems and Wall Furring

ASTM C841, and ASTM C847.

##### 2.1.1.2 Non-load Bearing Wall Framing

NAAMM EMLA 920.

#### 2.1.2 Materials for Attachment of Gypsum Wallboard

##### 2.1.2.1 Suspended and Furred Ceiling Systems

ASTM C645.

##### 2.1.2.2 Non-load Bearing Wall Framing and Furring

ASTM C645, but not thinner than[ 0.0179 inch thickness, with 0.0329 inch minimum thickness supporting wall hung items such as cabinetwork,

equipment and fixtures][ 0.0329 inch thickness regardless of the ASTM certified third party testing statement for equivalent thicknesses].

#### 2.1.2.3 Furring Structural Steel Columns

ASTM C645. Steel (furring) clips and support angles listed in UL Fire Resistance may be provided in lieu of steel studs for erection of gypsum wallboard around structural steel columns.

#### 2.1.2.4 Z-Furring Channels with Wall Insulation

Not lighter than 26 gage galvanized steel, Z-shaped, with 1-1/4 inch and 3/4 inch flanges and [ [1] [1 1/2] [2] [3] inch furring depth] [depth as required by the insulation thickness provided].

### PART 3 EXECUTION

#### 3.1 INSTALLATION

##### 3.1.1 Systems for Attachment of Lath

##### 3.1.1.1 Suspended and Furred Ceiling Systems and Wall Furring

ASTM C841, except as indicated otherwise.

##### 3.1.1.2 Non-load Bearing Wall Framing

NAAMM EMLA 920, except provide framing members 16 inches o.c. unless indicated otherwise.

##### 3.1.2 Systems for Attachment of Gypsum Wallboard

##### 3.1.2.1 Suspended and Furred Ceiling Systems

ASTM C754, except provide framing members 16 inches o.c. unless indicated otherwise.

##### 3.1.2.2 Non-load Bearing Wall Framing and Furring

ASTM C754, except as indicated otherwise.

##### 3.1.2.3 Furring Structural Steel Columns

Install studs or galvanized steel clips and support angles for erection of gypsum wallboard around structural steel columns in accordance with the UL Fire Resistance, design number(s) [indicated] [of the fire resistance rating indicated].

##### 3.1.2.4 Z-Furring Channels with Wall Insulation

Install Z-furring channels vertically spaced not more than 24 inches o.c. Locate Z-furring channels at interior and exterior corners in accordance with manufacturer's printed erection instructions. Fasten furring channels to[ masonry][ and][ concrete] walls with powder-driven fasteners or hardened concrete steel nails through narrow flange of channel. Space fasteners not more than 24 inches o.c.

## 3.2 ERECTION TOLERANCES

Provide framing members which will be covered by finish materials such as wallboard, plaster, or ceramic tile set in a mortar setting bed, within the following limits:

- a. Layout of walls and partitions: 1/4 inch from intended position;
- b. Plates and runners: 1/4 inch in 8 feet from a straight line;
- c. Studs: 1/4 inch in 8 feet out of plumb, not cumulative; and
- d. Face of framing members: 1/4 inch in 8 feet from a true plane.

Provide framing members which will be covered by ceramic tile set in dry-set mortar, latex-portland cement mortar, or organic adhesive within the following limits:

- a. Layout of walls and partitions: 1/4 inch from intended position;
- b. Plates and runners: 1/8 inch in 8 feet from a straight line;
- c. Studs: 1/8 inch in 8 feet out of plumb, not cumulative; and
- d. Face of framing members: 1/8 inch in 8 feet from a true plane.

-- End of Section --

## SECTION 09 29 00

## GYPSUM BOARD

**08/16, CHG 4: 02/20**

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A108.11 (1992; Reaffirmed 2005) Specifications for Interior Installation of Cementitious Backer Units

## ASTM INTERNATIONAL (ASTM)

ASTM C475/C475M (2017) Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board

ASTM C514 (2004; R 2020) Standard Specification for Nails for the Application of Gypsum Board

ASTM C557 (2003; R 2017) Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing

ASTM C840 (2020) Standard Specification for Application and Finishing of Gypsum Board

ASTM C954 (2018) Standard Specification for 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

ASTM C1002 (2018) Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs

ASTM C1047 (2019) Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base

ASTM C1177/C1177M (2017) Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing

ASTM C1178/C1178M (2013) Standard Specification for Glass Mat Water-Resistant Gypsum Backing Panel

ASTM C1396/C1396M (2017) Standard Specification for Gypsum



## Board

ASTM C1629/C1629M	(2018a) Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels
ASTM C1766	(2015; R2019) Standard Specification for Factory-Laminated Gypsum Panel Products
ASTM D226/D226M	(2017) Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
ASTM D412	(2016) Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension
ASTM D624	(2000; R 2020) Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
ASTM D1037	(2012) Evaluating Properties of Wood-Base Fiber and Particle Panel Materials
ASTM D1149	(2007; R 2012) Standard Test Method for Rubber Deterioration - Surface Ozone Cracking in a Chamber
ASTM D2394	(2017) Standard Test Methods for Simulated Service Testing of Wood and Wood-Base Finish Flooring
ASTM D3273	(2016) Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
ASTM D5420	(2016) Standard Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Strike Impacted by a Falling Weight (Gardner Impact)
ASTM E84	(2020) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E90	(2009; R2016) Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
ASTM E336	(2020) Standard Test Method for Measurement of Airborne Sound Attenuation between Rooms in Buildings
ASTM E695	(2003; R 2015; E 2015) Measuring Relative Resistance of Wall, Floor, and Roof Construction to Impact Loading

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

CDPH SECTION 01350 (2010; Version 1.1) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers

FM GLOBAL (FM)

FM APP GUIDE (updated on-line) Approval Guide  
<http://www.approvalguide.com/>

GREEN SEAL (GS)

GS-36 (2013) Adhesives for Commercial Use

GYPSUM ASSOCIATION (GA)

GA 214 (2010) Recommended Levels of Gypsum Board Finish

GA 216 (2010) Application and Finishing of Gypsum Panel Products

GA 224 (2008) Installation of Predecorated Gypsum Board

GA 253 (2012) Application of Gypsum Sheathing

GA 600 (2009) Fire Resistance Design Manual

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS SCS Global Services (SCS) Indoor Advantage

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule 1168 (2017) Adhesive and Sealant Applications

UNDERWRITERS LABORATORIES (UL)

UL 2818 (2013) GREENGUARD Certification Program For Chemical Emissions For Building Materials, Finishes And Furnishings

UL Fire Resistance (2014) Fire Resistance Directory

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Cementitious Backer Units

Glass Mat Water-Resistant Gypsum Tile Backing Board

Water-Resistant Gypsum Backing Board

- [ Glass Mat Covered or Reinforced Gypsum Sheathing
- ][ Glass Mat Covered or Reinforced Gypsum Sheathing Sealant
- ][ Abuse Resistant Gypsum Board
- ] Accessories

Submit for each type of gypsum board and for cementitious backer units.

Gypsum Board

- [ Recycled Content for Gypsum Board; S
- ][ Recycled Content for Paper Facing and Gypsum Cores; S
- ] VOC Content of Joint Compound; S

#### SD-04 Samples

Predecorated Gypsum Board; G[, [\_\_\_\_\_]]

Submit for each color and pattern of predecorated gypsum board. Where colors are not indicated, submit color selection samples of not less than eight of the manufacturer's standard colors.

#### SD-06 Test Reports

- [ ASTM E90 Factory Test Report; G[, [\_\_\_\_\_]]
- ][ ASTM E336 Field Test Report; G[, [\_\_\_\_\_]]

#### ] SD-07 Certificates

Asbestos Free Materials; G[, [\_\_\_\_\_]]

Certify that gypsum board types, gypsum backing board types, cementitious backer units, and joint treating materials do not contain asbestos.

Indoor Air Quality for Gypsum Board; S

Indoor Air Quality for Non-aerosol Adhesives; S

Indoor Air Quality for Aerosol Adhesives; S

#### SD-08 Manufacturer's Instructions

Safety Data Sheets

#### SD-10 Operation and Maintenance Data

## Manufacturer Maintenance Instructions

## 1.3 CERTIFICATIONS

## 1.3.1 Indoor Air Quality Certifications

Submit required indoor air quality certifications in one submittal package.

## [1.3.1.1 Ceiling and Wall Systems

Provide products certified to meet indoor air quality requirements by UL 2818 (Greenguard) Gold, SCS Global Services Indoor Advantage Gold or provide certification or validation by other third-party program that products meet the requirements of this Section. Provide current product certification documentation from certification body. When product does not have certification, provide validation that product meets the indoor air quality product requirements cited herein.

## ]1.3.1.2 Adhesives and Sealants

Provide products certified to meet indoor air quality requirements by UL 2818 (Greenguard) Gold, SCS Global Services Indoor Advantage Gold or provide certification or validation by other third-party program that products meet the requirements of this Section. Provide current product certification documentation from certification body. When product does not have certification, provide validation that product meets the indoor air quality product requirements cited herein.

## 1.4 DELIVERY, STORAGE, AND HANDLING

## 1.4.1 Delivery

Deliver materials in the original packages, containers, or bundles with each bearing the brand name, applicable standard designation, and name of manufacturer, or supplier.

## 1.4.2 Storage

Keep materials dry by storing inside a sheltered building. Where necessary to store gypsum board and cementitious backer units outside, store off the ground, properly supported on a level platform, and protected from direct exposure to rain, snow, sunlight, and other extreme weather conditions. Provide adequate ventilation to prevent condensation. Store per manufacturer's recommendations for allowable temperature and humidity range. Do not store gypsum wallboard with materials which have high emissions of volatile organic compounds (VOCs) or other contaminants, including [\_\_\_\_]. Do not store panels near materials that may offgas or emit harmful fumes, such as kerosene heaters, fresh paint, or adhesives. Do not use materials that have visible moisture or biological growth.

## 1.4.3 Handling

Neatly stack gypsum board and cementitious backer units flat to prevent sagging or damage to the edges, ends, and surfaces.

## 1.5 QUALIFICATIONS

Furnish type of gypsum board work specialized by the installer with a

minimum of [3] [\_\_\_\_\_] years of documented successful experience.

#### 1.6 SCHEDULING

[The gypsum wallboard must be taped, finished and primed before the installation of the highly-emitting materials, including [\_\_\_\_\_] .] [The gypsum wallboard must be installed after the installation and ventilation period of the highly-emitting materials, including [\_\_\_\_\_] .]

Commence application only after the area scheduled for gypsum board work is completely weathertight. The heating, ventilating, and air-conditioning systems must be complete and in operation prior to application of the gypsum board. If the mechanical system cannot be activated before gypsum board is begun, the gypsum board work may proceed in accordance with an approved plan to maintain the environmental conditions specified below. Apply gypsum board prior to the installation of finish flooring and acoustic ceiling.

#### 1.7 ENVIRONMENTAL REQUIREMENTS

Do not expose the gypsum board to excessive sunlight prior to gypsum board application. Maintain a continuous uniform temperature of not less than 50 degrees F and not more than 80 degrees F for at least one week prior to the application of gypsum board work, while the gypsum board application is being done, and for at least one week after the gypsum board is set. Shield air supply and distribution devices to prevent any uneven flow of air across the plastered surfaces. Provide ventilation to exhaust moist air to the outside during gypsum board application, set, and until gypsum board jointing is dry. In glazed areas, keep windows open top and bottom or side to side 3 to 4 inches. Reduce openings in cold weather to prevent freezing of joint compound when applied. For enclosed areas lacking natural ventilation, provide temporary mechanical means for ventilation. In unglazed areas subjected to hot, dry winds or temperature differentials from day to night of 20 degrees F or more, screen openings with cheesecloth or similar materials. Avoid rapid drying. During periods of low indoor humidity, provide minimum air circulation following gypsum boarding and until gypsum board jointing complete and is dry.

#### [1.8 FIRE RESISTIVE CONSTRUCTION

Comply with specified fire-rated assemblies for design numbers indicated per UL Fire Resistance or FM APP GUIDE.

### ]PART 2 PRODUCTS

#### 2.1 MATERIALS

Conform to specifications, standards and requirements specified. Provide gypsum board types, gypsum backing board types, cementitious backing units, and joint treating materials manufactured from asbestos free materials only. Submit Safety Data Sheets and manufacturer maintenance instructions for gypsum materials including adhesives.

##### 2.1.1 Gypsum Board

ASTM C1396/C1396M.[ Gypsum board must contain a minimum of [5][10][\_\_\_\_\_] percent post-consumer recycled content, or a minimum of [20][40][\_\_\_\_\_] percent post-industrial recycled content. Provide data identifying percentage of recycled content for gypsum board.][ Paper facings must

contain a minimum of 100 percent recycled paper content. Gypsum cores must contain a minimum of [95][\_\_\_\_\_] percent post-industrial recycled gypsum content. Provide data identifying percentage of [recycled content for paper facing and gypsum cores.](#) Provide gypsum wall board and panels meeting the emissions requirements of [CDPH SECTION 01350](#) (limit requirements for either office or classroom spaces regardless of space type). Provide certification or validation of [indoor air quality for gypsum board.](#)

#### 2.1.1.1 Regular

48 inch wide, [1/2] [5/8] inch thick, [tapered][, tapered and featured] edges. [Provide tapered and featured edge gypsum board [in Rooms [\_\_\_\_\_] ] [as indicated].]

#### 2.1.1.2 Foil-Backed

48 inch wide, [1/2] [5/8] inch thick, [tapered] [tapered and featured] edges.

#### 2.1.1.3 Type X (Special Fire-Resistant)

48 inch wide, [1/2] [5/8] inch thick, [tapered] [tapered and featured] edges.

#### 2.1.1.4 Mold Resistant / Anti-Microbial Gypsum

[ASTM D3273](#). 48 inch wide, [1/2] [5/8] inch thick, [tapered][tapered and featured] edges.

#### 2.1.2 Gypsum Backing Board

[ASTM C1396/C1396M](#), gypsum backing board must be used as a base in a multilayer system.

#### 2.1.2.1 Regular

48 inch wide, [1/2] [5/8] inch thick, square edges.

#### 2.1.2.2 Foil-Backed

48 inch wide, [1/2] [5/8] inch thick, square edges.

#### 2.1.2.3 Type X (Special Fire-Resistant)

48 inch wide, [1/2] [5/8] inch thick, square edges.

#### 2.1.3 Regular Water-Resistant Gypsum Backing Board

[ASTM C1396/C1396M](#)

#### 2.1.3.1 Regular

48 inch wide, [1/2] [5/8] inch thick, tapered edges.

#### 2.1.3.2 Type X (Special Fire-Resistant)

48 inch wide, [1/2] [5/8] inch thick, tapered edges.

#### 2.1.4 Glass Mat Water-Resistant Gypsum Tile Backing Board

ASTM C1178/C1178M

##### 2.1.4.1 Regular

48 inch wide, [1/2] [5/8] inch thick, square edges.

##### 2.1.4.2 Type X (Special Fire-Resistant)

48 inch wide, [1/2] [5/8] inch thick, square edges.

#### [2.1.5 Glass Mat Covered or Reinforced Gypsum Sheathing

Exceeds physical properties of ASTM C1396/C1396M and ASTM C1177/C1177M. Provide [1/2][5/8] inch, gypsum sheathing. Provide gypsum board of with a noncombustible water-resistant core, with glass mat surfaces embedded to the gypsum core or reinforcing embedded throughout the gypsum core. Warrant gypsum sheathing board for at least twelve months against delamination due to direct weather exposure. Provide continuous, asphalt impregnated, building felt to cover exterior face of sheathing. [Seal all joints, seams, and penetrations with compatible sealant.]

##### [2.1.5.1 Glass Mat Covered or Reinforced Gypsum Sheathing Sealant

Provide sealant compatible with glass mat covered or reinforced gypsum sheathing, rubber washers for masonry veneer anchors, and other associated cavity wall components such as anchors and through wall flashing. Provide sealants for glass mat covered or reinforced gypsum sheathing board edge seams and veneer anchor penetrations recommended by the glass mat covered or reinforced gypsum sheathing manufacturer and have the following performance requirements:

- a. ASTM D412: Tensile Strength, 80 psi
- b. ASTM D412: Ultimate Tensile Strength (maximum elongation), 170 psi
- c. ASTM D624: Tear Strength, dieB, 27 pli
- d. ASTM D1149: Joint Movement Capability after 14 Days cure, plus or minus 50 percent.

#### ][2.1.6 Abuse Resistant Gypsum Board

48 inch wide, 5/8 inch thick, tapered edges.

Reinforced gypsum panel with imbedded fiber mesh or lexan backing tested in accordance with the following tests. Hard body impact test must attain a Level 2 performance in accordance with ASTM C1629/C1629M. Provide fasteners that meet manufacturer requirements and specifications stated within this section. Abuse resistant gypsum board, when tested in accordance with ASTM E84, have [a flame spread rating of 25 or less and a smoke developed rating of 50 or less for [\_\_\_\_]] [and] [a flame spread rating of 75 or less and a smoke developed rating of 100 or less for [\_\_\_\_]].

##### 2.1.6.1 Soft Body Impact Test

ASTM E695 or ASTM D2394 for impact penetration and deformation. ASTM E695 using a 60 lb leather bag filled with steel pellets, resisting no less than 300 ft. lb. cumulative impact energy before failure or ASTM D2394 using 5.5 inch hemispherical projectile resisting no less than 264 ft. lb. before failure. Provide test specimen stud spacing a minimum 16 inch on

center.

#### 2.1.6.2 Hard Body Impact Test

Comply with hard body impact test in accordance with [ASTM C1629/C1629M](#) Classification Level 2.

#### 2.1.6.3 Surface Abrasion Test

Comply with test surface abrasion test in accordance with [ASTM C1629/C1629M](#).

#### 2.1.6.4 Indentation Test

[ASTM D5420](#) or [ASTM D1037](#) for indentation resistance. [ASTM D5420](#) using a 32 oz weight with a 5/8 inch hemispherical impacting head dropped once 3 feet creating not more than 0.137 inch indentation or [ASTM D1037](#) using no less than 470 lb weight applied to the 0.438 inch diameter ball to create not more than a 0.0197 inch indentation depth.

#### ]2.1.7 Factory-Laminated Gypsum Board

[ [ASTM C1766](#), [regular] [Type X], 48 inch wide [1/2] [5/8] inch thick, sound dampening gypsum panel products composed of [two [or more]] factory-laminated gypsum panel laminated into a composite panel.

#### ] [2.1.7.1 [ASTM E90 Factory Test Report](#)

Submit Factory Test Report for proposed STC Rated wall assembly. Test reports must be prepared by an independent acoustical laboratory qualified under the National Voluntary Laboratory Accreditation Program (NVLAP) by the National Institute for Science and Technology (NIST). Test reports must indicate that the sound transmission classification (STC) of the proposed wall [and ceiling] assembly, based on tests at 16 third-octave band frequencies from 125 to 4,000 hertz, is no less than STC 50 for STC 45 assemblies and no less than STC 55 for STC 50 assemblies when tested in accordance with [ASTM E90](#).

#### ]2.1.8 [Predecorated Gypsum Board](#)

[ASTM C1396/C1396M](#), [regular] [Type X] gypsum board, 48 inch wide, [1/2] [5/8] inch thick, with a decorative wall covering (Class I) [or coating (Class II)] applied in-plant by the gypsum board manufacturer. The color [and pattern] of wall covering must be [\_\_\_\_\_] [as selected]. Provide [\_\_\_\_\_] color [and pattern] wall covering selected. [Furnish gypsum board with square edges, and a slight bevel to produce a shallow vee joint. Wrap all coverings around edges.] Furnish a predecorated gypsum board with [a flame spread rating of 25 or less and a smoke developed rating of 50 or less for [\_\_\_\_\_] [and] [a flame spread rating of 75 or less and a smoke developed rating of 100 or less for [\_\_\_\_\_] ]].

#### 2.1.9 [Cementitious Backer Units](#)

In accordance with the Tile Council of America (TCA) Handbook.

#### 2.1.10 Joint Treatment Materials

[ASTM C475/C475M](#). Product must be low emitting VOC types with VOC limits not exceeding 50 g/L. Provide data identifying [VOC content of joint compound](#). [Use all purpose joint and texturing compound containing inert



fillers and natural binders, including lime compound. Pre-mixed compounds must be free of antifreeze, vinyl adhesives, preservatives, biocides and other slow releasing compounds.]

#### 2.1.10.1 Embedding Compound

Specifically formulated and manufactured for use in embedding tape at gypsum board joints and compatible with tape, substrate and fasteners.

#### 2.1.10.2 Finishing or Topping Compound

Specifically formulated and manufactured for use as a finishing compound.

#### 2.1.10.3 All-Purpose Compound

Specifically formulated and manufactured to serve as both a taping and a finishing compound and compatible with tape, substrate and fasteners.

#### 2.1.10.4 Setting or Hardening Type Compound

Specifically formulated and manufactured for use with fiber glass mesh tape.

#### 2.1.10.5 Joint Tape

Use cross-laminated, tapered edge, reinforced paper, or fiber glass mesh tape recommended by the manufacturer.

#### 2.1.11 Fasteners

##### 2.1.11.1 Nails

**ASTM C514.** [For predecorated gypsum board provide special nails with factory coated heads of color to match wall covering materials as recommended by the predecorated gypsum board manufacturer.]

##### 2.1.11.2 Screws

**ASTM C1002**, Type "G", Type "S" or Type "W" steel drill screws for fastening gypsum board to gypsum board, wood framing members and steel framing members less than 0.033 inch thick. **ASTM C954** steel drill screws for fastening gypsum board to steel framing members 0.033 to 0.112 inch thick. Provide cementitious backer unit screws with a polymer coating.

##### 2.1.11.3 Staples

No. 16 USS gage flattened galvanized wire staples with 7/16 inch wide crown outside measurement and divergent point for base ply of two-ply gypsum board application. Use as follows:

<u>Length of Legs</u>	<u>Thickness of Gypsum Board</u>
1-1/8 inches	1/2 inch
1-1/4 inches	5/8 inch

## 2.1.12 Adhesives

Provide non-aerosol adhesive products used on the interior of the building (defined as inside of the weatherproofing system) meeting either emissions requirements of [CDPH SECTION 01350](#) (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of [SCAQMD Rule 1168](#). Provide aerosol adhesive products used on the interior of the building (defined as inside of the weatherproofing system) meeting either emissions requirements of [CDPH SECTION 01350](#) (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of [GS-36](#). Provide certification or validation of [indoor air quality for non-aerosol adhesives](#) applied on the interior of the building (inside of the weatherproofing system). Provide certification or validation of [indoor air quality for aerosol adhesives](#) used on the interior of the building (inside of the weatherproofing system).

## 2.1.12.1 Adhesive for Fastening Gypsum Board to Metal Framing

[Not permitted.][Type recommended by gypsum board manufacturer.]

## 2.1.12.2 Adhesive for Fastening Gypsum Board to Wood Framing

[Not permitted.][[ASTM C557](#).]

## 2.1.12.3 Adhesive for Laminating

[Not permitted.][ Adhesive attachment is not permitted for multi-layer gypsum boards. For laminating gypsum studs to face panels, provide adhesive recommended by gypsum board manufacturer.]

## 2.1.13 Gypsum Studs

Provide [one inch](#) minimum thickness and [6 inch](#) minimum width. Studs may be of [one inch](#) thick gypsum board or multilayers fastened to required thickness. Conform to [ASTM C1396/C1396M](#) for material and [GA 216](#) for installation.

## 2.1.14 Shaftwall Liner Panel

[ASTM C1396/C1396M](#). Conform to the [UL Fire Resistance](#) for the Design Numbers(s) indicated for shaftwall liner panels. Manufacture liner panel for cavity shaftwall system, with water-resistant paper faces, bevel edges, single lengths to fit required conditions, [\[1 inch\]](#) [\[3/4 inch\]](#) thick, by [24inch](#) wide.

## 2.1.15 Accessories

[ASTM C1047](#). Fabricate from [corrosion protected steel][ or ][plastic] designed for intended use. Accessories manufactured with paper flanges are not acceptable. Flanges must be free of dirt, grease, and other materials that may adversely affect bond of joint treatment. Provide prefinished or job decorated materials. [For predecorated gypsum board provide prefinished metal or plastic trim to match predecorated gypsum board.]

## 2.1.16 Asphalt Impregnated Building Felt

Provide a [15 lb](#) asphalt moisture barrier over glass mat covered or

reinforced gypsum sheathing. Conforming to ASTM D226/D226M Type 1 (No. 15) for asphalt impregnated building felt.

#### 2.1.17 Water

Provide clean, fresh, and potable water.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

##### 3.1.1 Framing and Furring

Verify that framing and furring are securely attached and of sizes and spacing to provide a suitable substrate to receive gypsum board and cementitious backer units. Verify that all blocking, headers and supports are in place to support plumbing fixtures and to receive soap dishes, grab bars, towel racks, and similar items. Do not proceed with work until framing and furring are acceptable for application of gypsum board and cementitious backer units.

##### 3.1.2 [Gypsum Board] [and] [Framing]

Verify that surfaces of [gypsum board] [and] [framing] to be bonded with an adhesive are free of dust, dirt, grease, and any other foreign matter. Do not proceed with work until surfaces are acceptable for application of gypsum board with adhesive.

##### 3.1.3 [Masonry] [and] [Concrete] Walls

Verify that surfaces of [masonry] [and] [concrete] walls to receive gypsum board applied with adhesive are dry, free of dust, oil, form release agents, protrusions and voids, and any other foreign matter. Do not proceed with work until surfaces are acceptable for application of gypsum board with adhesive.

##### 3.1.4 Building Construction Materials

Do not install building construction materials that show visual evidence of biological growth.

#### 3.2 APPLICATION OF GYPSUM BOARD

Apply gypsum board to framing and furring members in accordance with ASTM C840 or GA 216 and the requirements specified. Apply gypsum board with separate panels in moderate contact; do not force in place. Stagger end joints of adjoining panels. Neatly fit abutting end and edge joints. Use gypsum board of maximum practical length; select panel sizes to minimize waste. Cut out gypsum board to make neat, close, and tight joints around openings. In vertical application of gypsum board, provide panels in lengths required to reach full height of vertical surfaces in one continuous piece. Lay out panels to minimize waste; reuse cutoffs whenever feasible. Surfaces of gypsum board and substrate members may [not ]be bonded together with an adhesive[, except where prohibited by fire rating(s)]. Treat edges of cutouts for plumbing pipes, screwheads, and joints with water-resistant compound as recommended by the gypsum board manufacturer. Minimize framing by floating corners with single studs and drywall clips. [Install [5/8 inch][\_\_\_\_\_] gypsum or [1/2 inch][\_\_\_\_\_] ceiling board over framing at [24 inch][\_\_\_\_\_] on center.]

Provide type of gypsum board for use in each system specified herein as indicated.

#### 3.2.1 Application of Single-Ply Gypsum Board to Wood Framing

Apply in accordance with ASTM C840, System I or GA 216.

#### 3.2.2 Application of Two-Ply Gypsum Board to Wood Framing

Apply in accordance with ASTM C840, System II or GA 216.

#### 3.2.3 Adhesive Nail-On Application to Wood Framing

Apply in accordance with ASTM C840, System III or GA 216. This method may be used in lieu of ASTM C840, System I at the option of the Contractor.

#### 3.2.4 Semi-Solid Gypsum Board Partitions

Provide in accordance with ASTM C840, System IV or GA 216 .

#### 3.2.5 Solid Gypsum Board Partitions

Provide in accordance with ASTM C840, System V or GA 216.

#### 3.2.6 Adhesive Application to Interior Masonry or Concrete Walls

Apply in accordance with ASTM C840, System VI or GA 216.

#### 3.2.7 Application of Gypsum Board to Steel Framing and Furring

Apply in accordance with ASTM C840, System VIII or GA 216.

#### 3.2.8 Arches and Bending Radii

Apply gypsum board in accordance with ASTM C840, System IX or GA 216.

#### 3.2.9 Gypsum Board for Wall Tile or Tile Base Applied with Adhesive

In dry areas (areas other than tubs, shower enclosures, saunas, steam rooms, gang shower rooms), apply glass mat water-resistant gypsum tile backing board [or water-resistant gypsum backing board] in accordance with ASTM C840, System X or GA 216.

#### 3.2.10 Exterior Application

Apply exterior gypsum board (such as at soffits) in accordance with ASTM C840, System XI or GA 216.

#### 3.2.11 Glass Mat Covered or Fiber Reinforced Gypsum Sheathing

Apply glass mat covered or fiber reinforced gypsum sheathing in accordance to gypsum association publications GA 253. Follow gypsum sheathing manufacturer's requirements of design details for joints and fasteners and be properly installed to protect the substrate from moisture intrusion. Do not leave exposed surfaces of the glass mat covered or fiber reinforced gypsum sheathing beyond the manufacturer's recommendation without a weather barrier cladding. Provide continuous asphalt impregnated building felt over sheathing surface in shingle fashion with edges and ends lapped a minimum of 6 inch. Properly flash the openings. [Seal all joints,

seams, and penetrations with a compatible silicone sealant.]

### 3.2.12 Floating Interior Angles

Minimize framing by floating corners with single studs and drywall clips. Locate the attachment fasteners adjacent to ceiling and wall intersections in accordance with [ASTM C840](#), System XII or [GA 216](#), for [single-ply] [and] [two-ply] applications of gypsum board to wood framing.

### 3.2.13 Control Joints

Install expansion and contraction joints in ceilings and walls in accordance with [ASTM C840](#), System XIII or [GA 216](#). Fill control joints between studs in fire-rated construction with firesafing insulation to match the fire-rating of construction.

### 3.2.14 Application of Foil-Backed Gypsum Board

Apply foil-backed gypsum board in accordance with [ASTM C840](#), System XIV or [GA 216](#).

### 3.2.15 Application of Predecorated Gypsum Board

Apply predecorated gypsum board in accordance with [GA 224](#). Attach predecorated gypsum board with adhesive and fasteners as recommended by the manufacturer. Conceal fasteners in the finished work.

### 3.2.16 Application of Abuse Resistant Gypsum Board

Apply in accordance with applicable system of [ASTM C840](#) as specified or [GA 216](#). Follow manufacturers written instructions on how to cut, drill and attach board.

### [3.2.17 Application of Factory-Laminated Gypsum Board

Apply in accordance with manufacturer instructions for testing sound assembly. Face of laminated surface must not be on finished side of assembly.

## ]3.3 APPLICATION OF CEMENTITIOUS BACKER UNITS

### 3.3.1 Application

In wet areas (tubs, shower enclosures, saunas, steam rooms, gang shower rooms), apply cementitious backer units in accordance with [ANSI A108.11](#). Place a 15 lb asphalt impregnated, continuous felt paper membrane behind cementitious backer units, between backer units and studs or base layer of gypsum board. Place membrane with a minimum 6 inch overlap of sheets laid shingle style.

### 3.3.2 Joint Treatment

[ANSI A108.11](#).

## 3.4 FINISHING OF GYPSUM BOARD

Tape and finish gypsum board in accordance with [ASTM C840](#), [GA 214](#) and [GA 216](#). Finish plenum areas above ceilings to Level 1 in accordance with [GA 214](#). Finish water resistant gypsum backing board, [ASTM C1396/C1396M](#),

to receive ceramic tile to Level 2 in accordance with GA 214. Finish walls and ceilings to receive a heavy-grade wall covering or heavy textured finish before painting to Level 3 in accordance with GA 214. Finish walls and ceilings without critical lighting to receive flat paints, light textures, or wall coverings to Level 4 in accordance with GA 214. Unless otherwise specified, finish all gypsum board walls, partitions and ceilings to Level 5 in accordance with GA 214. Provide joint, fastener depression, and corner treatment. Tool joints as smoothly as possible to minimize sanding and dust. Do not use self-adhering fiber glass mesh tape with conventional drying type joint compounds; use setting or hardening type compounds only. Provide treatment for water-resistant gypsum board as recommended by the gypsum board manufacturer. Protect workers, building occupants, and HVAC systems from gypsum dust.

#### 3.4.1 Uniform Surface

Wherever gypsum board is to receive eggshell, semigloss or gloss paint finish, or where severe, up or down lighting conditions occur, finish gypsum wall surface in accordance with GA 214 Level 5. In accordance with GA 214 Level 5, apply a thin skim coat of joint compound to the entire gypsum board surface, after the two-coat joint and fastener treatment is complete and dry.

#### [3.4.2 Metal Trim for Predecorated Gypsum Board

Finish edges, ends, and joints of predecorated gypsum board, except prefinished vee joints and monolithic type joints, with metal or plastic trim selected to match the gypsum board finish.

#### ]3.5 SEALING

Seal openings around pipes, fixtures, and other items projecting through gypsum board and cementitious backer units as specified in Section 07 92 00 JOINT SEALANTS. Apply material with exposed surface flush with gypsum board or cementitious backer units.

#### [3.5.1 Sealing for Glass Mat or Reinforced Gypsum Board Sheathing

Apply silicone sealant in a 3/8 inch bead to all joints and trowel flat. Apply enough of the same sealant to all fasteners penetrating through the glass mat gypsum board surface to completely cover the penetration when troweled flat. [Do not place construction and materials behind sheathing until a visual inspection of sealed joints during daylight hours has been completed by Contracting Officer.]

#### ]3.6 FIRE-RESISTANT ASSEMBLIES

Wherever fire-rated construction is indicated, provide materials and application methods, including types and spacing of fasteners, [ wall [ and ceiling ] framing ] in accordance with the specifications contained in [ UL Fire Resistance for the Design Number(s) indicated ], [ or ] [ GA 600 for the File Number(s) indicated ]. Joints of fire-rated gypsum board enclosures must be closed and sealed in accordance with UL test requirements or GA requirements. Seal penetrations through rated partitions and ceilings tight in accordance with tested systems.

#### [3.7 SOUND RATED ASSEMBLIES

When sound rated assemblies are required, provide materials and

application methods, including panels, insulation, types and spacing of fasteners, [ wall [ and ceiling ] framing ] in accordance with the contract document and the description of the assembly in the [ASTM E90 Factory Test Report](#). Seal partitions continuously with acoustical foam or sealant (both sides) and finished to match wall wherever it abuts another element such as the floor, ceiling, wall, column, mullion, or another system or assembly.

### ]3.8 PATCHING

Patch surface defects in gypsum board to a smooth, uniform appearance, ready to receive finishes. [Remove predecorated gypsum board which cannot be restored to like-new condition. Provide new predecorated gypsum board.]

### 3.9 SHAFTWALL FRAMING

Install the shaftwall system in accordance with the system manufacturer's published instructions. Coordinate bucks, anchors, blocking and other items placed in or behind shaftwall framing with electrical and mechanical work. Patch or replace fireproofing materials which are damaged or removed during shaftwall construction.

### [3.10 SOUND RATED ASSEMBLY FIELD TESTING

Provide third party testing of sound rated assemblies tested in accordance with [ASTM E336](#). Provide the [ASTM E336 Field Test Report](#) verifying that the installed assemblies perform no less than five ASTC rating points below the [ASTM E90 Factory Test Report](#). Examine, modify adjust, and retest any installation not meeting the STC Rating until compliance is obtained.

] -- End of Section --

## SECTION 09 30 10

PORCELAIN AND GLASS TILING  
08/20

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A108/A118/A136.1	(2019) American National Standard Specifications for the Installation of Ceramic Tile
ANSI A137.1	(2019) American National Standards Specifications for Ceramic Tile
ANSI A137.2	(2019) American National Standards Specifications for Glass Tile
ANSI A137.3/A108.19	(2017) American National Standard Specifications for Porcelain Tile and Gauged Porcelain Tile Panels/Slabs

## ASTM INTERNATIONAL (ASTM)

ASTM A1064/A1064M	(2017) Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
ASTM C33/C33M	(2018) Standard Specification for Concrete Aggregates
ASTM C144	(2018) Standard Specification for Aggregate for Masonry Mortar
ASTM C150/C150M	(2020) Standard Specification for Portland Cement
ASTM C206	(2014) Standard Specification for Finishing Hydrated Lime
ASTM C207	(2018) Standard Specification for Hydrated Lime for Masonry Purposes
ASTM C373	(2018) Standard Test Methods for Determination of Water Absorption and Associated Properties by Vacuum Method for Pressed Ceramic Tiles and Glass Tiles and Boil Method for Extruded Ceramic Tiles and



Non-tile Fired Ceramic Whiteware Products

ASTM C648	(2020) Standard Test Method for Breaking Strength of Ceramic Tile
ASTM C847	(2014a) Standard Specification for Metal Lath
ASTM C1026	(2013; R 2018) Standard Test Method for Measuring the Resistance of Ceramic and Glass Tile to Freeze-Thaw Cycling
ASTM C1027	(2009; R 2017) Standard Test Method for Determining Visible Abrasion Resistance of Glazed Ceramic Tile

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

CDPH SECTION 01350	(2010; Version 1.1) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers
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GREEN SEAL (GS)

GS-36	(2013) Adhesives for Commercial Use
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SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	SCS Global Services (SCS) Indoor Advantage
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SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule 1168	(2017) Adhesive and Sealant Applications
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TILE COUNCIL OF NORTH AMERICA (TCNA)

TCNA Hdbk	(2017) Handbook for Ceramic, Glass, and Stone Tile Installation
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U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

36 CFR 1191	Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines
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UNDERWRITERS LABORATORIES (UL)

UL 2818	(2013) GREENGUARD Certification Program For Chemical Emissions For Building Materials, Finishes And Furnishings
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## 1.2 SUBMITTALS

Approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29.05 20 SUSTAINABILITY REPORTING FOR

DESIGN-BUILD. Submit the following in accordance with Section 01 33 00.05 20  
CONSTRUCTION SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings; G

SD-03 Product Data

Porcelain Tile

Recycled Content for Porcelain Tile; S

Porcelain Tile; G

]

Recycled Content for Glass Tile; S

]

Transition Strips

Metal Strips

Setting-Bed; G

Mortar, Grout, and Adhesive; G

Reinforcing Wire Fabric

Cementitious Backer Units; G

Waterproof Membrane; G

Crack Isolation Membrane; G

SD-04 Samples

Tile; G

Accessories; G

Transition Strips; G

Metal Strips; G

Grout; G

SD-07 Certificates

Indoor Air Quality for Adhesives; S

Indoor Air Quality for Sealants; S

Water Absorption Rates

SD-08 Manufacturer's Instructions

Manufacturer's Approved Cleaning Instructions

SD-10 Operation and Maintenance Data

Gauged Porcelain Tile, Data Package 1; G

Porcelain Tile, Data Package 1

Mosaic Tile, Data Package 1

Transition Strips, Data Package 1

Metal Strips, Data Package 1

### 1.3 CERTIFICATIONS

#### 1.3.1 Indoor Air Quality Certifications

Provide products certified to meet indoor air quality requirements by [UL 2818](#) (Greenguard) Gold, [SCS](#) Global Services Indoor Advantage Gold or provide certification or validation by other third-party programs that products meet the requirements of this Section. Provide current product certification documentation from certification body. When product does not have certification, provide validation that product meets the indoor air quality product requirements cited in this Section.

#### 1.3.2 Water Absorption Rates Certification

Provide certification for each tile type indicating compliance with the following water absorption (wa) rates per [ANSI A137.1](#) criteria as tested per [ASTM C373](#) requirements.

- a. Porcelain Tile (Impervious): Provide water absorption (wa) of 0.5 percent or less.

#### 1.4 QUALITY ASSURANCE

Provide installers having a minimum of two years of experience with a company specializing in performing the type of work described. Each type and color of tile to be provided from a single source. Each type and color of mortar, adhesive, and grout to be provided from the same source.

### 1.5 DELIVERY, STORAGE, AND HANDLING

Ship tiles in sealed packages and clearly marked with the grade, type of tile, producer identification, and country of origin. Deliver materials to the project site in manufacturer's original unopened containers with seals unbroken and labels and hallmarks intact. Protect materials from weather, and store them under cover in accordance with manufacturer's printed instructions. Store and handle tiles per manufacturer's instructions for gauged porcelain tile and gauged porcelain tile panels/slabs.

### 1.6 ENVIRONMENTAL REQUIREMENTS

Do not perform ceramic tile work unless the substrate and ambient temperature is at least [50 degrees F](#) and rising. Maintain temperature above [50 degrees F](#) while the work is being performed and for at least 7 days after completion of the work. When temporary heaters are used, ventilate the area to the outside to avoid carbon dioxide damage to new tilework.

## 1.7 WARRANTY

Provide manufacturer's warranty to repair or replace defective tiling materials and workmanship, including tile, mortar and grout products and installation as a system, for a period of one year from date of final acceptance of the work..

## 1.8 EXTRA MATERIALS

Supply an extra 2 percent of each type tile used in clean and marked cartons.

## PART 2 PRODUCTS

### 2.1 TILE

Provide tiles that comply with ANSI A137.1 and are standard grade tiles, the exception is glass tile. Furnish glass tiles that comply with ANSI A137.2. Provide a minimum breaking strength of 125 lbs. for wall tile and 250 lbs. for floor tile in accordance with ASTM C648. Provide exterior building tile for cold climate projects that is approved by the manufacturer for exterior use when tested in accordance with ASTM C1026. Provide floor tiles with a minimum wet dynamic coefficient of friction (DCOF) value of 0.42 when tested in accordance with ANSI A137.1 requirements. Provide glazed floor tile with a Class IV-Commercial classification as rated by the manufacturer when tested in accordance with ASTM C1027 for visible abrasion resistance as related to foot traffic. For materials like tile, accessories, and transition strips submit samples of sufficient size to show color range, pattern, type and joints.

Submit manufacturers' descriptive product data for each type of ceramic, and glass tiling indicated. Include manufacturers' literature, finishes, profiles and thicknesses of materials.

Submit manufacturers' operations and maintenance data for each type of ceramic, and glass tiling indicated in accordance with Section 01 78 23 OPERATIONS AND MAINTENANCE DATA.

#### 2.1.1 Porcelain Tile

Provide unglazed through body (surface color and pattern go all the way through the tile body), rectified porcelain tile. Provide tile with a V2 (minimum) aesthetic classification. Blend tiles in factory and in a packages to have same color range and continuous blend for installation. Provide nominal tile size(s) of 12 by 24 inch and 5/16 inch thick.

Provide porcelain tiling materials that contain a minimum of 10 percent recycled content. Provide data identifying percentage of recycled content for porcelain tile.

#### 2.1.2 Mosaic Tile

Furnish mosaic tile accent band composed of porcelain and glass. Provide tile with a V4 aesthetic classification. Blend tiles in factory and in a packages to have same color range and continuous blend for installation. Provide nominal tile size of 2 inch by 1 inch, brick joint, on 12 inch by 13 inch sheet. 1/4 inch thick..

Provide mosaic tiling materials that contain a minimum of 3 percent

recycled content. Provide data identifying percentage of recycled content for mosaic tile.

## 2.2 SETTING-BED

Submit manufacturer's catalog data. Compose the setting-bed of the following materials:

### 2.2.1 Aggregate for Concrete Fill

Conform to [ASTM C33/C33M](#) for aggregate fill. Do not exceed one-half the thickness of concrete fill for maximum size of coarse aggregate.

### 2.2.2 Portland Cement

Conform to [ASTM C150/C150M](#) for cement, Type I, white for wall mortar and gray for other uses.

### 2.2.3 Sand

Conform to [ASTM C144](#) for sand.

### 2.2.4 Hydrated Lime

Conform to [ASTM C206](#) for hydrated lime, Type S or [ASTM C207](#), Type S.

### 2.2.5 Metal Lath

Conform to [ASTM C847](#) for flat expanded type metal lath, and weighing a minimum 2.5 pound/square yard.

### 2.2.6 Reinforcing Wire Fabric

Conform to [ASTM A1064/A1064M](#) for wire fabric. Provide 2 by 2 inch mesh, 16/16 wire or 1-1/2 by 2 inch mesh, 16/13 wire.

## 2.3 WATER

Provide potable water.

## 2.4 MORTAR, GROUT, AND ADHESIVE

Provide non-aerosol adhesive products used on the interior of the building (defined as inside of the weatherproofing system) meeting either emissions requirements of [CDPH SECTION 01350](#) (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of [SCAQMD Rule 1168](#). Provide aerosol adhesives used on the interior of the building meeting either emissions requirements of [CDPH SECTION 01350](#) (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of [GS-36](#). For products located on the interior of the building (inside of the weatherproofing system, provide certification or validation of [indoor air quality for adhesives](#). Provide bond coat, mortar, and grout supplied from the same manufacturer.

### 2.4.1 Dry-Set Portland Cement Mortar

[TCNA Hdbk](#).

## 2.4.2 Latex-Portland Cement Mortar2.4.3 Epoxy Resin Grout

TCNA Hdbk. Water cleanable epoxy conforming to ANSI A108/A118/A136.1; provide manufacturer proportioned and packaged kit having hardener, resin and colored filler and horizontal and vertical grade products as applicable. Provide antimicrobial additive designed for prevention of mold and mildew.

## 2.4.4 Sealants

Comply with applicable regulations regarding toxic and hazardous materials and as specified. Provide sealant that does not change the color or alter the appearance of the grout. Refer to Section 07 92 00 JOINT SEALANTS.

Provide sealants used on the interior of the building (defined as inside of the weatherproofing system) meeting either emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of SCAQMD Rule 1168. For products located on the interior of the building (inside of the weatherproofing system), provide certification or validation of indoor air quality for sealants.

## 2.5 SUBSTRATES

Refer to Section 09 29 00 GYPSUM BOARD for cementitious backer units.

## 2.5.1 Cementitious Backer Units

Provide cementitious backer unit, for use as tile substrate as indicated, in accordance with TCNA Hdbk. Furnish 5/8 inch thick cementitious backer units.

## 2.6 MISCELLANEOUS TRIMS

## 2.6.1 Transition Strips

Provide nickel anodized aluminum transitions between tile and other specified flooring. Provide types as recommended by flooring manufacturer for both edges and transitions of flooring materials specified. Provide transition strips that comply with 36 CFR 1191 requirements.

## 2.6.2 Metal Strips

Provide trim shapes as indicated in IN-series drawings, height to match tile and setting thickness, designed specifically for flooring, and wall applications. Provide extruded, clear brushed nickel anodized aluminum, stainless steel, or rigid-vinyl cove strip where floor tile abuts wall tile for sanitary transition and elimination of cove tile base.

## 2.7 WATERPROOF MEMBRANE

## 2.7.1 General

Manufacturer's standard product that complies with ANSI A108/A118/A136.1 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

### 2.7.2 Chlorinated-Polyethylene Shower Waterproof Membrane

Nonplasticized, chlorinated polyethylene faced on both sides with nonwoven polyester fabric; 0.040 inch nominal thickness.

## 2.8 CRACK ISOLATION MEMBRANE

### 2.8.1 General

Manufacturer's standard product that complies with ANSI A108/A118/A136.1 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

### 2.8.2 Chlorinated-Polyethylene Crack Isolation Membrane

Nonplasticized, chlorinated polyethylene faced on both sides with nonwoven polyester fabric; 0.030 inch nominal thickness.

## 2.9 COLOR, TEXTURE, AND PATTERN

Provide color, pattern and texture as specified in IN-series drawings.

# PART 3 EXECUTION

## 3.1 PREPARATORY WORK AND WORKMANSHIP

Inspect surface to receive tile in conformance to the requirements of TCNA Hdbk for surface conditions for the type setting bed specified and for workmanship. Provide variations of tiled surfaces that fall within maximum values shown below:

TYPE	WALLS	FLOORS
Dry-Set Mortar	1/8 inch in 8 ft.	1/8 inch in 10 ft.
Organic Adhesives	1/8 inch in 8 ft.	1/16 inch in 3 ft.
Latex-Portland Cement Mortar	1/8 inch in 8 ft.	1/8 inch in 10 ft.
Epoxy	1/8 inch in 8 ft.	1/8 inch in 10 ft.

## 3.2 GENERAL INSTALLATION REQUIREMENTS

Do not start tile work until roughing in for mechanical and electrical work has been completed and tested, and built-in items requiring membrane waterproofing have been installed and tested. Close space, in which tile is being set, to traffic and other work. Keep closed until tile is firmly set. Do not start floor tile installation in spaces requiring wall tile until after wall tile has been installed. Apply tile in colors and patterns indicated in the area shown on the drawings. Install tile with the respective surfaces in true even planes to the elevations and grades shown. Provide special shapes as required for sills, jambs, recesses, offsets, external corners, and other conditions to provide a complete and neatly finished installation. Solidly back tile bases and coves with mortar. Do not walk or work on newly tiled floors without using kneeling boards or equivalent protection of the tiled surface. Keep traffic off

horizontal portland cement mortar installations for at least 72 hours. Keep all traffic off epoxy installed floors for at least 40 hours after grouting, and heavy traffic off for at least 7 days, unless otherwise specifically authorized by manufacturer. Dimension and draw [detail drawings](#) at a minimum scale of 1/4 inch = 1 foot. Include drawings of pattern at inside corners, outside corners, termination points and location of all equipment items such as thermostats, switch plates, mirrors and toilet accessories mounted on surface. Submit drawings showing ceramic tile pattern elevations and floor plans. Submit manufacturer's preprinted installation instructions.

Do not install building construction materials that show visual evidence of biological growth.

### 3.3 INSTALLATION OF SUBSTRATES

#### 3.3.1 Cementitious Backer Units

Install in accordance with manufacturer's written instructions.

### 3.4 INSTALLATION OF WALL TILE

Install wall tile in accordance with the [TCNA Hdbk](#), method W247-20 and with grout joints as recommended by the manufacturer for the type of tile. Install thinner wall tile flush with thicker wall tile applied on same wall and provide installation materials as recommended by the tile and setting materials manufacturer's to achieve flush installation.

#### 3.4.1 Installation of Porcelain Tile

Install porcelain tile in accordance with [TCNA Hdbk](#) method W247-20 and [ANSI A137.3/A108.19](#) for thin-bed method bonded with modified dry-set cement mortar over improved modified dry-set cement mortar.

#### 3.4.2 Dry-Set Mortar and Latex-Portland Cement Mortar

Use dry-set or latex-portland cement to install tile in accordance with [TCNA Hdbk](#) method W247-20. Use latex-portland cement when installing porcelain ceramic tile.

#### 3.4.3 Epoxy Resin Grout

Prepare and install epoxy resin grout in accordance with [TCNA Hdbk](#) and manufacturer's recommendations.

### 3.5 INSTALLATION OF FLOOR TILE

Install floor tile in accordance with [TCNA Hdbk](#) method F115-20 and with grout joints as recommended by the manufacturer for the type of tile and no larger than 3/16 inch..

#### 3.5.1 Installation of Porcelain Tile

Install gauged porcelain tile in accordance with [TCNA Hdbk](#) method F115-20 and [ANSI A137.3/A108.19](#) for thin-bed method bonded with modified dry-set cement mortar over improved modified dry-set cement mortar.



### 3.5.2 Workable or Cured Mortar Bed

Install floor tile over a workable mortar bed or a cured mortar bed at the option of the Contractor. Conform to TCNA Hdbk method F115-20 for workable mortar bed materials and installation. Conform to TCNA Hdbk method F115-20 for cured mortar bed materials and installation. Provide minimum 1/4 inch to maximum 3/8 inch joints in uniformed width.

### 3.5.3 Dry-Set and Latex-Portland Cement

Use dry-set or latex-portland cement mortar to install tile directly over properly cured, plane, clean concrete slabs in accordance with TCNA Hdbk method F115-20. Use latex-portland cement when installing porcelain ceramic tile.

### 3.5.4 Ceramic Tile Grout

Prepare and install ceramic tile grout in accordance with TCNA Hdbk method F115-20. Provide and apply manufacturer's standard epoxy grout product for sealing grout joints in accordance with manufacturer's recommendations.

### 3.5.5 Waterproof and Crack Isolation Membranes

Install as indicated in accordance with manufacturer's written instructions.

### 3.5.6 Concrete Fill

## 3.6 INSTALLATION OF MISCELLANEOUS TRIMS

### 3.6.1 Transition Strips

Install transition strips where indicated, in a manner similar to that of the ceramic tile floor and as recommended by the manufacturer. Provide thresholds full width of the opening. Install head joints at ends not exceeding 1/4 inch in width and grouted full.

### 3.6.2 Metal Trims

Install trim where indicated. Embed anchoring leg in setting mortar in accordance with manufacturer's instructions. During grouting of tile joints, immediately wipe grout from finish surface.

## 3.7 CLEANING AND PROTECTING

Upon completion, thoroughly clean tile surfaces in accordance with manufacturer's approved cleaning instructions. Do not use acid for cleaning glazed tile. Clean floor tile with resinous grout or with factory mixed grout in accordance with printed instructions of the grout manufacturer. After the grout has set, provide a protective coat of a noncorrosive soap or other approved method of protection for tile wall surfaces. Cover tiled floor areas with building paper before foot traffic is permitted over the finished tile floors. Provide board walkways on tiled floors that are to be continuously used as passageways by workmen. Replace damaged or defective tiles.

-- End of Section --



## SECTION 09 51 00

## ACOUSTICAL CEILINGS

**08/20**

## PART 1 GENERAL

## 1.1 REFERENCES

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

## ASTM INTERNATIONAL (ASTM)

ASTM A489	(2018; E 2018) Standard Specification for Carbon Steel Eyebolts
ASTM A641/A641M	(2019) Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
ASTM A653/A653M	(2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A1008/A1008M	(2020) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
ASTM B633	(2019) Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel
ASTM C423	(2009a) Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
ASTM C635/C635M	(2017) Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings
ASTM C636/C636M	(2013) Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels
ASTM C834	(2017) Standard Specification for Latex Sealants
ASTM E413	(2016) Classification for Rating Sound Insulation
ASTM E580/E580M	(2020) Standard Practice for Installation of Ceiling Suspension Systems for

Acoustical Tile and Lay-in Panels in Areas  
Subject to Earthquake Ground Motions

ASTM E795

(2016) Standard Practices for Mounting  
Test Specimens During Sound Absorption  
Tests

ASTM E1111/E1111M

(2014) Standard Test Method for Measuring  
the Interzone Attenuation of Open Office  
Components

ASTM E1264

(2019) Acoustical Ceiling Products

ASTM E1414/E1414M

(2011a; E 2014) Airborne Sound Attenuation  
Between Rooms Sharing a Common Ceiling  
Plenum

ASTM E1477

(1998a; R 2017; E 2018) Standard Test  
Method for Luminous Reflectance Factor of  
Acoustical Materials by Use of  
Integrating-Sphere Reflectometers

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

CDPH SECTION 01350

(2010; Version 1.1) Standard Method for  
the Testing and Evaluation of Volatile  
Organic Chemical Emissions from Indoor  
Sources using Environmental Chambers

GREEN SEAL (GS)

GS-36

(2013) Adhesives for Commercial Use

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule 1168

(2017) Adhesive and Sealant Applications

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-301-01

(2019) Structural Engineering

## 1.2 SUBMITTALS

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SD-02 Shop Drawings

Approved Detail Drawings;

SD-03 Product Data

Acoustical Ceiling Systems;

Recycled Content for Type IV Ceiling Tiles; S

Recycled Content for Type XII Ceiling Tiles; S

Recycled Content for Suspension Systems; S

Acoustical Performance;

#### SD-04 Samples

Acoustical Units;

Acoustical Ceiling Tiles;

#### SD-07 Certificates

Indoor Air Quality for Type IV Ceiling Tiles; S

Indoor Air Quality for Type XII Ceiling Tiles; S

### 1.3 DELIVERY, STORAGE. AND HANDLING

Deliver materials to the site in the manufacturer's original unopened containers with brand name and type clearly marked. Carefully handle and store materials in dry, watertight enclosures. Immediately before installation, store acoustical units for not less than 24 hours at the same temperature and relative humidity as the space where they will be installed in order to assure proper temperature and moisture acclimation.

### 1.4 ENVIRONMENTAL REQUIREMENTS

Maintain a uniform temperature of not less than 60 degrees F nor more than 85 degrees F and a relative humidity of not more than 70 percent for 24 hours before, during, and 24 hours after installation of acoustical units.

### 1.5 SCHEDULING

Complete and dry interior finish work such as plastering, concrete and terrazzo work before ceiling installation. Complete mechanical, electrical, and other work above the ceiling line; install and start operating heating, ventilating, and air conditioning systems in order to maintain temperature and humidity requirements.

### 1.6 WARRANTY

Provide manufacturer's warranty to repair or replace defective materials and workmanship including but not limited to, sagging and warping of panels and rusting and of grid systems, for a period of one year from date of final acceptance of the work.

### 1.7 EXTRA MATERIALS

Furnish spare tiles, from the same lot as those installed, of each color at the rate of 5 tiles for each 1000 tiles installed.

## PART 2 PRODUCTS

### 2.1 SYSTEM DESCRIPTION

Provide sound controlling units mechanically mounted on a ceiling

suspension system for acoustical treatment. Provide the unit size, texture, finish, and color as specified. The Contractor has the option to substitute inch-pound (I-P) Recessed Light Fixtures (RLF) for metric RLF. If the Contractor opts to provide I-P RLF, then provide I-P products for other ceiling elements like acoustical ceiling tiles, air diffusers, air registers and grills. Coordinate the entire ceiling system with other details, like the location of access panels and ceiling penetrations, for instance, shown on the drawings. The Contractor is responsible for the final assembly and performance of the specified work and products if I-P products are used. Provide the location and extent of acoustical treatment as shown on the [approved detail drawings](#). Submit drawings showing suspension system, method of anchoring and fastening, details, and reflected ceiling plan. Coordinate with paragraph RECLAMATION PROCEDURES for reclamation of mineral fiber acoustical ceiling panels to be removed from the job site.

#### 2.1.1.1 Acoustical Performance

##### 2.1.1.1.1 Ceiling Sound Transmission

Provide ceiling systems with the specified Ceiling Attenuation Class (CAC) ratings as determined in accordance with [ASTM E1414/E1414M](#) and [ASTM E413](#). Provide sound attenuators over light fixtures, air terminals and other ceiling penetrations, provide acoustical blanket insulation on top of the ceiling or adjacent to partitions to provide lightweight acoustical plenum barriers above partitions as required to achieve the specified CAC ratings. Provide test ceiling continuous at the partition and assembled in the suspension system in the same manner that the ceiling will be installed on the project.

##### 2.1.1.1.2 Ceiling Sound Absorption

Determine the Noise Reduction Coefficient (NRC) in accordance with [ASTM C423](#). Determine Articulation Class (AC) in accordance with [ASTM E1111/E1111M](#).

##### 2.1.2 Light Reflectance

Determine light reflectance factor in accordance with [ASTM E1477](#) test method.

#### 2.2 ACOUSTICAL UNITS

Submit samples of each type of acoustical unit and each type of suspension grid tee section showing texture, finish, and color. Conform acoustical units to [ASTM E1264](#), Class A, and the following requirements:

##### 2.2.1 Units for Exposed-Grid System

###### 2.2.1.1 Type

IV (non-asbestos mineral fiber with membrane-faced overlay). Provide Type IV Acoustical Ceiling Tiles containing a minimum of 60 percent recycled content. Provide data identifying percentage of recycled content for Type IV ceiling tiles. Provide certification of indoor air quality for Type IV Ceiling Tiles.

XII (fiberglass base with membrane-faced overlay). Provide Type XII Acoustical Ceiling Tiles containing a minimum of 25 percent recycled content. Provide data identifying percentage of recycled content for Type XII ceiling tiles. Provide certification of indoor air quality for Type XII Ceiling Tiles.

#### 2.2.1.2 Flame Spread

Class A, 25 or less

#### 2.2.1.3 Minimum NRC

.85 when tested on mounting Type E-400 of ASTM E795.

#### 2.2.1.4 Minimum Light Reflectance Coefficient

LR-1, 0.75 or greater

#### 2.2.1.5 Nominal Size

24 by 24 inch

#### 2.2.1.6 Edge Detail

Square

#### 2.2.1.7 Finish

Factory-applied standard finish. See paragraph COLORS AND STANDARDS.

#### 2.2.1.8 Minimum CAC

.35

2.2.2 Ceiling Cloud - provide formations drywall cloud kit of parts with aircraft hangers as indicated on AR-Series and IN-Series drawings.

### 2.3 SUSPENSION SYSTEM

Provide standard suspension system conforming to ASTM C635/C635M for intermediate-duty systems. Provide surfaces exposed to view of aluminum or steel with a factory-applied white and black color baked-enamel finish. IN-Series drawings indicate color locations. Provide wall molding having a flange of not less than 9/16 inch. Provide manufacturer hold down clips for fire rated assemblies and wall or edge molding. Provide a suspension system with a maximum deflection of 1/360 of the span length capable of supporting the finished ceiling, light fixtures, air diffusers, and accessories, as shown. Conform seismic details to the guidance in UFC 3-301-01 and ASTM E580/E580M.

### 2.4 HANGERS

Provide hangers and attachment capable of supporting a minimum 300 pound ultimate vertical load without failure of supporting material or attachment.

#### 2.4.1 Wires

Conform wires to ASTM A641/A641M, Class 1, no less than 0.106-inch in

diameter.

#### 2.4.2 Straps

Provide straps of 1 by 3/16 inch galvanized steel conforming to ASTM A653/A653M, with a light commercial zinc coating or ASTM A1008/A1008M with an electrodeposited zinc coating conforming to ASTM B633, Type RS.

#### 2.4.3 Rods

Provide 3/16 inch diameter threaded steel rods, zinc or cadmium coated.

#### 2.4.4 Eyebolts

Provide eyebolts of weldless, forged-carbon-steel, with a straight-shank in accordance with ASTM A489.

#### 2.4.5 Masonry Anchorage Devices

Comply with ASTM C636/C636M for anchorage devices for eyebolts . Where aluminum is in contact with concrete, coat aluminum with bituminous paint or where exposed, with a chromatic primer and 2-coats of enamel paint.

### 2.5 ACCESS PANELS

Provide access panels that match adjacent acoustical units, designed and equipped with suitable framing and fastenings for removal and replacement without damage. Size panel to be not less than 12 by 12 inch or more than 12 by 24 inch.

- a. Attach an identification plate of 0.032 inch thick aluminum, 3/4 inch in diameter, stamped with the letters "AP" and finished the same as the unit, near one corner on the face of each access panel.
- b. Identify ceiling access panel by a number utilizing white identification plates or plastic buttons with contrasting numerals. Provide plates or buttons of minimum 1 inch diameter and securely attached to one corner of each access unit. Provide a typewritten card framed under glass listing the code identification numbers and corresponding system descriptions listed above. Mount the framed card where directed and furnish a duplicate card to the Contracting Officer. Code identification system is as follows:

- (1) Fire detection/alarm system
- (2) Air conditioning controls
- (3) Plumbing system
- (4) Heating and steam systems
- (5) Air conditioning duct system
- (6) Sprinkler system
- (7) Intercommunication system
- (9) Pneumatic tube system



- (11) Program entertainment
- (12) Telephone junction boxes
- (14)

## 2.6 ADHESIVE

Use adhesive as recommended by tile manufacturer. Provide non-aerosol adhesive products used on the interior of the building (defined as inside of the weatherproofing system) that meet either emissions requirements of [CDPH SECTION 01350](#) (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of [SCAQMD Rule 1168](#). Provide aerosol adhesives used on the interior of the building that meet either emissions requirements of [CDPH SECTION 01350](#) (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of [GS-36](#). For products located on the interior of the building (inside of the weatherproofing system), provide certification or validation of [indoor air quality for adhesives](#).

## 2.7 FINISHES

Use manufacturer's standard textures, patterns and finishes as specified for acoustical units and suspension system members. Treat ceiling suspension system components to inhibit corrosion.

## 2.8 COLORS AND PATTERNS

Use colors and patterns for acoustical units and suspension system components [as indicated in IN-Series drawings](#).

## 2.9 ACOUSTICAL SEALANT

Conform acoustical sealant to [ASTM C834](#), nonstaining. Provide sealants used on the interior of the building (defined as inside of the weatherproofing system)

# PART 3 EXECUTION

## 3.1 INSTALLATION

Do not install building construction materials that show visual evidence of biological growth.

Examine surfaces to receive directly attached acoustical units for unevenness, irregularities, and dampness that would affect quality and execution of the work. Rid areas, where acoustical units will be cemented, of oils, form residue, or other materials that reduce bonding capabilities of the adhesive. Complete and dry interior finish work such as plastering, concrete, and terrazzo work before installation. Complete and approve mechanical, electrical, and other work above the ceiling line prior to the start of acoustical ceiling installation. Provide acoustical work complete with necessary fastenings, clips, and other accessories required for a complete installation. Do not expose mechanical fastenings in the finished work. Lay out hangers for each individual room or space. Provide hangers to support framing around beams, ducts, columns, grilles, and other penetrations through ceilings. Keep main runners and carrying channels clear of abutting walls and partitions. Provide at least two main runners for each ceiling span. Wherever required to bypass an object

with the hanger wires, install a subsuspension system so that all hanger wires will be plumb.

#### 3.1.1.1 Suspension System

Install suspension system in accordance with ASTM C636/C636M and as specified herein. Do not suspend hanger wires or other loads from underside of steel decking.

##### 3.1.1.1.1 Plumb Hangers

Install hangers plumb and not pressing against insulation covering ducts and pipes. Where lighting fixtures are supported from the suspended ceiling system, provide hangers at a minimum of four hangers per fixture and located not more than 6 inch from each corner of each fixture.

##### 3.1.1.1.2 Splayed Hangers

Splay (slope or slant) hangers around obstructions, offsetting the resulting horizontal force by bracing, countersplaying, or other acceptable means.

#### 3.1.2 Wall Molding

Provide wall molding where ceilings abut vertical surfaces. Miter corners where wall moldings intersect or install corner caps. Secure wall molding not more than 3 inch from ends of each length and not more than 16 inch on centers between end fastenings. Provide wall molding springs at each acoustical unit in semi-exposed or concealed systems.

#### 3.1.3 Acoustical Units

Install acoustical units in accordance with the approved installation instructions of the manufacturer. Ensure that edges of acoustical units are in close contact with metal supports, with each other, and in true alignment. Arrange acoustical units so that units less than one-half width are minimized. Hold units in exposed-grid system in place with manufacturer's standard hold-down clips, if units weigh less than 1 psf or if required for fire resistance rating.

#### 3.1.4 Acoustical Sealant

Seal all joints around pipes, ducts or electrical outlets penetrating the ceiling. Apply a continuous ribbon of acoustical sealant on vertical web of wall or edge moldings.

#### 3.1.5 Adhesive Application

Wipe back of tile to remove accumulated dust. Daub acoustical units on back side with four equal daubs of adhesive. Apply daubs near corners of tiles. Ensure that contact area of each daub is at least 2 inch diameter in final position. Press units into place, aligning joints and abutting units tight and uniform without differences in joint widths.

### 3.2 CEILING ACCESS PANELS

Locate ceiling access panels directly under the items which require access.

### 3.3 CLEANING

Following installation, clean dirty or discolored surfaces of acoustical units and leave them free from defects. Remove units that are damaged or improperly installed and provide new units as directed.

### 3.4 RECLAMATION PROCEDURES

Neatly stack completely dry ceiling tile, designated for recycling by the Contracting Officer, on 4 by 4 foot pallets not higher than 4 foot. Shrink wrap and symmetrically stack pallets on top of each other without falling over.

-- End of Section --

## SECTION 09 65 00

## RESILIENT FLOORING

**08/10**

## PART 1 GENERAL

## 1.1 REFERENCES

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

## ASTM INTERNATIONAL (ASTM)

ASTM D4078 (2002; R 2015) Water Emulsion Floor Polish

ASTM E648 (2019a) Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source

ASTM F710 (2019; E 2020) Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring

ASTM F1482 (2015) Installation and Preparation of Panel Type Underlayments to Receive Resilient Flooring

ASTM F1700 (2020) Standard Specification for Solid Vinyl Floor Tile

ASTM F1861 (2016) Standard Specification for Resilient Wall Base

ASTM F1869 (2016a) Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride

ASTM F2170 (2019a) Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes

## CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

CDPH SECTION 01350 (2010; Version 1.1) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers

## GREEN SEAL (GS)

GS-36 (2013) Adhesives for Commercial Use

## SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS SCS Global Services (SCS) Indoor Advantage

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule 1168 (2017) Adhesive and Sealant Applications

UNDERWRITERS LABORATORIES (UL)

UL 2818 (2013) GREENGUARD Certification Program  
For Chemical Emissions For Building  
Materials, Finishes And Furnishings

1.2 SUBMITTALS

Approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29.05 20 SUSTAINABILITY REPORTING FOR DESIGN-BUILD. Submit the following in accordance with Section 01 33 00.05 20 CONSTRUCTION SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Resilient Flooring and Accessories; G

SD-03 Product Data

Resilient Flooring and Accessories; G

Adhesives

Luxury Vinyl Tile

Recycled content for Luxury Vinyl Tile; S

Wall Base

SD-04 Samples

Resilient Flooring and Accessories

SD-06 Test Reports

Moisture, Alkalinity and Bond Tests

SD-07 Certificates

Indoor Air Quality for Luxury Vinyl Tile; S

Indoor Air Quality for Wall Base; S

Indoor Air Quality for Adhesives; S

SD-08 Manufacturer's Instructions

Surface Preparation

Installation

SD-10 Operation and Maintenance Data

Resilient Flooring and Accessories

1.3 CERTIFICATES

1.3.1 Indoor Air Quality

Submit required indoor air quality certifications and validations in one submittal package.

1.3.1.1 Floor Covering Materials

Provide Luxury Vinyl Tile, and wall base products certified to meet indoor air quality requirements by FLOORSCORE, [UL 2818](#) (Greenguard) Gold, [SCS](#) Global Services Indoor Advantage Gold or provide certification by other third-party programs. Provide current product certification documentation from certification body.

1.3.1.2 Adhesives, Caulking and Sealants

Provide products certified to meet indoor air quality requirements by [UL 2818](#) (Greenguard) Gold, [SCS](#) Global Services Indoor Advantage Gold or provide certification or validation by other third-party programs that products meet the requirements of this Section. Provide current product certification documentation from certification body. When product does not have certification, provide validation that product meets the indoor air quality product requirements cited herein.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the building site in original unopened containers bearing the manufacturer's name, style name, pattern color name and number, production run, project identification, and handling instructions. Store materials in a clean, dry, secure, and well-ventilated area [free from strong contaminant sources and residues](#)

with ambient air temperature maintained above 68 degrees F and below 85 degrees F, stacked according to manufacturer's recommendations. Remove resilient flooring products from packaging to allow ventilation prior to installation. Protect materials from the direct flow of heat from hot-air registers, radiators and other heating fixtures and appliances. Observe ventilation and safety procedures specified in the MSDS. Do not store rubber surface products with materials that have a high capacity to adsorb volatile organic compound (VOC) emissions. Do not store exposed rubber surface materials in occupied spaces. Do not store luxury vinyl tile near materials that may offgas or emit harmful fumes, such as kerosene heaters, fresh paint, or adhesives.

#### 1.5 ENVIRONMENTAL REQUIREMENTS

Maintain areas to receive resilient flooring at a temperature above 68 degrees F and below 85 degrees F for 3 days before application, during application and 2 days after application, unless otherwise directed by the flooring manufacturer for the flooring being installed. Maintain a minimum temperature of 55 degrees F thereafter. Provide adequate ventilation to remove moisture from area and to comply with regulations limiting concentrations of hazardous vapors.

#### 1.6 SCHEDULING

Schedule resilient flooring application after the completion of other work which would damage the finished surface of the flooring.

#### 1.7 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a one year period.

#### 1.8 EXTRA MATERIALS

Provide extra flooring material of each color and pattern at the rate of 5 square feet for each 1000 square feet of sheet flooring installed. Provide extra wall base material composed of 20 linear feet of each type, color and pattern. Package all extra materials in original properly marked containers bearing the manufacturer's name, brand name, pattern color name and number, production run, and handling instructions. Provide extra materials from the same lot as those installed. Leave extra stock at the site in location assigned by Contracting Officer.

### PART 2 PRODUCTS

#### 2.1 LUXURY VINYL TILE

Conform to ASTM F1700 Class III printed film with a minimum wear layer thickness 0.040 inch (40 mil) and minimum overall thickness 0.098 inch, Type B (embossed). Provide 18 inch square tile. Provide tile with a factory protective finish that enhances cleanability and durability.

Provide Luxury Vinyl Tile containing a minimum of 35 percent recycled content. Provide data identifying percentage of recycled content for Luxury Vinyl Tile.

Provide certification of indoor air quality for Luxury Vinyl Tile.

## 2.2 WALL BASE

Conform to ASTM F1861, Type TS (vulcanized thermoset rubber) or Type TP (thermoplastic rubber) , Style A (straight - installed with carpet) , and Style B (coved - installed with resilient flooring) . Provide 6 inch high and a minimum 1/8 inch thick wall base. Provide job formed corners in matching height, shape, and color.

Provide certification of indoor air quality for Wall Base.

## 2.3 MOULDING

Provide tapered mouldings of clear anodized aluminum and types as recommended by flooring manufacturer for both edges and transitions of flooring materials specified. Provide vertical lip on moulding of maximum 1/4 inch. Provide bevel change in level between 1/4 and 1/2 inch with a slope no greater than 1:2.

## 2.4 ADHESIVES

Provide adhesives for flooring, base and accessories as recommended by the manufacturer and comply with local indoor air quality standards. Submit manufacturer's descriptive data, documentation stating physical characteristics, and mildew and germicidal characteristics.

Provide non-aerosol adhesive products used on the interior of the building (defined as inside of the weatherproofing system) that meet either emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of SCAQMD Rule 1168. Provide aerosol adhesives used on the interior of the building that meet either emissions requirements of CDPH SECTION 01350 (use the office or classroom requirements, regardless of space type) or VOC content requirements of GS-36. Provide certification or validation of indoor air quality for adhesives.

## 2.5 SURFACE PREPARATION MATERIALS

Provide surface preparation materials, such as panel type underlayment, lining felt, and floor crack fillers as recommended by the flooring manufacturer for the subfloor conditions. Comply with ASTM F1482 for panel type underlayment products. Use one of the following substrates:

f. Concrete.

## 2.6 POLISH/FINISH

Provide polish finish as recommended by the manufacturer and conform to ASTM D4078 for polish.

## 2.7 CAULKING AND SEALANTS

Provide caulking and sealants in accordance with Section 07 92 00 JOINT SEALANTS.



## 2.8 MANUFACTURER'S COLOR, PATTERN AND TEXTURE

Provide color, pattern and texture for resilient flooring and accessories as indicated in the IN-series drawings. Provide floor patterns as specified in the IN-series drawings. Provide flooring in any one continuous area or replacement of damaged flooring in continuous area from same production run with same shade and pattern. Submit scaled drawings indicating patterns (including location of patterns and colors) and dimensions. Submit manufacturer's descriptive data and three samples of each indicated color and type of flooring, base, mouldings, and accessories sized a minimum 2-1/2 by 4 inch. Submit Data Package 1 in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

## 2.9 FIRE RESISTANCE TESTING REQUIREMENTS

Provide a minimum average critical radiant flux of 0.45 watts per square centimeter for flooring in corridors and exits when tested in accordance with ASTM E648.

# PART 3 EXECUTION

## 3.1 EXAMINATION

Examine and verify that site conditions are in agreement with the design package. Report all conditions that will prevent a proper installation. Do not take any corrective action without written permission from the Government. Work will proceed only when conditions have been corrected and accepted by the installer. Submit manufacturer's printed installation instructions for all flooring materials and accessories, including preparation of substrate, seaming techniques, and recommended adhesives.

## 3.2 SURFACE PREPARATION

Provide a smooth, true, level plane for surface preparation of the flooring, except where indicated as sloped. Floor to be flat to within 3/16 inch in 10 feet. Prepare subfloor in accordance with flooring manufacturer's recommended instructions. Prepare the surfaces of lightweight concrete slabs (as defined by the flooring manufacturer) as recommended by the flooring manufacturer. Comply with ASTM F710 for concrete subfloor preparation. Floor fills or toppings may be required as recommended by the flooring manufacturer. Install underlayments, when required by the flooring manufacturer, in accordance with manufacturer's recommended printed installation instructions. Comply with ASTM F1482 for panel type underlayments. Before any work under this section is begun, correct all defects such as rough or scaling concrete, chalk and dust, cracks, low spots, high spots, and uneven surfaces. Repair all damaged portions of concrete slabs as recommended by the flooring manufacturer. Remove concrete curing and sealer compounds from the slabs, other than the type that does not adversely affect adhesion. Remove paint, varnish, oils, release agents, sealers, waxes, and adhesives, as required by the flooring product in accordance with manufacturer's printed installation instructions.

## 3.3 MOISTURE, ALKALINITY AND BOND TESTS

Determine the suitability of the concrete subfloor for receiving the resilient flooring with regard to moisture content and pH level by moisture and alkalinity tests. Conduct moisture testing in accordance with ASTM F1869 or ASTM F2170, unless otherwise recommended by the

flooring manufacturer. Conduct alkalinity testing as recommended by the flooring manufacturer. Determine the compatibility of the resilient flooring adhesives to the concrete floors by a bond test in accordance with the flooring manufacturer's recommendations. Submit copy of test reports for moisture and alkalinity content of concrete slab, and bond test stating date of test, person conducting the test, and the area tested.

### 3.4 GENERAL INSTALLATION

Do not install building construction materials that show visual evidence of biological growth.

### 3.5 PLACING LUXURY VINYL TILES

Install luxury vinyl tile flooring using glue down installation. Install flooring and accessories in accordance with manufacturer's printed installation instructions. Prepare and apply adhesives in accordance with manufacturer's directions for installation method specified. Keep tile lines and joints square, symmetrical, tight, and even. Keep each floor in true, level plane, except where slope is indicated. Vary edge width as necessary to maintain full-size tiles in the field, no edge tile to be less than one-half the field tile size, except where irregular shaped rooms make it impossible. Cut flooring to fit around all permanent fixtures, built-in furniture and cabinets, pipes, and outlets. Cut, fit, and scribe edge tile to walls and partitions after field flooring has been applied.

### 3.6 PLACING MOULDING

Provide moulding where flooring termination is higher than the adjacent finished flooring and at transitions between different flooring materials. When required, locate moulding under door centerline. Moulding is not required at doorways where thresholds are provided. Secure moulding with adhesive as recommended by the manufacturer. Prepare and apply adhesives in accordance with manufacturer's printed directions. Anchor aluminum moulding to floor surfaces as recommended by the manufacturer.

### 3.7 PLACING WALL BASE

Install wall base in accordance with manufacturer's printed installation instructions. Prepare and apply adhesives in accordance with manufacturer's printed directions. Tighten base joints and make even with adjacent resilient flooring. Fill voids along the top edge of base at masonry walls with caulk. Roll entire vertical surface of base with hand roller, and press toe of base with a straight piece of wood to ensure proper alignment. Avoid excess adhesive in corners.

### 3.8 CLEANING

Immediately upon completion of installation of flooring in a room or an area, dry and clean the flooring and adjacent surfaces to remove all surplus adhesive. Clean flooring as recommended in accordance with manufacturer's printed maintenance instructions and within the recommended time frame. As required by the manufacturer, apply the recommended number of coats and type of polish and finish in accordance with manufacturer's written instructions.

### 3.9 PROTECTION

From the time of installation until acceptance, protect flooring from damage as recommended by the flooring manufacturer. Remove and replace flooring which becomes damaged, loose, broken, or curled and wall base which is not tight to wall or securely adhered.

-- End of Section --

## SECTION 09 66 23

## RESINOUS MATRIX TERRAZZO FLOORING

**08/16**

## PART 1 GENERAL

## 1.1 SUMMARY

Apply [resinous terrazzo flooring](#), in the colors indicated, in the areas shown on the [detail drawings](#). Submit two [6 x 6 inches](#), (minimum) samples of each color of resinous terrazzo and two [6 inches](#) lengths, of each type of strip. Flooring must be an epoxy terrazzo system that conforms to the requirements specified in paragraphs 2.01A and B of [NTMA Info Guide](#)

## 1.2 REFERENCES

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

## ASTM INTERNATIONAL (ASTM)

[ASTM D56](#) (2016a) Standard Test Method for Flash Point by Tag Closed Cup Tester

## CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

[CDPH SECTION 01350](#) (2010; Version 1.1) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

[NFPA 99](#) (2021) [Health Care Facilities Code](#)

## NATIONAL TERRAZZO AND MOSAIC ASSOCIATION (NTMA)

[NTMA Info Guide](#) (2017) Terrazzo Reference Guide

## SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

[SCAQMD Rule 1113](#) (2016) Architectural Coatings

[SCAQMD Rule 1168](#) (2017) Adhesive and Sealant Applications

## 1.3 SUBMITTALS

Approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section [01 33 29.05 20](#) SUSTAINABILITY REPORTING FOR [DESIGN-BUILD](#). Submit the following in accordance with Section [01 33 00.05 20](#) CONSTRUCTION SUBMITTAL PROCEDURES:

[SD-02 Shop Drawings](#)

Detail Drawings; G

Strips; G

Control Joint Strips; G

#### SD-03 Product Data

Resin

Recycled Content for Marble Chips; S

Indoor Air Quality for Primer; S

Indoor Air Quality for Resin; S

Indoor Air Quality for Grout; S

Indoor Air Quality for Sealer; S

Mixing, Proportioning, and Installation

Cleaning and Sealing

#### SD-04 Samples

Resinous Terrazzo Flooring

#### SD-06 Test Reports

Certified Test Reports; G

#### SD-07 Certificates

Qualifications of Installer; G

### 1.4 QUALITY ASSURANCE

Applicator must be approved by the resin manufacturer and shall have a minimum of 3 years experience in the application of the materials to be used and must have completed 8 successful installations within the past 2 years. Furnish a written statement from the manufacturer detailing the [Qualifications of Installer](#).

### 1.5 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the project site in manufacturer's original unopened containers. Keep materials in a clean, dry, area with temperatures controlled between 50 and 90 degrees F.

### 1.6 ENVIRONMENTAL REQUIREMENTS

Maintain areas to receive terrazzo at a temperature above 50 degrees F for 2 days prior to installation and for 7 days following installation.

## PART 2 PRODUCTS

### 2.1 PRIMER

Primer must be a material recommended by the resin manufacturer which will penetrate the pores of the substrate and bond with the topping to form a permanent monolithic bond between the substrate and the topping. Primer products used on the interior of the building (defined as inside of the weatherproofing system) must meet either emissions requirements of [CDPH SECTION 01350](#) (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of [SCAQMD Rule 1113](#). Provide validation of [indoor air quality for primer](#).

### 2.2 RESIN

Resin for the specified terrazzo flooring must conform to the requirements shown in [NTMA Info Guide](#). Submit resin manufacturer's descriptive data, plus mixing, proportioning, and installation instructions. Resin products used on the interior of the building (defined as inside of the weatherproofing system) must meet either emissions requirements of [CDPH SECTION 01350](#) (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of [SCAQMD Rule 1113](#). Provide validation of [indoor air quality for resin](#). [Poured-Epoxy Terrazzo Floor System - A 3/8-inch thick \(minimum\) epoxy terrazzo floor system in accordance with the "NTMA Epoxy Thin Set Terrazzo Specification" and manufacturer specifications.](#)

### 2.3 FILLERS

Fillers, if required, must be inert mineral or cellulosic material as recommended by the manufacturer and best suited for the resin binder used. Fillers must be furnished in the quantity necessary to impart the required color and physical characteristics. [Aggregate mixture to include marble and/or granite chips, 15 percent minimum colored glass chips and 20 percent minimum recycled mirror chips.](#)

### 2.4 MARBLE CHIPS

Marble chips must be of domestic origin of sizes and colors to match [NTMA Info Guide](#) color plate indicated on the drawings. Chips must be a range of sizes up to and including the NTMA Standard No. 0 through Standard No. 2 for [3/8 inch thick floors](#). [Provide data identifying percentage of recycled content for marble chips.](#)

### 2.5 STRIPS

Submit drawings indicating the type, size, and layout of divider strips and control joint strips.

#### 2.5.1 Divider Strips

Divider strips must be as deep as required, [18 gauge](#) and of zinc.

#### 2.5.2 Control Joint Strips

Control joint strips must be as deep as required, [16 gauge](#) and of zinc. Provide neoprene filler [as recommended by manufacturer](#).

## 2.6 GROUT

Grout must be as recommended by the manufacturer of the resin. Grout products used on the interior of the building (defined as inside of the weatherproofing system) must meet either emissions requirements of [CDPH SECTION 01350](#) (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of [SCAQMD Rule 1168](#). Provide validation of [indoor air quality for grout](#).

## 2.7 SEALER

Sealer must have a pH factor between 7 and 10 and must be a penetrating type specially prepared for use on terrazzo. The sealer must not discolor or amber the terrazzo and must produce a slip resistant surface. Flash point of sealer must be a minimum of [80 degrees F](#) when tested in accordance with [ASTM D56](#). Sealer products used on the interior of the building (defined as inside of the weatherproofing system) must meet either emissions requirements of [CDPH SECTION 01350](#) (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of [SCAQMD Rule 1113](#). Provide validation of [indoor air quality for sealer](#). Provide an [800-grit level polished finish](#).

# PART 3 EXECUTION

## 3.1 PREPARATION OF CONCRETE SUBFLOOR

Do not commence installation of the floor topping until the concrete substrate has cured for at least 28 calendar days. Prepare the concrete surfaces in accordance with the instructions of the resin manufacturer. [Provide moisture vapor primer system, crack isolation membrane and all other items as recommended by manufacturer.](#)

## 3.2 MIXING, PROPORTIONING, AND INSTALLATION

Mixing, proportioning, and installing must be in accordance with the approved instructions of the manufacturer. Install strips in locations indicated. Apply the topping to give a finish thickness of [3/8 inch](#). Provide cove type bases cast-in-place with [1 inch](#) radius cove and [6 inch](#) high. [Wall base must be separate, top set, precast epoxy terrazzo, flat tile base.](#)

## 3.3 TESTING

Between 30 and 45 days after flooring installation is completed, and prior to its use, test the conductive resinous terrazzo flooring in accordance with paragraph 12-4.1.3.8(b) (7) of [NFPA 99](#). The resistance of the conductive floor at any one location must be more than 5,000 ohms in areas with 110 volts service, more than 10,000 ohms in areas with 220 volt service, and average less than 1,000,000 ohms and more than 25,000 ohms in all areas. Submit certificates indicating conformance with specified requirements. Accompany certificates with [certified test reports](#) showing that the conductive resinous terrazzo floor has been tested and meets the requirements specified.

## 3.4 CLEANING AND SEALING

Wash the terrazzo with a neutral cleaner and where required, clean with a fine abrasive to remove any stains or cement smears. Rinse the cleaned

surfaces. When dry, apply a terrazzo sealer in accordance with the manufacturer's directions. Submit maintenance literature for terrazzo cleaning and sealing.

### 3.5 PROTECTION

cover and protect the terrazzo work from damage until completion of the work of all other trades.

-- End of Section --



## SECTION 09 68 00

## CARPETING

**11/17**

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)

AATCC 16	(2004; E 2008; E 2010) Colorfastness to Light
AATCC 107	(2013) Colorfastness to Water
AATCC 134	(2016) Electrostatic Propensity of Carpets
AATCC 165	(2013) Colorfastness to Crocking: Textile Floor Coverings - Crockmeter Method
AATCC 174	(2016) Antimicrobial Activity Assessment of New Carpets

## ASTM INTERNATIONAL (ASTM)

ASTM D297	(2015; R 2019) Rubber Products - Chemical Analysis
ASTM D1335	(2017; E 2018) Standard Test Method for Tuft Bind of Pile Yarn Floor Coverings
ASTM D2859	(2016) Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials
ASTM D3278	(1996; R 2011) Flash Point of Liquids by Small Scale Closed-Cup Apparatus
ASTM D5793	(2018) Standard Test Method for Binding Sites Per Unit Length or Width of Pile Yarn Floor Coverings
ASTM D6859	(2011) Standard Test Method for Pile Thickness of Finished Level Pile Yarn Floor Coverings
ASTM D7330	(2015) Standard Test Method for Assessment of Surface Appearance Change in Pile Floor Coverings Using Standard Reference Scales
ASTM E648	(2019a) Standard Test Method for Critical Radiant Flux of Floor-Covering Systems

Using a Radiant Heat Energy Source

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

CDPH SECTION 01350 (2010; Version 1.1) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers

CARPET AND RUG INSTITUTE (CRI)

CRI 104 (2015) Carpet Installation Standard for Commercial Carpet

CRI 105 (2015) Carpet Installation Standard for Residential Carpet

CRI GLP QM (2017) Green Label Plus Quality Manual

CRI Test Method 103 (2015) Standard Test Method for the Evaluation of Texture Appearance Retention of Carpet Standards Program

GREEN SEAL (GS)

GS-36 (2013) Adhesives for Commercial Use

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 2551 (2020) Textile Floor Coverings and Textile Floor Coverings in Tile Form- Determination of Dimensional Changes Due to the Effects of Varied Water and Heat Conditions and Distortion Out of Plane

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS SCS Global Services (SCS) Indoor Advantage

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule 1113 (2016) Architectural Coatings

SCAQMD Rule 1168 (2017) Adhesive and Sealant Applications

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

16 CFR 1630 Standard for the Surface Flammability of Carpets and Rugs (FF 1-70)

UNDERWRITERS LABORATORIES (UL)

UL 2818 (2013) GREENGUARD Certification Program For Chemical Emissions For Building Materials, Finishes And Furnishings

1.2 SUBMITTALS

Approval is required for submittals with a "G" designation; submittals not

having a "G" designation are for Contractor Quality Control approval. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29.05 20 SUSTAINABILITY REPORTING FOR DESIGN-BUILD. Submit the following in accordance with Section 01 33 00.05 20 CONSTRUCTION SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation Drawings; G

SD-03 Product Data

Carpet; G

Recycled Content for Carpeting; S

Recycled Content for Fiber Cushion; S

Recycled Content for Rubber Cushion; S

Recycled Content for Polyurethane-Foam Cushion; S

Moldings; G

Indoor Air Quality for Aerosol Adhesives; S

Indoor Air Quality for Non-Aerosol Adhesives; S

Indoor Air Quality for Concrete Primer; S

SD-04 Samples

Carpet; G

Moldings; G

Carpet Cushion; G

SD-06 Test Reports

Moisture and Alkalinity Tests; G

SD-07 Certificates

Indoor Air Quality for Carpet; S

Indoor Air Quality for Fiber Cushion; S

Indoor Air Quality for Rubber Cushion; S

Indoor Air Quality for Polyurethane-Foam Cushion; S

SD-08 Manufacturer's Instructions

Surface Preparation

SD-10 Operation and Maintenance Data

## Cleaning and Protection

## Maintenance Service

## SD-11 Closeout Submittals

## Warranty

## 1.3 CERTIFICATIONS

## 1.3.1 Indoor Air Quality Certifications

## 1.3.1.1 Floor Covering Materials

Provide carpet and cushion products certified to meet indoor air quality requirements by [UL 2818](#) (GreenGuard) Gold, [SCS](#) Global Services Indoor Advantage Gold, [CRI GLP QM](#) or provide certification or validation by other third-party program that products meet the requirements of this Section. Provide current product certification documentation from certification body. When product does not have certification, provide validation that product meets the indoor air quality product requirements cited herein.

## 1.4 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the site in the manufacturer's original wrappings and packages clearly labeled with the manufacturer's name, brand name, size, dye lot number, and related information. Remove materials from packaging and store them in a clean, dry, well ventilated area ([100 percent outside air supply, minimum of 1.5 air changes per hour, and no recirculation](#)), protected from damage, soiling, and moisture, [and strong contaminant sources and residues](#), and maintain at a temperature above 60 degrees F for 2 days prior to installation. [Do not store carpet or carpet tiles with materials which have high emissions of volatile organic compounds \(VOCs\) or other contaminants, including paints and adhesives.](#) Do not store carpet near materials that may off gas or emit harmful fumes, such as kerosene heaters, fresh paint, or adhesives.

## 1.5 AMBIENT CONDITIONS

Maintain areas in which carpeting is to be installed at a temperature above 60 degrees F and below 90 degrees F for 2 days before installation, during installation, and for 2 days after installation. Provide temporary ventilation during work of this section. Maintain a minimum temperature of 55 degrees F thereafter for the duration of the contract.

## 1.6 WARRANTY

Provide manufacturer's standard performance guarantees or warranties including minimum ten year wear warranty, two year material and workmanship and ten year tuft bind and delamination.

## PART 2 PRODUCTS

## 2.1 CARPET

Furnish first quality carpet that is free of visual blemishes, streaks, poorly dyed areas, fuzzing of pile yarn, spots or stains, and other physical and manufacturing defects. Provide carpet materials and treatments as reasonably nonallergenic and free of other recognized health

hazards. Provide a static control construction on all grade carpets which gives adequate durability and performance. Submit manufacturer's catalog data and printed documentation stating physical characteristics, durability, resistance to fading, and flame resistance characteristics for each type of carpet material and installation accessory. Submit manufacturer's Product Data for 1) Carpet, 2) Moldings, and 3) Carpet Cushion. Also, submit Samples of the following:

- a. Carpet: Two "Production Quality" samples 18 by 18 inches of each carpet proposed for use, showing quality, pattern, and color specified
- c. Carpet Cushion: Two samples minimum 6 by 6 inches

#### 2.1.1.1 Recycled Content

Carpeting must contain a minimum of 20 percent recycled content. Provide data identifying percentage of [recycled content for carpeting](#).

#### 2.1.1.2 Indoor Air Quality Requirements

Products must meet emissions requirements of [CDPH SECTION 01350](#). Provide certification or validation of [indoor air quality for carpet](#).

#### 2.1.1.3 Physical Characteristics for Modular Tile Entrance Carpet

##### 2.1.1.3.1 Carpet Construction

Woven

##### 2.1.1.3.2 Type

[Modular tile 18 by 36 inch square with 0.15 percent growth/shrink rate in accordance with ISO 2551](#). See Section [09 69 13 RIGID GRID ACCESS FLOORING](#) for size required for a one to one alignment with raised access floor panels.

##### 2.1.1.3.3 Pile Type

[Textured Patterned Loop](#)

##### 2.1.1.3.4 Pile Fiber

Commercial 100 percent branded (federally registered trademark) nylon continuous filament .

##### 2.1.1.3.5 Gauge or Pitch

Minimum [1/12 inch](#) in accordance with [ASTM D5793](#)

##### 2.1.1.3.6 Stitches or Rows/Wires

Minimum [11](#) per [square inch](#)

##### 2.1.1.3.7 Pile Thickness

Minimum [.126 inch](#) in accordance with [ASTM D6859](#)

#### 2.1.3.8 Pile Density

Minimum 6000 oz./cubic yard minimum

#### 2.1.3.9 Dye Method

Solution dyed

#### 2.1.3.10 Backing Materials

Provide primary backing materials like synthetic material . Provide secondary backing to suit project requirements of those customarily used and accepted by the trade for each type of carpet.

#### 2.1.3.11 Attached Cushion

Provide an attached cushion chemically frothed polyurethane with minimum weight of 18 oz/sq. yard, minimum density of 11 lb/cubic foot . Do not exceed the maximum ash content of 50 percent when tested in accordance with ASTM D297.

### 2.2 PERFORMANCE REQUIREMENTS

#### 2.2.1 Texture Appearance Retention Rating (TARR)

Provide carpet with a greater than or equal to 3.5 (Severe) TARR traffic level classification in accordance with ASTM D7330 or CRI Test Method 103.

#### 2.2.2 Static Control

Provide static control to permanently regulate static buildup to less than 3.0 kV when tested at 20 percent relative humidity and 70 degrees F in accordance with AATCC 134.

#### 2.2.3 Flammability and Critical Radiant Flux Requirements

Comply with 16 CFR 1630 or ASTM D2859. Provide carpet in corridors and exits with a minimum average critical radiant flux of 0.45 watts per square centimeter when tested in accordance with ASTM E648.

#### 2.2.4 Tuft Bind

Comply with ASTM D1335 for tuft bind force required to pull a tuft or loop free from carpet backing with a minimum 8 pound average force for modular carpet tile.

#### 2.2.5 Colorfastness to Crocking

Comply dry and wet crocking with AATCC 165 and with a Class 4 minimum rating on the AATCC Color Transference Chart for all colors.

#### 2.2.6 Colorfastness to Light

Comply colorfastness to light with AATCC 16, Test Option E "Water-Cooled Xenon-Arc Lamp, Continuous Light" and with a minimum 4 grey scale rating after 40 hours.

### 2.2.7 Colorfastness to Water

Comply colorfastness to water with [AATCC 107](#) and with a minimum 4.0 gray scale rating and a minimum 4.0 transfer scale rating.

### 2.2.8 Delamination Strength

Provide delamination strength for tufted carpet with a secondary back of minimum [2.5 lbs/inch](#).

### 2.2.9 Antimicrobial

Nontoxic antimicrobial treatment in accordance with [AATCC 174](#) Part I (qualitative), guaranteed by the carpet manufacturer to last the life of the carpet.

## 2.3 ADHESIVES AND CONCRETE PRIMER

Comply with applicable regulations regarding toxic and hazardous materials. Provide water resistant, mildew resistant, nonflammable, and nonstaining adhesives and concrete primers for carpet installation as required by the carpet manufacturer. [Provide release adhesive for modular tile carpet as recommended by the carpet manufacturer. Provide adhesives flashpoint of minimum 140 degrees F in accordance with ASTM D3278.](#) Non-aerosol adhesive products used on the interior of the building (defined as inside of the weatherproofing system) must meet either emissions requirements of [CDPH SECTION 01350](#) (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of [SCAQMD Rule 1168](#). Aerosol adhesive products used on the interior of the building (defined as inside of the weatherproofing system) must meet either emissions requirements of [CDPH SECTION 01350](#) (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of [GS-36](#). Provide validation of [indoor air quality for aerosol adhesives](#). Provide validation of [indoor air quality for non-aerosol adhesives](#). Concrete primer products used on the interior of the building (defined as inside of the weatherproofing system) must meet either emissions requirements of [CDPH SECTION 01350](#) (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of [SCAQMD Rule 1113](#). Provide validation of [indoor air quality for concrete primer](#).

## 2.4 COLOR, TEXTURE, AND PATTERN

Provide color, texture, and pattern in accordance with [the IN-Series drawings](#).

## PART 3 EXECUTION

### 3.1 SURFACE PREPARATION

Do not install carpet on surfaces that are unsuitable and will prevent a proper installation. Prepare subfloor in accordance with flooring manufacturer's recommended instructions. Repair holes, cracks, depressions, or rough areas using material recommended by the carpet or adhesive manufacturer. Free floor of any foreign materials and sweep clean. Before beginning work, test subfloor with glue and carpet to determine "open time" and bond. Submit three copies of the manufacturer's printed Installation instructions for the carpet, including Surface Preparation, seaming techniques, and recommended adhesives and tapes.

### 3.2 MOISTURE AND ALKALINITY TESTS

Test concrete slab for moisture content and excessive alkalinity in accordance with CRI 104/CRI 105. Submit three copies of reports of Moisture and Alkalinity Tests including content of concrete slab stating date of test, person conducting the test, and the area tested.

### 3.3 PREPARATION OF CONCRETE SUBFLOOR

Do not commence installation of the carpeting until concrete substrate is at least 90 days old. Prepare the concrete surfaces in accordance with the carpet manufacturer's instructions. Match carpet, when required, and adhesives to prevent off-gassing to a type of curing compounds, leveling agents, and concrete sealer.

### 3.4 INSTALLATION

Isolate area of installation from rest of building. Perform all work by manufacturer's approved installers. Conduct installation in accordance with the manufacturer's printed instructions and CRI 104/CRI 105. Protect edges of carpet meeting hard surface flooring with molding and install in accordance with the molding manufacturer's printed instructions. Use autofoam mothproofing system for wool carpets. Follow ventilation, personal protection, and other safety precautions recommended by the adhesive manufacturer. Continue ventilation during installation and for at least 72 hours following installation. Do not permit traffic or movement of furniture or equipment in carpeted area for 24 hours after installation. Complete other work which would damage the carpet prior to installation of carpet. Submit three copies of Installation Drawings for 1) Carpet, 2) Carpet Cushion, and 3) Moldings indicating areas receiving carpet, carpet types, patterns, direction of pile, location of seams, and locations of edge molding.

Do not install building construction materials that show visual evidence of biological growth.

#### 3.4.1 Modular Tile Installation

Install modular tiles with manufacturer approved adhesive tab system adhesive and snug joints. Use horizontal brick ashlar installation method. Comply with manufacturer installation instructions for required drying time of releasable adhesive so it sets up properly. Provide accessibility to the subfloor where required. Carpet tile on stairs and sloped surfaces must be installed with a more permanent installation method in accordance with the manufacturer's instructions and with manufacturer recommended adhesives for this application. See Section 09 69 13 RIGID GRID ACCESS FLOORING and 09 69 19 STRINGERLESS ACCESS FLOORING for installation method of carpet tile on access flooring.

### 3.5 CLEANING AND PROTECTION

Submit three copies of carpet manufacturer's maintenance instructions describing recommended type of cleaning equipment and material, spotting and cleaning methods, and cleaning cycles.

#### 3.5.1 Cleaning

As specified in Section 01 78 00 CLOSEOUT SUBMITTALS. After installation



of the carpet, remove debris, scraps, and other foreign matter. Remove soiled spots and adhesive from the face of the carpet with appropriate spot remover. Cut off and remove protruding face yarn. Vacuum carpet clean with a high-efficiency particulate air (HEPA) filtration vacuum.

### 3.5.2 Protection

Protect the installed carpet from soiling and damage with heavy, reinforced, nonstaining kraft paper, plywood, or hardboard sheets. Lap and secure edges of kraft paper protection to provide a continuous cover. Restrict traffic for at least 48 hours. Remove protective covering when directed by the Contracting Officer.

### 3.6 REMNANTS

Manage waste as specified in the Waste Management Plan. Provide remnants remaining from the installation, consisting of scrap pieces more than 2 feet in dimension with more than 6 square feet total to the Government. Set aside and return non-retained scraps to manufacturer for recycling into new product.

### 3.7 MAINTENANCE

#### 3.7.1 Extra Materials

Provide extra material from same dye lot consisting of uncut carpet tiles for future maintenance. Provide a minimum of three percent of total square yards of each carpet type, pattern, and color. Furnish three percent extra of total adhesive tabs.

#### 3.7.2 Maintenance Service

Collect information from the manufacturer about maintenance agreement green lease options, and submit to Contracting Officer. Service must reclaim materials for recycling and/or reuse. Service must not landfill or burn reclaimed materials. When such a service is not available, seek local recyclers to reclaim the materials. Submit documentation of manufacturer's take-back program for carpet. Include contact information, summary of procedures, and the limitations and conditions applicable to the project. Indicate manufacturer's commitment to reclaim materials for recycling and reuse.

-- End of Section --

SECTION 09 69 13

RIGID GRID ACCESS FLOORING  
**11/15, CHG 1: 08/18**

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7-16 (2017; Errata 2018; Supp 1 2018) Minimum Design Loads and Associated Criteria for Buildings and Other Structures

APA - THE ENGINEERED WOOD ASSOCIATION (APA)

APA E30 (2016) Engineered Wood Construction Guide

APA L870 (2010) Voluntary Product Standard, PS 1-09, Structural Plywood

ASTM INTERNATIONAL (ASTM)

ASTM A780/A780M (2020) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings

ASTM B85/B85M (2018) Standard Specification for Aluminum-Alloy Die Castings

ASTM E84 (2020) Standard Test Method for Surface Burning Characteristics of Building Materials

ASTM E648 (2019a) Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source

ASTM F150 (2006; R 2013) Standard Test Method for Electrical Resistance of Conductive and Static Dissipative Resilient Flooring

ASTM F1700 (2020) Standard Specification for Solid Vinyl Floor Tile

ASTM F1861 (2016) Standard Specification for Resilient Wall Base

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

CDPH SECTION 01350 (2010; Version 1.1) Standard Method for the Testing and Evaluation of Volatile

Organic Chemical Emissions from Indoor  
Sources using Environmental Chambers

CEILINGS AND INTERIOR SYSTEMS CONSTRUCTION ASSOCIATION (CISCA)

CISCA Access Floors (2007) Recommended Test Procedures for  
Access Floors

COMPOSITE PANEL ASSOCIATION (CPA)

CPA A208.1 (2016) Particleboard

CPA A208.2 (2016) Medium Density Fiberboard (MDF) for  
Interior Applications

GREEN SEAL (GS)

GS-36 (2013) Adhesives for Commercial Use

ICC EVALUATION SERVICE, INC. (ICC-ES)

ICC-ES AC300 (2014) Acceptance Criteria for Access  
Floors

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC (2018) International Building Code

MASTER PAINTERS INSTITUTE (MPI)

MPI 58 (2012) Stain for Concrete Floors

MPI 99 (2012) Sealer, Water Based, for Concrete  
Floors

MPI 104 (2012) Sealer, Solvent Based, for Concrete  
Floors

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI/NEMA LD 3 (2005) Standard for High-Pressure  
Decorative Laminates

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 75 (2020) Standard for the Protection of  
Information Technology Equipment

NFPA 99 (2021) Health Care Facilities Code

NFPA 253 (2011) Standard Method of Test for  
Critical Radiant Flux of Floor Covering  
Systems Using a Radiant Heat Energy Source

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule 1113 (2016) Architectural Coatings

SCAQMD Rule 1168 (2017) Adhesive and Sealant Applications

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-301-01 (2019) Structural Engineering

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS TT-C-490 (Rev G; 2019) Cleaning Methods for Ferrous Surfaces and Pretreatments for Organic Coatings

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

36 CFR 1191 Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

### SD-02 Shop Drawings

Detailed Installation Drawings; G[, [\_\_\_\_]]

Fabrication Drawings; G[, [\_\_\_\_]]

### SD-03 Product Data

Access Flooring System; G[, [\_\_\_\_]]

Recycled Content of Access Flooring System; S

Indoor Air Quality For Pedestal Adhesive; S

Indoor Air Quality For Concrete Sealer; S

Indoor Air Quality For Adhesives; S

### SD-04 Samples

Floor Panels

Floor Covering; G[, [\_\_\_\_]]

Panel Support System

Accessories; G[, [\_\_\_\_]]

Fascia; G[, [\_\_\_\_]]

Exposed Step and Ramp Structure; G[, [\_\_\_\_]]

Railings; G[, [\_\_\_\_\_]]

Perforated Directional Air Supply Panels; G[, [\_\_\_\_\_]]

Cut Outs; G[, [\_\_\_\_\_]]

#### SD-05 Design Data

Seismic Calculations

#### SD-06 Test Reports

Factory Tests

Concentrated Load

Uniform Live Load

Rolling Load

Impact Load

Ultimate Load

Stringer Load

Pedestal Axial Load

Bonding Strength of Pedestal Adhesive

Electrical Resistance

Field Tests

#### SD-07 Certificates

Compliance with ICC-ES AC308

Compliance with ICC IBC

Certificate of Compliance

Qualification of Manufacturer

#### SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals; G[, [\_\_\_\_\_]]

#### SD-11 Closeout Submittals

Lifting Device

Warranty[; G, [\_\_\_\_\_]]

### 1.3 SPARE PARTS

[Furnish spare floor panels for each finish including bare panels for carpet tile, complete pedestal assemblies, and stringers at the rate of one for each 100 or fraction thereof required.][ Provide [four] [\_\_\_\_\_] floor panels complete with specified floor covering for future use.][ Provide four spare panels with identical floor covering pedestals and stringers for each 1,000 square feet of access flooring and total of 10 linear feet of cut-out trim. Store extra stock in same manner and location as project materials.][ Provide extra carpet tile from same dye lot consisting of uncut tiles for future maintenance. Provide a minimum of [three][\_\_\_\_\_] percent of total square yards of each carpet type, pattern, and color. [Furnish [[five][\_\_\_\_\_] percent extra of total adhesive tabs][[one][\_\_\_\_\_] percent extra of total components] required for installing carpet tile.]]

### 1.4 QUALITY CONTROL

#### 1.4.1 Qualification of Manufacturer

Access flooring manufacturer must have at least 5 years experience in manufacturing access flooring systems. Certify that the manufacturer of the access flooring system meets requirements specified under paragraph entitled QUALIFICATION OF MANUFACTURER.

### 1.5 DELIVERY, STORAGE, AND HANDLING

#### 1.5.1 Delivery

Deliver materials to site in undamaged condition, in original containers or packages, complete with accessories and instructions. Label packages with manufacturer's name and brand designations. Package materials covered by specific references bearing specification number, type and class as applicable.

#### 1.5.2 Storage

Store all materials in original protective packaging in a safe, dry, and clean location. Store panels at temperatures between 40 and 90 degrees F, and between 20 and 70 percent humidity. Replace defective or damaged materials.

#### 1.5.3 Handling

Handle and protect materials in a manner to prevent damage during the entire construction period.

### 1.6 WARRANTY

Minimum manufacturer warranty must have no dollar limit, cover full system, and must have a minimum duration of [1] [5] [\_\_\_\_\_] years. Include an agreement to repair or replace floor panels, pedestals or stringers that fail within the warranty period in the standard performance guarantee or warranty. Failures include, but are not limited to, sagging and warping of panels; rusting and manufacturers defects of panels or support system.[ For [high pressure laminate][conductive high pressure laminate][solid vinyl tile][luxury vinyl tile] provide manufacturer's standard performance guarantees or warranties that extend beyond a one-year period for finish materials.][ For

[conductive][static-dissipative] vinyl tile provide manufacturer's standard performance guarantees or warranties that extend beyond one year, standard warranty must not be less than a five year wear warranty and ten year conductivity warranty.][ For carpet tile provide manufacturer's standard performance guarantees or warranties including a minimum two years for material and workmanship and ten years for wear, static control, tuft bind and delamination.]

## PART 2 PRODUCTS

### 2.1 SYSTEM DESCRIPTION

- a. Provide for self-alignment of floor panels, adjustable pedestals and readily removable floor panels covered as specified.
- b. Lateral stability of floor support system must be independent of panels. Provide a finished assembly that is rigid and free of vibration, noises, and rocking panels.[ Provide bolted stringer system with equipotential plane grounding.]
- c. Submit certificate of compliance attesting that the installed access floor system meets specification requirements, including all special equipment loads and specific electrical and or cable requirements for the complete access flooring system including, but not limited to the following:
  - (1) Compliance with ICC-ES AC300 and Compliance with ICC IBC Acceptance Criteria for Access Floors.
  - (2) Load-bearing capabilities of pedestals, floor panels, and pedestal adhesive resisting force.
  - (3) Supporting independent laboratory test reports. For panel, stringer and pedestal load test results include concentrated loads at center of panel, panel edge midpoint, ultimate loads and uniform loads.
  - (4) Floor electrical characteristics.
  - (5) Material requirements.
  - (6) An elevated floor system free of defects in materials, fabrication, finish, and installation, that will remain so for a period of not less than [\_\_\_\_\_] [1] years after completion.
- d. Submit manufacturer's product data for access flooring system consisting of descriptive data, catalog cuts, and installation instructions. Include in the data information about any design and production techniques, total system including all accessories and finish coatings of under-floor components, procedures and policies used to conserve energy, reduce material, improve waste management or incorporate green building/recycled products into the manufacturer of their components or products. Include cleaning and maintenance instructions. Systems which contain zinc electroplated anti-corrosion coatings are prohibited.

#### 2.1.1 Design Requirements

Conduct floor panel testing in accordance with CISCA Access Floors. When tested as specified, make all deflection and deformation measurements at

the point of load application on the top surface of the panel. Floor panels must be capable of supporting the following loads:

- a. Concentrated load of [1000] [1250] [1500] [2000] [2500] [\_\_\_\_\_] pounds on one square inch, at any point on panel, without a top-surface deflection more than 0.10 inch, and a permanent set not to exceed 0.01 inch in any of the specified tests. Testing must be in accordance with CISCA Access Floors, Section 1 Concentrated Loads with test panels being supported by understructure to be used with installed system instead of steel support blocks.
- b. Uniform live load of [250] [300] [350] [400] [500] [\_\_\_\_\_] psf, without a top-surface deflection more than 0.06 inch, and a permanent set not to exceed 0.01 inch in any of the specified tests, when tested in accordance with CISCA Access Floors, Section 7 Uniform Load Test with test panels being supported by understructure to be used with installed system instead of steel support blocks.
- c. A rolling load of [600] [800] [1000] [1200] [1600] [\_\_\_\_\_] pounds applied through hard rubber surfaced wheel 6 inch diameter by 2 inch wide for 10,000 cycles over the same path. Permanent set at conclusion of test must not exceed 0.040 inch when tested in accordance with CISCA Access Floors, Section 3 Rolling Loads.
- d. A rolling load of [800] [1000] [1250] [1500] [2000] [\_\_\_\_\_] pounds applied through a 3 inch diameter by 1-13/16 inch wide caster for 10 cycles over the same path, without developing a local overall surface deformation greater than 0.04 inch. In accordance with CISCA Access Floors, Section 3 Rolling Loads, the permanent deformation limit under rolling load must be satisfied in all of the specified tests.
- e. An impact load of [150] pounds anywhere on the panel dropped from a height of 36 inches onto a 1 square inch area without failure of the system, according to CISCA Access Floors, Section 8 Drop Impact Load Test.
- f. Ultimate Load. Panels must meet manufactures published Ultimate Load rating of [1400] [1800] [2500] [2800] [3100] [\_\_\_\_\_] pounds when tested in accordance with CISCA Access Floors, Section 2 Ultimate Loading.
- g. Safety Factor. Panels must provide a minimum Safety Factor of 5 times the uniform load specified above in accordance with ICC-ES AC300.
- h. Recycled Content. Provide Access Flooring System (panels, stringers and pedestals) containing a minimum of [20] [\_\_\_\_\_] percent recycled content. Provide data identifying percentage of recycled content of access flooring system.

#### 2.1.2 Allowable Tolerances

##### 2.1.2.1 Floor Panel Flatness

Plus or minus 0.035 inches on diagonal on top of panel or underneath edge.

##### 2.1.2.2 Floor Panel Length

Plus or minus 0.015 inch.



### 2.1.2.3 Floor Panel Squareness

Plus or minus 0.02 inch in panel length.

### 2.1.3 Stringers

Provide stringers capable of supporting a [\_\_\_\_\_] pound[ 250 pound][ 200 pounds] [ 350 pound] [ 450 pound] concentrated load at midspan without permanent deformation in excess of 0.010 inch, when tested in accordance with CISCA Access Floors, Section 4 Stringer Load Testing.

### 2.1.4 Pedestals

Pedestals must be capable of supporting a 5000 pound axial load without permanent deformation, when tested in accordance with CISCA Access Floors, Section 5 Pedestal Axial Load Test.

### 2.1.5 Bonding Strength of Pedestal Adhesive

Adhesive for anchoring pedestal bases must have a bonding strength capable of resisting an overturning moment of[ 1,000 lbf-in][ 2,000 lbf-in] [\_\_\_\_\_] when a force is applied to the top of the pedestal in any direction, when tested in accordance with CISCA Access Floors, Section 6 Pedestal Overturning Moment Test. Pedestal adhesive must meet emissions requirement of CDPH SECTION 01350 (use the office or classroom requirements, regardless of space type). Provide validation of indoor air quality for pedestal adhesive.

### 2.1.6 Bond Strength of Factory Installed Covering

Bond strength of floor covering must be sufficient to permit handling of the panels by use of the panel lifting device, and to withstand moving caster loads up to[800] [1000] [1250] [1500] [2000] [\_\_\_\_\_] pounds, without separation of the covering from the panel.

### 2.1.7 Seismic Calculations

#### 2.1.7.1 Navy Project Specific Requirements

Submit seismic calculations for lateral bracing, sealed by a Professional Engineer. Document that access flooring system complies with seismic requirements of ICC IBC and ASCE 7-16 for Occupancy Importance Factor (Ip) of [1.0] [1.5], and seismic horizontal force (Fp) determined in accordance with UFC 3-301-01 and Section 1615 of the ICC IBC and ASCE 7-16, Minimum Design Loads for buildings and other structures.

#### 2.1.7.2 Army Project Specific Requirements

Submit seismic calculations for special bracing to resist the effects of seismic or other forces [in accordance with UFC 3-301-01, ICC IBC and ASCE 7-16] [as shown on the approved detailed installation drawings]. Submit design calculations which demonstrate that the proposed floor system meets requirements for seismic loading. Certified copies of test reports may be submitted in lieu of calculations.

## 2.2 FLOOR PANELS

### 2.2.1 Floor System Drawings And Planer Quality

- a. Submit [Fabrication Drawings](#) for elevated floor systems consisting of fabrication and assembly details to be performed in the factory.
- b. Indicate on Location Drawings exact location of pedestals, ventilation openings, cable cutouts, and the panel installation pattern.
- c. Provide Detail Drawings showing details of the pedestals, pedestal-floor interlocks, floor panels, panel edging, floor openings, floor opening edging, floor registers, floor grilles, cable cutout treatment, perimeter base, expansion, and peripheral support facilities.
- d. Design and workmanship of the floor, as installed, must be completely planar within plus or minus 0.060 inch in 10 feet, 0.100 inch for the entire floor, and 0.030 inch across panel joints.
- e. Floor-panel joint-width tolerances must not exceed 0.017 inch as measured with a feeler gage at any point in any joint when the panels are installed and as long as the air leakage requirements specified in this section are met.
- f. Submit [three][\_\_\_\_\_] complete samples of floor panels.

### 2.2.2 Detailed Installation Drawings

Submit [Detailed Installation Drawings](#) that as a minimum indicate the following:

- a. Location of panels
- b. Layout of supports, panels, and cutout locations
- c. Stair, handrail, and ramp framing
- d. Sizes and details of components
- e. Details at floor perimeter and height above structural floor
- f. Method of anchorage to structural subfloor
- g. Lateral bracing
- h. Typical cutout details
- i. Gasketing, return air grilles, supply air registers, and perforated panels. Include air transfer capacity of grilles, registers and panels
- j. Description of [shop] [factory] coating
- k. Floor finishes
- l. Location of connection to building grounding electrode

## 2.2.3 Panel Construction

- a. Base access floor system on a 24 by 24 inch square module providing minimum of [6] [12] [ ] inch clearance between structural floor and underside of panel and stringer. Fabricate so accurate job cutting and fitting may be done using standard sizes for perimeters and around columns.
- b. Do not expose metal on finished top surface of panels. Provide cutouts and cutout closures to accommodate utility systems and equipment intercabling. Reinforce cutouts to meet design load requirements. Provide extra support pedestals at each corner of cutout for cutout panels that do not meet specified design load requirements.
- c. Panel design must provide for convenient panel removal for underfloor servicing and for openings for new equipment. Use panels of uniform dimensions within specified tolerances. Permanently mark panels to indicate load rating and model number.
- d. Machine square floor panels to within plus or minus 0.015 inch with edge straightness plus or minus 0.0025 inch. If plastic edging is applied to the panel, the tolerances apply to the panel before the plastic edging is applied.
- [ e. Provide panels with holes drilled in corners to align precisely with threaded holes in pedestal heads and to accept countersunk corrosion resistant screws with heads that are flush with top of panel.]

## [2.2.3.1 Aluminum

Provide aluminum panels of die-cast or extruded construction conforming to ASTM B85/B85M.

## ][2.2.3.2 Hollow Formed Steel

Steel panels must be of die-formed construction, consisting of a flat steel top sheet welded to one or more formed steel stiffener sheets or components. Panels must be chemically cleaned, bonderized, and painted with the manufacturer's standard finish.

## ][2.2.3.3 Cementitious-Filled Formed Steel (Composite Panels)

- a. Provide composite panels of die-formed steel construction totally enclosing the panel, including the top surface. The void spaces between the top sheet and the formed steel bottom sheet must be completely filled with an incombustible cementitious or concrete material. Seal cut edges in accordance with manufacturer's recommendations. Gravity held panels with bolted stringer understructure: Fasten end of each stringer and mid-point of each 4 foot stringer positively to pedestal heads, using manufacturer's standard screws. Provide screws that are removable from top.
- b. Grid supported panels must be further tested by supporting them at two opposite edges and applying a 500-pound load at the center of a panel selected; the panel must be similarly tested while supported at the other two edges. Weld failure at any point under this loading is not acceptable. This additional test must be applied to one panel per 500 square feet of floor in the system, but in no case less than two

panels. When any weld fails, the number of panels designated by the Contracting Officer must be similarly tested; replace those panels that have a weld failure at no cost to the Government.

#### ] [2.2.3.4 Metal-Clad Wood Core

Provide wood core panels with cores of wood particleboard conforming to [CPA A208.1](#), Grade 1-M-3, or of plywood conforming to [CPA A208.2](#), [APA E30](#), and [APA L870](#), EXT-DFPA-C-C. The core must be not less than 1 inch thick, and be faced on all sides with structurally bonded zinc-coated steel sheets not lighter than 24 gauge. All edges and corners must be sealed with zinc-coated steel or extruded aluminum. The completed panels must have a flame spread rating of 25 or less when tested in accordance with [ASTM E84](#). Provide zinc-coated steel, extruded aluminum, fire resistant vinyl, or other fire resistant edging to protect shop and field edge cuts and cutouts through the face of panels in a manner to meet specified flame spread, smoke developed and Class A fire rating requirements.

#### ] [2.2.3.5 Lightweight Concrete Filled Panels (Exposed Concrete)

Provide lightweight concrete of lightweight structural concrete with either structural reinforcing or a die-formed, hot dipped galvanized steel bottom pan. All concrete surfaces, including those resulting from field cuts, must be sealed with the manufacturer's standard sealer before covering the surfaces with other materials. Concrete sealer must meet either emissions requirements of [CDPH SECTION 01350](#) (use the office or classroom requirements, regardless of space type) or VOC content requirements of [SCAQMD Rule 1113](#). Provide validation of [indoor air quality for concrete sealer](#).

#### ] 2.2.4 Floor Covering

Surface floor panels with [factory applied finish materials firmly bonded in place with waterproof adhesive][carpet tile installed in the field]. Provide finish flooring materials in corridors and exits with a critical radiant flux of not less than [0.45 watts per square centimeter (Class 1)] [0.22 watts per square centimeter (Class 2)] when tested in accordance with [ASTM E648](#) or [NFPA 253](#). The electrical resistance must remain stable over the life expectancy of the floor covering. Any anti-static agent used in the manufacturing process must be an integral part of the material, not surface applied. Bolt heads or similar attachments must not rise above the traffic surface. Submit [three] [\_\_\_\_\_] separate samples of each specified floor covering finish and color.

##### ] 2.2.4.1 High Pressure Laminate

Provide factory applied high pressure laminate surfacing conforming to [ANSI/NEMA LD 3](#), High-Wear type, Grade [HDM, 1/16 inch thickness][\_\_\_\_\_]. Finish material must consist of one piece to cover the face of the panel. Provide edge detail that is [integral to the finish material][ or ][is an applied trim piece that finishes the edges of the panel, is flush with floor finish, and is [PVC][ or ][ABS][\_\_\_\_\_]]. The total system electrical resistance from the wearing surface of the floor to the ground connection must be between 1,000,000 ( $1.0 \times 10^6$ ) ohms and 20,000,000,000 ohms ( $2.0 \times 10^{10}$ ).

## ][2.2.4.2 Conductive High Pressure Laminate

Provide factory applied high pressure laminate surfacing conforming to ANSI/NEMA LD 3, High-Wear type, Grade [HDM, 1/16 inch thickness][\_\_\_\_\_]. Finish material must consist of one piece to cover the face of the panel. Provide edge detail that is [integral to the finish material][ or ][is an applied trim piece that finishes the edges of the panel, is flush with floor finish, and is [PVC][ or ][ABS][\_\_\_\_\_]]. The total system electrical resistance from the wearing surface of the floor to the ground connection must be between 25,000 ohms ( $2.5 \times 10^4$ ) and 1,000,000 ohms ( $1.0 \times 10^6$ ).

## ][2.2.4.3 Solid Vinyl Tile

Provide factory applied conductive vinyl tile that is a homogeneous vinyl product and conforms to ASTM F1700, Class I monolithic (minimum wear layer thickness 0.125 inch and minimum overall thickness 0.125 inch), Type A smooth surface. Finish material must consist of one piece to cover the face of the panel. Provide edge detail that is [integral to the finish material][ or ][is an applied trim piece that finishes the edges of the panel, is flush with floor finish, and is [PVC][ or ][ABS][\_\_\_\_\_]].

## ][2.2.4.4 Luxury Vinyl Tile

Provide factory applied luxury vinyl tile conforming to Class III printed film minimum wear layer thickness of 0.020 inch and minimum overall thickness 0.125 inch, Type [A (smooth)] [B (embossed)]. Finish material must consist of one piece to cover the face of the panel. Provide edge detail that is [integral to the finish material][ or ][is an applied trim piece that finishes the edges of the panel, is flush with floor finish, and is [PVC][ or ][ABS][\_\_\_\_\_]].

## ][2.2.4.5 Conductive Vinyl Tile

Provide factory applied conductive vinyl tile that is a homogeneous vinyl product and conforms to ASTM F1700, Class I monolithic, Type A smooth surface. Provide electrical resistance from surface to surface and surface to ground between 25,000 ohms ( $2.5 \times 10^4$ ) and 1,000,000 ohms ( $1.0 \times 10^6$ ) when tested in accordance with ASTM F150. Material must consist of one piece to cover the face of the panel. Provide edge detail that is [integral to the finish material][ or ][is an applied trim piece that finishes the edges of the panel, is flush with floor finish, and is [PVC][ or ][ABS][\_\_\_\_\_]].

## ][2.2.4.6 Static-Dissipative Vinyl Tile

Provide factory applied static-dissipative vinyl tile that is a homogeneous vinyl product and conforms to ASTM F1700, Class I monolithic, Type A smooth surface. Provide electrical resistance from surface to surface and surface to ground between 1,000,000 ohms ( $1.0 \times 10^6$ ) and 1,000,000,000 ohms ( $1.0 \times 10^9$ ) when tested in accordance with ASTM F150. Material must consist of one piece to cover the face of the panel. Provide edge detail that is [integral to the finish material][ or ][is an applied trim piece that finishes the edges of the panel, is flush with floor finish, and is [PVC][ or ][ABS][\_\_\_\_\_]].

## ][2.2.4.7 Carpet Tile

Reference Section [09 68 00 CARPETING][ and ][09 62 38 STATIC-CONTROL FLOORING (static-control carpet tile)] for carpet tile specification requirements including recycled content, volatile organic compound (VOC) limits, and additional flammability testing requirements for carpet tile. Carpet tile must be field installed and comply with the following:

- a. Installation method on level surfaces must allow carpet tile to be easily removed and replaced in the field and must be installed in accordance with manufacturer's recommended installation instructions.
- b. Install carpet tile in a [monolithic][1/4 turn][ashlar][brick][random][\_\_\_\_] pattern.
- [ c. Install carpet tile on secure and level surfaces offset from the access floor grid with a [manufacturer approved odor-free adhesive tab system][ or ][with full spread releasable adhesive using manufacturer recommended adhesives. Comply with manufacturer installation instructions for required drying time so the adhesive sets up properly].
- ][d. Install carpet tile on secure and level surfaces with the access flooring manufacturer's recommended installation method and components for a one to one alignment with floor panels (one carpet tile to one floor panel); equal to Tate PosiTile[, \_\_\_\_] or Haworth CarpetLok. This installation method requires the removal of only one carpet tile to access one raised access panel. Carpet tile size for a one-to-one installation must be slightly smaller than a standard 24 inch by 24 inch tile, coordinate required size with the raised access flooring manufacturer. Factory applied carpet tile with perimeter edge strip and field applied one to one carpet tile installation over raised access floor panels with permanent or releasable adhesive are not acceptable installation methods.
- ][e. Carpet tile on access flooring stairs and sloped surfaces must be installed with a more permanent installation method in accordance with manufacturer's instructions and with manufacturer recommended adhesives for these types of locations.

## )][2.2.4.8 Lightweight Concrete Filled (Exposed Concrete)

Provide lightweight concrete filled panel with a [MPI 58 concrete stain][ and ][[MPI 104 concrete floor sealer][ or ][[MPI 99 water based concrete floor sealer]]. Apply coatings in accordance with manufacturer's instructions.

## ][2.2.5 Accessories

Provide the manufacturer's standard registers, grilles, perforated panels, and plenum dividers type where indicated. Provide registers, grilles, and perforated panels designed to support the same static loads as floor panels without structural failure, and capable of delivering the air volumes indicated. Registers and perforated panels must be 25 percent open area and equipped with adjustable dampers. Submit [three][\_\_\_\_] samples and colors of each accessory.

#### 2.2.6 Resilient Base

Conform to [ASTM F1861](#), [[Type TS (vulcanized thermoset rubber)] [or] [Type TP (thermoplastic rubber)]] [, or] [Type TV (thermoplastic vinyl)], [Style A (straight - installed with carpet)] [and] [Style B (coved - installed with resilient flooring)]. Provide [\[4\] \[6\] inch](#) high and a minimum [1/8 inch](#) thick wall base. Provide [preformed] [job formed] corners in matching height, shape, and color.

#### 2.2.7 Adhesives

Provide adhesives as recommended by the manufacturer. Provide non-aerosol adhesive products that meet either emissions requirements of [CDPH SECTION 01350](#) (use the requirements for either office or classroom, regardless of space type) or VOC content requirements of [SCAQMD Rule 1168](#). Provide aerosol adhesives that meet either emissions requirements of [CDPH SECTION 01350](#) (use the requirements for office or classroom, regardless of space type) or VOC content requirements of [GS-36](#). Provide validation of [indoor air quality for adhesives](#). [ Provide conductive adhesive as recommended by the manufacturer of the static-control flooring. ] [ Provide conductive releasable adhesive as recommended by the manufacturer for static-control carpet tile. ]

#### 2.2.8 Lifting Device

At turn over provide one floor panel lifting device standard with the floor manufacturer, for each individual floor area (room or corridor). Furnish a minimum of two devices. [ For [AIR FORCE projects, at turnover, provide a total of two suction-type floor panel lifting devices for each floor area \(room or corridor\).](#) ]

### 2.3 PANEL SUPPORT SYSTEM

Design support system to allow for 360 degree clearance in laying out cable and cutouts for service to machines and so that panel and stringer together take up maximum of [2 inches](#). Submit one sample of suspension system proposed for use.

#### 2.3.1 Pedestals

Provide pedestals made of steel or aluminum or a combination thereof. Ferrous materials must have a factory-applied corrosion-resistant finish. Provide pedestal base plates with a minimum of [16 square inches](#) of bearing surface and a minimum of [1/8 inch](#) thickness. Pedestal shafts must be threaded to permit height adjustment within a range of approximately [2 inches](#), to permit overall floor adjustment within plus or minus [0.10 inch](#) of the required elevation, and to permit leveling of the finished floor surface within [0.062 inch](#) in [10 feet](#) in all directions. Provide locking devices to positively lock the final pedestal vertical adjustments in place. Pedestal caps must interlock with [panels] [stringers] to preclude tilting or rocking of the panels.

#### 2.3.2 Stringers

Provide stringers of rolled steel or extruded aluminum, to interlock with the pedestal heads to prevent lateral movement. Provide stringers that can be added or removed after floor is in place.

### 2.3.3 Gaskets

Provide continuous gasketing at contact surfaces between panel and stringers to deaden sound and seal off the underfloor cavity from above for air tightness, and to maintain panel alignment.

### 2.4 FASCIA

Provide aluminum or steel fascia plates at open ends of floor, at sides of ramps and steps, and elsewhere as required to enclose the free area under the raised floor. Steel plates must have a factory applied baked enamel finish. Finish on aluminum plates must be standard with the floor system manufacturer. Fascia plates must be reinforced on the back, and supported using the manufacturer's standard lateral bracing at maximum 4 feet on center. Provide trim, angles, and fasteners as required. Submit [three][\_\_\_\_\_] color samples for fascia.

### 2.5 STEPS AND RAMPS

Securely fasten steps and ramps to the access flooring system and to the structural floor. Include in the construction standard floor system components and custom components as required, and all supports, fasteners, and trim necessary for a finished installation. Step nosings, threshold strips, and floor bevel strips must be cast or extruded aluminum with non-slip traffic surfaces. Submit [three][\_\_\_\_\_] color samples for exposed step and ramp structure.

#### 2.5.1 Steps

Height of risers must comply with applicable codes. Design steps to support a uniform load of 150 psf. Surface treads with the manufacturer's standard non-slip floor finish. Floor covering must be [\_\_\_\_\_].

#### 2.5.2 Ramps

Slope of ramps must comply with applicable codes and 36 CFR 1191 Americans with Disabilities Act (ADA). Design ramps to support the same loads as specified for floor panels. Surface ramps with the manufacturer's standard non-slip floor finish. Floor covering must be [\_\_\_\_\_].

### 2.6 RAILINGS

Provide railings compliant with applicable codes and 36 CFR 1191 Americans with Disabilities Act (ADA). As a minimum railings must be of the double rail and post type, fabricated of at least [ 1 inch] [\_\_\_\_\_] [round] [square] seamless [aluminum tubing] [\_\_\_\_\_] with a [satin natural anodized] [\_\_\_\_\_] finish. At steps and ramps, make the top rail a minimum of 36 inches high and parallel to the incline. Make the top rail 42 inches high at open ends of the floor. Guardrails must have intermediate rails or an ornamental pattern such that a sphere 4 inches in diameter cannot pass through. Space posts maximum of [4] [5] [6] feet oc. Provide railings complete with anchorages, floor plates, and end caps.[ Electronically ground hand rails to raised floor system to prevent static build-up.] Submit [three][\_\_\_\_\_] color samples for railings.

### 2.7 FACTORY TESTS

Factory test access flooring, using an independent laboratory, at the same position and maximum design elevation and in the same arrangement as shown



on the drawings for installation so as to duplicate service conditions as much as possible.

#### 2.7.1 Load Tests

Conduct floor panel, stringer, and pedestal testing in accordance with **CISCA Access Floors** to determine deformation and permanent set of panels and sytem due to concentrated, Uniform, rolling, impact and ultimate loading when panels are supported by actual understructure.

#### 2.7.2 Bond Strength of Covering

Conduct test for bond strength of covering in accordance with **CISCA Access Floors** for rolling loads, except as specified. Panels must be tested with specified hard surface flooring and on the pedestals and stringers as specified for the installed floor. Brace the supports as necessary to prevent sideways movement during the test. Impose a test load of [800] [1000] [1250] [1500] [2000] [\_\_\_\_\_] pounds on the test assembly through a 3 inches in diameter and 1 inch wide hard plastic caster. Roll the caster completely across the center of the panel. The panel shall withstand 20 passes of the caster with no delamination or separation of the covering.

### [2.8 REGISTERS AND GRILLES

Registers and grilles must be [\_\_\_\_\_] inches by [\_\_\_\_\_] inches long with a minimum free area of [\_\_\_\_\_] square inches, made from extruded [aluminum] [\_\_\_\_\_] , in [mill] [\_\_\_\_\_] finish, to sustain point loads of 250 pounds per vane without failure or permanent deformation. No part of a grille may project more than 1/8 inch above the floor. Registers and grills are not permitted in a laminate floor tile system.

### ] [2.9 PERFORATED AIR SUPPLY PANELS

Provide air supply floor panels that meet the design criteria specified for standard panels, are fabricated of 14-gage perforated steel sheet welded to minimum 16-gage side channels, are covered with high pressure laminate to match standard panels, and have a uniform perforated pattern to allow even air distribution.

### ] [2.10 PERFORATED DIRECTIONAL AIR SUPPLY PANELS

Provide directional air supply floor panels that meet or exceed the design criteria specified for standard panels, are fabricated of [light weight die cast aluminum with powder coat finish] [welded steel vanes with powder coat finish] [perforated steel sheet welded to a formed steel pan with powder coat finish]. Submit [three][\_\_\_\_\_] color samples for **perforated directional air supply panels**.

### ] [2.11 CUT OUTS

Provide cable cutouts finished with rigid polyvinylchloride or molded polypropylene edging to conform to the appearance level of the floor surface and to cover raw edges of the cutout panel. Extrusion must be of a configuration to permit its effective and convenient use when new cable openings are required. Provide at least 24 feet of additional extrusion for future use. Submit [three][\_\_\_\_\_] color samples for **cut outs**.

a. Provide non-metallic adapter for openings less than 4 inches wide.

Secure adapter adhesively in cutout to preclude removal from panel. Provide at least two adapters per 1000 square feet for future use.

- b. Openings larger than 4 inches wide must use rigid polyvinylchloride or molded polypropylene edging. Perform cutting of panels, including cutouts, outside of the building.
- c. When size of cutout reduces the performance requirement of panel, provide intermediate stringers adjacent to cutouts.

#### ]2.12 EDGE CLOSURE

Provide 1/16 inch aluminum closure plate and extruded aluminum nosing at exposed edge of floor. Back up the closure plates with aluminum or steel framing braced diagonally, or anchor at bottom to continuous angle.

#### ]2.13 COLOR

Color must be [in accordance with Section 09 06 00 SCHEDULES FOR FINISHES] [as indicated] [\_\_\_\_\_]. Color listed is not intended to limit the selection of equal colors from other manufacturers.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

Install access flooring at the location and elevation and in the arrangement shown on the approved detailed installation drawings. The floor system must be of the rigid grid stringer type, complete with all supplemental items, and be the standard product of a manufacturer specializing in access flooring systems.

Install the floor system in accordance with the manufacturer's instructions. Open ends of the floor, where the floor system does not abut wall or other construction, must have positive anchorage and rigid support. Maintain areas to receive access flooring between [60] [40] and 90 degrees F, and between 20 and 70 percent humidity for 24 hours prior to and during installation.

##### 3.1.1 Preparation for Installation

Clear out all debris in the area in which the floor system is to be installed. Thoroughly clean structural floor surfaces and remove all dust. Install floor coatings, required for dust or vapor control, prior to installation of pedestals, only if the pedestal adhesive will not damage the coating. If the coating and adhesive are not compatible, apply the coating after the pedestals have been installed and the adhesive has cured.

##### 3.1.2 Pedestals

Pedestals must be accurately spaced, and set plumb and in true alignment. Set base plates in full and firm contact with the structural floor, and secured to the structural floor with adhesive or steel expansion anchors in accordance with manufacturer's instructions.

##### 3.1.3 Stringers

Interlock stringers with the pedestal caps to preclude lateral movement,

spaced uniformly in parallel lines at the indicated elevation.

#### 3.1.4 Auxiliary Framing

Provide auxiliary framing or pedestals around columns and other permanent construction, at sides of ramps, at open ends of the floor, and beneath panels that are substantially cut to accommodate utility systems. Use special framing for additional lateral support as shown on the approved detailed installation drawings. Provide additional pedestals and stringers designed to specific heights and lengths to meet structural irregularities and design loads. Connect auxiliary framing to main framing.

#### 3.1.5 Panels

Interlock panels with supports in a manner that will preclude lateral movement. Fasten perimeter panels, cutout panels, and panels adjoining columns, stairs, and ramps to the supporting components to form a rigid boundary for the interior panels. Level floors within the specified tolerances. Cut edges of [steel and wood-core panels must be [painted] [finished] [\_\_\_\_\_] as recommended by the panel manufacturer.][ Exposed edges of composite panels must be coated with a silicone rubber sealant or with an adhesive recommended by the panel manufacturer.] Secure extruded vinyl edging in place at all cut edges of all panel cut-outs to prevent abrasion of cables.[ Where the space below the floor is a plenum, close cutouts for conduit and similar penetrations using self-extinguishing sponge rubber or air sealing grommets.]

#### 3.1.6 Carpet Tile

Reference carpet tile paragraph in FLOOR COVERING for carpet tile installation requirements.

#### 3.1.7 Resilient Base

Provide base at vertical wall intersections as indicated in the [drawings][\_\_\_\_\_]. Apply the base after the floor system has been completely installed. Install wall base in accordance with manufacturer's printed installation instructions. Prepare and apply adhesives in accordance with manufacturer's printed directions. Tighten base joints and make even with adjacent flooring. Fill voids along the top edge of base at masonry walls with caulk. Roll entire vertical surface of base with hand roller, and press toe of base with a straight piece of wood to ensure proper alignment. Avoid excess adhesive in corners.

#### 3.1.8 Fascia Plates

Cover exposed floor ends and exposed openings of ramps and stairs with [aluminum] [steel closures] [finish material as indicated on the drawings].

#### 3.1.9 Repair of Zinc Coating

Repair zinc coating that has been damaged, and cut edges of zinc-coated components and accessories, by the application of a galvanizing repair paint conforming to [ASTM A780/A780M](#). Areas to be repaired must be thoroughly cleaned prior to application of the paint.

### 3.2 FIELD TESTS

Submit certified copies of test reports from an approved testing laboratory, attesting that the proposed floor system components meet the performance requirements specified.

#### 3.2.1 Acceptance Tests

Conduct acceptance tests after installation of floor system. Make at least one test for each [400] [1000] [\_\_\_\_\_] square feet of floor area. Conduct tests in presence of Contracting Officer and representatives of manufacturer and installer. Submit certified copies of test reports from an approved testing laboratory, attesting that the proposed floor system components meet the performance requirements specified.

#### 3.2.2 Air Leakage

When the space below the finished floor is an air plenum, air leakage through the joints between panels and around the perimeter of the floor system must not exceed 0.1 cubic foot of air per minute per linear foot of joint subjected to [.05 inches h2o (Pa)][0.1 inches h2o (Pa)], water gauge, positive pressure in the plenum, when tested in accordance with CISCA Access Floors, Section 10 Air Leakage Test. Measure the leakage rate on the finished raised floor system, which may include carpet.

#### 3.2.3 Grounding

Ground the access flooring system for safety hazard and static suppression. Provide positive contact between components for safe, continuous electrical grounding of entire floor system. Total system resistance from wearing surface of floor to building grounding electrode must be within range of [0.5 to 20,000 megohms] [0.2 to 2.0 megohms] [0.025 to 1.0 megohms].

##### 3.2.3.1 Metal Grilles

Exposed metal is not allowed at wearing surface of access floor system, except at metal grilles and registers. When grilles and metal registers are provided, insulate as required to provide same grounding resistance as wearing surface.

##### 3.2.3.2 Joint Resistance

Electrical joint resistance between individual stringer and pedestal junctions must be less than 0.1 milliohms. Electrical resistance between stringers and floor panels, as mounted in normal use, must be less than 3 ohms when tested in accordance with ASTM F150.

##### 3.2.4 Electrical Resistance

Conduct testing of electrical resistance, in the completed installation, in the presence of the Contracting Officer in accordance with NFPA 99, modified by placing one electrode on the center of the panel surface and connecting the other electrode to the metal flooring support. Take measurements at five or more locations. Each measurement must be the average of five readings of 15 seconds duration at each location. During the tests, relative humidity must be 45 to 55 percent and temperature set at 69 to 75 degrees F. Select panels used in the testing at random and include two panels most distant from the ground connection. Measure

electrical resistance with instruments that are accurate within 2 percent and that have been calibrated within 60 days prior to the performance of the resistance tests. The metal-to-metal resistance from panel to supporting pedestal must not exceed 10 ohms. The resistance between the wearing surface of the floor covering and the ground connection, as measured on the completed installation, must be in accordance with paragraph FLOOR COVERING.

#### [3.2.5 SEISMIC SPECIAL INSPECTION AND TESTING

Perform special inspections and testing for seismic-resisting systems and components in accordance with [UFC 3-301-01](#) and Section [01 45 35](#) SPECIAL INSPECTIONS.

#### ]3.3 CLEANING AND PROTECTION

##### 3.3.1 Cleaning

Keep the space below the completed floor free of all debris. Before any traffic or other work on the completed raised floor is started, clean the completed floor in accordance with the floor covering manufacturer's instructions.[ Do not permit seepage of cleaner between individual panels.][ Cleaning of ferrous surfaces must conform to [FS TT-C-490](#).]

##### 3.3.2 Protection

Protect traffic areas of raised floor systems with a covering of building paper, fiberboard, or other suitable material to prevent damage to the surface. Cover cutouts with material of sufficient strength to support the loads to be encountered. Place plywood or similar material on the floor to serve as runways for installation of heavy equipment not in excess of design load capacity. Maintain protection until the raised floor system is accepted.

##### 3.3.3 Surplus Material Removal

Clean surfaces of the work, and adjacent surfaces soiled as a result of the work. Remove all installation equipment, surplus materials, and rubbish from the work site.

#### [3.4 FIRE SAFETY

Install an automatic detection system below the raised floor meeting the requirements of [NFPA 75](#) paragraph 5-2.1 to sound an audible and visual alarm. Air space below the raised floor must be subdivided into areas not exceeding 10,000 square feet by tight, noncombustible bulkheads. Seal all penetrations for piping and cables to maintain bulkhead properties.

#### ]3.5 OPERATION AND MAINTENANCE MANUALS

Submit maintenance instructions for proper care of the floor panel surface. When conductive flooring is specified, also submit maintenance instructions to identify special cleaning and maintenance requirements to maintain "conductivity" properties of the panel finish.

-- End of Section --

SECTION 09 72 00

WALLCOVERINGS

**08/17**

PART 1 GENERAL

1.1 REFERENCES

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

ASTM INTERNATIONAL (ASTM)

ASTM E84 (2020) Standard Test Method for Surface Burning Characteristics of Building Materials

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

CDPH SECTION 01350 (2010; Version 1.1) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers

GREEN SEAL (GS)

GS-36 (2013) Adhesives for Commercial Use

GYPSUM ASSOCIATION (GA)

GA 214 (2010) Recommended Levels of Gypsum Board Finish

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC (2018) International Building Code

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 265 (2019) Standard Methods of Fire Tests for Evaluating Room Fire Growth Contribution of Textile or Expanded Vinyl Wall Coverings on Full Height Panels and Walls

NFPA 286 (2019) Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS SCS Global Services (SCS) Indoor Advantage

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule 1168 (2017) Adhesive and Sealant Applications

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS CCC-W-408 (Rev D; Notices 1, 2) Wallcovering, Vinyl Coated

UNDERWRITERS LABORATORIES (UL)

UL 723 (2018) UL Standard for Safety Test for Surface Burning Characteristics of Building Materials

UL 2818 (2013) GREENGUARD Certification Program For Chemical Emissions For Building Materials, Finishes And Furnishings

1.2 SUBMITTALS

Approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29.05 20 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00.05 20 CONSTRUCTION SUBMITTAL PROCEDURES:

SD-03 Product Data

Wallcoverings and Accessories; G

Primer and Adhesive

Recycled Content for vinyl wallcovering; S

SD-04 Samples

Wallcoverings and Accessories; G

SD-07 Certificates

Indoor Air Quality; S

SD-08 Manufacturer's Instructions

Wallcoverings and Accessories

SD-10 Operation and Maintenance Data

Wallcoverings and Accessories

1.3 CERTIFICATIONS

1.3.1 Indoor Air Quality Certifications

Submit required indoor air quality certifications and validations in one submittal package.

1.3.1.1 Fabrics and Wallcoverings

Provide products certified to meet indoor air quality requirements by

UL 2818 (Greenguard) Gold, SCS Global Services Indoor Advantage Gold or provide certification or validation by other third-party program that products meet the requirements of this Section. Provide current product certification documentation from certification body.

#### 1.3.1.2 Primers and Adhesives

Provide products certified to meet indoor air quality requirements by UL 2818 (Greenguard) Gold, SCS Global Services Indoor Advantage Gold or provide certification or validation by other third-party programs that products meet the requirements of this Section. Provide current product certification documentation from certification body. When product does not have certification, provide validation that product meets the indoor air quality product requirements cited herein.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

Deliver the material to the site in manufacturer's original wrappings and packages and clearly label with the manufacturer's name, brand name, pattern and color name and number, dye lot number, size, and other related information. Store in a safe, dry, clean, and well-ventilated area at temperatures not less than 50 degrees F and within a relative humidity range of 30 to 60 percent. Store wallcovering material in a flat position and protected from damage, soiling, and moisture. Do not open containers until needed for installation, unless verification inspection is required.

#### 1.5 ENVIRONMENTAL REQUIREMENTS

Comply with wallcovering manufacturer's printed installation instructions for minimum temperature of area to receive requirements for conditioning adhesive and wallcovering. Provide a minimum 50 degrees F area temperature, 72 hours prior to installation, during installation, and until the adhesive dries. Observe ventilation and safety procedures.

#### 1.6 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a one-year period.

#### 1.7 EXTRA MATERIALS

Provide one linear foot of full-width wallcovering of each pattern and color for each 100 linear feet of wallcovering installed. Provide the same manufacturer, type, pattern, color, and lot number of extra stock as the installed wallcovering. Provide full rolls, packed for storage and marked with content, manufacturer's name, pattern and color name and number and dye lot number. Leave extra stock at the site at a location as directed by the Contracting Officer.

### PART 2 PRODUCTS

#### 2.1 WALLCOVERINGS AND ACCESSORIES

Provide wall coverings and accessories material designed specifically for the specified use. Provide vinyl wallcovering and borders with a mercury, cadmium, lead, and chromium free base. Protect wallcoverings with bactericides and mildew inhibitors against microbiological and mildew growth.



#### 2.1.1 Product Data

- a. Wallcovering: Submit manufacturer's descriptive data, documenting physical characteristics, flame resistance, mildew and germicidal characteristics for wallcovering.
- b. Accessories: Submit manufacturer's descriptive data for corner guard and wainscot cap.
- c. Primer and Adhesive: Submit manufacturer's descriptive data, documenting physical characteristics, mildew and germicidal characteristics.

#### 2.1.2 Samples

##### 2.1.2.1 Digital Printed Wallcovering

Submit three samples of each indicated type, pattern, and color of wallcovering. Provide minimum 5 by 7 inch samples of wallcovering to show pattern repeat of sufficient size.

##### 2.1.2.2 Accessories

Submit three samples of each indicated type corner guard and wainscot cap; provide samples a minimum of 3 inch long. Submit three samples of each indicated type of frame for presentation dry erase wallcovering; provide samples a minimum of 3 inch long.

##### 2.1.2.3 Wallcovering Mockup Panels

After samples are approved, and prior to starting installation, provide a minimum 8 by 8 foot wallcovering mock-up for each color and type of vinyl wallcovering, using the proposed primers and adhesives and actual substrate materials. Once approved, use the mock-up samples as a standard of workmanship for installation within the facility. Written notification to the Contracting Officer at least 48 hours prior to mock-up installation.

#### 2.1.3 Certificates

Submit manufacturer's statement attesting that the product furnished meets or exceeds specification requirements. Date the statement after the award of the contract, state Contractor's name and address, name the project and location, and list the requirements being certified. Include these certificates:

- (1) Certified laboratory test reports of the physical properties for vinyl wallcovering, as specified.
- (2) Certificates of Compliance for UL fire hazard classification listing, as specified.
- (3) Certificates of Compliance for contact adhesive.

#### 2.1.4 Manufacturer's Instructions

Submit preprinted installation instructions for wallcovering and accessories, adhesives and primers. Include substrate preparation and material application in the instructions.

### 2.1.5 Operations and Maintenance Data

- a. Submit Data Package 1 in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.
- b. Submit three copies of manufacturer's maintenance instructions for each type of vinyl wallcovering and accessory describing recommended type of cleaning equipment and materials, spotting and cleaning methods, and cleaning cycles. Instructions to also include preventative maintenance, recommended cleaning materials and precautions in the use of cleaning materials that may be detrimental to the wallcovering surface and accessories when improperly applied.

### 2.2 VINYL WALLCOVERING TYPE A

Provide a vinyl coated woven or nonwoven wallcovering fabric. Conform to FS CCC-W-408 for vinyl wallcovering, Type II (Medium Duty) with a minimum total weight of 13 ounces/square yard and 20 ounces/linear yard. Provide width of 52/54 inch. Test vinyl wallcovering in accordance with NFPA 286 or meet the requirements of Class A when tested in accordance with ASTM E84 or UL 723.

Provide certification of indoor air quality for vinyl wallcovering.

### 2.3 PRIMER AND ADHESIVE

Provide a type primer and adhesive recommended by the wallcovering manufacturer, containing a non-mercury based mildewcide, and complying with local indoor air quality standards. Primer must permit removal of the wallcovering and protect the wall surface during removal. Do not damage gypsum wallboard facing paper during removal of wallcovering. Provide a strippable type adhesive. When substrate color variations show through vinyl wallcovering, provide a white pigmented primer as recommended by the wallcovering manufacturer used to conceal the variations. Provide a recommended type adhesive to install corner guards and wainscot cap by the manufacturer of the corner guards and wainscot cap.

Provide primers and non-aerosol adhesive products used on the interior of the building (defined as inside of the weatherproofing system) that meet either emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of SCAQMD Rule 1168. Provide aerosol adhesives used on the interior of the building that meet either emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of GS-36. Provide certification or validation of indoor air quality for primer; also, provide certification or validation of indoor air quality for adhesives.

### 2.4 COLOR, TEXTURE, AND PATTERN

Provide color, texture and pattern in accordance with the IN-Series drawings.

## PART 3 EXECUTION

### 3.1 EXAMINATION

Inspect all areas and conditions under which wallcoverings are to be

installed. Notify the Contracting Officer, in writing, of any conditions detrimental to the proper and timely completion of the installation. Work will proceed only when conditions have been corrected and accepted by the installer.

### 3.2 SURFACE PREPARATION

Do not apply wallcovering to surfaces that are rough, that contain stains which will bleed through the wallcovering, or that are otherwise unsuitable for proper installation. Fill cracks and holes; sand rough spots smooth. Finish walls to receive presentation dry erase wallcovering to a Level 4 gypsum wallboard finish in accordance with [GA 214](#) unless Level 5 is recommended by the wallcovering manufacturer. Thoroughly dry surfaces at least 30 days prior to installation of vinyl wallcovering. Provide interior surfaces of new and existing gypsum wallboard with a wallcovering primer in accordance with the manufacturer's printed instructions. As required, use white primer when substrate color variations are visible through thin or light color wallcovering. Seal interior surfaces of exterior masonry walls to prevent moisture penetration, then prime with a wallcovering primer in accordance with the manufacturer's printed instructions. Provide masonry walls with flush joints. Test moisture content of plaster, concrete, and masonry with an electric moisture meter of a maximum five percent reading. Apply a thin coat of joint compound or cement plaster, as recommended by the wallcovering manufacturer, to the concrete and masonry walls as a substrate preparation. To promote adequate adhesion of wall lining over masonry walls, prime the walls as recommended by the wall lining manufacturer. Prime the surfaces of walls as required by the manufacturer's printed instructions to permit ultimate removal of wallcovering from the wall surfaces. Allow primer to completely dry before adhesive application.

### 3.3 INSTALLATION

Do not install building construction materials that show visual evidence of biological growth.

#### 3.3.1 Wallcovering

Install wallcovering in accordance with the manufacturer's printed installation instructions. Remove glue and adhesive spillage from wallcovering face and seams with a remover recommended by the manufacturer.

##### 3.3.1.1 Textile Wallcovering

When textile wallcoverings are specified to comply with [NFPA 265](#), [NFPA 286](#), or [ICC IBC](#) (Section 803.5 Textile wall coverings) testing, install the wallcovering in accordance with the manufacturer's printed installation instructions for compliance with the testing using the same product mounting system, including adhesive. After the installation is complete, vacuum the fabric with a ceiling to floor motion.

#### 3.3.2 Wall Liner

Install wall liner over masonry walls that are to receive wallcovering. Install liner in accordance with the manufacturer's printed installation instructions. Install liner perpendicular to wallcovering to prevent overlapping of seams between liner and wallcovering.

### 3.3.3 Corner Guards and Wainscot Cap

Install corner guards and wainscot cap as indicated on the IN-Series drawings sheets IN110-114. and in accordance with the manufacturer's printed instructions. Run corner guards as indicated in the IN-Series Typical Finish Elevations in a continuous length.

### 3.4 CLEAN-UP

Upon completion of the work, clean wallcovering free of dirt, soiling, stain, or residual film. Remove and clean surplus materials, rubbish, and debris resulting from the wallcovering installation.

-- End of Section --

SECTION 09 84 20

ACOUSTICAL WALL PANELS

**08/16**

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)

AATCC 16 (2004; E 2008; E 2010) Colorfastness to Light

ASTM INTERNATIONAL (ASTM)

ASTM C423 (2009a) Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method

ASTM D5034 (2009; R 2017) Standard Test Method for Breaking Strength and Elongation of Textile Fabrics (Grab Test)

ASTM E84 (2020) Standard Test Method for Surface Burning Characteristics of Building Materials

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC (2018) International Building Code

1.2 SUBMITTALS

Approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29.05 20 SUSTAINABILITY REPORTING FOR DESIGN-BUILD. Submit the following in accordance with Section 01 33 00.05 20 CONSTRUCTION SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Approved Detail Drawings; G

SD-03 Product Data

Installation

Acoustical Wall Panels; G

Recycled Content for Wood Panels; S

Recycled Content for Fabric Panels; S

Indoor Air Quality for Composite Wood and Agrifiber Products; S

SD-04 Samples

Acoustical Wall Panels; G

SD-07 Certificates

Acoustical Wall Panels

Certified Sustainably Harvested Wood; S

SD-11 Closeout Submittals

Warranty

### 1.3 DELIVERY, STORAGE, AND HANDLING

Protect materials delivered and placed in storage from the weather, humidity and temperature variations, dirt, dust, or other contaminants.

### 1.4 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a one year period.

## PART 2 PRODUCTS

### 2.1 SYSTEM DESCRIPTION

#### 2.1.1 Design

Provide fabric wrapped mineral / glass-fiber core acoustical wall panel materials in the manufacturer's standard sizes and finishes of the type, design and configuration indicated.

### 2.2 FABRIC COVERED ACOUSTICAL WALL PANELS

Provide acoustical wall panels consisting of prefinished, factory assembled, seamless fabric covered, fiber glass or mineral fiber core system as described below manufactured to the dimensions and configurations shown on the [approved detail drawings](#); submit drawings showing plan locations, elevations and details of method of anchorage, location of doors and other openings, base detail and shape and thickness of materials. Perimeter edges must be reinforced by either an aluminum frame or a formulated resin edge hardener. Acoustical wall panels installed in non-sprinklered areas must comply with the requirements of [ICC IBC](#), Standard 42-2. Submit manufacturer's descriptive data and catalog cuts; fabric and vinyl swatches, minimum 18 inches wide by 24 inches long 3 samples of each color range specified; and certificates of compliance from an independent laboratory accredited by the National Laboratory Accreditation Program of the National Institute of Standards. A label or listing from the testing laboratory will be acceptable evidence of compliance. Wall panels must conform to the following:

2.2.1 Panel Width

Panel width must be as detailed in the IN-Series drawings.

2.2.2 Panel Height

Panel height must be as detailed in the IN-Series drawings.

2.2.3 Thickness

1" panel thickness or as required to meet the indicated NRC range.

2.2.4 Fabric Covering

Seamless [non-woven, embossed texture, needle punched 100 percent polyester, minimum 11 ounces/linear yard. Tear strength a minimum 25 pounds machine direction and minimum 40 pounds cross-machine direction. Tensile strength a minimum 50 pounds machine direction and minimum 75 pounds cross-machine direction in accordance with ASTM D5034.] [plain woven 2-ply 100 percent polyester, minimum 15 ounces/linear yard. Tear strength a minimum 29 pounds. Tensile strength 150 pounds minimum in accordance with ASTM D5034.] [perforated vinyl covering with fabric backing, minimum 20 ounces/linear yard total weight.] Stretch fabric covering free of wrinkles and then bond to the edges and back or bond directly to the panel face, edges, and back of panel a minimum distance standard with the manufacturer. Light fastness (fadeometer) approximately 40 hours in accordance with AATCC 16.

2.2.5 Fire Rating for the Complete Composite System

Class A, 200 or less smoke density and flame spread less than 25, when tested in accordance with ASTM E84.

2.2.6 Substrate

Fiber glass or mineral fiber

2.2.7 Noise Reduction Coefficient (NRC) Range

0.80-0.90 ASTM C423

2.2.8 Edge Detail

Square edge with fabric wrapped on all four sides.

2.2.9 Core Type

High impact acoustical core

2.2.10 Mounting Acoustical Panels

Mount acoustical panels by manufacturer's standard factory installed Z-Clips.

2.3 COLOR

As indicated in the IN-Series drawings.

2.4 Modular Architectural Panels - provide and install MAP1 where

indicated on drawings. Install per manufacturers instructions and per instructions on IN-Series basis of design schedule.

### PART 3 EXECUTION

#### 3.1 SURFACE CONDITIONS

mustshall be clean, smooth, oil free and prepared in accordance with panel manufacturer's instructions. Do not begin installation until all wet work, such as, plastering, painting, and concrete are completely dry.

#### 3.2 INSTALLATION

Panel installation must be by personnel familiar with and normally engaged in installation of acoustical wall panels. Apply panels in accordance with the manufacturer's installation instructions. Submit manufacturer's installation instructions and recommended cleaning instructions.

#### 3.3 CLEANING

Following installation, clean dirty or stained panel surfaces in accordance with manufacturer's instructions and leave free from defects. Remove and replace panels that are damaged, discolored, or improperly installed.

-- End of Section --



## SECTION 09 90 00

## PAINTS AND COATINGS

**02/21**

## PART 1 GENERAL

## 1.1 RELATED REQUIREMENTS

## 1.1.1 Painting Included

Where a space or surface is indicated to be painted, include the following unless indicated otherwise.

- a. Surfaces behind portable objects and surface mounted articles readily detachable by removal of fasteners, such as screws and bolts.
- b. New factory finished surfaces that require identification or color coding and factory finished surfaces that are damaged during performance of the work.
- c. Existing coated surfaces that are damaged during performance of the work.

## 1.1.1.1 Exterior Painting

Includes new surfaces[, existing coated surfaces,][ and ][existing uncoated surfaces,] of the building[s] and appurtenances. Also included are existing coated surfaces made bare by cleaning operations.

## 1.1.1.2 Interior Painting

Includes new surfaces[, existing uncoated surfaces,][ and ][existing coated surfaces] of the building[s] and appurtenances as indicated and existing coated surfaces made bare by cleaning operations. Where a space or surface is indicated to be painted, include the following items, unless indicated otherwise.

- a. Exposed columns, girders, beams, joists, and metal deck; and
- b. Other contiguous surfaces.

## 1.1.2 Painting Excluded

Do not paint the following unless indicated otherwise.

- a. Surfaces concealed and made inaccessible by panelboards, fixed ductwork, machinery, and equipment fixed in place.
- b. Surfaces in concealed spaces. Concealed spaces are defined as enclosed spaces above suspended ceilings, furred spaces, attic spaces, crawl spaces, elevator shafts and chases.
- c. Steel to be embedded in concrete.
- d. Copper, stainless steel, aluminum, anodized aluminum, brass, and lead except existing coated surfaces.

e. Hardware, fittings, and other factory finished items.

[ f. Do not paint surfaces in the following areas: [\_\_\_\_].

### ]1.1.3 Mechanical and Electrical Painting

Includes field coating of [interior][ and ][exterior] new[ and existing] surfaces.

a. Where a space or surface is indicated to be painted, include the following items unless indicated otherwise.

(1) Exposed piping, conduit, and ductwork;

(2) Supports, hangers, air grilles, and registers;

(3) Miscellaneous metalwork and insulation coverings.

[ b. Do not paint the following, unless indicated otherwise:

[ (1) New zinc-coated, aluminum, and copper surfaces under insulation

] [ (2) New aluminum jacket on piping

] [ (3) New interior ferrous piping under insulation.

### ]][1.1.3.1 Fire Extinguishing Sprinkler Systems

Clean, pretreat, prime, and paint new fire extinguishing sprinkler systems including valves, piping, conduit, hangers, supports, miscellaneous metalwork, and accessories. Apply coatings to clean, dry surfaces, using clean brushes.

### ]1.1.4 Exterior Painting of Site Work Items

Field coat the following items:

	New Surfaces	Existing Surfaces
a.		
b.		
c.		

### ]1.1.5 Miscellaneous Painting

#### 1.1.5.1 Lettering [Building ][Room Number(s)]

Provide lettering [as scheduled on the drawings][block][Gothic] type, [black enamel][water-type decalcomania, finished with a protective coating of spar varnish]. Samples must be approved before application.

#### [1.1.5.2 Obstructions To Aviation

Paint the following obstructions to aviation in the pattern and color prescribed by FAA AC 70/7460-1: [smokestacks][poles][buildings][\_\_\_\_]

## ]1.2 REFERENCES

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

## AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)

ACGIH 0100 (2017; Suppl 2020) Documentation of the Threshold Limit Values and Biological Exposure Indices

## ASME INTERNATIONAL (ASME)

ASME A13.1 (2020) Scheme for the Identification of Piping Systems

## ASTM INTERNATIONAL (ASTM)

ASTM C920 (2018) Standard Specification for Elastomeric Joint Sealants

ASTM D235 (2002; R 2012) Mineral Spirits (Petroleum Spirits) (Hydrocarbon Dry Cleaning Solvent)

ASTM D523 (2014; R 2018) Standard Test Method for Specular Gloss

ASTM D2824/D2824M (2018) Standard Specification for Aluminum-Pigmented Asphalt Roof Coatings, Non-Fibered, and Fibered without Asbestos

ASTM D4214 (2007; R 2015) Standard Test Method for Evaluating the Degree of Chalking of Exterior Paint Films

ASTM D4263 (1983; R 2018) Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method

ASTM D4444 (2013; R 2018) Standard Test Method for Laboratory Standardization and Calibration of Hand-Held Moisture Meters

ASTM D6386 (2016a) Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting

ASTM F1869 (2016a) Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride

## CENTERS FOR DISEASE CONTROL AND PREVENTION (CDC)

Intelligence Bulletin 65 (2013) Occupational Exposure to Carbon Nanotubes and Nanofibers

## MASTER PAINTERS INSTITUTE (MPI)

MPI 1	(2012) Aluminum Paint
MPI 2	(2012) Aluminum Heat Resistant Enamel (up to 427 C and 800 F
MPI 3	(2016) Primer, Alkali Resistant, Water Based
MPI 4	(2016) Interior/Exterior Latex Block Filler
MPI 5	(2015) Primer, Exterior Alkyd Wood
MPI 6	(2015) Primer, Exterior Latex Wood
MPI 8	(2016) Alkyd, Exterior Flat (MPI Gloss Level 1)
MPI 9	(2016) Alkyd, Exterior Gloss (MPI Gloss Level 6)
MPI 10	(2016) Latex, Exterior Flat (MPI Gloss Level 1)
MPI 11	(2016) Latex, Exterior Semi-Gloss, MPI Gloss Level 5
MPI 13	(2016) Stain, Exterior Solvent-Based, Semi-Transparent
MPI 16	(2016) Stain, Exterior, Water Based, Solid Hide
MPI 17	(2016) Primer, Bonding, Water Based
MPI 19	(2012) Primer, Zinc Rich, Inorganic
MPI 21	(2012) Heat Resistant Coating, (Up to 205°C/402°F), MPI Gloss Level 6
MPI 22	(2012) Aluminum Paint, High Heat (up to 590° C/1100° F)
MPI 23	(2015) Primer, Metal, Surface Tolerant
MPI 27	(2016) Floor Enamel, Alkyd, Gloss (MPI Gloss Level 6)
MPI 31	(2012) Varnish, Polyurethane, Moisture Cured, Gloss (MPI Gloss Level 6)
MPI 38	(2016) Elastomeric Coating, Exterior, Water Based, Non-Flat
MPI 39	(2018) Primer, Latex, for Interior Wood
MPI 42	(2012) Textured Coating, Latex, Flat

MPI 44	(2016) Latex, Interior, (MPI Gloss Level 2)
MPI 45	(2016) Primer Sealer, Interior Alkyd
MPI 46	(2016) Undercoat, Enamel, Interior
MPI 47	(2016) Alkyd, Interior, Semi-Gloss (MPI Gloss Level 5)
MPI 48	(2016) Alkyd, Interior, Gloss (MPI Gloss Level 6-7)
MPI 49	(2015) Alkyd, Interior, Flat (MPI Gloss Level 1)
MPI 50	(2015) Primer Sealer, Latex, Interior
MPI 51	(2016) Alkyd, Interior, (MPI Gloss Level 3)2
MPI 52	(2016) Latex, Interior, (MPI Gloss Level 3)
MPI 54	(2016) Latex, Interior, Semi-Gloss (MPI Gloss Level 5)
MPI 56	(2012) Varnish, Interior, Polyurethane, Oil Modified, Gloss
MPI 57	(2012) Varnish, Interior, Polyurethane, Oil Modified, Satin
MPI 59	(2016) Floor Paint, Alkyd, Low Gloss
MPI 60	(2016) Floor Paint, Latex, Low Gloss
MPI 68	(2016) Floor Paint, Latex, Gloss
MPI 71	(2012) Varnish, Polyurethane, Moisture Cured, Flat (MPI Gloss Level 1)
MPI 72	(2016) Polyurethane, Two-Component, Pigmented, Gloss (MPI Gloss Level 6-7)
MPI 76	(2016) Primer, Alkyd, Quick Dry, for Metal
MPI 77	(2015) Epoxy, Gloss
MPI 79	(2016) Primer, Alkyd, Anti-Corrosive for Metal
MPI 90	(2012) Stain, Semi-Transparent, for Interior Wood
MPI 94	(2016) Alkyd, Exterior, Semi-Gloss (MPI Gloss Level 5)
MPI 95	(2015) Primer, Quick Dry, for Aluminum
MPI 101	(2016) Primer, Epoxy, Anti-Corrosive, for

## Metal

MPI 107	(2016) Primer, Rust-Inhibitive, Water Based
MPI 108	(2015) Epoxy, High Build, Low Gloss
MPI 113	(2018) Elastomeric, Pigmented, Exterior, Water Based, Flat
MPI 116	(2012) Block Filler, Epoxy
MPI 119	(2016) Latex, Exterior, Gloss (MPI Gloss Level 6)
MPI 120	(2020) Epoxy, High Build, Self Priming, Low Gloss
MPI 134	(2015) Primer, Galvanized, Water Based
MPI 138	(2016) Latex, Interior, High Performance Architectural, (MPI Gloss Level 2)
MPI 139	(2016) Latex, Interior, High Performance Architectural, (MPI Gloss Level 3)
MPI 140	(2016) Latex, Interior, High Performance Architectural, (MPI Gloss Level 4)
MPI 141	(2016) Latex, Interior, High Performance Architectural, Semi-Gloss (MPI Gloss Level 5)
MPI 144	(2016) Latex, Interior, Institutional Low Odor/VOC, (MPI Gloss Level 2)
MPI 145	(2016) Latex, Interior, Institutional Low Odor/VOC, ( MPI Gloss Level 3)
MPI 146	(2016) Latex, Interior, Institutional Low Odor/VOC, (MPI Gloss Level 4)
MPI 147	(May 2016) Latex, Interior, Institutional Low Odor/VOC, Semi-Gloss (MPI Gloss Level 5)
MPI 149	(2016) Primer Sealer, Interior, Institutional Low Odor/VOC
MPI 151	(2016) Light Industrial Coating, Interior, Water Based (MPI Gloss Level 3)
MPI 153	(2016) Light Industrial Coating, Interior, Water Based, Semi-Gloss (MPI Gloss Level 5)
MPI 154	(2016) Light Industrial Coating, Interior, Water Based, Gloss (MPI Gloss Level 6)
MPI 161	(2016) Light Industrial Coating, Exterior, Water Based ( MPI Gloss Level 3)

MPI 163	(2016) Light Industrial Coating, Exterior, Water Based, Semi-Gloss (MPI Gloss Level 5)
MPI 164	(2016) Light Industrial Coating, Exterior, Water Based, Gloss (MPI Gloss Level 6)
MPI 177	(2020) Epoxy, Semi-Gloss (MPI Gloss Level 5)
MPI 214	(2016) Latex, Exterior (MPI Gloss Level 2)
MPI ASM	(2019) Architectural Painting Specification Manual
MPI GPS-1-14	(2014) Green Performance Standard GPS-1-14
MPI GPS-2-14	(2014) Green Performance Standard GPS-2-14
MPI MRM	(2015) Maintenance Repainting Manual

## SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC 7/NACE No.4	(2007) Brush-Off Blast Cleaning
SSPC Glossary	(2011) SSPC Protective Coatings Glossary
SSPC Guide 6	(2015) Guide for Containing Surface Preparation Debris Generated During Paint Removal Operations
SSPC Guide 7	(2015) Guide to the Disposal of Lead-Contaminated Surface Preparation Debris
SSPC PA 1	(2016) Shop, Field, and Maintenance Coating of Metals
SSPC QP 1	(2019) Standard Procedure for Evaluating the Qualifications of Industrial/Marine Painting Contractors (Field Application to Complex Industrial Steel Structures and Other Metal Components)
SSPC SP 1	(2015) Solvent Cleaning
SSPC SP 2	(2018) Hand Tool Cleaning
SSPC SP 3	(2018) Power Tool Cleaning
SSPC SP 6/NACE No.3	(2007) Commercial Blast Cleaning
SSPC SP 10/NACE No. 2	(2007) Near-White Blast Cleaning
SSPC VIS 1	(2002; E 2004) Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning
SSPC VIS 3	(2004) Guide and Reference Photographs for

	Steel Surfaces Prepared by Hand and Power Tool Cleaning
SSPC VIS 4/NACE VIS 7	(1998; E 2000; E 2004) Guide and Reference Photographs for Steel Surfaces Prepared by Waterjetting
SSPC-SP WJ-1/NACE WJ-1	(2012) Clean to Bare Substrate, Waterjet Cleaning of Metals
SSPC-SP WJ-2/NACE WJ-2	(2012) Very Thorough Cleaning, Waterjet Cleaning of Metals
SSPC-SP WJ-3/NACE WJ-3	(2012) Thorough Cleaning, Waterjet Cleaning of Metals
SSPC-SP WJ-4/NACE WJ-4	(2012) Light Cleaning, Waterjet Cleaning of Metals

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE AMS-STD-595A	(2017) Colors used in Government Procurement
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U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2014) Safety and Health Requirements Manual
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U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-PRF-680	(2010; Rev C; Notice 1 2015) Degreasing Solvent
MIL-STD-101	(2014; Rev C) Color Code for Pipelines and for Compressed Gas Cylinders

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA Method 24	(2000) Determination of Volatile Matter Content, Water Content, Density, Volume Solids, and Weight Solids of Surface Coatings
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U.S. FEDERAL AVIATION ADMINISTRATION (FAA)

FAA AC 70/7460-1	(2016; Rev L; Change 2) Obstruction Marking and Lighting
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U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FED-STD-313	(2018) Material Safety Data, Transportation Data and Disposal Data for Hazardous Materials Furnished to Government Activities
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U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.1000	Air Contaminants
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29 CFR 1910.1001 Asbestos

29 CFR 1910.1025 Lead

29 CFR 1926.62 Lead

### 1.3 DEFINITIONS

#### 1.3.1 Qualification Testing

Qualification testing is the performance of all test requirements listed in the product specification. This testing is accomplished by MPI to qualify each product for the MPI Approved Product List, and may also be accomplished by Contractor's third-party testing lab if an alternative to Batch Quality Conformance Testing by MPI is desired.

#### 1.3.2 Batch Quality Conformance Testing

Batch quality conformance testing determines that the product provided is the same as the product qualified to the appropriate product specification. This testing must be accomplished by an MPI testing lab.

#### 1.3.3 Coating

**SSPC Glossary**; (1) A liquid, liquefiable, or mastic composition that is converted to a solid protective, decorative, or functional adherent film after application as a thin layer; (2) Generic term for paint, lacquer, enamel.

#### 1.3.4 DFT or dft

Dry film thickness, the film thickness of the fully cured, dry paint or coating.

#### 1.3.5 DSD

Degree of Surface Degradation, the MPI system of defining degree of surface degradation. Five levels are generically defined under the Assessment sections in the **MPI MRM**, MPI Maintenance Repainting Manual.

#### 1.3.6 EXT

MPI short term designation for an exterior coating system.

#### 1.3.7 INT

MPI short term designation for an interior coating system.

#### 1.3.8 Loose Paint

Paint or coating that can be removed with a dull putty knife.

#### 1.3.9 mil / mils

The English measurement for 0.001 in or one one-thousandth of an inch.

## 1.3.10 MPI Gloss Levels

MPI system of defining gloss. Seven gloss levels (G1 to G7) are generically defined under the Evaluation sections of the MPI Manuals. Traditionally, Flat refers to G1/G2, Eggshell refers to G3, Semigloss refers to G5, and Gloss refers to G6.

Gloss levels are defined by MPI as follows:

Gloss Level	Description	Units at 60 degree angle	Units at 80 degree angle
G1	Matte or Flat	0 to 5	10 max
G2	Velvet	0 to 10	10 to 35
G3	Eggshell	10 to 25	10 to 35
G4	Satin	20 to 35	35 min
G5	Semi-Gloss	35 to 70	
G6	Gloss	70 to 85	
G7	High Gloss		

Gloss is tested in accordance with [ASTM D523](#). Historically, the Government has used Flat (G1 / G2), Eggshell (G3), Semi-Gloss (G5), and Gloss (G6).

## 1.3.11 MPI System Number

The MPI coating system number in each MPI Division found in either the MPI Architectural Painting Specification Manual or the Maintenance Repainting Manual and defined as an exterior (EXT/REX) or interior system (INT/RIN).

## 1.3.12 Paint

[SSPC Glossary](#); (1) Any pigmented liquid, liquefiable, or mastic composition designed for application to a substrate in a thin layer that is converted to an opaque solid film after application. Used for protection, decoration, identification, or to serve some other functional purposes; (2) Application of a coating material.

## 1.3.13 REX

MPI short term designation for an exterior coating system used in repainting projects or over existing coating systems.

## 1.3.14 RIN

MPI short term designation for an interior coating system used in repainting projects or over existing coating systems.

## 1.4 SCHEDULING

Allow paint, polyurethane, varnish, and wood stain installations to cure prior to the installation of materials that adsorb VOCs, including[ carpets,][ textiles,][ unprimed gypsum wallboard,][ acoustical ceiling

panels,][\_\_\_\_].

## 1.5 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

Samples of specified materials may be taken and tested for compliance with specification requirements.

### SD-02 Shop Drawings

Piping Identification

### SD-03 Product Data

Coating; G[, [\_\_\_\_]]

Product Data Sheets

Sealant

### SD-04 Samples

Color; G[, [\_\_\_\_]]

Textured Wall Coating System; G[, [\_\_\_\_]]

[ Sample Textured Wall Coating System Mock-Up; G[, [\_\_\_\_]]

### ] SD-07 Certificates

Qualification Testing laboratory for coatings; G[, [\_\_\_\_]]

Indoor Air Quality for Paints and Primers

[ Indoor Air Quality for Consolidated Latex Paints

### ] SD-08 Manufacturer's Instructions

Application Instructions

Mixing

Manufacturer's Safety Data Sheets

### SD-10 Operation and Maintenance Data

Coatings, Data Package 1; G[, [\_\_\_\_]]

## 1.6 QUALITY ASSURANCE

### 1.6.1 Regulatory Requirements

#### 1.6.1.1 Environmental Protection

In addition to requirements specified elsewhere for environmental protection, provide coating materials that conform to the restrictions of the local Air Pollution Control District and regional jurisdiction. Notify Contracting Officer of any paint specified herein which fails to conform.

#### 1.6.1.2 Lead Content

Do not use coatings having a lead content over 0.06 percent by weight of nonvolatile content.

#### 1.6.1.3 Chromate Content

Do not use coatings containing zinc-chromate or strontium-chromate.

#### 1.6.1.4 Asbestos Content

Provide asbestos-free materials.

#### 1.6.1.5 Mercury Content

Provide materials free of mercury or mercury compounds.

#### 1.6.1.6 Silica

Provide abrasive blast media containing no free crystalline silica.

#### 1.6.1.7 Human Carcinogens

Provide materials that do not contain ACGIH 0100 confirmed human carcinogens (A1) or suspected human carcinogens (A2).

#### 1.6.1.8 Carbon Based Fibers / Tubes

Materials must not contain carbon based fibers such as carbon nanotubes or carbon nanofibers. Intelligence Bulletin 65 ranks toxicity of carbon nanotubes on a par with asbestos.

### [1.6.2 Coating Contractor's Qualification

Submit the name, address, telephone number, and e-mail address of the Contractor that will be performing all surface preparation and coating application. Submit evidence that key personnel have successfully performed surface preparation and application of coatings on [\_\_\_\_\_] on a minimum of three similar projects within the past three years. List information by individual and include the following:

a. Name of individual and proposed position for this work.

b. Information about each previous assignment including:

Position or responsibility

Employer (if other than the Contractor)

Name of facility owner

Mailing address and telephone number of facility owner

Name of individual in facility owner's organization who can be contacted as a reference

Location, size and description of structure

Dates work was carried out

Description of work carried out on structure

#### ] [1.6.3 SSPC QP 1 Certification

Contractors that perform surface preparation or coating application on steel substrates must be certified by the Society for Protective Coatings (formerly Steel Structures Painting Council) (SSPC) to the requirements of **SSPC QP 1** prior to Contract award, and must remain certified while accomplishing any surface preparation or coating application. If a Contractor's certification expires, the firm will not be allowed to perform any work until the certification is reissued. Requests for extension of time for any delay to the completion of the project due to an inactive certification will not be considered. Notify the Contracting Officer of any change in Contractor certification status. Notify the Contracting Officer of all scheduled and unannounced on-site audits from SSPC and furnish a copy of all audit reports.

#### ] 1.6.4 Approved Products List

The current MPI, "Approved Product List" which lists paint by brand, label, product name and product code as of the date of Contract award, will be used to determine compliance with the submittal requirements of this specification. The Contractor may choose to use a subsequent MPI "Approved Product List", however, only one list may be used for the entire Contract and each coating system is to be from a single manufacturer. Provide all coats on a particular substrate from a single manufacturer. No variation from the MPI Approved Products List is acceptable.

#### 1.6.5 Paints and Coatings Indoor Air Quality Certifications

Provide paint and coating products certified to meet indoor air quality requirements by **MPI GPS-1-14**, **MPI GPS-2-14** or provide certification by other third-party programs. Provide current product certification documentation from certification body.

Provide certification of **Indoor Air Quality for Paints and Primers**.  
[Provide certification of **Indoor Air Quality for Consolidated Latex Paints**.]  
]Submit required indoor air quality certifications in one submittal package.

#### 1.6.6 Field Samples and Tests

The Contracting Officer may choose up to two coatings that have been delivered to the site to be tested at no cost to the Government. Take samples of each chosen product as specified in the paragraph SAMPLING

PROCEDURE. Test each chosen product as specified in the paragraph TESTING PROCEDURE. Remove products from the job site which do not conform, and replace with new products that conform to the referenced specification. Test replacement products that failed initial testing as specified in the paragraph TESTING PROCEDURE at no cost to the Government.

[ Another required testing is Batch Quality Conformance Testing to prove conformance of the manufacturer's paint to the specified MPI standard. This testing is accomplished before the materials are delivered to the job site. Provide testing for [\_\_\_\_\_] paint products. Test paint products as specified in the paragraph TESTING PROCEDURE.

]

#### 1.6.6.1 Sampling Procedure

Select paint at random from the products that have been delivered to the job site for sample testing. The Contractor must provide one quart samples of the selected paint materials. Take samples in the presence of the Contracting Officer, and label, and identify each sample. Provide labels in accordance with the paragraph PACKAGING, LABELING, AND STORAGE.

#### 1.6.6.2 Testing Procedure

Provide Batch Quality Conformance Testing for specified products, as defined by and performed by MPI. As an alternative to Batch Quality Conformance Testing, the Contractor may provide Qualification Testing for specified products above to the appropriate MPI product specification, using the third-party laboratory approved under the paragraph QUALIFICATION TESTING laboratory for coatings. Include the backup data and summary of the test results within the qualification testing lab report. Provide a summary listing of all the reference specification requirements and the result of each test. Clearly indicate in the summary whether the tested paint meets each test requirement. Note that Qualification Testing may take 4 to 6 weeks to perform, due to the extent of testing required.

Submit name, address, telephone number, FAX number, and e-mail address of the independent third party laboratory selected to perform testing of coating samples for compliance with specification requirements. Submit documentation that laboratory is regularly engaged in testing of paint samples for conformance with specifications, and that employees performing testing are qualified. If MPI is chosen to perform the Batch Quality Conformance testing, the above submittal information is not required, only a letter is required from the Contractor stating that MPI will perform the testing.

#### 1.6.7 Textured Wall Coating System

Three complete samples of each indicated type, pattern, and color of textured wall coating system applied to a panel of the same material as that on which the coating system will be applied in the work. Provide samples of wall coating systems minimum 5 by 7 inches and of sufficient size to show pattern repeat and texture.

#### [1.6.8 Sample Textured Wall Coating System Mock-Up

After coating samples are approved and prior to starting installation, provide a minimum 8 foot by 8 foot mock-up for each substrate and for each color and type of textured wall coating using the actual substrate materials. Use the approved mock-up samples as a standard of workmanship

for installation within the facility. Submit at least 48 hour advance written notice to the Contracting Officer's Representative prior to mock-up installation.

#### ]1.7 PACKAGING, LABELING, AND STORAGE

Provide paints in sealed containers that legibly show the Contract specification number, designation name, formula or specification number, batch number, color, quantity, date of manufacture, manufacturer's formulation number, manufacturer's directions including any warnings and special precautions, and name and address of manufacturer. Furnish pigmented paints in containers not larger than 5 gallons. Store paints and thinners in accordance with the manufacturer's written directions, and as a minimum, stored off the ground, under cover, with sufficient ventilation to prevent the buildup of flammable vapors, and at temperatures between 40 to 95 degrees F. Do not store paint, polyurethane, varnish, or wood stain products with materials that have a high capacity to absorb VOC emissions[, including [\_\_\_\_\_]]. Do not store paint, polyurethane, varnish, or wood stain products in occupied spaces.

#### 1.8 SAFETY AND HEALTH

Comply with applicable Federal, State, and local laws and regulations, and with the ACCIDENT PREVENTION PLAN, including the Activity Hazard Analysis as specified in Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS and in Appendix A of EM 385-1-1. Include in the Activity Hazard Analysis the potential impact of painting operations on painting personnel and on others involved in and adjacent to the work zone.

##### 1.8.1 Toxic Materials

To protect personnel from overexposure to toxic materials, conform to the most stringent guidance of:

- a. The applicable manufacturer's Safety Data Sheets (SDS) or local regulation.
- b. 29 CFR 1910.1000.
- c. ACGIH 0100, threshold limit values.
- [ d. The appropriate OSHA standard in 29 CFR 1910.1025 and 29 CFR 1926.62 for surface preparation on painted surfaces containing lead. Removal and disposal of coatings which contain lead is specified in Section 02 83 00 LEAD REMEDIATION. Additional guidance is given in SSPC Guide 6 and SSPC Guide 7. Refer to drawings for list of hazardous materials located on this project. Coordinate paint preparation activities with this specification section.
- ] e. The appropriate OSHA standards in 29 CFR 1910.1001 for surface preparation of painted surfaces containing asbestos. Removal and disposal of coatings which contain asbestos materials is specified in Section 02 82 00 ASBESTOS REMEDIATION. Refer to drawings for list of hazardous materials located on this project. Coordinate paint preparation activities with this specification section.
- ] Submit manufacturer's Safety Data Sheets for coatings, solvents, and other potentially hazardous materials, as defined in FED-STD-313.

## 1.9 ENVIRONMENTAL REQUIREMENTS

Comply, at minimum, with manufacturer recommendations for space ventilation during and after installation. [ Isolate area of application from rest of building when applying high-emission paints or coatings.]

## 1.9.1 Coatings

Do not apply coating when air or substrate conditions are:

- a. Less than 5 degrees F above dew point;
- b. Below 50 degrees F or over 95 degrees F, unless specifically pre-approved by the Contracting Officer and the product manufacturer. Do not, under any circumstances, violate the manufacturer's application recommendations.

## 1.9.2 Post-Application

Vacate space for as long as possible after application. Wait a minimum of 48 hours before occupying freshly painted rooms. Maintain one of the following ventilation conditions during the curing period, or for 72 hours after application:

- a. Supply 100 percent outside air 24 hours a day.
- b. Supply airflow at a rate of 6 air changes per hour, when outside temperatures are between 55 degrees F and 85 degrees F and humidity is between 30 percent and 60 percent.
- c. Supply airflow at a rate of 1.5 air changes per hour, when outside air conditions are not within the range stipulated above.

## PART 2 PRODUCTS

## 2.1 MATERIALS

Conform to the coating specifications and standards referenced in PART 3. Submit Product Data Sheets for specified coatings and solvents. Provide preprinted cleaning and maintenance instructions for all coating systems. Submit Manufacturer's Instructions on Mixing: Detailed mixing instructions, minimum and maximum application temperature and humidity, pot life, and curing and drying times between coats.

## [2.2 COLOR CODING FOR SHORE-TO SHIP UTILITY CONNECTIONS

Color Coding For Shore-To-Ship Utility Connections: Paint hose connection fittings and shut-off valves the designated color. In addition to color coding provide 2 inch high stenciled letters using black stencil paint, clearly designating service for each connection.

Color Coding for Shore-to-Ship		
Utility Connections		
Service	Color	SAE AMS-STD-595A No.



Color Coding for Shore-to-Ship		
Potable Water*	Blue	15044
Water Provided for Fire Protection**	Red	11105
Chilled Water	Striped Blue/White	15044 / 17886
Oily Waste Water	Striped Yellow/Black	13528 / 17038
Sewer	Gold	17043
Steam	White	17886
High Pressure Air	Gray	16081
Low Pressure Air	Tan	10324
Fuels	Yellow	13655
* This includes connections serving domestic functions.		
** This includes non-potable salt water or, at some locations, fresh water connections provided for fire protection (may also include flushing and cooling requirements). Note: This does not include waterfront fire hydrants.		

### ]2.3 COLOR SELECTION OF FINISH COATS

Provide colors of finish coats as indicated or specified. Allow Contracting Officer to select colors not indicated or specified. Manufacturers' names and color identification are used for the purpose of color identification only. Named products are acceptable for use only if they conform to specified requirements. Products of other manufacturers are acceptable if the colors are approximately the colors indicated and the product conforms to specified requirements.

Provide color, texture, and pattern of wall coating systems [as indicated][in accordance with Section 09 06 00 SCHEDULES FOR FINISHES] [\_\_\_\_\_]. Submit manufacturer's samples of paint colors. Cross reference color samples to color scheme as indicated. Submit color stencil codes. Tint each coat progressively darker to enable confirmation of the number of coats.

## PART 3 EXECUTION

### 3.1 PROTECTION OF AREAS AND SPACES NOT TO BE PAINTED

Prior to surface preparation and coating applications, remove, mask, or otherwise protect hardware, hardware accessories, machined surfaces, radiator covers, plates, lighting fixtures, public and private property, and other such items not to be coated that are in contact with surfaces to be coated. Following completion of painting, reinstall removed items by workmen skilled in the trades. Restore surfaces contaminated by coating materials, to original condition and repair damaged items.

### [3.2 REPUTTYING AND REGLAZING

Remove cracked, loose, and defective putty or glazing compound on glazed sash and provide new putty or glazing compound. Where defective putty or glazing compound constitutes 30 percent or more of the putty at any one light, remove the glass and putty or glazing compound and reset the glass. Remove putty or glazing compound without damaging sash or glass. Clean rabbets to bare wood or metal and prime prior to reglazing. Provide linseed oil putty for wood sash. Patch surfaces to provide smooth transition between existing and new surfaces. Finish putty or glazing compound to a neat and true bead. Allow glazing compound time to cure, in accordance with manufacturer's recommendation, prior to coating application. Allow putty to set one week prior to coating application.

### ] [3.3 RESEALING OF EXISTING EXTERIOR JOINTS

#### 3.3.1 Surface Condition

Begin with surfaces that are clean, dry to the touch, and free from frost and moisture; remove grease, oil, wax, lacquer, paint, defective backstop, or other foreign matter that would prevent or impair adhesion. Where adequate grooves have not been provided, clean out to a depth of 1/2 inch and grind to a minimum width of 1/4 inch without damage to adjoining work. Grinding is not required on metal surfaces.

#### 3.3.2 Backstops

In joints more than 1/2 inch deep, install glass fiber roving or neoprene, butyl, polyurethane, or polyethylene foams free of oil or other staining elements as recommended by sealant manufacturer. Provide backstop material compatible with sealant. Do not use oakum and other types of absorptive materials as backstops.

#### 3.3.3 Primer and Bond Breaker

Install the type recommended by the sealant manufacturer.

#### 3.3.4 Ambient Temperature

Between 38 degrees F and 95 degrees F when applying sealant.

#### 3.3.5 Exterior Sealant

For joints in vertical surfaces, provide ASTM C920, Type S or M, Grade NS, Class 25, Use NT. For joints in horizontal surfaces, provide ASTM C920, Type S or M, Grade P, Class 25, Use T. Color(s) will be selected by the Contracting Officer. Apply the sealant in accordance with the manufacturer's printed instructions. Force sealant into joints with sufficient pressure to fill the joints solidly. Apply sealant uniformly smooth and free of wrinkles.

#### 3.3.6 Cleaning

Immediately remove fresh sealant from adjacent areas using a solvent recommended by the sealant manufacturer. Upon completion of sealant application, remove remaining smears and stains and leave the work in a clean condition. Allow sealant time to cure, in accordance with manufacturer's recommendations, prior to coating.

### ]3.4 SURFACE PREPARATION

Remove dirt, splinters, loose particles, grease, oil, [ disintegrated coatings,] and other foreign matter and substances deleterious to coating performance as specified for each substrate before application of paint or surface treatments. Remove oil and grease prior to mechanical cleaning. Schedule cleaning so that dust and other contaminants will not fall on wet, newly painted surfaces. Spot-prime exposed ferrous metals such as nail heads on or in contact with surfaces to be painted with water-thinned paints, with a suitable corrosion-inhibitive primer capable of preventing flash rusting and compatible with the coating specified for the adjacent areas. Refer to [MPI ASM](#) and [MPI MRM](#) for additional more specific substrate preparation requirements.

#### [3.4.1 Additional Requirements for Preparation of Surfaces With Existing Coatings

Before application of coatings, perform the following on surfaces covered by soundly-adhered coatings, defined as those which cannot be removed with a putty knife:

- a. Test existing finishes for lead before sanding, scraping, or removing. If lead is present, refer to paragraph Toxic Materials.
- b. Wipe previously painted surfaces to receive solvent-based coatings, except stucco and similarly rough surfaces clean with a clean, dry cloth saturated with mineral spirits, [ASTM D235](#) or as specified in [MPI MRM](#). Wipe the surfaces dry with a clean, dry, lint free cloth. Wipe immediately preceding the application of the first coat of any coating, unless specified otherwise.
- c. Sand existing glossy surfaces to be painted to reduce gloss. Brush, and wipe clean with a damp cloth to remove dust.
- d. The requirements specified are minimum. Comply also with the [application instructions](#) of the paint manufacturer and specific surface preparation requirements as outlined in [MPI MRM](#) Exterior Surface Preparation and Interior Surface Preparation.
- e. Thoroughly clean previously painted surfaces[ specified to be repainted][ damaged during construction] of all grease, dirt, dust or other foreign matter.
- f. Remove blistering, cracking, flaking and peeling or otherwise deteriorated coatings.
- g. Remove chalk so that when tested in accordance with [ASTM D4214](#), the chalk resistance rating is no less than 8.
- h. Roughen slick surfaces. Repair damaged areas such as, but not limited to, nail holes, cracks, chips, and spalls with suitable material to match adjacent undamaged areas.
- i. Feather and sand smooth edges of chipped paint.
- j. Clean rusty metal surfaces in accordance with SSPC requirements. Use solvent, mechanical, or chemical cleaning methods to provide surfaces suitable for painting.

- k. Provide new, proposed coatings that are compatible with existing coatings.

#### ] [3.4.2 Existing Coated Surfaces with Minor Defects

[Sand, spackle, and treat minor defects to render them smooth. Minor defects are defined as scratches, nicks, cracks, gouges, spalls, alligatoring, chalking, and irregularities due to partial peeling of previous coatings.][ Remove chalking by sanding[ or blasting] so that when tested in accordance with [ASTM D4214](#), the chalk rating is not less than 8.]

#### ] [3.4.3 Removal of Existing Coatings

Remove existing coatings from the following surfaces:

- a. Surfaces containing large areas of minor defects;
- b. Surfaces containing more than 20 percent peeling area; and
- c. Surfaces designated by the Contracting Officer, such as surfaces where rust shows through existing coatings.

#### ] 3.4.4 Substrate Repair

- a. Repair substrate surface damaged during coating removal;
- b. Sand edges of adjacent soundly-adhered existing coatings so they are tapered as smooth as practical to areas involved with coating removal; and
- c. Clean and prime the substrate as specified.

### 3.5 PREPARATION OF METAL SURFACES

#### 3.5.1 Existing and New Ferrous Surfaces

- a. Ferrous Surfaces including Shop-coated Surfaces and Small Areas That Contain Rust, Mill Scale and Other Foreign Substances: [Solvent clean][ or ][detergent wash] in accordance with [SSPC SP 1](#) to remove oil and grease. Where shop coat is missing or damaged, clean according to [[SSPC SP 2](#), ][[SSPC SP 3](#), ][[SSPC SP 6/NACE No.3](#), ] or [[SSPC SP 10/NACE No. 2](#)]. [ Brush-off blast remaining surface in accordance with [SSPC 7/NACE No.4](#)]; [Water jetting to [SSPC-SP WJ-4/NACE WJ-4](#) may be used to remove loose coating and other loose materials. Use inhibitor as recommended by coating manufacturer to prevent premature rusting.] Protect shop-coated ferrous surfaces from corrosion by treating and touching up corroded areas immediately upon detection.
- b. Surfaces With More Than 20 Percent Rust, Mill Scale, and Other Foreign Substances: Clean entire surface in accordance with [[SSPC SP 6/NACE No.3](#) / [SSPC-SP WJ-3/NACE WJ-3](#)][[SSPC SP 10/NACE No. 2](#) / [SSPC-SP WJ-2/NACE WJ-2](#)].
- [ c. Metal Floor Surfaces to Receive Nonslip Coating: Clean in accordance with [[SSPC SP 10/NACE No. 2](#)][[SSPC-SP WJ-2/NACE WJ-2](#)].

## ]3.5.2 Final Ferrous Surface Condition:

## 3.5.2.1 Tool Cleaned Surfaces

Comply with SSPC SP 2 and SSPC SP 3. Use as a visual reference, photographs in SSPC VIS 3 for the appearance of cleaned surfaces.

## 3.5.2.2 Abrasive Blast Cleaned Surfaces

Comply with SSPC 7/NACE No.4, SSPC SP 6/NACE No.3, and SSPC SP 10/NACE No. 2. Use as a visual reference, photographs in SSPC VIS 1 for the appearance of cleaned surfaces.

## 3.5.2.3 Waterjet Cleaned Surfaces

Comply with SSPC-SP WJ-1/NACE WJ-1, SSPC-SP WJ-2/NACE WJ-2, SSPC-SP WJ-3/NACE WJ-3 or SSPC-SP WJ-4/NACE WJ-4. Use as a visual reference, photographs in SSPC VIS 4/NACE VIS 7 for the appearance of cleaned surfaces.

## 3.5.3 Galvanized Surfaces

- a. New or Existing Galvanized Surfaces With Only Dirt and Zinc Oxidation Products: Clean with [solvent, ][steam, ][or ][non-alkaline detergent solution ]in accordance with SSPC SP 1. Completely remove coating by brush-off abrasive blast if the galvanized metal has been passivated or stabilized. Do not "passivate" or "stabilize" new galvanized steel to be coated. If the absence of hexavalent stain inhibitors is not documented, test as described in ASTM D6386, Appendix X2, and remove by one of the methods described therein.
- b. Galvanized with Slight Coating Deterioration or with Little or No Rusting: Water jetting to SSPC-SP WJ-3/NACE WJ-3 to remove loose coating from surfaces with less than 20 percent coating deterioration and no blistering, peeling, or cracking. Use inhibitor as recommended by the coating manufacturer to prevent rusting.
- c. Galvanized With Severe Deteriorated Coating or Severe Rusting: [Water jet to SSPC-SP WJ-3/NACE WJ-3 degree of cleanliness.][ Spot abrasive blast rusted areas as described for steel in SSPC SP 6/NACE No.3, and waterjet to SSPC-SP WJ-3/NACE WJ-3 to remove existing coating.]

## 3.5.4 Non-Ferrous Metallic Surfaces

Aluminum and aluminum-alloy, lead, copper, and other nonferrous metal surfaces.

Surface Cleaning: Solvent clean in accordance with SSPC SP 1 and wash with mild non-alkaline detergent to remove dirt and water soluble contaminants.

## 3.5.5 Terne-Coated Metal Surfaces

Solvent clean surfaces with mineral spirits, ASTM D235. Wipe dry with clean, dry cloths.

## 3.5.6 Existing Surfaces with a Bituminous or Mastic-Type Coating

Remove chalk, mildew, and other loose material by washing with a solution

of 1/2 cup trisodium phosphate, 1/4 cup household detergent, one quart 5 percent sodium hypochlorite solution and 3 quarts of warm water.

### 3.6 PREPARATION OF CONCRETE AND CEMENTITIOUS SURFACE

#### 3.6.1 Concrete and Masonry

- a. Curing: Allow concrete, stucco and masonry surfaces to cure at least 30 days before painting, and concrete slab on grade to cure at least 90 days before painting.
- b. Surface Cleaning: Remove the following deleterious substances.
  - (1) Dirt, [ Chalking,] Grease, and Oil: Wash new[ and existing uncoated] surfaces with a solution composed of 1/2 cup trisodium phosphate, 1/4 cup household detergent, and 4 quarts of warm water. Then rinse thoroughly with fresh water.[ Wash existing coated surfaces with a suitable detergent and rinse thoroughly.] For large areas, water blasting may be used.
  - (2) Fungus and Mold: Wash [new][, existing coated,] [and existing uncoated] surfaces with a solution composed of 1/2 cup trisodium phosphate, 1/4 cup household detergent, one quart 5 percent sodium hypochlorite solution and 3 quarts of warm water. Rinse thoroughly with fresh water.
  - (3) Paint and Loose Particles: Remove by wire brushing.
  - (4) Efflorescence: Remove by scraping or wire brushing followed by washing with a 5 to 10 percent by weight aqueous solution of hydrochloric (muriatic) acid. Do not allow acid to remain on the surface for more than five minutes before rinsing with fresh water. Do not acid clean more than 4 square feet of surface, per workman, at one time.
  - [ (5) Removal of Existing Coatings: For surfaces to receive textured coating MPI 42, remove existing coatings including soundly adhered coatings if recommended by textured coating manufacturer.
- ] c. Cosmetic Repair of Minor Defects: Repair or fill mortar joints and minor defects, including but not limited to spalls, in accordance with manufacturer's recommendations and prior to coating application.
- d. Allowable Moisture Content: Latex coatings may be applied to damp surfaces, but not to surfaces with droplets of water. Do not apply epoxies to damp vertical surfaces as determined by ASTM D4263 or horizontal surfaces that exceed 3 lbs of moisture per 1000 square feet in 24 hours as determined by ASTM F1869. In all cases follow manufacturer's recommendations. Allow surfaces to cure a minimum of 30 days before painting.

#### 3.6.2 Gypsum Board, Plaster, and Stucco

##### 3.6.2.1 Surface Cleaning

Verify that plaster and stucco surfaces are free from loose matter and that gypsum board is dry. Remove loose dirt and dust by brushing with a soft brush, rubbing with a dry cloth, or vacuum-cleaning prior to application of the first coat material. A damp cloth or sponge may be

used if paint is water-based.

### 3.6.2.2 Repair of Minor Defects

Prior to painting, repair joints, cracks, holes, surface irregularities, and other minor defects with patching plaster or spackling compound and sand smooth.

### 3.6.2.3 Allowable Moisture Content

Latex coatings may be applied to damp surfaces, but not surfaces with droplets of water. Do not apply epoxies to damp surfaces as determined by [ASTM D4263](#). Verify that new plaster to be coated has a maximum moisture content of 8 percent, when measured in accordance with [ASTM D4444](#), Method A, unless otherwise authorized. In addition to moisture content requirements, allow new plaster to age a minimum of 30 days before preparation for painting.

### [3.6.3 Existing Asbestos Cement Surfaces

Remove oily stains by solvent cleaning with mineral spirits in accordance with [MIL-PRF-680](#) or [ASTM D235](#). Remove loose dirt, dust, and other deleterious substances by brushing with a soft brush or rubbing with a dry cloth prior to application of the first coat material. Do not wire brush or clean using other abrasive methods. Verify surfaces are dry and clean prior to application of the coating.

## ] [3.7 PREPARATION OF WOOD AND PLYWOOD SURFACES

### 3.7.1 New[, Existing Uncoated,][ and][ Existing Coated] Plywood and Wood Surfaces, Except Floors:

- a. Surface Cleaning: Clean wood surfaces of foreign matter. Verify that surfaces are free from dust and other deleterious substances and in a condition approved by the Contracting Officer prior to receiving paint or other finish. Do not use water to clean uncoated wood.[ Scrape to remove loose coatings. Lightly sand to roughen the entire area of previously enamel-coated wood surfaces.]
- [ b. Removal of Fungus and Mold: Wash existing coated surfaces with a solution composed of 3 ounces (2/3 cup) trisodium phosphate, one ounce (1/3 cup) household detergent, one quart 5 percent sodium hypochlorite solution and 3 quarts of warm water. Rinse thoroughly with fresh water.
- ] c. Do not exceed 12 percent moisture content of the wood as measured by a moisture meter in accordance with [ASTM D4444](#), Method A, unless otherwise authorized.
- d. Prime or touch up wood surfaces adjacent to surfaces to receive water-thinned paints before applying water-thinned paints.
- e. Cracks and Nailheads: Set and putty stop nailheads and putty cracks after the prime coat has dried.
- f. Cosmetic Repair of Minor Defects:
  - (1) Knots and Resinous Wood[ and Fire, Smoke, Water, and Color Marker Stained Existing Coated Surface]: Prior to application of

coating, cover knots and stains with two or more coats of 3-pound-cut shellac varnish, plasticized with 5 ounces of castor oil per gallon. Scrape away existing coatings from knotty areas, and sand before treating. Prime before applying any putty over shellacked area.

(2) Open Joints and Other Openings: Fill with whiting putty, linseed oil putty. Sand smooth after putty has dried.

(3) Checking: Where checking of the wood is present, sand the surface, wipe and apply a coat of pigmented orange shellac. Allow to dry before paint is applied.

g. Prime Coat For New Exterior Surfaces: Prime coat [wood doors, ][windows, ][frames, ][and ][trim] before wood becomes dirty, warped[ or weathered].

### 3.7.2 Wood Floor Surfaces, Natural Finish

a. Initial Surface Cleaning: As specified in Article SURFACE PREPARATION.

[ b. Existing Loose Boards and Shoe Molding: Before sanding, renail loose boards. Countersink nails and fill with an approved wood filler. Remove shoe molding before sanding and reinstall after completing other work. At Contractor's option, new shoe molding may be provided in lieu of reinstalling old. Provide new wood molding of the same size, wood species, and finish as the existing.

] c. Sanding and Scraping: Sanding of wood floors is specified in Section [ 09 64 29 WOOD STRIP AND PLANK FLOORING] [09 64 23 WOOD PARQUET FLOORING] [09 64 66 WOOD ATHLETIC FLOORING] [09 64 00 PORTABLE (DEMOUNTABLE) WOOD FLOORING]. Fill floors of oak or similar open-grain wood with wood filler recommended by the finish manufacturer and the excess filler removed.

d. Final Cleaning: After sanding, sweep and vacuum floors clean. Do not walk on floors thereafter until specified sealer has been applied and is dry.

### 3.7.3 Interior Wood Surfaces, Stain Finish

Sand interior wood surfaces to receive stain. Fill oak and other open-grain wood to receive stain with a coat of wood filler not less than 8 hours before the application of stain; remove excess filler and sand the surface smooth.

### 3.7.4 Water Blasting of Existing Coated Wood Surfaces:

Provide water blasting for the following surfaces: [\_\_\_\_\_].

a. Sample Panel: Prior to the initial surface cleaning, water blast a representative surface designated by the Contracting Officer. Provide surface cleaning of the remaining work to match the sample panel approved by the Contracting Officer.

b. Initial Surface Cleaning: Water blast surfaces to receive paint with a high pressure spray, to remove loose paint, dirt, and other foreign or deleterious materials. Provide working pressure less than 2500 pounds per square inch gage (psig). Do not flood vents or damage



windows and floors. If the pressure specified will cause damage to existing wood, advise the Contracting Officer and obtain permission to vary the pressure. Direct the wash nozzle at the surface at an angle of approximately 75 degrees with the surface and at a distance not greater than 5 feet to apply water pressure required to remove loose paint, dirt, chalking, and other foreign matter.

- c. Final Surface Cleaning: After allowing the surfaces to dry for a minimum of 24 hours, remove remaining dirt, splinters, loose particles, disintegrated and loose paint, grease, oil, and other foreign matter from the surface.

### ]3.8 APPLICATION

#### 3.8.1 Coating Application

- a. Comply with applicable federal, state and local laws enacted to ensure compliance with Federal Clean Air Standards. Apply coating materials in accordance with SSPC PA 1. SSPC PA 1 methods are applicable to all substrates, except as modified herein.
- b. At the time of application, paint must show no signs of deterioration. Maintain uniform suspension of pigments during application.
- c. Unless otherwise specified or recommended by the paint manufacturer, paint may be applied by brush, roller, or spray. Use trigger operated spray nozzles for water hoses. Use rollers for applying paints and enamels of a type designed for the coating to be applied and the surface to be coated. Wear protective clothing and respirators when applying oil-based paints or using spray equipment with any paints.
- d. Only apply paints, except water-thinned types, to surfaces that are completely free of moisture as determined by sight or touch.
- e. Thoroughly work coating materials into joints, crevices, and open spaces. Pay special attention to ensure that all edges, corners, crevices, welds, and rivets receive a film thickness equal to that of adjacent painted surfaces.
- f. Apply each coat of paint so that dry film is of uniform thickness and free from runs, drops, ridges, waves, pinholes or other voids, laps, brush marks, and variations in color, texture, and finish. Completely hide all blemishes.
- g. Touch up damaged coatings before applying subsequent coats.[ Broom clean and clear dust from interior areas before and during the application of coating material.]
- [ h. Apply paint to new fire extinguishing sprinkler systems including valves, piping, conduit, hangers, supports, miscellaneous metal work, and accessories. Shield sprinkler heads with protective coverings while painting is in progress. Remove sprinkler heads which have been painted and replace with new sprinkler heads. Unfinished spaces include attic spaces, spaces above suspended ceilings, crawl spaces, pipe chases, mechanical equipment room, and space where walls or ceiling are not painted or not constructed of a prefinished material. Upon completion of painting, remove protective covering from sprinkler heads.

- i. Piping in Unfinished Areas: Provide primed surfaces with one coat of red alkyd gloss enamel (MPI 9) applied to a minimum dry film thickness of 1.0 mil in attic spaces, spaces above suspended ceilings, crawl spaces, pipe chases, mechanical equipment room, and spaces where walls or ceiling are not painted or not constructed of a prefinished material.
- j. Piping in Finished Areas: Provide primed surfaces with two coats of paint to match adjacent surfaces, except provide valves and operating accessories with one coat of red alkyd gloss enamel (MPI 9) applied to a minimum dry film thickness of 1.0 mil or two component gloss polyurethane (MPI 72) in exterior applications.
- k. Provide labeling on the surfaces of all feed and cross mains to show the pipe function such as "Sprinkler System", "Fire Department Connection", "Standpipe". For pipe sizes 4-inch and larger provide white painted stenciled letters and arrows, a minimum of 2 in in height and visible from at least two sides when viewed from the floor. For pipe sizes less than 4-inch, provide white painted stenciled letters and arrows, a minimum of 0.75 in in height and visible from the floor.
- l. All fire suppression system valves must be marked with permanent tags indicating normally open or normally closed.
- ] m. Drying Time: Allow time between coats, as recommended by the coating manufacturer, to permit thorough drying, but not to present topcoat adhesion problems. Provide each coat in specified condition to receive next coat.
- n. Primers, and Intermediate Coats: Do not allow primers or intermediate coats to dry more than 30 days, or longer than recommended by manufacturer, before applying subsequent coats. Follow manufacturer's recommendations for surface preparation if primers or intermediate coats are allowed to dry longer than recommended by manufacturers of subsequent coatings. Cover each preceding coat or surface completely by ensuring visually perceptible difference in shades of successive coats.
- o. Finished Surfaces: Provide finished surfaces free from runs, drops, ridges, waves, laps, brush marks, and variations in colors.
- p. Thermosetting Paints: Apply topcoats over thermosetting paints (epoxies and urethanes) within the overcoat window recommended by the manufacturer.
- q. Floors: [For nonslip surfacing on level floors, as the intermediate coat is applied, cover wet surface completely with almandite garnet, Grit No. 36, with maximum passing U.S. Standard Sieve No. 40 less than 0.5 percent. When the coating is dry, use a soft bristle broom to sweep up excess grit, which may be reused, and vacuum up remaining residue before application of the topcoat.][For nonslip surfacing on ramps, provide MPI 77 with non-skid additive, applied by roller in accordance with manufacturer's instructions.]

### 3.8.2 Mixing and Thinning of Paints

Reduce paints to proper consistency by adding fresh paint, except when

thinning is mandatory to suit surface, temperature, weather conditions, application methods, or for the type of paint being used. Obtain written permission from the Contracting Officer to use thinners. Verify that the written permission includes quantities and types of thinners to use.

When thinning is allowed, thin paints immediately prior to application with not more than one pint of suitable thinner per gallon. The use of thinner does not relieve the Contractor from obtaining complete hiding, full film thickness, or required gloss. Thinning cannot cause the paint to exceed limits on volatile organic compounds. Do not mix paints of different manufacturers.

### 3.8.3 Two-Component Systems

Mix two-component systems in accordance with manufacturer's instructions. Follow recommendation by the manufacturer for any thinning of the first coat to ensure proper penetration and sealing for each type of substrate.

### 3.8.4 Coating Systems

- a. Systems by Substrates: Apply coatings that conform to the respective specifications listed in the following Tables:

Table for Exterior Applications	
MPI Division	Substrate Application
MPI Division 3	Exterior Concrete Paint Table
MPI Division 4	Exterior Concrete Masonry Units Paint Table
MPI Division 5	Exterior Metal, Ferrous and Non-Ferrous Paint Table
MPI Division 6	Exterior Wood; Dressed Lumber, Paneling, Decking, Shingles Paint Table
MPI Division 9	Exterior Stucco Paint Table
MPI Division 10	Exterior Cloth Coverings and Bituminous Coated Surfaces Paint Table

Table for Interior Applications	
MPI Division	Substrate Application
MPI Division 3	Interior Concrete Paint Table
MPI Division 4	Interior Concrete Masonry Units Paint Table
MPI Division 5	Interior Metal, Ferrous and Non-Ferrous Paint Table
MPI Division 6	Interior Wood Paint Table

Table for Interior Applications	
MPI Division 9	Interior Plaster, Gypsum Board, Textured Surfaces Paint Table

- b. Minimum Dry Film Thickness (DFT): Apply paints, primers, varnishes, enamels, undercoats, and other coatings to a minimum dry film thickness of 1.5 mil each coat unless specified otherwise in the Tables. Coating thickness, where specified, refers to the minimum dry film thickness.
- c. Coatings for Surfaces Not Specified Otherwise: Coat unspecified surfaces the same as surfaces having similar conditions of exposure.
- d. Existing Surfaces Damaged During Performance of the Work, Including New Patches In Existing Surfaces: Coat surfaces with the following:
  - (1) One coat of primer.
  - (2) One coat of undercoat or intermediate coat.
  - (3) One topcoat to match adjacent surfaces.
- e. Existing Coated Surfaces To Be Painted: Apply coatings conforming to the respective specifications listed in the Tables herein, except that pretreatments, sealers and fillers need not be provided on surfaces where existing coatings are soundly adhered and in good condition. Do not omit undercoats or primers.

### 3.9 COATING SYSTEMS FOR METAL

Apply coatings of Tables in MPI Division 5 for Exterior and Interior.

- a. Apply specified ferrous metal primer to steel surfaces on the same day that surface is cleaned, to surfaces that meet all specified surface preparation requirements at time of application.
- b. Inaccessible Surfaces: Prior to erection, use one coat of specified primer on metal surfaces that will be inaccessible after erection.
- c. Shop-primed Surfaces: Touch up exposed substrates and damaged coatings to protect from rusting prior to applying field primer.
- d. Surface Previously Coated with Epoxy or Urethane: Apply MPI 101, 1.5 mils DFT immediately prior to application of epoxy or urethane coatings.
- e. Pipes and Tubing: The semitransparent film applied to some pipes and tubing at the mill is not to be considered a shop coat. Overcoat these items with the specified ferrous-metal primer prior to application of finish coats.
- f. Exposed Nails, Screws, Fasteners, and Miscellaneous Ferrous Surfaces. On surfaces to be coated with water thinned coatings, spot prime exposed nails and other ferrous metal with latex primer MPI 107.

## 3.10 COATING SYSTEMS FOR CONCRETE AND CEMENTITIOUS SUBSTRATES

Apply coatings of Tables in MPI Division 3, 4 and 9 for Exterior and Interior.

## 3.11 COATING SYSTEMS FOR WOOD AND PLYWOOD

a. Apply coatings of Tables in MPI Division 6 for Exterior and Interior.

b. Prior to erection, apply two coats of specified primer to treat and prime wood[ and plywood] surfaces which will be inaccessible after erection.

c. Apply stains in accordance with manufacturer's printed instructions.

[ d. Wood Floors to Receive Natural Finish: Thin first coat 2 to 1 using thinner recommended by coating manufacturer. Apply all coatings at rate of 300 to 350 square feet per gallon. Apply second coat not less than 2 hours and not over 24 hours after first coat has been applied. Apply with lamb's wool applicators or roller as recommended by coating manufacturer. Buff or lightly sand between intermediate coats as recommended by coating manufacturer's printed instructions.

## ]3.12 PIPING IDENTIFICATION

Piping Identification, Including Surfaces In Concealed Spaces: Provide in accordance with [MIL-STD-101][ASME A13.1]. Place stenciling in clearly visible locations. On piping not covered by [MIL-STD-101][ASME A13.1], stencil approved names or code letters, in letters a minimum of 1/2 inch high for piping and a minimum of 2 inches high elsewhere. Stencil arrow-shaped markings on piping to indicate direction of flow using black stencil paint.

## 3.13 INSPECTION AND ACCEPTANCE

In addition to meeting previously specified requirements, demonstrate mobility of moving components, including swinging and sliding doors, cabinets, and windows with operable sash, for inspection by the Contracting Officer. Perform this demonstration after appropriate curing and drying times of coatings have elapsed and prior to invoicing for final payment.

## 3.14 WASTE MANAGEMENT

As specified in the Waste Management Plan and as follows. Do not use kerosene or any such organic solvents to clean up water based paints. Properly dispose of paints or solvents in designated containers. Close and seal partially used containers of paint to maintain quality as necessary for reuse. Store in protected, well-ventilated, fire-safe area at moderate temperature. Place materials defined as hazardous or toxic waste in designated containers.[ Coordinate with manufacturer for take-back program. Set aside scrap to be returned to manufacturer for recycling into new product. When such a service is not available, contact local recyclers to reclaim the materials.][ Set aside extra paint for future color matches or reuse by the Government.][ Where local options exist for leftover paint recycling, collect all waste paint by type and provide for delivery to recycling or collection facility for reuse by local organizations.]

## 3.15 PAINT TABLES

All DFT's are minimum values.[ Use only materials with a MPI GPS-1-14 green check mark having a minimum MPI "Environmentally Friendly" [E1] [E2] [E3] rating based on VOC (EPA Method 24) content levels.] Acceptable products are listed in the MPI Green Approved Products List, available at <http://www.specifygreen.com/APL/ProductIdxByMPInum.asp>.

## 3.15.1 Exterior Paint Tables

## 3.15.1.1 MPI Division 3: Exterior Concrete Paint Table

## A. Concrete; Vertical Surfaces, Undersides of Balconies and Soffits

(1) [New and uncoated existing][ and ][Existing, previously painted] concrete; vertical surfaces, including undersides of balconies and soffits but excluding tops of slabs

Latex					
New and uncoated existing	Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
MPI EXT 3.1A-G1 (Flat)	MPI REX 3.1A-G1 (Flat)	MPI 3	MPI 10	MPI 10	3.5 mils
MPI EXT 3.1A-G2 (Velvet)	MPI REX 3.1A-G2 (Velvet)	MPI 3	MPI 214	MPI 214	3.5 mils
MPI EXT 3.1A-G5 (Semigloss)	MPI REX 3.1A-G5 (Semigloss)	MPI 3	MPI 11	MPI 11	3.5 mils
MPI EXT 3.1A-G6 (Gloss)	MPI REX 3.1A-G6 (Gloss)	MPI 3	MPI 119	MPI 119	3.5 mils
Primer as recommended by manufacturer. Topcoat: Coating to match adjacent surfaces.					

(2) [New and uncoated existing][ and ][Existing, previously painted] concrete, textured system; vertical surfaces, including undersides of balconies and soffits but excluding tops of slabs

Latex Aggregate					
New and uncoated existing	Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
MPI EXT 3.1B-G2 (Flat)	MPI REX 3.1A-G1 (Flat)	MPI 42	MPI 10	MPI 10	N/A
MPI EXT 3.1B-G5 (Semigloss)	MPI REX 3.1A-G5 (Semigloss)	MPI 42	MPI 11	MPI 11	N/A

MPI EXT 3.1B-G6 (Gloss)	MPI REX 3.1A-G6 (Gloss)	MPI 42	MPI 119	MPI 119	N/A
Texture - [Fine] [Medium] [Coarse]. Surface preparation and number of coats in accordance with manufacturer's instructions. Topcoat: Coating to match adjacent surfaces.					

(3) [New and uncoated existing][ and ][Existing, previously painted] concrete, elastomeric system; vertical surfaces, including undersides of balconies and soffits but excluding tops of slabs

Elastomeric Coating					
New and uncoated existing	Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
MPI EXT 3.1F-G1 (Flat)	MPI REX 3.1F-G1 (Flat)	Per Manufacturer	MPI 113	MPI 113	16 mils
MPI EXT 3.1F-G2/3 (Velvet)	MPI REX 3.1F-G2/3 (Velvet)	Per Manufacturer	MPI 38	MPI 38	16 mils
Primer as recommended by manufacturer. Topcoat: Coating to match adjacent surfaces. Surface preparation and number of coats in accordance with manufacturer's instructions. NOTE: Apply sufficient coats to achieve a minimum dry film thickness of 16 mils.					

#### B. Concrete; Swimming Pools

(1) [New and uncoated existing][ and ][Existing, previously painted] concrete: Walls and bottom of swimming pools

Swimming Pool Paint					
New and uncoated existing	Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
Per Manufacturer	Per Manufacturer	Per Manufacturer	Per Manufacturer	Per Manufacturer	Per Manufacturer
Primer as recommended by manufacturer. Surface preparation and number of coats in accordance with manufacturer's instructions.					

#### C. Cementitious Composition Board

(1) [New][ and ][Existing] Cementitious composition board (including

Asbestos cement board)

Latex					
New and uncoated existing	Existing	Primer	Intermediate	Topcoat	System DFT
MPI EXT 3.3A-G1 (Flat)	MPI REX 3.3A-G1 (Flat)	MPI 10	MPI 10	MPI 10	N/A
MPI EXT 3.3A-G5 (Semigloss)	MPI REX 3.3A-G5 (Semigloss)	MPI 11	MPI 11	MPI 11	N/A
MPI EXT 3.3A-G6 (Gloss)	MPI REX 3.3A-G6 (Gloss)	MPI 119	MPI 119	MPI 119	N/A
Topcoat: Coating to match adjacent surfaces.					

## 3.15.1.2 MPI Division 4: Exterior Concrete Masonry Units Paint Table

A. [New][ and ][Existing] concrete masonry on uncoated surface

Latex						
New	Existing	Block Filler	Primer	Intermediate	Topcoat	System DFT
MPI EXT 4.2A-G1 (Flat)	MPI REX 4.2A-G1 (Flat)	MPI 4	N/A	MPI 10	MPI 10	11 mils
MPI EXT 4.2A-G5 (Semigloss)	MPI REX 4.2A-G5 (Semigloss)	MPI 4	N/A	MPI 11	MPI 11	11 mils
MPI EXT 4.2A-G6 (Gloss)	MPI REX 4.2A-G6 (Gloss)	MPI 4	N/A	MPI 119	MPI 119	11 mils
Topcoat: Coating to match adjacent surfaces.						

B. [New][ and ][Existing] concrete masonry, textured system; on uncoated surface

Latex Aggregate					
New	Existing	Primer	Intermediate	Topcoat	System DFT
MPI EXT 4.2B-G1 (Flat)	MPI REX 3.1A-G1 (Flat)	MPI 42	MPI 42	MPI 10	N/A
MPI EXT 4.2B-G5 (Semigloss)	MPI REX 3.1A-G5 (Semigloss)	MPI 42	MPI 42	MPI 11	N/A



MPI EXT 4.2B-G6 (Gloss)	MPI REX 3.1A-G6 (Gloss)	MPI 42	MPI 42	MPI 119	N/A
Texture - [Fine] [Medium] [Coarse]. Surface preparation and number of coats in accordance with manufacturer's instructions. Topcoat: Coating to match adjacent surfaces.					

C. [New][ and ][Existing] concrete masonry, elastomeric system; on uncoated surfaces

Elastomeric Coating					
New and uncoated existing	Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
MPI EXT 3.1F-G1 (Flat)	MPI REX 3.1F-G1 (Flat)	Per Manufacture	MPI 113	MPI 113	16 mils
Primer as recommended by manufacturer. Topcoat: Coating to match adjacent surfaces. Surface preparation and number of coats in accordance with manufacturer's instructions. NOTE: Apply sufficient coats of MPI 113 to achieve a minimum dry film thickness of 16 mils.					

### 3.15.1.3 MPI Division 5: Exterior Metal, Ferrous and Non-Ferrous Paint Table

#### A. Steel / Ferrous Surfaces

(1) New Steel that has been hand or power tool cleaned to SSPC SP 2 or SSPC SP 3

Alkyd					
New	Existing, uncoated	Primer	Intermediate	Topcoat	System DFT
MPI EXT 5.1Q-G5 (Semigloss)	MPI REX 5.1D-G5 (Semigloss)	MPI 23	MPI 94	MPI 94	5.25 mils
MPI EXT 5.1Q-G6 (Gloss)	MPI REX 5.1D-G6 (Gloss)	MPI 23	MPI 9	MPI 9	5.25 mils
Topcoat: Coating to match adjacent surfaces.					

(2) New Steel that has been blast-cleaned to SSPC SP 6/NACE No.3

Alkyd					
New	Existing, uncoated	Primer	Intermediate	Topcoat	System DFT

MPI EXT 5.1D-G5 (Semigloss)	MPI REX 5.1D-G5 (Semigloss)	MPI 79	MPI 94	MPI 94	5.25 mils
MPI EXT 5.1D-G6 (Gloss)	MPI REX 5.1D-G6 (Gloss)	MPI 79	MPI 9	MPI 9	5.25 mils
Topcoat: Coating to match adjacent surfaces.					

(3) Existing steel that has been spot-blasted to SSPC SP 6/NACE No.3

(a) Surface previously coated with alkyd or latex

Waterborne Light Industrial Coating				
Existing, previously coated with alkyd or latex	Primer	Intermediate	Topcoat	System DFT
MPI REX 5.1C-G5 (Semigloss)	MPI 79	MPI 163	MPI 163	5 mils
MPI REX 5.1C-G6 (Gloss)	MPI 79	MPI 164	MPI 164	5 mils
Topcoat: Coating to match adjacent surfaces.				

(b) Surfaces previously coated with epoxy

Waterborne Light Industrial Coating				
Existing, previously coated with epoxy	Primer	Intermediate	Topcoat	System DFT
MPI REX 5.1L-G5 (Semigloss)	MPI 101	MPI 163	MPI 163	5 mils
MPI REX 5.1L-G6 (Gloss)	MPI 101	MPI 164	MPI 164	5 mils
Topcoat: Coating to match adjacent surfaces.				

Pigmented Polyurethane				
Existing, previously coated with epoxy	Primer	Intermediate	Topcoat	System DFT
MPI REX 5.1H-G6 (Gloss)	MPI 101	MPI 108	MPI 72	8.5 mils

Topcoat: Coating to match adjacent surfaces.

(4) New [and existing] steel blast cleaned to SSPC SP 10/NACE No. 2

Waterborne Light Industrial					
New	Existing	Primer	Intermediate	Topcoat	System DFT
MPI EXT 5.1R-G5 (Semigloss)	MPI EXT 5.1R-G5 (Semigloss)	MPI 101	MPI 108	MPI 163	8.5 mils
MPI EXT 5.1R-G6 (Gloss)	MPI EXT 5.1R-G6 (Gloss)	MPI 101	MPI 108	MPI 164	8.5 mils
Topcoat: Coating to match adjacent surfaces.					

Pigmented Polyurethane					
New	Existing	Primer	Intermediate	Topcoat	System DFT
MPI EXT 5.1J-G6 (Gloss)	MPI EXT 5.1J-G6 (Gloss)	MPI 101	MPI 108	MPI 72	8.5 mils
Topcoat: Coating to match adjacent surfaces.					

(5) Metal floors (non-shop-primed surfaces or non-slip deck surfaces) with non-skid additive (NSA), load at manufacturer's recommendations

Epoxy					
New	Existing	Primer	Intermediate	Topcoat	System DFT
MPI EXT 5.1S-G5 (Semi Gloss)	MPI EXT 5.1S-G5 (Semi Gloss)	MPI 120	MPI 177	MPI 177	5.25 mils
MPI EXT 5.1S-G6 (Gloss)	MPI EXT 5.1S-G6 (Gloss)	MPI 120	MPI 77	MPI 77	5.25 mils
Topcoat: Coating to match adjacent surfaces. Load Non-Skid Additive at manufacturer's recommendations.					

## B. Exterior Galvanized Surfaces

(1) New Galvanized surfaces

Waterborne Primer / Latex				
New Galvanized Surfaces	Primer	Intermediate	Topcoat	System DFT
MPI EXT 5.3H-G1 (Flat)	MPI 134	MPI 10	MPI 10	4.5 mils
EXT 5.3H-G5 (Semigloss)	MPI 134	MPI 11	MPI 11	4.5 mils
MPI EXT 5.3H-G6 (Gloss)	MPI 134	MPI 119	MPI 119	4.5 mils
Topcoat: Coating to match adjacent surfaces.				

Waterborne Primer / Waterborne Light Industrial Coating				
New Galvanized Surfaces	Primer	Intermediate	Topcoat	System DFT
MPI EXT 5.3J-G5 (Semigloss)	MPI 134	MPI 163	MPI 163	4.5 mils
MPI EXT 5.3J-G6 (Gloss)	MPI 134	MPI 164	MPI 164	4.5 mils
Topcoat: Coating to match adjacent surfaces.				

Epoxy Primer / Waterborne Light Industrial Coating				
New Galvanized Surfaces	Primer	Intermediate	Topcoat	System DFT
MPI EXT 5.3K-G5 (Semigloss)	MPI 101	MPI 163	MPI 163	5 mils
MPI EXT 5.3K-G6 (Gloss)	MPI 101	MPI 164	MPI 164	5 mils
Topcoat: Coating to match adjacent surfaces.				

Pigmented Polyurethane				
New Galvanized Surfaces	Primer	Intermediate	Topcoat	System DFT
MPI EXT 5.3L-G6 (Gloss)	MPI 101	N/A	MPI 72	5 mils

Topcoat: Coating to match adjacent surfaces.

- (2) Galvanized surfaces with slight coating deterioration; little or no rusting

Waterborne Light Industrial Coating				
Galvanized Surfaces with slight coating deterioration	Primer	Intermediate	Topcoat	System DFT
MPI REX 5.3J-G5 (Semigloss)	MPI 134	N/A	MPI 163	4.5 mils
Topcoat: Coating to match adjacent surfaces.				

Pigmented Polyurethane				
Galvanized Surfaces with slight coating deterioration	Primer	Intermediate	Topcoat	System DFT
MPI REX 5.3D-G6 (Gloss)	MPI 101	N/A	MPI 72	5 mils
Topcoat: Coating to match adjacent surfaces.				

- (3) Galvanized surfaces with severely deteriorated coating or rusting

Waterborne Light Industrial Coating				
Galvanized surfaces with severely deteriorated coating or rusting	Primer	Intermediate	Topcoat	System DFT
MPI REX 5.3L-G5 (Semigloss)	MPI 101	MPI 108	MPI 163	8.5 mils
MPI REX 5.3L-G6 (Gloss)	MPI 101	MPI 108	MPI 164	8.5 mils
Topcoat: Coating to match adjacent surfaces.				

Pigmented Polyurethane
------------------------

Galvanized surfaces with severely deteriorated coating or rusting	Primer	Intermediate	Topcoat	System DFT
MPI REX 5.3D-G6 (Gloss)	MPI 101	MPI 72	MPI 72	5 mils
Topcoat: Coating to match adjacent surfaces.				

## C. Exterior Surfaces, Other Metals (Non-Ferrous)

(1) Aluminum, aluminum alloy and other miscellaneous non-ferrous metal items not otherwise specified except hot metal surfaces, roof surfaces, and new prefinished equipment

Alkyd				
New Galvanized Surfaces	Primer	Intermediate	Topcoat	System DFT
MPI EXT 5.4F-G1 (Flat)	MPI 95	MPI 8	MPI 8	5 mils
MPI EXT 5.4F-G5 (Semigloss)	MPI 95	MPI 94	MPI 94	5 mils
MPI EXT 5.4F-G6 (Gloss)	MPI 95	MPI 9	MPI 9	5 mils
Topcoat: Coating to match adjacent surfaces.				

Waterborne Light Industrial Coating				
New Galvanized Surfaces	Primer	Intermediate	Topcoat	System DFT
MPI EXT 5.4F-G1 (Flat)	MPI 95	MPI 161	MPI 161	5 mils
MPI EXT 5.4F-G5 (Semigloss)	MPI 95	MPI 163	MPI 163	5 mils
MPI EXT 5.4F-G6 (Gloss)	MPI 95	MPI 164	MPI 164	5 mils
Topcoat: Coating to match adjacent surfaces.				

(2) Existing roof surfaces previously coated

Aluminum Pigmented Asphalt Roof Coating				
Existing roof surfaces previously coated	N/A	Intermediate	Topcoat	System DFT
Non-MPI System	ASTM D2824/D2824	N/A	N/A	8 mils
Sufficient coats to provide not less than 8 mils of finished coating system (without asbestos fibers).				

Aluminum Paint				
Existing roof surfaces previously coated	Primer	Intermediate	Topcoat	System DFT
MPI REX 10.2D	MPI 107	MPI 1	MPI 1	3.5 mils
Topcoat: Coating to match adjacent surfaces.				

(3) Surfaces adjacent to painted surfaces; [Mechanical,] [Electrical,] [Fire extinguishing sprinkler systems including valves, conduit, hangers, supports,] [exposed copper piping,] [and miscellaneous metal items] not otherwise specified except floors, hot metal surfaces, and new prefinished equipment

Alkyd				
New	Primer	Intermediate	Topcoat	System DFT
MPI EXT 5.1D-G1 (Flat)	MPI 79	MPI 8	MPI 8	5.25 mils
MPI EXT 5.1D-G5 (Semigloss)	MPI 79	MPI 94	MPI 94	5.25 mils
MPI EXT 5.1D-G6 (Gloss)	MPI 79	MPI 9	MPI 9	5.25 mils
Topcoat: Coating to match adjacent surfaces.				

Waterborne Light Industrial Coating				
New	Primer	Intermediate	Topcoat	System DFT

MPI EXT 5.1C-G3 (Eggshell)	MPI 79	MPI 161	MPI 161	5 mils
MPI EXT 5.1C-G5 (Semigloss)	MPI 79	MPI 163	MPI 163	5 mils
MPI EXT 5.1C-G6 (Gloss)	MPI 79	MPI 164	MPI 164	5 mils
Primer as recommended by manufacturer. Topcoat: Coating to match adjacent surfaces.				

## D. Exterior Hot Surfaces

(1) Hot metal surfaces [including smokestacks] subject to temperatures up to 400 degrees F

Heat Resistant Enamel				
New	N/A	Intermediate	Topcoat	System DFT
MPI EXT 5.2A	MPI 21	N/A	N/A	Per Manufacturer
Surface preparation and number of coats per manufacturer's instructions.				

(2) Ferrous metal subject to high temperature, up to 750 degrees F

Inorganic Zinc Rich Coating				
New	N/A	Intermediate	Topcoat	System DFT
MPI EXT 5.2C	MPI 19	N/A	N/A	Per Manufacturer
Surface preparation and number of coats per manufacturer's instructions.				

Heat Resistant Aluminum Enamel				
New	N/A	Intermediate	Topcoat	System DFT
MPI EXT 5.2B	MPI 2	N/A	N/A	Per Manufacturer
Surface preparation and number of coats per manufacturer's instructions.				

(3) [New surfaces][ and ][Existing surfaces] made bare subject to temperatures up to 1100 degrees F



(1) [New surfaces][ and ][Existing surfaces] made bare cleaning to SSPC SP 10/NACE No. 2 subject to temperatures up to 1100 degrees F

Heat Resistant Coating					
New	Existing	N/A	Intermediate	Topcoat	System DFT
MPI EXT 5.2D	MPI REX 5.2D	MPI 22	N/A	N/A	Per Manufacturer
Surface preparation and number of coats per manufacturer's instructions.					

#### 3.15.1.4 MPI Division 6: Exterior Wood; Dressed Lumber, Paneling, Decking, Shingles Paint Table

A. New [and Existing, uncoated] Dressed lumber, Wood and plywood, trim, [including top, bottom and edges of doors] not otherwise specified

Alkyd					
New	Existing, uncoated	Primer	Intermediate	Topcoat	System DFT
MPI EXT 6.3B-G5 (Semigloss)	MPI EXT 6.3B-G5 (Semigloss)	MPI 5	MPI 94	MPI 94	5 mils
MPI EXT 6.3B-G6 (Gloss)	MPI EXT 6.3B-G6 (Gloss)	MPI 5	MPI 9	MPI 9	5 mils
Topcoat: Coating to match adjacent surfaces.					

Latex					
New	Existing, uncoated	Primer	Intermediate	Topcoat	System DFT
MPI EXT 6.3A-G1 (Flat)	MPI EXT 6.3A-G1 (Flat)	MPI 5	MPI 10	MPI 10	5 mils
MPI EXT 6.3A-G5 (Semigloss)	MPI EXT 6.3B-G5 (Semigloss)	MPI 5	MPI 11	MPI 11	5 mils
MPI EXT 6.3A-G6 (Gloss)	MPI EXT 6.3B-G6 (Gloss)	MPI 5	MPI 119	MPI 119	5 mils
Topcoat: Coating to match adjacent surfaces.					

Waterborne Solid Color Stain					
New	Existing, uncoated	Primer	Intermediate	Topcoat	System DFT
MPI EXT 6.3K	MPI EXT 6.3K	MPI 5	MPI 16	MPI 16	4.25 mils
Topcoat: Coating to match adjacent surfaces.					

B. Existing, dressed lumber, Wood and plywood, trim, [including top, bottom and edges of doors] previously coated with an alkyd / oil based

finish coat not otherwise specified

Alkyd				
Existing, previously coated	Primer	Intermediate	Topcoat	System DFT
MPI REX 6.3B-G5 (Semigloss)	MPI 5	MPI 94	MPI 94	5 mils
MPI REX 6.3B-G6 (Gloss)	MPI 5	MPI 9	MPI 9	5 mils

Latex				
Existing, previously coated	Primer	Intermediate	Topcoat	System DFT
MPI REX 6.3A-G1 (Flat)	MPI 5	MPI 10	MPI 10	5 mils
MPI REX 6.3B-G5 (Semigloss)	MPI 5	MPI 11	MPI 11	5 mils
MPI REX 6.3B-G6 (Gloss)	MPI 5	MPI 119	MPI 119	5 mils

C. Existing, dressed lumber, Wood and plywood, trim, [including top, bottom and edges of doors] previously coated with a latex / waterborne finish coat not otherwise specified

Latex				
Existing, previously coated	Primer	Intermediate	Topcoat	System DFT
MPI REX 6.3L-G1 (Flat)	MPI 6	MPI 10	MPI 10	4.5 mils
MPI REX 6.3L-G5 (Semigloss)	MPI 6	MPI 11	MPI 11	4.5 mils
MPI REX 6.3L-G6 (Gloss)	MPI 6	MPI 119	MPI 119	4.5 mils
Topcoat: Coating to match adjacent surfaces.				

Waterborne Solid Color Stain				
Existing, previously coated	Primer	Intermediate	Topcoat	System DFT
MPI EXT 6.3K	MPI 6	MPI 16	MPI 16	4 mils
Topcoat: Coating to match adjacent surfaces.				

D. Wood Siding

## (1) New, Uncoated wood siding

Semi-Transparent Stain				
New	Primer	Intermediate	Topcoat	System DFT
MPI EXT 6.3D	N/A	MPI 13	MPI 13	N/A
Topcoat: Coating to match adjacent surfaces.				

## (2) Existing, previously stained wood siding

Latex				
Existing, previously stained	Primer	Intermediate	Topcoat	System DFT
MPI REX 6.2K-G1 (Flat)	MPI 5	MPI 10	MPI 10	4.5 mils
MPI REX 6.2K-G5 (Semigloss)	MPI 5	MPI 11	MPI 11	4.5 mils
Topcoat: Coating to match adjacent surfaces.				

## (3) Existing Uncoated or previously semitransparent stained wood siding

Semi-Transparent Stain				
Existing	Primer	Intermediate	Topcoat	System DFT
MPI REX 6.3D	N/A	MPI 13	MPI 13	Per Manufacturer
Topcoat: Coating to match adjacent surfaces.				

E. Wood: [Steps,] [platforms,] [floors of open porches,] and [\_\_\_\_\_] [with non-skid additive (NSA), load at manufacturer's recommendations.]

Latex Floor Paint				
New	Primer	Intermediate	Topcoat	System DFT
MPI EXT 6.5A-G2 (Flat)	MPI 5	MPI 60 [plus NSA]	MPI 60 [plus NSA]	4.5 mils
MPI EXT 6.5A-G6 (Gloss)	MPI 5	MPI 68 [plus NSA]	MPI 68 [plus NSA]	4.5 mils

Topcoat: Coating to match adjacent surfaces.  
Load non-skid additive (NSA) at manufacturer's recommendations.

#### Alkyd Floor Paint

New	Primer	Intermediate	Topcoat	System DFT
MPI EXT 6.5B-G2 (Flat)	MPI 59	MPI 59 [plus NSA]	MPI 59 [plus NSA]	5 mils
MPI EXT 6.5B-G6 (Gloss)	MPI 27	MPI 27 [plus NSA]	MPI 27 [plus NSA]	5 mils

Topcoat: Coating to match adjacent surfaces.  
Load non-skid additive (NSA) at manufacturer's recommendations.

### 3.15.1.5 MPI Division 9: Exterior Stucco Paint Table

#### A. [New][ and Existing] stucco

#### Latex

New	Existing	Primer	Intermediate	Topcoat	System DFT
MPI EXT 9.1A-G1 (Flat)	MPI REX 9.1A-G2 (Flat)	MPI 10	MPI 10	MPI 10	4.5 mils
MPI EXT 9.1A-G5 (Semigloss)	MPI REX 9.1A-G5 (Semigloss)	MPI 11	MPI 11	MPI 11	4.5 mils
MPI EXT 9.1A-G6 (Gloss)	MPI REX 9.1A-G6 (Gloss)	MPI 119	MPI 119	MPI 119	4.5 mils

Primer as recommended by manufacturer.  
Topcoat: Coating to match adjacent surfaces.  
On existing stucco, apply primer based on surface condition.

#### B. [New][ and ][Existing] stucco, elastomeric system

#### Elastomeric Coating

New	Existing	Primer	Intermediate	Topcoat	System DFT
MPI EXT 9.1C-G1 (Flat)	MPI REX 9.1C-G1 (Flat)	N/A	MPI 113	MPI 113	16 mils

Primer as recommended by manufacturer.  
Topcoat: Coating to match adjacent surfaces.  
Surface preparation and number of coats in accordance with manufacturer's instructions  
Apply sufficient coats of MPI 113 to achieve a minimum dry film thickness of 16 mils.

## 3.15.1.6 MPI Division 10: Exterior Cloth Coverings and Bituminous Coated Surfaces Paint Table

A. Insulation and surfaces of insulation coverings (canvas, cloth, paper): (Interior and Exterior Applications)

Latex				
New	Primer	Intermediate	Topcoat	System DFT
MPI EXT 10.1A-G1 (Flat)	N/A	MPI 10	MPI 10	3.2 mils
MPI EXT 10.1A-G5 (Semigloss)	N/A	MPI 11	MPI 11	3.2 mils
MPI EXT 10.1A-G6 (Gloss)	N/A	MPI 119	MPI 119	3.2 mils
Topcoat: Coating to match adjacent surfaces.				

## 3.15.2 Interior Paint Tables

## 3.15.2.1 MPI Division 3: Interior Concrete Paint Table

A. [New and uncoated existing][ and Existing, previously painted]  
Concrete, vertical surfaces, not specified otherwise

Latex					
New, uncoated Existing	Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
MPI INT 3.1A-G2 (Flat)	MPI RIN 3.1A-G2 (Flat)	MPI 3	MPI 44	MPI 44	4 mils
MPI INT 3.1A-G3 (Eggshell)	MPI RIN 3.1A-G3 (Eggshell)	MPI 3	MPI 52	MPI 52	4 mils
MPI INT 3.1A-G5	MPI RIN 3.1A-G5 (Semigloss)	MPI 3	MPI 54	MPI 54	4 mils
Topcoat: Coating to match adjacent surfaces.					

High Performance Architectural Latex					
New, uncoated Existing	Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
MPI INT 3.1C-G2 (Flat)	MPI RIN 3.1J-G2 (Flat)	MPI 3	MPI 138	MPI 138	4 mils

MPI INT 3.1C-G3 (Eggshell)	MPI RIN 3.1J-G3 (Eggshell)	MPI 3	MPI 139	MPI 139	4 mils
MPI INT 3.1C-G4 (satin)	MPI RIN 3.1J-G4	MPI 3	MPI 140	MPI 140	4 mils
MPI INT 3.1C-G5 (Semigloss)	MPI RIN 3.1J-G5 (Semigloss)	MPI 3	MPI 141	MPI 141	4 mils
Topcoat: Coating to match adjacent surfaces.					

Institutional Low Odor / Low VOC Latex					
New, uncoated Existing	Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
MPI INT 3.1M-G2 (Flat)	MPI RIN 3.1L-G2 (Flat)	MPI 149	MPI 144	MPI 144	4 mils
MPI INT 3.1M-G3 (Eggshell)	MPI RIN 3.1L-G3 (Eggshell)	MPI 149	MPI 145	MPI 145	4 mils
MPI INT 3.1M-G4 (satin)	MPI RIN 3.1L-G4	MPI 149	MPI 146	MPI 146	4 mils
MPI INT 3.1M-G5 (Semigloss)	MPI RIN 3.1L-G5 (Semigloss)	MPI 149	MPI 147	MPI 147	4 mils
Topcoat: Coating to match adjacent surfaces.					

## B. Concrete Ceilings, Uncoated

Latex Aggregate				
New, uncoated	Primer	Intermediate	Topcoat	System DFT
MPI INT 3.1N-G1 (Flat)	N/A	N/A	MPI 42	Per Manufacturer
Texture - [Fine] [Medium] [Coarse]. Surface preparation, number of coats, and primer in accordance with manufacturer's instructions. Topcoat: Coating to match adjacent surfaces.				

C. [New and uncoated existing][ and ][Existing, previously painted]  
Concrete in [toilets,] [food-preparation,] [food-serving,] [restrooms,]  
[laundry areas,] [shower areas,] [areas requiring a high degree of  
sanitation,] [\_\_\_\_\_] [and other high-humidity areas] not otherwise  
specified except floors

Waterborne Light Industrial Coating					
New, uncoated Existing	Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
MPI INT 3.1L-G3 (Eggshell)	MPI RIN 3.1C-G3 (Eggshell)	MPI 3	MPI 151	MPI 151	4.8 mils
MPI INT 3.1L-G5 (Semigloss)	MPI RIN 3.1C-G5 (Semigloss)	MPI 3	MPI 153	MPI 153	4.8 mils
MPI INT 3.1L-G6 (Gloss)	MPI RIN 3.1C-G6 (Gloss)	MPI 3	MPI 154	MPI 154	4.8 mils
Topcoat: Coating to match adjacent surfaces.					

Alkyd					
New, uncoated Existing	Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
MPI INT 3.1D-G3 (Eggshell)	MPI RIN 3.1D-G3 (Eggshell)	MPI 3	MPI 51	MPI 51	4.5 mils
MPI INT 3.1D-G5 (Semigloss)	MPI RIN 3.1D-G5 (Semigloss)	MPI 3	MPI 47	MPI 47	4.5 mils
MPI INT 3.1D-G6 (Gloss)	MPI RIN 3.1D-G6 (Gloss)	MPI 3	MPI 48	MPI 48	4.5 mils
Topcoat: Coating to match adjacent surfaces.					

Epoxy					
New, uncoated Existing	Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
MPI INT 3.1F-G6 (Gloss)	MPI RIN 3.1E-G6 (Gloss)	MPI 77	MPI 77	MPI 77	4 mils
Note: Primer may be reduced for penetration per manufacturer's instructions.					

D. [New and uncoated existing][ and Existing, previously painted]  
concrete walls and bottom of swimming pools

Chlorinated Rubber					
New and uncoated existing	Existing, previously painted	Primer	Intermediate	Topcoat	System DFT

Chlorinated Rubber	Per Manufacturer	Per Manufacturer	Per Manufacturer	Per Manufacturer	Per Manufacturer
Note: Primer may be reduced for penetration per manufacturer's instructions.					

Epoxy					
New, uncoated Existing	Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
MPI INT 3.1F	MPI RIN 3.1E	MPI 77	MPI 77	MPI 77	4 mils
Note: Primer may be reduced for penetration per manufacturer's instructions.					

E. [New and uncoated existing][ and Existing, previously painted]  
concrete floors in following areas [\_\_\_\_\_]

Latex Floor Paint					
New, uncoated Existing	Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
MPI INT 3.2A-G2 (Flat)	MPI RIN 3.2A-G2 (Flat)	MPI 60	MPI 60	MPI 60	5 mils

Alkyd Floor Paint					
New, uncoated Existing	Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
MPI INT 3.2B-G2 (Flat)	MPI RIN 3.2B-G2 (Flat)	MPI 59	MPI 59	MPI 59	5 mils
Note: Primer may be reduced for penetration per manufacturer's instructions.					

Epoxy					
New, uncoated Existing	Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
MPI INT 3.2C-G6 (Gloss)	MPI RIN 3.2C-G6 (Gloss)	MPI 77	MPI 77	MPI 77	5 mils
Note: Primer may be reduced for penetration per manufacturer's instructions.					



## 3.15.2.2 MPI Division 4: Interior Concrete Masonry Units Paint Table

## A. New[ and uncoated Existing] Concrete Masonry

High Performance Architectural Latex					
New, uncoated Existing	Filler	Primer	Intermediate	Topcoat	System DFT
MPI INT 4.2D-G2 (Flat)	MPI 4	N/A	MPI 139	MPI 138	11 mils
MPI INT 4.2D-G3 (Eggshell)	MPI 4	N/A	MPI 139	MPI 139	11 mils
MPI INT 4.2D-G4 (Satin)	MPI 4	N/A	MPI 140	MPI 140	11 mils
MPI INT 4.2D-G5 (Semigloss)	MPI 4	N/A	MPI 141	MPI 141	11 mils
Fill all holes in masonry surface					

Institutional Low Odor / Low VOC Latex					
New, uncoated Existing	Filler	Primer	Intermediate	Topcoat	System DFT
MPI INT 4.2E-G2 (Flat)	MPI 4	N/A	MPI 144	MPI 144	4 mils
MPI INT 4.2E-G3 (Eggshell)	MPI 4	N/A	MPI 145	MPI 145	4 mils
MPI INT 4.2E-G4 (Satin)	MPI 4	N/A	MPI 146	MPI 146	4 mils
MPI INT 4.2E-G5 (Semigloss)	MPI 4	N/A	MPI 147	MPI 147	4 mils
Fill all holes in masonry surface					

## B. Existing, Previously Painted Concrete Masonry

High Performance Architectural Latex					
Existing, previously painted	Filler	Primer	Intermediate	Topcoat	System DFT
MPI RIN 4.2K-G2 (Flat)	N/A	MPI 138	MPI 138	MPI 138	4.5 mils

MPI RIN 4.2K-G3 (Eggshell)	N/A	MPI 139	MPI 139	MPI 139	4.5 mils
MPI RIN 4.2K-G4	N/A	MPI 140	MPI 140	MPI 140	4.5 mils
MPI RIN 4.2K-G5 (Semigloss)	N/A	MPI 141	MPI 141	MPI 141	4.5 mils

Institutional Low Odor / Low VOC Latex					
Existing, previously painted	Filler	Primer	Intermediate	Topcoat	System DFT
MPI RIN 4.2L-G2 (Flat)	N/A	MPI 144	MPI 144	MPI 144	4 mils
MPI RIN 4.2L-G3 (Eggshell)	N/A	MPI 145	MPI 145	MPI 145	4 mils
MPI RIN 4.2L-G4 (Satin)	N/A	MPI 146	MPI 146	MPI 146	4 mils
MPI RIN 4.2L-G5 (Semigloss)	N/A	MPI 147	MPI 147	MPI 147	4 mils

C. New[ and uncoated Existing] Concrete masonry units in [toilets,] [food-preparation,] [food-serving,] [restrooms,] [laundry areas,] [shower areas,] [areas requiring a high degree of sanitation,] [\_\_\_\_\_,] [and other high humidity areas] unless otherwise specified

Waterborne Light Industrial Coating					
New, uncoated Existing	Filler	Primer	Intermediate	Topcoat	System DFT
MPI INT 4.2K-G3 (Eggshell)	MPI 4	N/A	MPI 151	MPI 151	11 mils
MPI INT 4.2K-G5 (Semigloss)	MPI 4	N/A	MPI 153	MPI 153	11 mils
MPI INT 4.2K-G6 (Gloss)	MPI 4	N/A	MPI 154	MPI 154	11 mils
Fill all holes in masonry surface					

Alkyd					
New, uncoated Existing	Filler	Primer	Intermediate	Topcoat	System DFT

MPI INT 4.2K-G3 (Eggshell)	MPI 4	MPI 50	MPI 51	MPI 51	12 mils
MPI INT 4.2K-G5 (Semigloss)	MPI 4	MPI 50	MPI 47	MPI 47	12 mils
MPI INT 4.2K-G6 (Gloss)	MPI 4	MPI 50	MPI 48	MPI 48	12 mils
Fill all holes in masonry surface					

Epoxy					
New, uncoated Existing	Filler	Primer	Intermediate	Topcoat	System DFT
MPI INT 4.2G-G6 (Gloss)	MPI 116	N/A	MPI 77	MPI 77	10 mils
Fill all holes in masonry surface					

D. Existing, previously painted, concrete masonry units in [toilets,] [food-preparation,] [food-serving,] [restrooms,] [laundry areas,] [shower areas,] [areas requiring a high degree of sanitation,] [\_\_\_\_\_,] [and other high humidity areas] unless otherwise specified

Waterborne Light Industrial Coating					
Existing, previously painted	Filler	Primer	Intermediate	Topcoat	System DFT
MPI RIN 4.2G-G3 (Eggshell)	N/A	MPI 151	MPI 151	MPI 151	4.5 mils
MPI RIN 4.2G-G5 (Semigloss)	N/A	MPI 153	MPI 153	MPI 153	4.5 mils
MPI RIN 4.2G-G6 (Gloss)	N/A	MPI 154	MPI 154	MPI 154	4.5 mils

Alkyd					
Existing, previously painted	Filler	Primer	Intermediate	Topcoat	System DFT
MPI RIN 4.2C-G3 (Eggshell)	N/A	MPI 17	MPI 51	MPI 51	4.5 mils
MPI RIN 4.2C-G5 (Semigloss)	N/A	MPI 17	MPI 47	MPI 47	4.5 mils

MPI RIN 4.2C-G6 (Gloss)	N/A	MPI 17	MPI 48	MPI 48	4.5 mils
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Epoxy					
Existing, previously painted	Filler	Primer	Intermediate	Topcoat	System DFT
MPI RIN 4.2D-G6 (Gloss)	N/A	MPI 77	MPI 77	MPI 77	5 mils

### 3.15.2.3 MPI Division 5: Interior Metal, Ferrous and Non-Ferrous Paint Table

#### A. Interior Steel / Ferrous Surfaces

(1) Metal, [ Mechanical, ] [ Electrical, ] [ Fire extinguishing sprinkler systems including valves, conduit, hangers, supports, ] [ Surfaces adjacent to painted surfaces (Match surrounding finish), ] [ exposed copper piping, ] [ and miscellaneous metal items ] not otherwise specified except floors, hot metal surfaces, and new prefinished equipment

High Performance Architectural Latex				
New, uncoated Existing	Primer	Intermediate	Topcoat	System DFT
MPI INT 5.1R-G2 (Flat)	MPI 76	MPI 138	MPI 138	5 mils
MPI INT 5.1R-G3 (Eggshell)	MPI 76	MPI 139	MPI 139	5 mils
MPI INT 5.1R-G5 (Semigloss)	MPI 76	MPI 141	MPI 141	5 mils
Topcoat: Coating to match adjacent surfaces.				

Alkyd				
New, uncoated Existing	Primer	Intermediate	Topcoat	System DFT
MPI INT 5.1E-G2 (Flat)	MPI 76	MPI 49	MPI 49	5.25 mils
MPI INT 5.1E-G3 (Eggshell)	MPI 76	MPI 51	MPI 51	5.25 mils
MPI INT 5.1E-G5 (Semigloss)	MPI 76	MPI 47	MPI 47	5.25 mils
MPI INT 5.1E-G6 (Gloss)	MPI 76	MPI 48	MPI 48	5.25 mils

Topcoat: Coating to match adjacent surfaces.

(2) Metal floors (non-shop-primed surfaces or non-slip deck surfaces) with non-skid additive (NSA), load at manufacturer's recommendations

Alkyd (over q.d. Alkyd Primer)				
New, uncoated Existing	Primer	Intermediate	Topcoat	System DFT
MPI INT 5.1E-G5 (Semi-Gloss)	MPI 76	MPI 47	MPI 47	5.25 mils
Topcoat: Coating to match adjacent surfaces.				

Epoxy				
New, uncoated Existing	Primer	Intermediate	Topcoat	System DFT
MPI INT 5.1L-G6 (Gloss)	MPI 101	MPI 101	MPI 101	5.25 mils
Topcoat: Coating to match adjacent surfaces.				

(3) Metal in[ toilets,][ food-preparation,][ food-serving,][ restrooms,][ laundry areas,][ shower areas,][ areas requiring a high degree of sanitation,][ \_\_\_\_\_,][ and other high-humidity areas] not otherwise specified except floors, hot metal surfaces, and new prefinished equipment

Alkyd				
New, uncoated Existing	Primer	Intermediate	Topcoat	System DFT
MPI INT 5.1E-G3 (Eggshell)	MPI 76	MPI 51	MPI 51	5.25 mils
MPI INT 5.1E-G5 (Semigloss)	MPI 76	MPI 47	MPI 47	5.25 mils
MPI INT 5.1E-G6 (Gloss)	MPI 76	MPI 48	MPI 48	5.25 mils
Topcoat: Coating to match adjacent surfaces.				

Alkyd; For Hand Tool Cleaning				
New, uncoated Existing	Primer	Intermediate	Topcoat	System DFT

MPI INT 5.1T-G3 (Eggshell)	MPI 23	MPI 51	MPI 51	5.25 mils
MPI INT 5.1T-G5 (Semigloss)	MPI 23	MPI 47	MPI 47	5.25 mils
MPI INT 5.1T-G6 (Gloss)	MPI 23	MPI 48	MPI 48	5.25 mils
Topcoat: Coating to match adjacent surfaces.				

(4) Ferrous metal in concealed damp spaces or in exposed areas having unpainted adjacent surfaces as follows: [\_\_\_\_\_]

Aluminum Paint				
New, uncoated Existing	Primer	Intermediate	Topcoat	System DFT
MPI INT 5.1M	MPI 76	MPI 1	MPI 1	4.25 mils
Topcoat: Coating to match adjacent surfaces.				

(5) Miscellaneous non-ferrous metal items not otherwise specified except floors, hot metal surfaces, and new prefinished equipment. Match surrounding finish

High Performance Architectural Latex				
New, uncoated Existing	Primer	Intermediate	Topcoat	System DFT
MPI INT 5.4F-G2 (Flat)	MPI 95	MPI 138	MPI 138	5 mils
MPI INT 5.4F-G3 (Eggshell)	MPI 95	MPI 139	MPI 139	5 mils
MPI INT 5.4F-G4 (Satin)	MPI 95	MPI 140	MPI 140	5 mils
MPI INT 5.4F-G5 (Semigloss)	MPI 95	MPI 141	MPI 141	5 mils
Topcoat: Coating to match adjacent surfaces.				

Alkyd				
New, uncoated Existing	Primer	Intermediate	Topcoat	System DFT

MPI INT 5.4J-G2 (Flat)	MPI 95	MPI 49	MPI 49	5 mils
MPI INT 5.4J-G3 (Eggshell)	MPI 95	MPI 51	MPI 51	5 mils
MPI INT 5.4J-G5 (Semigloss)	MPI 95	MPI 47	MPI 47	5 mils
MPI INT 5.4J-G6 (Gloss)	MPI 95	MPI 48	MPI 48	5 mils
Topcoat: Coating to match adjacent surfaces.				

## B. Hot Surfaces

(1) Hot metal surfaces [including smokestacks] subject to temperatures up to 400 degrees F

Heat Resistant Enamel				
New	N/A	Intermediate	Topcoat	System DFT
MPI INT 5.2A	MPI 21	N/A	N/A	Per Manufacturer
Surface preparation and number of coats per manufacturer's instructions.				

(2) Ferrous metal subject to high temperature, up to 750 degrees F

Inorganic Zinc Rich Coating				
New	N/A	Intermediate	Topcoat	System DFT
MPI INT 5.2C	MPI 19	N/A	N/A	Per Manufacturer
Surface preparation and number of coats per manufacturer's instructions.				

Heat Resistant Aluminum Enamel				
New	N/A	Intermediate	Topcoat	System DFT
MPI INT 5.2B (Aluminum Finish)	MPI 2	N/A	N/A	Per Manufacturer
Surface preparation and number of coats per manufacturer's instructions.				

(3) New and Existing Surfaces made bare subject to temperatures up to 1100 degrees F

(1) [New surfaces][ and ][Existing surfaces] made bare cleaning to SSPC SP 10/NACE No. 2 subject to temperatures up to 1100 degrees F:

Heat Resistant Coating					
New	Existing	N/A	Intermediate	Topcoat	System DFT
MPI INT 5.2D	MPI RIN 5.2D	MPI 22	N/A	N/A	Per Manufacturer
Surface preparation and number of coats per manufacturer's instructions.					

### 3.15.2.4 MPI Division 6: Interior Wood Paint Table

#### A. Interior Wood and Plywood

(1) New[ and Existing, uncoated] Wood and plywood not otherwise specified

High Performance Architectural Latex				
New, uncoated Existing	Primer	Intermediate	Topcoat	System DFT
MPI INT 6.4S-G3 (Eggshell)	MPI 39	MPI 139	MPI 139	4.5 mils
MPI INT 6.4S-G4 (Satin)	MPI 39	MPI 140	MPI 140	4.5 mils
MPI INT 6.4S-G5 (Semigloss)	MPI 39	MPI 141	MPI 141	4.5 mils
Topcoat: Coating to match adjacent surfaces.				

Alkyd				
New, uncoated Existing	Primer	Intermediate	Topcoat	System DFT
MPI INT 6.4B-G3 (Eggshell)	MPI 45	MPI 51	MPI 51	4.5 mils
MPI INT 6.4B-G5 (Semigloss)	MPI 45	MPI 47	MPI 47	4.5 mils
MPI INT 6.4B-G6 (Gloss)	MPI 45	MPI 48	MPI 48	4.5 mils
Topcoat: Coating to match adjacent surfaces.				

Institutional Low Odor / Low VOC Latex
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New, uncoated Existing	Primer	Intermediate	Topcoat	System DFT
MPI INT 6.3V-G2 (Flat)	MPI 39	MPI 144	MPI 144	4 mils
MPI INT 6.3V-G3 (Eggshell)	MPI 39	MPI 145	MPI 145	4 mils
MPI INT 6.3V-G4 (Satin)	MPI 39	MPI 146	MPI 146	4 mils
MPI INT 6.3V-G5 (Semigloss)	MPI 39	MPI 147	MPI 147	4 mils

(2) Existing, previously painted Wood and plywood not otherwise specified

High Performance Architectural Latex				
Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
MPI RIN 6.4B-G3 (Eggshell)	MPI 39	MPI 139	MPI 139	4.5 mils
MPI RIN 6.4B-G4 (Satin)	MPI 39	MPI 140	MPI 140	4.5 mils
MPI RIN 6.4B-G5 (Semigloss)	MPI 39	MPI 141	MPI 141	4.5 mils
Topcoat: Coating to match adjacent surfaces.				

Alkyd				
Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
MPI RIN 6.4C-G3 (Eggshell)	MPI 46	MPI 51	MPI 51	4.5 mils
MPI RIN 6.4C-G5 (Semigloss)	MPI 46	MPI 47	MPI 47	4.5 mils
MPI RIN 6.4C-G6 (Gloss)	MPI 46	MPI 48	MPI 48	4.5 mils
Topcoat: Coating to match adjacent surfaces.				

Institutional Low Odor / Low VOC Latex
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Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
MPI RIN 6.4D-G2 (Flat)	MPI 39	MPI 144	MPI 144	4 mils
MPI RIN 6.4D-G3 (Eggshell)	MPI 39	MPI 145	MPI 145	4 mils
MPI RIN 6.4D-G4 (Satin)	MPI 39	MPI 146	MPI 146	4 mils
MPI RIN 6.4D-G5 (Semigloss)	MPI 39	MPI 147	MPI 147	4 mils

B. Interior New [and Existing, previously finished or stained] Wood and Plywood, except floors; natural finish or stained

Natural finish, oil-modified polyurethane					
New	Existing	Primer	Intermediate	Topcoat	System DFT
MPI INT 6.4J-G4	MPI RIN 6.4L-G4	MPI 57	MPI 57	MPI 57	4 mils
MPI INT 6.4J-G6 (Gloss)	MPI RIN 6.4L-G6 (Gloss)	MPI 56	MPI 56	MPI 56	4 mils

Stained, oil-modified polyurethane						
New	Existing	Stain	Primer	Intermediate	Topcoat	System DFT
MPI INT 6.4E-G4	MPI RIN 6.4G-G4	MPI 90	MPI 57	MPI 57	MPI 57	4 mils
MPI INT 6.4E-G6 (Gloss)	MPI RIN 6.4G-G6 (Gloss)	MPI 90	MPI 56	MPI 56	MPI 56	4 mils

Stained, Moisture Cured Urethane						
New	Existing	Stain	Primer	Intermediate	Topcoat	System DFT
MPI INT 6.4V-G2 (Flat)	MPI RIN 6.4V-G2 (Flat)	MPI 90	MPI 71	MPI 71	MPI 71	4 mils
MPI INT 6.4V-G6 (Gloss)	MPI RIN 6.4V-G6 (Gloss)	MPI 90	MPI 31	MPI 31	MPI 31	4 mils

C. Interior New[ and Existing, previously finished or stained] Wood Floors; Natural finish or stained

Natural finish, oil-modified polyurethane					
New	Existing, previously finished or stained	Primer	Intermediate	Topcoat	System DFT
MPI INT 6.5C-G6 (Gloss)	MPI RIN 6.5C-G6 (Gloss)	MPI 56	MPI 56	MPI 56	4 mils

Natural finish, Moisture Cured Polyurethane					
New	Existing, previously finished or stained	Primer	Intermediate	Topcoat	System DFT
MPI INT 6.5K-G6 (Gloss)	MPI RIN 6.5D-G6 (Gloss)	MPI 31	MPI 31	MPI 31	4 mils

Stained, oil-modified polyurethane						
New	Existing, previously finished or stained	Stain	Primer	Intermediate	Topcoat	System DFT
MPI INT 6.5B-G6 (Gloss)	MPI RIN 6.5B-G6 (Gloss)	MPI 90	MPI 56	MPI 56	MPI 56	4 mils

Stained, Moisture Cured Urethane						
New	Existing, previously finished or stained	Stain	Primer	Intermediate	Topcoat	System DFT
MPI INT 6.4V-G6 (Gloss)	MPI RIN 6.4V-G6 (Gloss)	MPI 90	MPI 31	MPI 31	MPI 31	4 mils

D. New [and Existing, previously coated] Wood floors; pigmented finish

Latex Floor Paint					
New	Existing, previously finished	Primer	Intermediate	Topcoat	System DFT

MPI INT 6.5G-G2 (Flat)	MPI RIN 6.5J-G2 (Flat)	MPI 45	MPI 60	MPI 60	4.5 mils
MPI INT 6.5G-G6 (Gloss)	MPI RIN 6.5J-G6 (Gloss)	MPI 45	MPI 68	MPI 68	4.5 mils
Topcoat: Coating to match adjacent surfaces.					

Alkyd Floor Paint					
New	Existing, previously finished	Primer	Intermediate	Topcoat	System DFT
MPI INT 6.5A-G2 (Flat)	MPI RIN 6.5A-G2 (Flat)	MPI 59	MPI 59	MPI 59	4.5 mils
MPI INT 6.5A-G6 (Gloss)	MPI RIN 6.5A-G6 (Gloss)	MPI 27	MPI 27	MPI 27	4.5 mils
Topcoat: Coating to match adjacent surfaces.					

E. Interior New[ and Existing, uncoated] wood surfaces in[ toilets,][ food-preparation,][ food-serving,][ restrooms,][ laundry areas,][ shower areas,][ areas requiring a high degree of sanitation,][ \_\_\_\_][ and other high humidity areas] not otherwise specified

High-Build Glaze Coatings
As specified in Section 09 96 59 HIGH-BUILD GLAZE COATINGS.

Waterborne Light Industrial				
New, uncoated Existing	Primer	Intermediate	Topcoat	System DFT
MPI INT 6.3P-G5 (Semigloss)	MPI 45	MPI 153	MPI 153	4.5 mils
MPI INT 6.3P-G6 (Gloss)	MPI 45	MPI 154	MPI 154	4.5 mils
Topcoat: Coating to match adjacent surfaces.				

Alkyd
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New, uncoated Existing	Primer	Intermediate	Topcoat	System DFT
MPI INT 6.3B-G5 (Semigloss)	MPI 45	MPI 47	MPI 47	4.5 mils
MPI INT 6.3B-G6 (Gloss)	MPI 45	MPI 48	MPI 48	4.5 mils
Topcoat: Coating to match adjacent surfaces.				

F. Existing, previously painted wood surfaces in[ toilets,][ food-preparation,][ food-serving,][ restrooms,][ laundry areas,][ shower areas,][ areas requiring a high degree of sanitation,][ \_\_\_\_\_][ and other high humidity areas] not otherwise specified

High-Build Glaze Coatings
As specified in Section 09 96 59 HIGH-BUILD GLAZE COATINGS.

Waterborne Light Industrial				
Existing, previously finished	Primer	Intermediate	Topcoat	System DFT
MPI RIN 6.3P-G5 (Semigloss)	MPI 39	MPI 153	MPI 153	4.5 mils
MPI RIN 6.3P-G6 (Gloss)	MPI 39	MPI 154	MPI 154	4.5 mils
Topcoat: Coating to match adjacent surfaces.				

Alkyd				
Existing, previously finished	Primer	Intermediate	Topcoat	System DFT
MPI RIN 6.3B-G5 (Semigloss)	MPI 46	MPI 47	MPI 47	4.5 mils
MPI RIN 6.3B-G6 (Gloss)	MPI 46	MPI 48	MPI 48	4.5 mils
Topcoat: Coating to match adjacent surfaces.				

G. Interior New [and Existing, previously finished or stained] Wood Doors; Natural Finish or Stained

Natural finish, oil-modified polyurethane
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New	Existing, previously finished or stained	Primer	Intermediate	Topcoat	System DFT
MPI INT 6.3K-G4	MPI RIN 6.3K-G4	MPI 57	MPI 57	MPI 57	4 mils
MPI INT 6.3K-G6 (Gloss)	MPI RIN 6.3K-G6 (Gloss)	MPI 56	MPI 56	MPI 56	4 mils
Note: Sand between all coats per manufacturers recommendations.					

Stained, oil-modified polyurethane						
New	Existing, previously finished or stained	Stain	Primer	Intermediate	Topcoat	System DFT
MPI INT 6.3E-G4	MPI RIN 6.3E-G4	MPI 90	MPI 57	MPI 57	MPI 57	4 mils
MPI INT 6.5B-G6 (Gloss)	MPI RIN 6.5B-G6 (Gloss)	MPI 90	MPI 56	MPI 56	MPI 56	4 mils
Note: Sand between all coats per manufacturers recommendations.						

Stained, Moisture Cured Urethane						
New	Existing, previously finished or stained	Stain	Primer	Intermediate	Topcoat	System DFT
MPI INT 6.4V-G2 (Flat)	MPI RIN 6.4V-G2 (Flat)	MPI 90	MPI 71	MPI 71	MPI 71	4 mils
MPI INT 6.4V-G6 (Gloss)	MPI RIN 6.4V-G6 (Gloss)	MPI 90	MPI 31	MPI 31	MPI 31	4 mils
Note: Sand between all coats per manufacturers recommendations.						

## H. New [ and Existing, uncoated] Wood Doors; Pigmented finish

Alkyd				
New, uncoated Existing	Primer	Intermediate	Topcoat	System DFT
MPI INT 6.3B-G5 (Semigloss)	MPI 45	MPI 47	MPI 47	4.5 mils
MPI INT 6.3B-G6 (Gloss)	MPI 45	MPI 48	MPI 48	4.5 mils

Note: Sand between all coats per manufacturers recommendations.

Pigmented Polyurethane				
New, uncoated Existing	Primer	Intermediate	Topcoat	System DFT
MPI INT 6.1E-G6 (Gloss)	MPI 72	MPI 72	MPI 72	4.5 mils
Note: Sand between all coats per manufacturers recommendations.				

#### I. Existing, previously painted Wood Doors; Pigmented finish

Alkyd				
Existing, previously finished	Primer	Intermediate	Topcoat	System DFT
MPI RIN 6.3B-G5 (Semigloss)	MPI 46	MPI 47	MPI 47	4.5 mils
MPI RIN 6.3B-G6 (Gloss)	MPI 46	MPI 48	MPI 48	4.5 mils
Note: Sand between all coats per manufacturers recommendations.				

### 3.15.2.5 MPI Division 9: Interior Plaster, Gypsum Board, Textured Surfaces Paint Table

#### A. Interior New[ and Existing, previously painted][ Plaster][ and][ Wallboard] not otherwise specified

Latex					
New	Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
MPI INT 9.2A-G2 (Flat)	RIN 9.2A-G2 (Flat)	MPI 50	MPI 44	MPI 44	4 mils
MPI INT 9.2A-G3 (Eggshell)	RIN 9.2A-G3 (Eggshell)	MPI 50	MPI 52	MPI 52	4 mils
MPI INT 9.2A-G5 (Semigloss)	RIN 9.2A-G5 (Semigloss)	MPI 50	MPI 54	MPI 54	4 mils
Topcoat: Coating to match adjacent surfaces.					

High Performance Architectural Latex - High Traffic Areas

New	Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
MPI INT 9.2B-G2 (Flat)	MPI RIN 9.2B-G2 (Flat)	MPI 50	MPI 138	MPI 138	4 mils
MPI INT 9.2B-G3 (Eggshell)	MPI RIN 9.2B-G3 (Eggshell)	MPI 50	MPI 139	MPI 139	4 mils
MPI INT 9.2B-G5 (Semigloss)	MPI RIN 9.2B-G5 (Semigloss)	MPI 50	MPI 141	MPI 141	4 mils
Topcoat: Coating to match adjacent surfaces.					

## Institutional Low Odor / Low VOC Latex, New

Institutional Low Odor / Low VOC Latex				
New	Primer	Intermediate	Topcoat	System DFT
MPI INT 9.2M-G2 (Flat)	MPI 149	MPI 144	MPI 144	4 mils
MPI INT 9.2M-G3 (Eggshell)	MPI 149	MPI 145	MPI 145	4 mils
MPI INT 9.2M-G4 (Satin)	MPI 149	MPI 146	MPI 146	4 mils
MPI INT 9.2M-G5 (Semigloss)	MPI 149	MPI 147	MPI 147	4 mils
Topcoat: Coating to match adjacent surfaces.				

## Institutional Low Odor / Low VOC Latex, Existing, previously painted

Institutional Low Odor / Low VOC Latex				
Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
MPI RIN 9.2M-G2 (Flat)	MPI 144	MPI 144	MPI 144	4 mils
MPI RIN 9.2M-G3 (Eggshell)	MPI 144	MPI 145	MPI 145	4 mils
MPI RIN 9.2M-G4 (Satin)	MPI 144	MPI 146	MPI 146	4 mils
MPI RIN 9.2M-G5 (Semigloss)	MPI 144	MPI 147	MPI 147	4 mils



Topcoat: Coating to match adjacent surfaces.

B. Interior New[ and Existing, previously painted][ Plaster][ and][ Wallboard] in[ toilets,][ food-preparation,][ food-serving,][ restrooms,][ laundry areas,][ shower areas,][ areas requiring a high degree of sanitation,][ \_\_\_\_\_][ and other high humidity areas] not otherwise specified

Waterborne Light Industrial Coating					
New, uncoated Existing	Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
MPI INT 9.2L-G5 (Semigloss)	MPI RIN 9.2L-G5 (Semigloss)	MPI 50	MPI 153	MPI 153	4 mils
Topcoat: Coating to match adjacent surfaces.					

Alkyd					
New, uncoated Existing	Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
MPI INT 9.2C-G5 (Semigloss)	MPI RIN 9.2C-G5 (Semigloss)	MPI 50	MPI 47	MPI 47	4 mils
Topcoat: Coating to match adjacent surfaces.					

Epoxy, New, uncoated Existing

Epoxy				
New, uncoated Existing	Primer	Intermediate	Topcoat	System DFT
MPI INT 9.2E-G6 (Gloss)	MPI 50	MPI 77	MPI 77	4 mils
Topcoat: Coating to match adjacent surfaces.				

Epoxy, Existing, previously painted

Epoxy				
Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
MPI RIN 9.2D-G6 (Gloss)	MPI 17	MPI 77	MPI 77	4 mils

Topcoat: Coating to match adjacent surfaces.
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-- End of Section --

## SECTION 09 96 00

## HIGH-PERFORMANCE COATINGS

**11/14**

## PART 1 GENERAL

## 1.1 REFERENCES

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

MASTER PAINTERS INSTITUTE (MPI)

MPI ASM (2019) Architectural Painting  
Specification Manual

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC 7/NACE No.4 (2007) Brush-Off Blast Cleaning

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

QPL-TNT-AP-28 (2004) Paint, Aluminum, Heat Resisting  
(1200 Degrees F)

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-01 Preconstruction Submittals

Equipment List[; G[, [\_\_\_\_]]]

## SD-03 Product Data

Heat-Resistant Coatings[; G[, [\_\_\_\_]]]

Epoxy Coatings[; G[, [\_\_\_\_]]]

Polyurethane Coatings[; G[, [\_\_\_\_]]]

Chlorinated-Rubber Coatings[; G[, [\_\_\_\_]]]

## SD-04 Samples

Color Chips[; G[, [\_\_\_\_]]]

## SD-07 Certificates

Heat-Resistant Coatings[; G[, [\_\_\_\_]]]

Epoxy Coatings[; G[, [\_\_\_\_]]]

Polyurethane Coatings[; G[, [\_\_\_\_]]]

Chlorinated-Rubber Coatings[; G[, [\_\_\_\_]]]

Manufacturer's Printed Instructions[; G[, [\_\_\_\_]]]

### 1.3 QUALITY CONTROL

Comply with Master Painters Institute (MPI) Standards indicated and listed in "MPI Approved Products List." Comply with the requirements in "MPI Architectural Painting Specification Manual" before any project is started.

Submit an **equipment list** consisting of a list of proposed equipment to be used in performance of construction work.

Submit three **color chips 3-inch by 4-inch** or manufacture's pull-down of each finish color and gloss as scheduled.

### 1.4 DELIVERY, STORAGE, AND HANDLING

Deliver special coating materials to the project in their original containers bearing manufacturer's name, descriptive label, and coating formulations. Provide new and unopened containers.

Store special coating materials in tightly closed containers in a covered, well-ventilated area where they are not exposed to excessive heat, fumes, sparks, flame, or direct sunlight. Protect water-based coatings against freezing.

Store solvents, thinners, and equipment cleaners with the same care as the coating materials with ambient temperatures continuously maintained at a minimum **45 degrees F**.

## PART 2 PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

Submit manufacturer's catalog data including manufacturer's name and identification. Include detailed data analysis of each special coating material required for the project, with all the coating constituents measured as percentages of the total weight of the coating. Also provide manufacturer's data concerning application, thinning, and average coverage per **gallon**

#### 2.1.1 Heat-Resistant Coatings

##### 2.1.1.1 Category 1, 50 to 400 Degrees F

Provide alkyd resin-based material for surface temperature coatings not exceeding **400 degrees F**. Apply a minimum two coats of coating with a dry-film thickness of a minimum **4 mils**.

Apply an epoxy zinc primer as a first coat conforming to **MPI ASM**, No. 20 with the resin solids and zinc pigment not less than 80 percent of the total weight of the material.

White and color pigmented finish coats are an alkyd resin-based material

with the resin solids and pigments not less than 85 percent of the total weight of the material. Ensure pigments are heat-stable materials, formulated to colors as scheduled.

Ensure black-pigmented finish coats are an alkyd resin, carbon-black pigmented material with resin solids and pigments not less than 50 percent of the total weight of the material.

Provide aluminum pigmented finish coats that are an alkyd resin-based material with resin solids and pigments not less than 50 percent of the total weight of the material.

#### 2.1.1.2 Category 2, 300 to 600 Degrees F

Coatings for surface temperatures not exceeding 600 degrees F are based on modified silicone and silicone-based resins. Apply coatings in not less than two coats with a dry-film thickness of not less than 3 mils.

Provide a silicone-based resin zinc-pigmented material with the resin solids and zinc pigment for the first coat not less than 80 percent of the total weight of the material.

Apply color pigmented finish coats using silicone-based resin material with the resin solids and pigments not less than 80 percent of the material's total weight. Pigments are heat-stable materials, formulated to colors as scheduled.

Ensure black-pigmented finish coat is a silicone-based resin carbon-black pigmented material with resin solids and pigments not less than 50 percent of the total weight of the material.

Aluminum-pigmented finish coats are a modified, silicone-based-resin material with the resin solids and pigments not less than 50 percent of the total weight of the material.

#### 2.1.1.3 Category 3, 600 to 800 Degrees F

Provide a modified silicone or a silicone-based material of coating for surface temperatures not exceeding 800 degrees F. Apply a minimum two coats with a dry-film thickness of a minimum 1 mils per manufacturer's recommendations.

Provide a silicone-based resin, zinc-pigmented material first coat with the resin solids and zinc pigment for the first coat not less than 80 percent of the total weight of the material.

Ensure black-pigmented finish coat is a silicone-based resin, carbon-black pigmented material with resin solids and pigments not less than 50 percent of the total weight of the material.

Aluminum-pigmented finish coat is a a modified, silicone-based-resin material with the resin solids and pigments not less than 50 percent of the total weight of the material.

#### 2.1.1.4 Category 4, 800 to 1,200 Degrees F

Provide an aluminum-pigmented, silicone-resin-based coating for surface temperatures not exceeding 1,200 degrees F conforming to QPL-TNT-AP-28, as modified.

Apply a minimum two coats with a minimum dry-film thickness of 2 mils.

Ensure the coating pigment contains a minimum 28 percent aluminum, based on the total weight of the material. Ensure coating contains a minimum of 22 percent silicone resin and a maximum of 49 percent of volatile thinners and driers based on the total weight of the material.

## 2.2 MATERIALS

### 2.2.1 Epoxy Coatings

Conform to MPI ASM, No. 116 for epoxy coatings and epoxy block filler, as modified.

Resins for finish coats are based on a polyamide-cured, epoxy-resin material. Apply finish coats with a dry-film thickness of not less than 4 mils per coat. Finish color and gloss are as indicated.

#### 2.2.1.1 Concrete Surface Coatings

Apply a [epoxy coating system in conformance with MPI ASM, No. 77] [water-based epoxy coating system in conformance with MPI ASM, No. 115] for vertical concrete surfaces. Apply an epoxy slip-resistant deck coating system in conformance with MPI ASM, No. 82. Apply a prime coat to fill concrete surface pores with a total dry-film thickness of not less than 2 mils.

#### 2.2.1.2 Masonry Surfaces Coatings

Apply a[n] [Water-Based, Light-Industrial Coating System in conformance with MPI ASM, No. 110] [Epoxy Coating System in conformance with MPI ASM, No. 77] [Water-Based Epoxy Coating System in conformance with MPI ASM, No. 115] [Polyurethane, Pigmented, Over Epoxy Coating System in conformance with MPI ASM, No. 72]. Apply a block filler to fill surface pores with a total dry-film thickness of not less than 7 mils.

#### 2.2.1.3 Ferrous and Galvanized Metal Surface Coatings

Coatings on ferrous and galvanized metal surfaces consist of a prime coat and not less than two finish coats. Comply with MPI ASM, No. 101 for an epoxy zinc primer with a metallic-zinc pigment for the substrate to be coated and the end use of the coated surface. Ensure resin solids and zinc pigment are not less than 80 percent of the total weight of the coating material. Apply prime coat with a total dry-film thickness of not less than 4 mils. Provide an epoxy-based finished coat as specified.

#### 2.2.1.4 Aluminum Surface Coatings

Apply an Epoxy Coating System in conformance with MPI ASM, No. 80 and MPI ASM, No. 77. Apply a prime coat with a total dry-film thickness of not less than 4 mils.

### 2.2.2 Polyurethane Coatings

Ensure polyurethane coatings conform to MPI ASM for each substrate indicated.

Resins for finish coats are based on a two-part, prepolymer,

catalytic-cured, polyurethane material. Apply catalytic-cured coatings with a total dry-film thickness of not less than 10 mils per coat. Indicate finish color and gloss on the schedules.

#### 2.2.2.1 Concrete Surface Coatings

Apply a [polyurethane, pigmented coating system in conformance with MPI ASM, No. 72 and MPI ASM, No. 80] [Polyurethane, Clear, Two-Component Coating System in conformance with MPI ASM, No. 78]. Ensure the prime coat fills surface pores with a total dry-film thickness of not less than 2 mils. Finish coats are polyurethane-based material as specified.

#### 2.2.2.2 Masonry Surface Coatings

Apply a polyurethane, clear, two-component coating system in conformance with MPI ASM, No. 78. Apply block filler to fill surface pores with a total dry-film thickness of not less than 7 mils. Finish coats are polyurethane-based material as specified.

#### 2.2.2.3 Ferrous and Galvanized Metal Surface Coatings

Apply a [polyurethane, pigmented coating system in conformance with MPI ASM, No. 72, MPI ASM, No. 77, and MPI ASM, No. 101] [high-performance architectural latex coating system in conformance with MPI ASM, No. 134, No. 138, and MPI ASM, No. 140]. Apply a prime coat with a dry-film thickness of not less than 2 mils. Finish coats are polyurethane-based material as specified.

#### 2.2.2.4 Aluminum Surface Coatings

Apply a water base, light industrial coating system in conformance with [MPI ASM, No. 95] [MPI ASM, No. 77 and MPI ASM, No. 80 for epoxy coating] [MPI ASM, No. 80 for polyurethane] coats on aluminum surfaces. Prime coat is a polyurethane-resin material as recommended by the coating manufacturer for the substrate to be coated. Apply prime coat with a dry-film thickness of not less than 2 mils. Finish coats are polyurethane-based material as specified.

#### 2.2.2.5 Wood Surface Coatings

Apply a [pigmented polyurethane coating in conformance with MPI ASM, No. 72] [clear polyurethane two-component coating in conformance with MPI ASM, No. 13 and MPI ASM, No. 78]. Apply prime coat with a dry-film thickness of not less than 5 mils. Finish coats are polyurethane-based material as specified.

#### 2.2.3 Chlorinated-Rubber Coatings

Base resins for finish coats on a modified, chlorinated-rubber, phenolic-resin material. Ensure coating materials contain not less than 20 percent chlorinated rubber resin, based on the total weight of the material. Apply finish coats with a dry-film thickness of not less than 3 mils per coat. Finish coating color is as indicated.

##### 2.2.3.1 Concrete Surface Coatings

Apply a minimum three coats on concrete surfaces. Provide prime coats with a chlorinated-rubber resin material as recommended by the coating

manufacturer for the substrate to be coated and the end use of the coated surfaces. Ensure the prime coat fills concrete surface pores with a total film thickness of not less than 2 mils. Finish coats are chlorinated-rubber-based coatings as specified.

#### 2.2.3.2 Masonry Surface Coatings

Apply a minimum of two finish coats of masonry block filler on masonry surfaces. Block fillers are based on an epoxy-ester resin material as recommended by the coating manufacturer for the substrate and end use of the coated surface. Fill surface pores with block filler at a total film thickness of not less than 7 mils. Finish coats are chlorinated-rubber-based coatings as specified.

#### 2.2.3.3 Ferrous and Galvanized Metal Surface Coatings

Apply a minimum two coats of high performance architectural latex coating in conformance with MPI ASM, No. 79 on ferrous and galvanized metal surfaces. Apply prime coat with a dry-film thickness of not less than 3 mils. Finish coats are chlorinated rubber-based coatings as specified.

#### 2.2.3.4 Aluminum Surface Coatings

Apply a minimum three coats of quick drying primer for aluminum surfaces. Ensure prime coats conform to MPI ASM, No. 80 for aluminum coating system.

### PART 3 EXECUTION

#### 3.1 PREPARATION

##### 3.1.1 Surface Preparation

Protect adjacent materials and equipment against damage from spillage, dripping, and spatter of coating materials. Leave clean building materials and equipment with all damaged surfaces corrected. Provide "WET PAINT" signs to indicate newly painted surfaces.

Protect work of other trades against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as approved by the Contracting Officer, and leave in an undamaged condition. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

Provide forced ventilation for interior spaces during application and drying of coatings to prevent the buildup of toxic or explosive concentrations of solvent vapors.

Provide fire extinguishers of the required quantity and correct type to combat flammable liquid fires.

Dispose of rags that are used to wipe up coating materials, solvents, and thinners by drenching with water and placing them in a covered metal container

##### 3.1.2 Cleaning

At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.



After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

Clean application equipment promptly and thoroughly with a suitable solvent after each use and stored in a clean, covered, well-ventilated container.

### 3.1.1.3 Concrete Surfaces

Conform to MPI ASM for substrates indicated. Remove plates, machined surfaces, and similar items already in place that are not to be coated. Provide surface-applied protection before surface preparation and coating where removal is impractical or impossible. After completing coating operations, reinstall items that were removed.

Clean dirt, oil, grease, and incompatible paints from substrates to ensure bonding. Coordination of shop-applied prime coats with high-performance coatings is critical. Remove incompatible primers. Reprime substrate with compatible primers as required to produce coating systems indicated.

#### 3.1.1.3.1 Concrete Substrates

Remove release agents, curing compounds, efflorescence, and chalk. Maximum allowable moisture content of concrete is 12 percent. Measure moisture content with an electronic moisture meter.

Clean surfaces with pressurized water. Use pressure range of [ 1500 to 4000 psi at 6 inch to 12 inch][ 4000 to 10,000 psi].

Comply with SSPC 7/NACE No.4 (NACE No. 4), "Brush-Off Blast Cleaning" for abrasive cleaning.

#### 3.1.1.3.2 Clay Masonry Substrates

Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces exceeds that permitted in manufacturer's written instructions.

Clean surfaces with pressurized water. Use pressure range of [ 100 to 600 psi] [ 1500 to 4000 psi] at 6 inch to 12 inch.

#### 3.1.1.3.3 Steel Substrates

Remove rust and loose mill scale. Clean using methods recommended in writing by coating manufacturer. Conform to SSPC 7/NACE No.4 for blast cleaning.

#### 3.1.1.3.4 Galvanized-Metal Substrates

Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied coatings.

#### 3.1.1.3.5 Aluminum Substrates

Remove surface oxidation.

#### 3.1.3.6 Wood Substrates

Wood substrates that contain small surface knots are prepped by sanding surfaces smooth. Apply a thin coat of knot sealer before applying an interior latex-based wood primer. Prime edges, ends, faces, undersides, and back sides of wood. After priming, fill holes and crevices to the finished surface with putty or plastic wood filler. After finished surface is dry, smooth surface by sanding, for a finished product.

#### 3.1.4 Coating Material Preparation

Mix and prepare coating materials in accordance with the coating [manufacturer's printed instructions](#) for applying the particular material and coat. Keep materials which are not in actual use in closed containers.

Coating materials that have been mixed with an automatic shaker are allowed to stand to let air bubbles escape, then given a final hand mixing before application. Stir materials so as to produce a mixture of uniform density. Stir at frequent intervals during application to prevent skinning. Do not stir film which may form on the surface of the material. Remove film and strain, if necessary.

##### 3.1.4.1 Thinning

Thinning is done in accordance with coating manufacturer's printed directions for the particular material and coat.

##### 3.1.4.2 Tinting

Ensure prime and intermediate coats of paint are slightly different tints from the finish coat to facilitate identification of each coat. Tinting is done by the coating manufacturer and clearly identified as to color and coat.

#### 3.2 APPLICATION

Do not perform exterior painting in damp or rainy weather. Interior painting is not allowed until the building is enclosed and has thoroughly dried out. Painting is not allowed below [50 degrees F](#) or above [95 degrees F](#). Apply paint in accordance with the coating manufacturer's recommendations, and as specified.

Ensure coating application is done by skilled applicators. Apply coatings to clean and properly prepared surfaces. Apply coatings with clean, high-quality application equipment. Allow sufficient time between coats to ensure complete drying and curing. Sand and dust surfaces between coatings, as required, to produce a surface free of visible defects. Lightly sand high gloss coatings and clear finishes between coats to ensure bond of following coats.

Apply coats to the surfaces in an even film. Cloudiness, spotting, holidays, laps, application marks, runs, sags, and other similar surface imperfections are not acceptable. Remove defective coating applications and re-coat as directed.

Ensure coating lines such as wainscots are sharp, true, and well-defined. Tape may be used to establish coating lines, providing tape is removed before ragging or sawtooth edges form.

Ensure surfaces, including edges, corners, crevices, welds, and other similar changes in surface plane, meet the dry-film thickness not less than specified.

#### 3.2.1 Brush Application

Use clean, proper size brushes for high-quality application of the specified coating materials. Brush out slow-dry coatings. Brush out quick-dry coatings only enough to spread out evenly.

#### 3.2.2 Roller Application

Use clean roller covers of the proper nap length, nap texture, and material for high-quality application of the specified coating materials.

Ensure roller application is equivalent in all respects to the same coats applied by high-quality brush application.

#### 3.2.3 Spray Application

[ Do not allow spray application of coatings. Spray application equipment is limited to airless-spray equipment and electrostatic-spray equipment. Ensure equipment is clean and operated by workmen skilled in high quality application of coating materials.

] [Spray application of coatings is limited to finish coats on metal frame works, siding, decking, wire mesh, and other surfaces where hand work would be inferior. Apply spray coatings as equivalent in all respects to the same coats applied by high quality brush application. Permit each spray coat to cure before the succeeding coat is applied. Do not double back with application equipment, for the purpose of building up film thickness of two coats in one operation.

] [Cover surfaces adjacent to sprayed areas to prevent damage from overspray, coating rebound, and spray drift.

### ] 3.3 FIELD QUALITY CONTROL

#### 3.3.1 Field Test

Government may take dry-film tests from time to time on finished surfaces. Apply additional coatings to surfaces where there is less than the minimum specified dry-film thickness.

#### 3.3.2 Repairing

Remove damaged and unacceptable portions of completed work and replace with new work to match adjacent surfaces at no additional cost to the Government.

-- End of Section --

## SECTION 09 97 13.00 40

## STEEL COATINGS

**11/19**

## PART 1 GENERAL

## 1.1 REFERENCES

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

## ASTM INTERNATIONAL (ASTM)

ASTM C920 (2018) Standard Specification for Elastomeric Joint Sealants

ASTM D4417 (2019) Field Measurement of Surface Profile of Blast Cleaned Steel

## MASTER PAINTERS INSTITUTE (MPI)

MPI 19 (2012) Primer, Zinc Rich, Inorganic

## SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC AB 1 (2015; E 2017) Mineral and Slag Abrasives

SSPC AB 2 (2015; E 2016) Cleanliness of Recycled Ferrous Metallic Abrasive

SSPC AB 3 (2003; E 2004) Ferrous Metallic Abrasive

SSPC PA 2 (2015; E 2018) Procedure for Determining Conformance to Dry Coating Thickness Requirements

SSPC SP 1 (2015) Solvent Cleaning

SSPC SP 10/NACE No. 2 (2007) Near-White Blast Cleaning

SSPC SP 11 (2012) Power Tool Cleaning to Bare Metal

## U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FED-STD-595 (Rev C; Notice 1) Colors Used in Government Procurement

## U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.134 Respiratory Protection

29 CFR 1910.1000 Air Contaminants

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S"

classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Inspection Forms; G[, [\_\_\_\_]]

Safety Plan; G[, [\_\_\_\_]]

SD-03 Product Data

Abrasive Blasting Material; G[, [\_\_\_\_]]

Sealant Compound; G[, [\_\_\_\_]]

Inorganic Zinc; G[, [\_\_\_\_]]

Inhibitive Polyamide Epoxy; G[, [\_\_\_\_]]

Aliphatic Polyurethane; G[, [\_\_\_\_]]

SD-04 Samples

Manufacturer's Standard Color Charts; G[, [\_\_\_\_]]

Inspection Forms; G[, [\_\_\_\_]]

SD-05 Design Data

Inorganic Zinc; G[, [\_\_\_\_]]

Inhibitive Polyamide Epoxy; G[, [\_\_\_\_]]

Aliphatic Polyurethane; G[, [\_\_\_\_]]

SD-06 Test Reports

Inspection Reports; G[, [\_\_\_\_]]

SD-07 Certificates

Abrasive Blasting Material

Sealant Compound

Inhibitive Polyamide Epoxy

Aliphatic Polyurethane

SD-08 Manufacturer's Instructions

Protective Coatings

1.3 QUALITY CONTROL

Submit a safety plan for protective coating systems in accordance with

OSHA regulations.

Submit [manufacturer's standard color charts](#) showing manufacturer's standard finish colors.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

Deliver materials in their original, unopened containers bearing the manufacturer's name, date of manufacture, product identification, and batch number.

Store coatings, thinners, and cleaners in tightly closed containers in a covered, well-ventilated area; protected from exposure to extreme cold or heat, sparks, flame, direct sunlight, or rainfall. Follow manufacturer's instructions for storage limitations.

### PART 2 PRODUCTS

#### 2.1 MATERIALS

##### 2.1.1 Abrasive Blasting Material

Ensure that abrasive blasting materials conform to [SSPC AB 1](#), [SSPC AB 2](#), and [SSPC AB 3](#).

##### 2.1.2 Sealant Compound

Sealant is a self-curing, single-component, polysulfide-rubber, conforming to [ASTM C920](#). Provide a sealant gray in color and capable of being applied into the joint with a caulking gun.

##### 2.1.3 Protective Coatings

###### 2.1.3.1 Coating Systems

The following two coating system definitions are to be specified for use on the surfaces listed in the Coating Schedule of this section, and as directed.

Coating System No. 1 consists of [inorganic zinc](#) only [, no top coat unless specified]. Select inorganic zinc from [MPI 19](#). Ensure that coatings, thinners, and cleaners are the product of one manufacturer.

Coating System No. 2 consists of an inorganic zinc first coat, with an [inhibitive polyamide epoxy](#) intermediate coat, and an [aliphatic polyurethane](#) finish coat. Select coatings from the following listing. Ensure that all coatings, thinners, and cleaners are the product of the same manufacturer. Ensure that each successive coating is a contrasting color to provide a visual assurance of complete coverage.

[ Coating System No. 3 [\_\_\_\_\_]

]

COATING SYSTEMS			
<u>INORGANIC ZINC</u>	<u>INHIBITIVE POLYAMIDE EPOXY</u>	<u>ALIPHATIC POLYURETHANE</u>	<u>MANUFACTURER</u>
Dimetcote 9 Metalhide 1001	Amercoat 370	Amercoat 450HS	PPG One PPG Place Pittsburgh, PA 15272 412/434-3131
CarboZinc 11	Carboguard 893	Carbothane 134HS	Carboline Company 2150 Schuetz Road St. Louis, MO 63146 314-644-1000
CathaCoat 304V CathaCoat 304K CathaCoat 304L	Devran 201 H	Devthane 379	International Paint LLC/ Devoe Coatings 6001 Antoine Drive Houston, TX 77091 (713) 682-1711 (800) 654-2616
ZincClad II	Macropoxy 646-100	Hi-Solids Poly-CA	Sherwin-Williams Company 101 Prospect Avenue N.W. Cleveland, OH 44115 (800) 336-1110

## PART 3 EXECUTION

### 3.1 PREPARATION

#### 3.1.1 Coating Hazards

Ensure that employees are trained in the safety plan. Specified coatings may have potential health hazards if ingested or improperly handled. Follow the coating manufacturer's written safety precautions throughout mixing, application, and curing of the coatings. During all cleaning, cleanup, surface preparation, and paint application phases, ensure that employees are protected from toxic and hazardous chemical agents that exceed concentrations in 29 CFR 1910.1000. Comply with respiratory protection requirements in 29 CFR 1910.134.

#### 3.1.2 Surface Preparation

For faying surfaces that become inaccessible after installation, abrasive-blast and coat with inorganic zinc only, before installation.

Clean surfaces that are part of slip-critical joints [according to SSPC SP10 (abrasive blasting) or SSPC SP 11 (power tool cleaning)] [according to SSPC SP10 (abrasive blasting) or SSPC SP 11 (power tool cleaning) and coated with MPI 19 (inorganic zinc)] before installation.

Do not apply coatings to areas to be welded. After welding is completed,

conduct the required surface preparation to the weld and any adjacent areas damaged by the welding operation, and feather in the required coating system.

Within 6 hours after completion of surface preparation and before rusting or recontamination occurs, clean prepared surfaces of abrasive residue, dust, and other contaminants and give the surface the first coat of paint. Re-prepare surfaces not coated within 6 hours or that show rusting or contamination, regardless of the length of time after preparation.

Sequence surface preparation and coating operations so that freshly applied coatings are not contaminated by dust or foreign matter.

Degrease surfaces as required in accordance with [SSPC SP 1](#) before surface preparation and the application of protective coatings. Degreasing is by solvent cleaning, detergent washing, or steam cleaning.

### 3.1.3 Abrasive Blasting (AB)

Dry abrasive blast all surfaces to be coated in accordance with the requirements of [SSPC SP 10/NACE No. 2](#). Round sharp edges of sheered members and remove weld slag, weld spatter, and foreign matter from surfaces to be coated prior to abrasive blasting. The blast profile, unless otherwise specified, is 1.5 to 2.5 mils as measured by [ASTM D4417](#), Method C. Use appropriate abrasive blast media to produce the desired surface profile and to give an angular anchor tooth pattern

Remove weld slag, weld spatter, and foreign matter from surfaces to be coated before abrasive blasting using mechanical methods as specified.

Remove all traces of abrasive residue and dust from the surface, leaving it clean and dry.

Surfaces not to be blasted are:

- a. Galvanized steel and non-ferrous or prefinished surfaces except when specified to be blast-cleaned in the coating schedule
- b. Piston rods and bearing surfaces
- c. [\_\_\_\_\_]

### 3.1.4 Power Tool Cleaning

Where specified, conduct power tool cleaning in accordance with the requirements of [SSPC SP 11](#).

## 3.2 APPLICATION

### 3.2.1 General Requirements

Manufacturer's instructions for thinning, mixing, handling, and applying products are considered a part of this specification. In the event of conflict between the requirements of this specification and the manufacturer's recommendations, this specification takes precedence.

Ensure that compressed air used for spraying coatings remains free of moisture and oil.



Ensure that each coat of applied material is free of runs; sags; blisters; bubbles; mud cracking; variations in color, gloss, and texture; holidays (missed areas); excessive film buildup; foreign contaminants; and dry overspray.

Do not apply coating when rain is imminent or when the temperature or humidity is outside the limits recommended by the coating manufacturer.

Ensure that the surface temperature is at least 5 degrees F above the dew point.

Apply coatings by airless or conventional spray. Use airless spray only for large, simply configured surfaces. Brush application is permitted only for striping and in areas that are otherwise inaccessible for spray application.

Protect newly coated surfaces from damage.

### 3.2.2 Mixing and Application Procedures

Mix multi-component paints according to the manufacturer's instructions. Use power agitation in a manner that does not introduce air into the mixed coating

Strain mixed material through a 30- to 60-mesh screen.

Continuously stir the inorganic zinc primer during application at a rate that will prevent the zinc from settling but will not introduce air into the material

Use brushes to work coatings thoroughly into joints, rough welds, crevices and around rivets and bolts. Pay special attention to cutouts, sharp edges, and irregular surfaces to ensure complete coverage and recommended thickness.

Measure the final dry film thickness after each coat in accordance with SSPC PA 2. Make all measurements with a Type 2 gage having an accuracy of 3 percent or better. Ensure the coating measurements meet the Level 1 thickness restrictions and are in compliance with the manufacturer's recommended minimum and maximum requirements. Repair areas of non-compliance by adding additional paint or mechanically removing the excess paint prior to the application of the succeeding coat.

### 3.2.3 Coating Systems

#### Coating System No. 1:

Inorganic zinc primer: [ 2.5 to 4 mils][3 to 6 mils,] inorganic zinc, as specified in Coating Schedule.

#### Coating System No. 2:

- a. Inorganic zinc primer: [ 2.5 to 4 mils][3 to 6 mils,] inorganic zinc, as specified in Coating Schedule.
- b. Inhibitive polyamide epoxy, second coat: 2 to 4 mils.[ Top coat [\_\_\_\_\_] 2 to 4 mils.]
- c. Aliphatic polyurethane, third coat: 2 to 4 mils, but sufficient to

hide previous coat [Second coat, inorganic zinc, 2 to 4 mils.]

[ Coating System No. 3: [\_\_\_\_\_] ]

#### ]3.2.4 Touch-Up

Touch up abrasions that occurred during shipment or erection as follows:

- a. If the substrate is showing any corrosion, the restore the required surface profile by spot blasting, and the entire coating system replaced at that location
- b. If the substrate is not corroding, prepare and coat the area in accordance with the manufacturer's guidance, feathering each coat into the existing coat to provide a smooth appearance.
- c. Use inhibitive polyamide epoxy and aliphatic polyurethane for touch-up and repair of Coating System No. 2.

#### 3.2.5 Sealant Compound Application

For Coating System No. 1, proceed with caulking after application and cure of inorganic zinc coating.

For Coating System No. 2, proceed with caulking after application and cure of inhibitive epoxy coat and before aliphatic polyurethane coat.

Caulk exterior joints, including, but not limited to, the following:

- a. Perimeter of faying and bearing surfaces of structural members
- b. Joints in members between intermittent welds
- c. Perimeter of bearing surfaces between floor plates and supporting members (inside, outside, top, and bottom)
- d. Stair treads, where joined to channel stringers
- e. Openings of 1/2 inch or smaller (Use foam filler backup as required.)
- f. Hot-dipped galvanized vent holes

### 3.3 FIELD QUALITY CONTROL

#### 3.3.1 Inspection

##### 3.3.1.1 Inspection Forms

At the pre-work conference, provide sample inspection forms to be completed by the Coating Inspector and submitted to the Contracting Officer.

##### 3.3.1.2 Coating Inspector

Work is inspected for compliance by a [Contracting Officer] [Contractor] provided [NACE CIP Level 2 inspector] [SPCC PCI Level 2 inspector] [\_\_\_\_\_] . Submit the completed Coating Inspector inspection reports [\_\_\_\_\_] [every week] [at the completion of the project].

For all protective coatings applied at off-site locations, provide full inspection by a NACE certified Coating Inspector. Ensure that the inspector is present at the prework conference to address necessary clarification of inspection and specification requirements. Report immediately any apparent deviation from the specified requirements or any out-of-tolerance condition to the Contracting Officer for determination of corrective action.

### 3.4 SCHEDULES

#### 3.4.1 Coating Schedule

SURFACE DESCRIPTION	SURFACE PREPARATION	FIRST COAT	SECOND COAT	THIRD COAT
Items or surfaces to be coated: [_____]	Near white metal blast cleaning	MPI #19	MPI #108 Finish Color: [_____]	MPI #72 Finish Color: [_____]
Items or surfaces to be coated: [_____]	Near white metal blast cleaning	MPI #19	[_____]	[_____]

Finish color as according to [FED-STD-595](#).

-- End of Section --

## SECTION 09 97 13.27

## HIGH PERFORMANCE COATING FOR STEEL STRUCTURES

**02/21**

## PART 1 GENERAL

## 1.1 REFERENCES

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

## ASTM INTERNATIONAL (ASTM)

ASTM C920	(2018) Standard Specification for Elastomeric Joint Sealants
ASTM D1200	(2010; R 2014) Viscosity by Ford Viscosity Cup
ASTM D1640/D1640M	(2014) Standard Test Methods for Drying, Curing, or Film Formation of Organic Coatings
ASTM D3276	(2015; E 2016) Standard Guide for Painting Inspectors (Metal Substrates)
ASTM D3925	(2002; R 2015) Sampling Liquid Paints and Related Pigmented Coatings
ASTM D4285	(1983; R 2012) Indicating Oil or Water in Compressed Air
ASTM D7127	(2017) Standard Test Method for Measurement of Surface Roughness of Abrasive Blast Cleaned Metal Surfaces using a Portable Stylus Instrument
ASTM E11	(2020) Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves

## INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 9001	(2015) Quality Management Systems-Requirements
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## SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC 7/NACE No.4	(2007) Brush-Off Blast Cleaning
SSPC AB 2	(2015; E 2016) Cleanliness of Recycled Ferrous Metallic Abrasive
SSPC AB 3	(2003; E 2004) Ferrous Metallic Abrasive
SSPC Guide 6	(2015) Guide for Containing Surface Preparation Debris Generated During Paint

## Removal Operations

SSPC Guide 12	(1998; E 2004) Guide for Illumination of Industrial Painting Projects
SSPC PA 1	(2016) Shop, Field, and Maintenance Coating of Metals
SSPC PA 2	(2015; E 2018) Procedure for Determining Conformance to Dry Coating Thickness Requirements
SSPC QP 1	(2019) Standard Procedure for Evaluating the Qualifications of Industrial/Marine Painting Contractors (Field Application to Complex Industrial Steel Structures and Other Metal Components)
SSPC QP 5	(2012) Standard Procedure for Evaluating the Qualifications of Coating and Lining Inspection Companies
SSPC QS 1	(2015) Standard Procedure for Evaluating a Contractor's Advanced Quality Management System
SSPC SP 1	(2015) Solvent Cleaning
SSPC SP 10/NACE No. 2	(2007) Near-White Blast Cleaning
SSPC SP COM	(2016; E 2017) Surface Preparation Commentary for Steel and Concrete Substrates
SSPC VIS 1	(2002; E 2004) Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning

## SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE AMS-STD-595A	(2017) Colors used in Government Procurement
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## U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-A-22262	(1993; Rev B; Am 2 1996) Abrasive Blasting Media Ship Hull Blast Cleaning
MIL-DTL-24441	(2009; Rev D) Paint, Epoxy-Polyamide, General Specification for
MIL-DTL-24441/19	(2009; Rev C) Paint, Epoxy-Polyamide, Zinc Primer, Formula 159, Type III
MIL-DTL-24441/31	(2009; Rev B) Paint, Epoxy-Polyamide, White, Formula 152, Type IV
MIL-PRF-85285	(2012; Rev E; Notice 1 2016) Coating: Polyurethane Aircraft and Support Equipment

MIL-STD-161 (2005; Rev G; Notice 1 2010)  
Identification Methods for Bulk Petroleum  
Products Systems Including Hydrocarbon  
Missile Fuels

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910-SUBPART Z Toxic and Hazardous Substances  
29 CFR 1910.134 Respiratory Protection  
29 CFR 1910.1000 Air Contaminants  
29 CFR 1926.59 Hazard Communication

1.2 DEFINITIONS

Definitions are provided throughout this Section, generally in the paragraph where used, and denoted by capital letters.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-05, Design Data

Containment System

SD-06 Test Reports

Joint Sealant Qualification Test Reports

Coatings Qualification Test Reports

Metallic Abrasive Qualification Test Reports

Coating Sample Test Reports

Abrasive Sample Test Reports

Inspection Report Forms

Daily Inspection Reports

Recycled Metallic Abrasive Field Test Reports (Daily and Weekly)

SD-07 Certificates

Contract Errors, Omissions, and Other Discrepancies

Corrective Action Procedures

Coating Work Plan

Qualifications of Certified Industrial Hygienist (CIH)  
Qualifications Of Individuals Performing Abrasive Blasting  
Qualifications of Certified Protective Coatings Specialist (PCS)  
Qualifications of Coating Inspection Company  
Qualifications of QC Specialist Coating Inspector  
Qualifications of Testing Laboratory for Coatings  
Qualifications of Testing Laboratory for Abrasive  
Qualifications of Coating Contractors  
Joint Sealant Materials  
Coating Materials  
Coating System Component Compatibility  
Non-metallic Abrasive  
Metallic Abrasive

SD-08 Manufacturer's Instructions

Joint Sealant Instructions  
Coating System Instructions

SD-11 Closeout Submittals

Disposal of Used Abrasive  
Inspection Logbook; G[, [\_\_\_\_]]

1.4 QUALITY ASSURANCE

1.4.1 Contract Errors, Omissions, and Other Discrepancies

Submit all errors, omissions, and other discrepancies in contract documents the Contracting Officer within 30 days of contract award for all work covered in this Section, other than the work that will not be uncovered until a later date. All such discrepancies shall be addressed and resolved, and the Coating Work Plan modified, prior to beginning the Initial and Follow-Up phases of work. Discrepancies that become apparent only after work is uncovered shall be identified at the earliest discoverable time and submitted for resolution. Schedule time (Float) should be built into the project schedule at those points where old work is to be uncovered or where access is not available during the first 30 days after award, to allow for resolution of contract discrepancies.

1.4.2 Corrective Action (CA)

CA shall be included in the Quality Control Plan.

#### 1.4.2.1 Corrective Action Procedures

Develop procedures for determining the root cause of each non-compliance, developing a plan to eliminate the root cause so that the non-compliance does not recur, and following up to ensure that the root cause was eliminated. Develop Corrective Action Request (CAR) forms for initiating CA, and for tracking and documenting each step.

#### 1.4.2.2 Implement Corrective Action

The Contractor shall take action to identify and eliminate the root cause of each non-compliance so as to prevent recurrence. These procedures shall apply to non-compliance in the work, and to non-compliance in the QC System. Corrective actions shall be appropriate to the effects of the non-compliance encountered. Each CAR shall be serialized, tracked in a Log to completion and acceptance by the Contracting Officer, and retained in project records. The Corrective Action Log, showing status of each CAR, shall be submitted to the Contracting Officer monthly. A CAR may be initiated by either the Contractor or the Contracting Officer. The Contracting Officer must approve each CAR at the root cause identification stage, the plan for elimination stage, and the close out stage after verification that the root cause has been eliminated.

#### 1.4.3 Coating Work Plan

This work plan shall be considered as part of the Quality Control Plan.

Provide procedures for reviewing contract documents immediately after award to identify errors, omissions, and discrepancies so that any such issues can be resolved prior to project planning and development of detailed procedures.

Provide procedures for verification of key processes during Initial Phase to ensure that contract requirements can be met. Key processes shall include surface preparation, coating application and curing, inspection, and documentation, and any other process that might adversely impact orderly progression of work.

Provide procedures for all phases of coating operations, including planned work, rework, repair, inspection, and documentation. Address mobilization and setup, surface preparation, coating application, coating initial cure, tracking and correction of noncompliant work, and demobilization. Coordinate work processes with health and safety plans and confined space entry plans. For each process, provide procedures that include appropriate work instructions, material and equipment requirements, personnel qualifications, controls, and process verification procedures. Provide procedures for inspecting work to verify and document compliance with contract requirements, including inspection forms and checklists, and acceptance and rejection criteria.

- [ Provide procedures for determining the existing surface profile under paint, and procedures for ensuring that the profile is not increased beyond the maximum profile specified herein.
- ] Provide procedures for correcting noncompliant work. Detailed procedures are required in advance to avoid delays in meeting overcoat windows as well as to avoid delays in production. Provide procedures for repairing defects in the coating film, such as runs, drips, sags, holidays, overspray, as well as how to handle correct coating thickness



noncompliance, any other areas of repair or rework that might be adversely affected by delays in preparing and approving new procedures.

If a procedure is based on a proposed or approved request for deviation, the deviation shall be referenced. Changes to procedures shall be noted by submittal number and date approved, clearly delineating old requirements and new requirements, so that the records provide a continuous log of requirements and procedures.

#### 1.4.4 Design Data

##### 1.4.4.1 Containment System

Submit complete design drawings and calculations for the scaffolding and containment system, including an analysis of the loads which will be added to the structure by the containment system and waste materials. A registered engineer shall approve calculations and scaffold system design.

#### 1.4.5 Test Reports

##### 1.4.5.1 Joint Sealant Qualification Test Reports

Submit test results from independent laboratory of representative samples of joint sealant material. Samples must have been tested within the last three years. Submit results as required in paragraph QUALITY ASSURANCE PROVISIONS of [ASTM C920](#). Note that testing in accordance with QUALITY ASSURANCE PROVISIONS is a pre-qualification requirement.

##### 1.4.5.2 Coatings Qualification Test Reports

Submit test results from independent laboratory of representative samples of each coating material. U.S. Department of Defense laboratories are considered to be independent laboratories for purposes of compliance with "QUALIFICATION INSPECTION" requirements herein. Samples must have been tested within the last three years. Submit results for epoxy materials as required in paragraph QUALIFICATION INSPECTION of [MIL-DTL-24441](#), and as revised by paragraph COATING SYSTEM herein. Submit results for polyurethane materials as required in paragraph QUALIFICATION INSPECTION of [MIL-PRF-85285](#), and as revised by paragraph COATING SYSTEM herein. Note that requirement for QUALIFICATION INSPECTION is a pre-qualification requirement, and involves the same testing required for listing in the Qualified Products List of the respective material. See appropriate Military Specification for specific test requirements.

##### 1.4.5.3 Metallic Abrasive Qualification Test Reports

Submit results for abrasive as required in paragraph 4 REQUIREMENTS of [SSPC AB 3](#). Submit test results from independent laboratory of representative samples of each abrasive to be used on the jobsite. Samples must have been tested within the last three years. Note that this testing is for the purpose of prequalifying the abrasive.

##### 1.4.5.4 Recycled Metallic Abrasive Field Test Reports (Daily and Weekly)

Submit test results from independent laboratory of daily and weekly Quality Control testing required by [SSPC AB 2](#), as modified in paragraph ABRASIVE.

#### 1.4.6 Qualifications

##### 1.4.6.1 Qualifications of Certified Industrial Hygienist (CIH)

Submit name, address, telephone number, FAX number, and e-mail address of the independent third party CIH. Submit documentation that hygienist is certified by the American Board of Industrial Hygiene in comprehensive practice, including certification number and date of certification/recertification. Provide evidence of experience with hazards involved in industrial coating application work.

##### 1.4.6.2 Qualifications of Certified Protective Coatings Specialist (PCS)

Submit name, address, telephone number, FAX number, and e-mail address of the independent third party PCS. Submit documentation that specialist is certified by SSPC: The Society for Protective Coatings (SSPC) as a PCS, including certification number and date of certification/recertification. If the PCS is employed by the same coating inspection company to which the coating inspector is employed, this does not violate the independent third-party requirements. The PCS shall remain certified during the entire project, and the Contracting Officer shall be notified of any change in certification status within 10 days of the change. The PCS shall not be the designated coating inspector.

##### 1.4.6.3 Qualifications of Coating Inspection Company

Submit documentation that the coating inspection company that will be performing all coating inspection functions is certified by SSPC to the requirements of [SSPC QP 5](#) prior to contract award, and shall remain certified while accomplishing any coating inspection functions. The coating inspection company must remain so certified for the duration of the project. If a coating inspection company's certification expires, the firm will not be allowed to perform any inspection functions, and all surface preparation and coating application work must stop, until the certification is reissued. Requests for extension of time for any delay to the completion of the project due to an inactive certification will not be considered and liquidated damages will apply. Notify the Contracting Officer of any change in coating inspection company certification status.

##### 1.4.6.4 Qualifications of QC Specialist Coating Inspector

Submit documentation that each coating inspector is employed, and qualified to [SSPC QP 5](#), Level III, by the selected coating inspection company. Each inspector shall remain employed by the coating inspection company while performing any coating inspection functions.

##### 1.4.6.5 Qualifications Of Individuals Performing Abrasive Blasting

Submit name, address, and telephone number of each person that will be performing abrasive blasting. Submit documentation that each blaster is qualified by SSPC to the SSPC C-7 Dry Abrasive Blaster Qualification Program. Each blaster shall remain qualified during the entire period of abrasive blasting, and the Contracting Officer shall be notified of any change in qualification status.

##### 1.4.6.6 Qualifications of Testing Laboratory for Coatings

Submit name, address, telephone number, FAX number, and e-mail address of the independent third party laboratory selected to perform testing of

coating samples for compliance with specification requirements. Submit documentation that laboratory is regularly engaged in testing of paint samples for conformance with specifications, and that persons performing analyses are qualified.

#### 1.4.6.7 Qualifications of Testing Laboratory for Abrasive

Submit name, address, telephone number, FAX number, and e-mail address of the independent third party laboratory selected to perform testing of abrasive for compliance with specification requirements. Submit documentation that laboratory has experience in testing samples of abrasive for conformance with specifications, and that persons performing analyses are qualified.

#### 1.4.6.8 Qualifications of Coating Contractors

All Contractors and Subcontractors that perform surface preparation or coating application shall be certified to either ISO 9001 or SSPC QP 1 and SSPC QS 1 prior to contract award, and shall remain certified while accomplishing any surface preparation or coating application. The painting Contractors and painting Subcontractors must remain so certified for the duration of the project. If a Contractor's or Subcontractor's certification expires, the firm will not be allowed to perform any work until the certification is reissued. Requests for extension of time for any delay to the completion of the project due to an inactive certification will not be considered and liquidated damages will apply. Notify the Contracting Officer of any change in Contractor certification status.

#### 1.4.6.9 Joint Sealant Materials

Provide manufacturer's certification of conformance to contract requirements.

#### 1.4.6.10 Coating Materials

Provide manufacturer's certification of conformance to contract requirements.

#### 1.4.6.11 Coating System Component Compatibility

Provide certification from each manufacturer of components of the coating system, epoxy primer, epoxy intermediate, and polyurethane topcoat, that the supplied coating material is suitable for use in the specified coating system. Each manufacturer shall identify the specific products, including manufacturer's name, which their product may be used with. The certification shall provide the name of the manufacturer that will provide technical support for the entire system. When all coating materials are manufactured by one manufacturer, this certification is not required.

#### 1.4.6.12 Non-metallic Abrasive

Provide manufacturer's certification that the materials are currently approved by the Naval Sea Systems Command and listed on the Qualified Products Lists (QPL) for the specified materials.

#### 1.4.6.13 Metallic Abrasive

Provide manufacturer's certification of conformance to contract

requirements and provide copies of test results.

#### 1.4.7 Protective Coating Specialist (PCS)

The PCS shall be considered a QC Specialist and shall report to the QC Manager, as specified in Section 01 45 00.00 10 01 45 00.00 20 01 45 00.00 40 QUALITY CONTROL. The PCS shall approve all submittals prior to submission to the QC Manager for approval or submission to the government for approval.

#### 1.4.8 Pre-Application Meeting

After approval of submittals but prior to the initiation of coating work, Contractor representatives, including at a minimum, project superintendent and QC manager, paint foreman, coating inspector, and PCS shall have a pre-application coating preparatory meeting. This meeting shall be in addition to the pre-construction conference. Specific items addressed shall include: corrective action requirements and procedures, coating work plan, safety plan, coordination with other Sections, inspection standards, inspection requirements and tools, test procedures, environmental control system, safety plan, and test logs. Notify Contracting Officer at least ten days prior to meeting.

### 1.5 PRODUCT DATA

#### 1.5.1 Joint Sealant Instructions

Submit manufacturer's printed instructions including detailed application procedures, minimum and maximum application temperatures, and curing procedures. Include Safety Data Sheets (SDS) for materials to be used at the job site in accordance with 29 CFR 1926.59.

#### 1.5.2 Coating System Instructions

Submit manufacturer's printed instructions including detailed mixing and application procedures, number and types of coats required, minimum and maximum application temperatures, and curing procedures. Include Safety Data Sheets (SDS) for materials to be used at the job site in accordance with 29 CFR 1926.59.

### 1.6 DELIVERY AND STORAGE

Ship, store, and handle materials in accordance with SSPC PA 1, and as modified in this Section. Maintain temperature in storage spaces between 40 and 85 degrees F, and air temperature more than 5 degrees F above the dew-point at all times. Inspect materials for damage prior to use and return non-compliant materials to manufacturer. Remove materials with expired shelf life from government property immediately and notify the Contracting Officer.

If materials are approaching shelf life expiration and an extension is desired, samples may be sent to the manufacturer, along with complete records of storage conditions, with a request for shelf life extension. If the manufacturer finds the samples and storage data suitable for shelf life extension, the manufacturer may issue an extension, referencing the product evaluation and the review of storage records. Products may not be extended longer than allowed in the product specification.

## 1.7 COATING HAZARDS

Ensure that employees are trained in all aspects of the safety plan. Specified coatings may have potential health hazards if ingested or improperly handled. The coating manufacturer's written safety precautions shall be followed throughout mixing, application, and curing of the coatings. During all cleaning, cleanup, surface preparation, and paint application phases, ensure that employees are protected from toxic and hazardous chemical agents which exceed concentrations in 29 CFR 1910.1000. Comply with respiratory protection requirements in 29 CFR 1910.134. The CIH shall approve work procedures and personal protective equipment.

## 1.8 JOB SITE REFERENCES

Make available to the Contracting Officer at least one copy each of ASTM D3276, ASTM D3925, ASTM D4285, ASTM D7127, SSPC SP COM, SSPC SP 1, SSPC 7/NACE No.4, SSPC SP 10/NACE No. 2, SSPC PA 1, SSPC PA 2, SSPC Guide 6, SSPC VIS 1, SSPC QP 1, SSPC QS 1, and an SSPC Certified Contractor Evaluation Form at the job site.

## PART 2 PRODUCTS

## 2.1 JOINT SEALANT

TT-S-00230, Type II, Class B

## 2.2 COATING SYSTEM

Alternate systems or products will not be considered. Provide a complete system (primer, intermediate coat, top coat) material from one supplier.

[ Apply the entire coating system in the field. Remove all shop-applied primer prior to final field surface preparation and coating system application. Adjust all shop preparation to avoid conflicts with final surface preparation requirements.

] [Prepare surface and apply the complete coating system in the shop. Follow all temperature, humidity, and testing requirements listed herein.

] The Military specification epoxy and polyurethane products specified in this Section do not require approval for listing on the QPL prior to contract award, as indicated in paragraph 3.2 of MIL-DTL-24441 and paragraph 3.1 of MIL-PRF-85285. Testing of products by an independent laboratory to the QUALIFICATION INSPECTION requirements of MIL-DTL-24441 and MIL-PRF-85285 prior to contract award is required. See specific submittal requirements in paragraph QUALITY ASSURANCE.

## 2.2.1 Zinc-Rich Epoxy Primer Coat

Epoxy polyamide, MIL-DTL-24441/19 (Formula 159, Type III).

## 2.2.2 Epoxy Intermediate Coat

Epoxy polyamide, MIL-DTL-24441/31 (Formula 152, Type IV, White (Tinted)). Tint to approximately SAE AMS-STD-595A color number 27778 parchment using pigment dispersions prepared for epoxy paint tinting. Manufacturer shall tint material and appropriately label. All other requirements of this Military Specification apply.

### 2.2.3 Polyurethane Topcoat

Polyurethane coating topcoat of MIL-PRF-85285, Type II, [White SAE AMS-STD-595A color number 17925][Beige SAE AMS-STD-595A color number 27769 in gloss][White SAE AMS-STD-595A color number 17875, and Orange SAE AMS-STD-595A color number 12197].

Modify paragraph 3.6.4 of MIL-PRF-85285, Viscosity and Pot Life, as follows:

The viscosity of the admixed coating, when tested in accordance with ASTM D1200 through a No. 4 Ford cup, shall be as follows:

Time from mix (minimum)	Maximum time through a No. 4 Ford cup
Initially	30 seconds
2 hours	60 seconds
4 hours	No gel

Modify paragraph 3.7.1 of MIL-PRF-85285, Drying Time, as follows:

When applied by spray techniques and when tested in accordance with ASTM D1640/D1640M, the coating shall be set-to-touch within four hours and dry-hard within eight hours (see 4.6 and table I).

### [2.3 COLOR IDENTIFICATION OF FUEL HANDLING AND STORAGE FACILITIES

Piping, conduit, and tank identification shall be in accordance with MIL-STD-161. Mark direction of fluids in accordance with MIL-STD-161. The NATO symbol for JP-8 is F-34.

### ]2.4 COATING SAMPLE COLLECTION AND SHIPPING KIT

Provide a kit that contains one quart can for the base of each coating material, an appropriately sized can for each activator, dipping cups for each component to be sampled, a shipping box sized for the samples to be shipped, and packing material. Mark cans for the appropriate component. Provide shipping documents, including either pre-paid shipping or a shipper number that can be used by the QC Manager to arrange pickup, addressed to the approved coating testing laboratory.

### 2.5 ABRASIVE SAMPLE COLLECTION AND SHIPPING KIT

Provide a kit that contains one suitable plastic bag or container for each sample to be collected. Mark containers for the appropriate component. Provide shipping documents, including either pre-paid shipping or a shipper number that can be used by the QC Manager to arrange pickup, addressed to the approved coating testing laboratory.

### 2.6 TEST KITS

#### 2.6.1 Test Kit for Measuring Chloride, Sulfate and Nitrate Ions on Steel and Coated Surfaces

Provide test kits called CHLOR\*TEST CSN Salts, as manufactured by

CHLOR\*RID International Inc. of Chandler, Arizona ([www.chlor-rid.com](http://www.chlor-rid.com)) or equal. An "equal" test kit shall meet the following requirements:

- a. Kit contains all materials, supplies, tools and instructions for field testing and on-site quantitative evaluation of chloride, sulfate and nitrate ions;
- b. Kit extract solution is acidic, factory pre-measured, pre-packaged, and of uniform concentration;
- c. Kit components and solutions are mercury free and environmentally friendly;
- d. Kit contains new materials and solutions for each test extraction;
- e. Extraction test container (vessel, sleeve, cell. etc.) creates a sealed, encapsulated environment during salt ion extraction;
- f. Test extract container is suitable for testing the following steel surfaces: horizontal (up/down configuration), vertical, flat, curved, smooth, pitted, and rough;
- g. All salt ion concentrations are directly measured in micrograms per square centimeter.

#### 2.6.2 Test Kit for Identifying Amine Blush on Epoxy Surfaces

After coating and/or primer has hardened and prior to applying the next coat, test for unreacted amines using the AMINE BLUSH CHECK, manufactured by Elcometer, Rochester Hills, Michigan, or equal. To be considered for approval as an "equal" test kit it shall meet the following requirements:

- a. Be a completely self-contained field test kit with all materials, supplies, tools and instructions to perform tests and indicate the presence of unreacted amines;
- b. Use an identifiable, consistent, uniform, pre-packaged, factory pre-measured indicating solution;
- c. Kit contains no mercury or lead and is environmentally friendly;
- d. Kit contains a solution of an unreacted amine for the purpose of "self checking" the indicator solution;

#### 2.7 ABRASIVE

The referenced abrasive specifications have maximum limits for soluble salts contamination, however, this maximum level of contamination does not guarantee that contamination will not be transferred to the steel surface during abrasive blasting. Other factors such as on-site handling and recycling can allow contamination of abrasive. Contractors are cautioned to verify that the chosen abrasive, along with work and storage processes, allow the final surface cleanliness requirements to be achieved. Successful testing of chlorides in abrasive does not negate the final acceptance testing of steel surfaces.

- [ Interpret [MIL-A-22262](#) to include the meaning that abrasive material contains a maximum one percent by weight of any toxic substance listed in either Table Z-1, Z-2, or Z-3 or [29 CFR 1910-SUBPART Z](#), with the

exception of inert or nuisance dust materials, arsenic, beryllium, cadmium, cobalt, lead, mercury, rhodium, silver, tellurium, thallium, and uranium.

]

#### 2.7.1 Non-metallic Abrasive

Conform to MIL-A-22262, Type I (Inorganic materials)[ except that the gross gamma radioactivity shall not exceed 5 picocuries per gram]. Abrasive shall be approved by the Naval Sea Systems Command and listed on the appropriate Qualified Products List (QPL) for the specified materials. Use sampling procedures and testing frequencies as prescribed in MIL-A-22262. Use abrasive that is specifically selected and graded to provide a sharp, angular profile to the specified depth. Do not use ungraded abrasive. Make adjustments to processes or abrasive gradation to achieve specified surface profile. Recycled non-metallic abrasive shall meet all requirements of the specification each time that it is placed in the blast pot.

#### 2.7.2 Metallic Abrasive

##### 2.7.2.1 New and Remanufactured Steel Grit

Conform to the chemical and physical properties of SSPC AB 3 Class 1 (Steel) only[, except that the gross gamma radioactivity shall not exceed 5 picocuries per gram]. Class 2 (Iron) abrasive shall not be used.

To develop a suitable work mix from new steel abrasive, a minimum of 200 - 400 recycles is required, therefore, it is advantageous for a Contractor to use remanufactured steel grit or grit reclaimed from a previous project. Such grit shall be considered to conform if it can be traced to new grit conforming to SSPC AB 3 Class 1 and it meets all cleanliness requirements of SSPC AB 3 Class 1 when brought to the current jobsite. Submit one representative sample of this work mix to the laboratory for testing, along with samples of new material. Acceptance and use of this work mix shall not be used to justify any deviation from surface preparation requirements.

##### 2.7.2.2 Recycled Steel Grit

Conform to the chemical and physical properties of SSPC AB 2

#### 2.8 WHITE ALUMINUM OXIDE NON-SKID GRIT

Size #60, dust free (washed and dry), minimum 99 percent pure, having the following sieve analysis when tested in accordance with ASTM E11 using a 2.2 pound sample:

Sieve #	Percent Retained
40	0
50	15-40
60	60-85

### PART 3 EXECUTION

Perform all work, rework, and repair in accordance with approved procedures in the Coating Work Plan.



### [3.1 REMOVAL OF COATINGS CONTAINING HAZARDOUS MATERIALS

Coatings containing hazardous materials and identified for disturbance during surface preparation, including removal, shall be handled in accordance with Section 02 83 00 LEAD REMEDIATION. Coordinate surface preparation requirements from Section 02 83 00 LEAD REMEDIATION with this Section.

### ]3.2 COATING AND ABRASIVE SAMPLE COLLECTION AND TESTING

Sample and test materials delivered to the jobsite. Notify Contracting Officer three days in advance of sampling. The QC Manager and either the PCS or coating inspector shall witness all sampling.

#### 3.2.1 Coating Sample Collection

Provide a sample collection kit as required in paragraph COATING SAMPLE COLLECTION AND SHIPPING KIT. From each lot, obtain a one quart sample of each base material, and proportional samples of each activator based on mix ratio, by random selection from sealed containers in accordance with ASTM D3925. Prior to sampling, mix contents of each sealed container to ensure uniformity. As an alternative to collecting small samples from kits, entire kits may be randomly selected and shipped to laboratory, observing all requirements for witnessing and traceability. For purposes of quality conformance inspection, a lot is defined as that quantity of materials from a single, uniform batch produced and offered for delivery at one time. A batch is defined as that quantity of material processed by the manufacturer at one time and identified by number on the label. Identify samples by designated name, specification number, batch number, project contract number, sample date, intended use, and quantity involved. The QC manager will take possession of the packaged samples, contact the shipping company to arrange for pickup, and relinquish the samples only to the shipping representative for shipment to the approved laboratory for testing as required by the paragraph COATING SAMPLE TEST REPORTS.

#### 3.2.2 Abrasive Sample Collection

Provide a sample collection kit as required in paragraph ABRASIVE SAMPLE COLLECTION AND SHIPPING KIT. For purposes of quality conformance inspection, a lot shall consist of all abrasive materials of the same type from a single, uniform batch produced and offered for delivery at one time. Obtain samples of each abrasive lot using the sampling techniques and schedule of MIL-A-22262. The addition of any substance to a batch shall constitute a new lot. Identify samples by designated name, specification number, lot number, project contract number, sample date, intended use, and quantity involved. The QC manager will take possession of the packaged samples, contact the shipping company to arrange for pickup, and relinquish the samples only to the shipping representative for shipment to the approved laboratory for testing as required by the paragraph ABRASIVE SAMPLE TEST REPORTS.

#### 3.2.3 Coating Sample Test Reports

Submit test results for each lot of coating material delivered to the jobsite. Test samples of primer, intermediate, and topcoat materials for compliance with requirements of Table I. Reject entire lot represented by samples that fail one or more tests, select new lots, and test samples.

### 3.2.4 Abrasive Sample Test Reports

Submit test results for each lot of abrasive delivered to the jobsite. Test samples of metallic abrasive to the requirements of paragraph REQUIREMENTS of SSPC AB 3, except paragraph 4.1.5 DURABILITY. Test samples of non-metallic abrasive as required in paragraph QUALITY CONFORMANCE INSPECTION of MIL-A-22262. Reject entire lot represented by samples that fail one or more tests, select new lots, and test samples.

### 3.3 SURFACES TO BE COATED

Coat exterior surfaces of [tank ][structure ][\_\_\_\_][including steel roof, shell, legs, stair, railing, and other exterior appurtenances].

### 3.4 LIGHTING

Provide lighting for all work areas as prescribed in SSPC Guide 12.

### 3.5 ENVIRONMENTAL CONDITIONS

#### 3.5.1 Containment

Design and provide a containment system for the capture, containment, collection, storage and disposal of the waste materials generated by the work under this Section, to meet the requirements of SSPC Guide 6, Class [1][2][3]. Vapor concentrations shall be kept at or below 10 percent of Lower Explosive Limit (LEL) at all times. Containment may be designed as fixed containment for complete structure or portable containment for sections of structure, however, containment shall remain in any one place from beginning of abrasive blasting through initial cure of coating. Waste materials covered by this paragraph shall not include any material or residue from removal of coatings containing lead, chromium, cadmium, PCB, or any other hazardous material.

It is the Contractors responsibility to insure the feasibility and workability of the containment system. The Contractor shall perform his operations and work schedule in a manner as to minimize leakage of the containment system. The containment system shall be properly maintained and shall not deviate from the approved drawings. If the containment system fails to function satisfactorily, the Contractor shall suspend all operations, except those required to minimize adverse impact on the environment or government property. Operations shall not resume until modifications have been made to correct the cause of the failure.

#### 3.5.2 Automated Monitoring Requirements

Provide continuous monitoring of temperature, relative humidity, and dew point data at pertinent points on the structure, during surface preparation, coating application, and initial cure. Locate sensors to provide pertinent data for the surface preparation and coat application being performed. Monitor any heating, cooling, or dehumidification equipment used. Make data available to the Contracting Officer through Internet access. Provide monitoring equipment to perform as follows:

- a. Data is collected in the field unit in one minute increments, and available for download (on-site) in a standard format. Contractor shall collect this data and make available to the Contracting Officer;

- b. Monitoring equipment shall have backup power such that data collection and transmission to web server will be uninterrupted during the entire period of the dehumidification requirement;
- c. Monitoring equipment shall have capability to measure surface temperatures at a minimum of four locations anywhere on a 150 foot diameter by 50 foot high tank;
- d. Monitoring equipment shall have capability to measure interior and exterior dry bulb temperature (DB), relative humidity (RH), and dewpoint temperature (DP);
- e. Data shall be available continuously through secure Internet connection, using widely available web browsers;
- f. Internet accessible data shall be collected and stored in maximum 15 minute increments, and lag time between data collection and online availability shall be no greater than 70 minutes;
- g. Internet accessible data shall be available for viewing online in tabular format, and graphical format using selected data;
- h. Internet accessible data shall be available for download in user-defined segments, or entire project to date, in a standard format usable by Microsoft Excel and other spreadsheet programs.
- i. Internet-based controls shall provide alerts to pre-designated parties through email messaging;
- j. Internet-based controls shall monitor data uploads from field unit and issue alert if data not initiated within 60 minutes of last upload;
- k. Internet-based controls shall monitor operation of DH equipment and issues alert when power remains off for more than 15 seconds, or if pre-determined temperature, RH, or DP conditions are exceeded;

The requirements listed here were developed around the Munters Exactaire Monitoring System, as this was the only monitoring system having Internet connectivity known to be commercially available. There is no requirement for connectivity of the monitoring system to control the DH equipment, therefore, any combination of equipment having the required functionality will be accepted.

### 3.6 SURFACE PREPARATION

#### 3.6.1 Abrasive Blasting Equipment

Use abrasive blasting equipment of conventional air, force-feed, or pressure type. Maintain a minimum pressure of 95 psig at nozzle. Confirm that air supply for abrasive blasting is free of oil and moisture when tested in accordance with ASTM D4285. Test air quality at each startup, but in no case less often than every five operating hours.

#### 3.6.2 Operational Evaluation of Abrasive

Test abrasive for salt contamination and oil contamination as required by the appropriate abrasive specification daily at startup and every five operating hours thereafter.

### 3.6.3 Surface Standard

Inspect surfaces to be coated, and select plate with similar properties and surface characteristics for use as a surface standard. Blast clean one or more **one foot** square steel panels as specified in paragraph SURFACE PREPARATION. Record blast nozzle type and size, air pressure at nozzle and compressor, distance of nozzle from panel, and angle of blast to establish procedures for blast cleaning. Measure surface profile in accordance with **ASTM D7127**. When the surface standard complies with all specified requirements, seal with a clearcoat protectant. Use the surface standard for comparison to abrasive blasted surfaces throughout the course of work.

### 3.6.4 Pre-Preparation Testing for Surface Contamination

Perform testing, abrasive blasting, and testing in the prescribed order.

#### 3.6.4.1 Pre-Preparation Testing for Oil and Grease Contamination

Inspect all surfaces for oil and/or grease contamination using two or more of the following inspection techniques: 1) Visual inspection, 2) WATER BREAK TEST, 3) CLOTH RUB TEST. Reject oil and/or grease contaminated surfaces, clean [using a water based pH neutral degreaser ]in accordance with **SSPC SP 1**, and recheck for contamination until surfaces are free of oil and grease.

**WATER BREAK TEST** - Spray atomized mist of distilled water onto surface, and observe for water beading. If water "wets" surface rather than beading up, surface can be considered free of oil or grease contamination. Beading of water (water forms droplets) is evidence of oil or grease contamination.

**CLOTH RUB TEST** - Rub a clean, white, lint free, cotton cloth onto surface and observe for discoloration. To confirm oil or grease contamination in lightly stained areas, a non-staining solvent may be used to aid in oil or grease extraction. Any visible discoloration is evidence of oil or grease contamination.

#### 3.6.4.2 Pre-Preparation Testing for Soluble Salts Contamination

Test surfaces for soluble salts, and wash as required, prior to abrasive blasting. Soluble salt testing is also required in paragraph PRE-APPLICATION TESTING FOR SOLUBLE SALTS CONTAMINATION as a final acceptance test of prepared surfaces after abrasive blasting, and successful completion of this phase does not negate that requirement. This phase is recommended since pre-preparation testing and washing are generally more advantageous than attempting to remove soluble salt contamination after abrasive blasting. Effective removal of soluble salts will require removal of any barrier to the steel surface, including rust. This procedure may necessitate combinations of wet abrasive blasting, high pressure water rinsing, and cleaning using a solution of water washing and soluble salts remover. The soluble salts remover shall be acidic, biodegradable, nontoxic, noncorrosive, and after application, will not interfere with primer adhesion. Delays between testing and preparation, or testing and coating application, may allow for the formation of new contamination. Use potable water, or potable water modified with soluble salt remover, for all washing or wet abrasive blasting. Test methods and equipment used in this phase are selected at the Contractor's discretion.

### 3.6.5 Abrasive Blasting

Abrasive blast steel surfaces to near-white metal in accordance with SSPC SP 10/NACE No. 2. Prepared surfaces shall conform to SSPC VIS 1 and shall match the prepared test-panels. Provide a 2 to 3 mil surface profile. Reject profile greater than 3 mils, discontinue abrasive blasting, and modify processes and materials to provide the specified profile. Measure surface profile in accordance with ASTM D7127, using Rmax as the measure of profile height. Record all measurements required in this standard. Measure profile at rate of three test areas for the first 1000 square feet plus one test area for each additional 1000 square feet or part thereof. When surfaces are reblasted for any reason, retest profile as specified. Following abrasive blasting, remove dust and debris by vacuum cleaning. Do not attempt to wipe surface clean.

### 3.6.6 Disposal of Used Abrasive

Dispose of used abrasive off Government property in accordance with Federal, State, and Local mandated regulations.

### 3.6.7 Pre-Application Testing For Surface Contamination

#### 3.6.7.1 Pre-Application Testing for Oil and Grease Contamination

Ensure surfaces are free of contamination as described in paragraph PRE-PREPARATION TESTING FOR OIL AND GREASE CONTAMINATION, except that only questionable areas need be checked for beading of water misted onto surface.

#### 3.6.7.2 Pre-Application Testing for Soluble Salts Contamination

Test surfaces for chloride contamination using the Test Kit described in TEST KIT FOR MEASURING CHLORIDE, SULFATE AND NITRATE IONS ON STEEL AND COATED SURFACES. Test all surfaces at rate of three tests for the first 1000 square feet plus one test for each additional 2000 square feet or part thereof. [Concentrate testing of bare steel at areas of coating failure to bare steel and areas of corrosion pitting. ][Perform 30 percent of tests on bare steel at welds, divided equally between horizontal and vertical welds. ]One or more readings greater than 3 micrograms per square centimeter of chlorides or 10 micrograms per square centimeter of sulfates or 5 micrograms per square centimeter of nitrates is evidence of soluble salt contamination. Reject contaminated surfaces, wash as discussed in paragraph PRE-PREPARATION TESTING FOR SOLUBLE SALTS CONTAMINATION, allow to dry, and re-test until all required tests show allowable results. Reblast tested and cleaned areas as required. Label all test tubes and retain for test verification.

#### 3.6.7.3 Pre-Application Testing for Surface Cleanliness

Apply coatings to dust free surfaces. To test surfaces, apply strip of clear adhesive tape to surface and rub onto surface with finger. When removed, the tape should show little or no dust, blast abrasive, or other contaminant. Reject contaminated surfaces and retest. Test surfaces at rate of three tests for the first 1000 square feet plus one test for each additional 1000 square feet or part thereof. Provide two additional tests for each failed test or questionable test. Attach test tapes to Daily Inspection Reports.

### 3.7 MIXING AND APPLICATION OF SEALANT AND COATING SYSTEM

#### 3.7.1 Preparation of Sealant and Coating Materials for Application

Each of the sealant, primer, intermediate, and topcoat materials is a two-component material supplied in separate containers.

##### 3.7.1.1 Mixing Sealant, Primer and Intermediate Coat Materials

Mix in accordance with manufacturer's instructions, which may differ for each product. Do not mix partial kits, or alter mix ratios. Mix materials in same temperature and humidity conditions specified in paragraph DELIVERY AND STORAGE. Allow mixed material to stand for the required induction time based on its temperature.

##### 3.7.1.2 Mixing Topcoat Material

Do not mix partial kits, or alter mix ratios. Mix polyurethane coating materials in same temperature conditions specified in paragraph DELIVERY AND STORAGE. The polyurethane coating material is moisture sensitive and any introduction of moisture or water into the material during mixing or application will shorten usable pot life. Use a mixer that does not create a vortex. Do not add solvent without specific written recommendation from the manufacturer. No induction time is required, only thorough agitation of the mixed material.

##### 3.7.1.3 Pot Life

Apply mixed products within stated pot life for each product. Stop applying when material becomes difficult to apply in a smooth, uniform wet film. Add all required solvent at time of mixing. Do not add solvent to extend pot life. Pot life is based on standard conditions at 70 degrees F and 50 percent relative humidity. For every 18 degrees F rise in temperature, pot life is reduced by approximately half, and for every 18 degrees F drop it is approximately doubled. Usable pot life depends on the temperature of the material at the time of mixing and the sustained temperature at the time of application. Other factors such as the shape of the container and volume of mixed material may also affect pot life. Precooling or exterior icing of components for at least 24 hours to a minimum of 50 degrees F in hot climates will extend pot life. High humidity at time of mixing and application shortens pot life of the Polyurethane topcoat material. Following are approximate pot life times:

Sealant	As specified by manufacturer
Epoxy primer and intermediate materials	4 hours
Polyurethane topcoat materials	2 hours.

##### 3.7.1.4 Application Conditions and Recoat Windows

The application condition requirements for the coating system are very time and temperature sensitive, and are intended to avoid the delamination problems frequently found on industrial structures. Plan coating application to ensure that specified temperature, humidity, and condensation conditions are met. If conditions do not allow for orderly application of sealant, primer, stripe coat, intermediate coat and topcoat, use appropriate means of controlling air and surface temperatures, as required. Partial or total enclosures, insulation, heating or cooling, or other appropriate measures may be required to control conditions to allow for orderly application of all required coats.

Maintain air and steel surface temperature between 60 and 100 degrees F during application and the first four hours of cure for epoxy coats and the first eight hours of cure for polyurethane coats. Maintain steel surface temperature more than 5 degrees F above the dew-point of the ambient air for the same period.

Use Table entitled "RECOAT WINDOWS" to determine appropriate recoat windows for each coat after the initial coat. Apply each coat during appropriate RECOAT WINDOW of preceding coat. If a RECOAT WINDOW is missed, the minimum and maximum primer and intermediate coat thickness may be adjusted to accommodate a FILL COAT, however, requirements for total epoxy coating thickness and total coating thickness will not be modified. Missing more than one RECOAT WINDOW may require complete removal of coating if maximum total coating thickness requirements cannot be achieved.

If coating is not applied during RECOAT WINDOW, or if surface temperature exceeds 120 degrees F between applications, provide GLOSS REMOVAL, apply next coat within 24 hours. If next planned coat is topcoat, apply FILL COAT if required to fill sanding marks. Sanding marks from GLOSS REMOVAL of intermediate coat reflecting through topcoat will be considered as noncompliant. Apply FILL COAT within 24 hours of GLOSS REMOVAL, then apply topcoat within RECOAT WINDOW of FILL COAT.

RECOAT WINDOWS						
<u>EPOXY OVER EPOXY</u>						
Temperature degrees F	60-70	71-80	12-36	91-100	101-110	111-120
RECOAT WINDOW (Hrs.)	24-72	18-60	16-48	12-36	8-18	4-6
<u>POLYURETHANE OVER EPOXY</u>						
Temperature degrees F	60-70	71-80	12-36	91-100	101-110	111-120
RECOAT WINDOW (Hrs.)	24-96	24-72	16-48	12-36	10-24	8-16
<u>POLYURETHANE OVER POLYURETHANE</u>						

RECOAT WINDOWS						
Temperature degrees F	60-70	71-80	12-36	91-100	101-110	111-120
RECOAT WINDOW (Hrs.)	8-48	6-48	4-36	3-24	2-12	1-2

The temperature ranges shown in the table above are for determining recoat windows. Choose recoat window based on the highest surface temperature that was sustained for one or more hours between coats. This applies to the entire time between coats. Measure and record air and surface temperatures on hourly basis to determine appropriate recoat windows. If surface temperature goes above 100 degrees F, measure and record temperatures every half hour.

FILL COAT - Where indicated, apply coat of intermediate coat epoxy, at 2 to 3 mils DFT, then apply next specified full coat within recoat window of FILL COAT. A FILL COAT may be used to adjust coating thickness to comply with requirements or to fill sanding marks in intermediate coat.

GLOSS REMOVAL - Where required, hand sand in a linear fashion to remove gloss using 120-200 grit wet/dry sandpaper, followed by solvent wiping with a clean rag soaked with denatured alcohol to remove all dust. GLOSS REMOVAL of primer coat is to scarify surface and shall consist of removal of approximately 1 mil of coating. If steel is exposed during GLOSS REMOVAL, repair in accordance with paragraph PROCEDURE FOR HOLIDAY AND SPOT REPAIRS OF NEWLY APPLIED COATING. GLOSS REMOVAL of intermediate coat may include removal of up to 3 mils of coating to avoid excess thickness, prior to application of FILL COAT.

### 3.7.2 Amine Blush Testing of Epoxy Coat Prior to Overcoating

Test epoxy surfaces prior to application of roof joint sealant, epoxy coat, or polyurethane topcoat for amine blush contamination using the Test Kit described in paragraph TEST KIT FOR IDENTIFYING AMINE BLUSH ON EPOXY SURFACES. Test all surfaces at rate of three tests for the first 1000 square feet plus one test for each additional 2000 square feet or part thereof. Remove any identified contamination using an approved procedure.

### 3.7.3 Application of Coating System and Joint Sealant

Apply coatings in accordance with SSPC PA 1 and as specified herein. Apply coatings to surfaces that meet all stated surface preparation requirements.

After application of primer coat and prior to application of each subsequent coat, perform testing prescribed in paragraph PRE-APPLICATION TESTING FOR SURFACE CONTAMINATION, as necessary, to ensure minimal intercoat contamination. This testing may be reduced to one half of the prescribed rate for bare steel if the testing indicates no contamination when sampling is evenly distributed over surfaces being tested. If



contamination is found between coats, revert to the specified testing rate. Generally, oil and grease contamination and soluble salts contamination are not encountered if subsequent coats are applied within specified recoat windows and unusual atmospheric events do not occur. Such atmospheric events as a coastal storm blowing onshore can bring unusual chloride contamination. Concern for intercoat contamination should be continually prevalent, and spot testing should be accomplished to verify satisfactory conditions. Where visual examination or spot testing indicates contamination, perform sufficient testing to verify non-contamination, or to define extent of contamination for appropriate treatment.

Apply each coat in a consistent wet film, at 90 degrees to previous coat. Ensure that primer and intermediate coat "cold joints" are no less than six inches from welds. Apply stripe coat by brush. For convenience, stripe coat material may be delivered by spray if followed immediately with brush-out and approved procedures include appropriate controls on thickness. Apply all other coats by spray application. Use appropriate controls to prevent airborne coating fog from drifting beyond[ 15] [ ] feet from the structure perimeter] [the tank berm]. Cover or protect all surfaces that will not be coated. The cleanliness, temperature, recoat windows, and airborne paint containment requirements may necessitate the use of enclosures, portable shelters, or other appropriate controls.

Apply coatings at the following specified thickness:

Coat	Minimum DFT (Mils)	Maximum DFT (Mils)
Primer	3	5
Intermediate	3	5
Top	2	3
Total system	8	13

#### 3.7.3.1 Application of Primer

Apply primer coat, maintaining paint supply container height within 3 feet of the paint nozzle for applying zinc primer. Maintain constant agitation of paint pot to ensure that zinc does not settle in container.

#### 3.7.3.2 Application of Stripe Coat

Apply a stripe coat of intermediate coat epoxy material within RECOAT WINDOW of primer, allowing sufficient dry time to allow application of intermediate coat within RECOAT WINDOW of primer. Apply by brush, working material into corners, crevices, angles, and welds, and onto outside corners and angles.

#### 3.7.3.3 Application of Intermediate Coat

Apply intermediate coat within RECOAT WINDOW of primer coat.

#### 3.7.3.4 Non-skid for Stairs and Top

Where non-skid is required, apply a second intermediate coat, and immediately follow with application of non-skid grit, broadcast at the

rate of 2 pounds per 100 square feet, and backroll. Apply topcoat as specified.

#### 3.7.3.5 Application of Topcoat

Make all required repairs to primer and intermediate coats as specified in paragraph entitled "Procedure for Holiday and Spot Repairs of Newly Applied Coating" prior to applying topcoat. Apply topcoat within RECOAT WINDOW of intermediate coat. The polyurethane topcoat may require multiple passes to achieve desired aesthetics and required thickness. Consult manufacturer for thinning and application procedures for anticipated temperature, humidity, and wind conditions. Touch-up blemishes and defects within recoat window of polyurethane topcoat. Retain sample of polyurethane topcoat, from the same batch used to coat structure, to make touch-ups that might be required later.

#### 3.7.3.6 Application of Joint Sealant

Apply joint sealant to back-to-back steel joints that are less than 3/8 inches wide and are not seal welded. Apply sealant to top and bottom, or each side, of narrow joints. Apply sealant within 48 hours of application of the topcoat, and touch-up with topcoat after appropriate cure of the sealant.

#### 3.7.3.7 Procedure for Holiday and Spot Repairs of Newly Applied Coating

Repair coating film defects at the earliest practicable time, preferably before application of the succeeding coat. Observe all requirements for soluble salts contamination, cleanliness between coats, and application conditions. Prepare defective area in accordance with SSPC SP 10/NACE No. 2, and feather coating as required to leave 4 inches of each succeeding coat feathered and abraded. Protect adjacent areas from damage and overspray. Remove dust and solvent wipe the prepared area plus an additional 4 inches beyond the prepared area with clean denatured alcohol. Apply each coat within RECOAT WINDOW of preceeding coat. Within four hours of preparation, apply zinc-rich primer to prepared steel and feather onto prepared primer. Apply intermediate coat to primed area and feather to prepared intermediate area. Apply topcoat to intermediate coat and feather to prepared topcoat. Apply each repair coat to approximate thickness of surrounding coating system.

#### 3.7.3.8 Structure Occupancy After Coating Application

Use clean canvas or other approved shoe covers when walking on coated surfaces, regardless of curing time allowed. For heavily trafficked areas, provide cushioned mats for additional protection.

### 3.8 PROJECT IDENTIFICATION

At the completion of the work, stencil the following information on the [structure ][tank exterior adjacent to the main manway opening ]in 3/4 to one inch Helvetica style letters of contrasting color using acrylic stencil paint:

Date exterior coated:  
Project Number:  
Contractor:  
Address:  
Coating System

Surface Prep: SSPC SP _____	Profile: _____
Primer: _____	Thickness: _____
Intermediate: _____	Thickness: _____
Topcoat: _____	Thickness: _____
Total Thickness: _____	

### 3.9 FIELD QUALITY CONTROL

For marking of tank surfaces, use chalk for marking bare steel, and water based markers for marking coated surfaces, and remove marks prior to coating. Do not use any wax or grease based markers, or any other markers that leave a residue or stain.

#### 3.9.1 Coating Inspector

The coating inspector shall be considered a QC Specialist and shall report to the QC Manager, as specified in Section 01 45 00.00 10 01 45 00.00 20 01 45 00.00 40 QUALITY CONTROL. The Coating Inspector shall be present during all pre-preparation testing, surface preparation, coating application, initial cure of the coating system, during all coating repair work, and during completion activities as specified in Section 01 45 00.00 10 01 45 00.00 20 01 45 00.00 40 QUALITY CONTROL. The Coating Inspector shall provide complete documentation of conditions and occurrences on the job site, and be aware of conditions and occurrences that are potentially detrimental to the coating system. The requirements for inspection listed in this Section are in addition to the QC inspection and reporting requirements specified in Section 01 45 00.00 10 01 45 00.00 20 01 45 00.00 40 QUALITY CONTROL.

#### 3.9.2 Field Inspection

##### 3.9.2.1 Inspection Requirements

Perform field inspection in accordance with ASTM D3276 and the approved Coating Work Plan. Document Contractor's compliance with the approved Coating Work Plan.

Provide all tools and instruments required to perform the required testing, as well as any tools or instruments that the inspector considers necessary to perform the required inspections and tests. Document each inspection and test, including required hold points and other required inspections and tests, as well as those inspections and tests deemed prudent from on-site evaluation to document a particular process or condition, as follows:

- a. Location or area;
- b. Purpose (required or special);
- c. Method;
- d. Criteria for evaluation;
- e. Results;
- f. Determination of compliance;
- g. List of required rework;
- h. Observations.

Collect and record Environmental Conditions as described in ASTM D3276 on a 24 hour basis, as follows:

- a. During surface preparation, every two hours or when changes occur;

- b. During coating application and the first four days of initial cure, every hour, or when changes occur;
- c. Note location, time, and temperature of the highest and lowest surface temperatures each day;
- d. Use a non-contact thermometer to locate temperature extremes, then verify with contact thermometers.

Document all equipment used in inspections and testing, including manufacturer, model number, serial number, last calibration date and future calibration date, and results of on-site calibration performed.

Document Contractors compliance with the approved Coating Work Plan.

#### 3.9.2.2 Inspection Report Forms

Develop project-specific report forms as required to report measurements, test results, and observations being complete and conforming to contract requirements. This includes all direct requirements of the contract documents and indirect requirements of referenced documents. Show acceptance criteria with each requirement and indication of conformity of each inspected item. The data may be in any format, but must be legible and presented so that entered data can be quickly compared to the appropriate requirement.

#### 3.9.2.3 Daily Inspection Reports

Submit one copy of daily inspection report completed each day when performing work under this Section, to the Contracting Officer. Note all non-compliance issues, and all issues that were reported for rework in accordance with QC procedures of Section 01 45 00.00 10 01 45 00.00 20 01 45 00.00 40 QUALITY CONTROL. Each report shall be signed by the coating inspector and the QC Manager. Submit report within 24 hours of date recorded on the report.

#### 3.9.2.4 Inspection Logbook

A continuous record of all activity related to this Section shall be maintained in an Inspection Logbook on a daily basis. The logbook shall be hard or spiral bound with consecutively numbered pages, and shall be used to record all information provided in the Daily Inspection Reports, as well as other pertinent observations and information. The Coating Inspector's Logbook that is sold by NACE is satisfactory. Submit the original Inspection Logbook to the Contracting Officer upon completion of the project and prior to final payment.

#### 3.9.2.5 Inspection Equipment

All equipment shall be in good condition, operational within its design range, and calibrated as required by the specified standard for use of each device.

### 3.10 FINAL CLEANUP

Following completion of the work, remove debris, equipment, and materials from the site. Remove temporary connections to Government or Contractor furnished water and electrical services. Restore existing facilities in and around the work areas to their original condition.

TABLE 1						
COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS						
Table 1a - Zinc-rich Epoxy Primer Coat <u>MIL-DTL-24441/19</u> Formula 159						
<u>Test</u>	<u>Component A</u>		<u>Component B</u>		<u>Mixed</u>	
	<u>Min.</u>	<u>Max.</u>	<u>Min.</u>	<u>Max.</u>	<u>Min.</u>	<u>Max.</u>
Pigment content, percent (zinc dust)	---	---	81.5	85.5	---	---
Volatiles, percent	42.8	44.3	8.0	8.4	---	---
Non-volatile vehicle percent	53.7	57.7	8.3	8.7	---	---
Weight, Kilograms/liter	0.87	1.01	3.30	3.40	2.80	2.91
Weight, Pounds/gallon	7.3	8.4	27.5	28.4	23.4	24.4
Flashpoint, Degrees C	35.6	---	37.8	---	---	---
Flashpoint, Degrees F	96	---	100	---	---	---
Consistency, grams	---	---	250	500	150	300
Set to touch time, hours at 23 degrees C, 73 degrees F	---	---	---	---	---	2
Dry hard time, hours at 23 degrees C, 73 degrees F	---	---	---	---	---	8
Pot life, hours at 23 degrees C, 73 degrees F	---	---	---	---	4	---
Sag resistance, Micrometers	---	---	---	---	300	---
Sag resistance, Mils	---	---	---	---	12	---
VOC, Grams/liter	---	---	---	---	---	304
VOC, Pounds/gallon	---	---	---	---	---	2.5

TABLE 1						
COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS						
Table Ia - Zinc-rich Epoxy Primer Coat MIL-DTL-24441/19 Formula 159						
<u>Test</u>	<u>Component A</u>		<u>Component B</u>		<u>Mixed</u>	
	<u>Min.</u>	<u>Max.</u>	<u>Min.</u>	<u>Max.</u>	<u>Min.</u>	<u>Max.</u>
NOTES: Test methods as specified in MIL-DTL-24441.						

TABLE 1						
COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS						
Table Ib. - Epoxy Intermediate Coat MIL-DTL-24441/31 Formula 152 Type IV (White (Tinted))						
<u>Test</u>	<u>Component A</u>		<u>Component B</u>		<u>Mixed</u>	
	<u>Min.</u>	<u>Max.</u>	<u>Min.</u>	<u>Max.</u>	<u>Min.</u>	<u>Max.</u>
Pigment content, percent	44.0	49.0	33.0	38.0	---	---
Volatiles, percent	29.0	35.0	16.0	21.0	---	---
Non-volatile vehicle percent	17.5	23.5	44.0	49.0	---	---
Coarse particles, percent	---	0.3	---	0.3	---	---
Consistency, grams	180	320	300	470	180	245
Weight, Kilograms/liter	1.39	1.45	1.29	1.35	1.34	1.4
Weight, Pounds/gallon	11.6	12.1	10.8	11.3	11.2	11.7
Set to touch time, hours at 23 degrees C, 73 degrees F	---	---	---	---	---	3

TABLE 1						
COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS						
Table Ib. - Epoxy Intermediate Coat MIL-DTL-24441/31 Formula 152 Type IV (White (Tinted))						
Test	Component A		Component B		Mixed	
	Min.	Max.	Min.	Max.	Min.	Max.
Dry hard time, hours at 23 degrees C, 73 degrees F	---	---	---	---	---	8
Fineness of grind, Hegman	4	---	4	---	---	---
Flashpoint, Degrees C	35.5	---	37.8	---	---	---
Flashpoint, Degrees F	96	---	100	---	---	---
Titanium dioxide, percent of pigment	91	---	---	---	---	---
Pot life, hours at 23 degrees C, 73 degrees F	---	---	---	---	4	---
Sag resistance, Micrometers	---	---	---	---	300	---
Sag resistance, Mils	---	---	---	---	12	---
Color of dry film to approximate color of SAE AMS-STD-595A color 27778	---	---	---	---	---	Conform
Contrast ratio, at 75 micrometers, 3 mils DFT	---	---	---	---	.098	---
Gloss, 60 degree specular	---	---	---	---	35	---
VOC, Grams/liter	---	---	---	---	---	340
VOC, Pounds/gallon	---	---	---	---	---	2.8
GENERAL NOTES: Test methods as specified in MIL-DTL-24441. Where "Conform" is indicated, refer to specific requirements of MIL-DTL-24441/31.						

TABLE I						
COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS						
Table Ic - Polyurethane TopcoatMIL-PRF-85285 Type II (White and Colors)						
Test	Component A		Component B		Mixed	
	Min.	Max.	Min.	Max.	Min.	Max.
Moisture content, percent	---	2	---	---	---	---
Course particles, percent	---	---	---	---	---	.5
Viscosity	---	---	---	---	---	See Note 1
Fineness of grind, Hegman	---	---	---	---	7	---
Drying to touch (See Note 2)	---	---	---	---	---	4
Dry-hard (See Note 2)	---	---	---	---	---	8
VOC, grams per liter	---	---	---	---	---	340
Color	---	---	---	---	delta E+1.0	
Gloss 60 degree specular gloss						
Gloss	---	---	---	---	---	90
Semi-gloss	---	---	---	---	15	45
Opacity	---	---	---	---	0.95	---
Flexibility	---	---	---	---	---	Conform
Fluid resistance	---	---	---	---	---	Conform
Heat resistance (cure)	---	---	---	---	---	Conform
Solvent resistance (cure)	---	---	---	---	---	Conform
Condition in container	---	---	---	---	---	Conform
Odor	---	---	---	---	---	Conform
Lead percent	---	---	---	---	---	0.06



TABLE I						
COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS						
Table Ic - Polyurethane TopcoatMIL-PRF-85285 Type II (White and Colors)						
Test	Component A		Component B		Mixed	
	Min.	Max.	Min.	Max.	Min.	Max.
Cadmium percent	---	---	---	---	---	0.06
Chromium percent	---	---	---	---	---	0.00
NOTES: (1) Modify paragraph 3.6.4 Viscosity and Pot Life, of MIL-PRF-85285 as follows:  The viscosity of the admixed coating, when tested in accordance with ASTM D1200 through a No. 4 Ford cup, shall be as follows:						
Time from mix (minimum)			Maximum time through a No. 4 Ford Cup			
Initially			30 seconds			
2 hours			60 seconds			
4 hours			No gel			
(2) Modify paragraph 3.7.1 Drying Time, of MIL-PRF-85285. When applied by spray techniques and when tested in accordance with ASTM D1640/D1640M, the coating shall be set-to-touch within four hours and dry-hard within eight hours (see 4.6 and table I).						
GENERAL NOTES: Test methods as specified in MIL-PRF-85285, except those marked with "*". Where "Conform" is indicated, refer to specific requirements of MIL-PRF-85285.						

-- End of Section --