JOINT BASE LEWIS McCHORD

DESIGN STANDARDS

DIVISION 05 - METALS SECTION 05 12 00

STRUCTURAL STEEL

# 07/18

PART 1 GENERAL

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* 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.

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 341 (2016) Seismic Provisions for Structural Steel Buildings

AISC 360 (2016) Specification for Structural Steel Buildings

AISC DESIGN GUIDE 10 (1997) Erection Bracing of Low-Rise

Structural Steel Buildings AMERICAN WELDING SOCIETY (AWS)

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

AWS D1.1/D1.1M (2015; Errata 1 2015; Errata 2 2016)

Structural Welding Code - Steel

ASME INTERNATIONAL (ASME)

ASME B46.1 (2009) Surface Texture, Surface Roughness, Waviness and Lay

ASTM INTERNATIONAL (ASTM)

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

ASTM A1085 (2013) Standard Specification for

Cold-Formed Welded Carbon Steel Hollow Structural Sections (HSS)

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

ASTM A143/A143M (2007; R 2014) Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement

ASTM A193/A193M (2016) Standard Specification for

Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service and Other Special Purpose Applications

ASTM A276/A276M (2017) Standard Specification for Stainless Steel Bars and Shapes

ASTM A29/A29M (2016) Standard Specification for General Requirements for Steel Bars, Carbon and Alloy, Hot-Wrought

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

ASTM A325 (2014) Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

ASTM A325M (2014) Standard Specification for Structural Bolts, Steel, Heat Treated, 830 MPa Minimum Tensile Strength (Metric)

ASTM A36/A36M (2014) Standard Specification for Carbon Structural Steel

ASTM A490 (2014a) Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength

ASTM A490M (2014a) Standard Specification for

High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints (Metric)

ASTM A500/A500M (2013) Standard Specification for

Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

ASTM A53/A53M (2012) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM A563 (2015) Standard Specification for Carbon and Alloy Steel Nuts

ASTM A563M (2007; R 2013) Standard Specification for Carbon and Alloy Steel Nuts (Metric)

ASTM A6/A6M (2017a) Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling

ASTM A668/A668M (2017) Standard Specification for Steel Forgings, Carbon and Alloy, for General Industrial Use

ASTM A780/A780M (2009; R 2015) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings

ASTM A992/A992M (2011) Standard Specification for Structural Steel Shapes

ASTM B695 (2004; R 2016) Standard Specification for

Coatings of Zinc Mechanically Deposited on Iron and Steel

ASTM C1107/C1107M (2017) Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)

ASTM C827/C827M (2016) Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures

ASTM F1554 (2017; E 2018) Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength

ASTM F1852 (2014) Standard Specification for "Twist Off" Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

ASTM F2280 (2014) Standard Specification for “Twist Off” Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 150 ksi Minimum Tensile Strength

ASTM F2329 (2013) Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners

ASTM F436 (2011) Hardened Steel Washers

ASTM F436M (2011) Hardened Steel Washers (Metric)

ASTM F844 (2007a; R 2013) Washers, Steel, Plain (Flat), Unhardened for General Use

ASTM F959/F959M (2017a) Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners, Inch and Metric Series

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

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

SSPC Paint 20 (2002; E 2004) 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 (1982; E 2004) Power Tool Cleaning

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

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-301-01 (2013; with Change 3) Structural Engineering

UFC 3-310-04 (2013; with Change 1) Seismic Design for Buildings

* 1. 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-01 Preconstruction Submittals

Erection Drawings; G

SD-02 Shop Drawings

Fabrication Drawings Including Description of Connections; G

SD-03 Product Data Shop Primer

Welding Electrodes and Rods Direct Tension Indicator Washers Non-Shrink Grout

Tension Control Bolts

SD-06 Test Reports Class B Coating

Bolts, Nuts, and Washers

Weld Inspection Reports

Direct Tension Indicator Washer Inspection Reports

Bolt Testing Reports

Embrittlement Test Reports

SD-07 Certificates Steel

Bolts, Nuts, and Washers

Welding Procedures and Qualifications Welding Electrodes and Rods

1.3 AISC QUALITY CERTIFICATION

Work must be fabricated in an AISC Certified Fabrication Plant, Category Standard. Submit AISC fabrication plant quality certification.

Work must be erected by an AISC Certified Erector, Category ASCE. Submit AISC erector quality certification.

1.5 QUALITY ASSURANCE

* + 1. Preconstruction Submittals
       1. Erection Drawings

Submit for record purposes. Indicate the sequence of erection, temporary shoring and bracing. The erection drawings must conform to AISC 303.

Erection drawings must be reviewed, stamped and sealed by a registered professional engineer.

* + 1. Fabrication Drawing Requirements

Submit fabrication drawings for approval prior to fabrication. Prepare in accordance with 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. Any deviations from the details shown on the contract drawings must be clearly highlighted on the fabrication drawings. Explain the reasons for any deviations from the contract drawings.

* + 1. Certifications
       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.

Conform to all requirements specified in AWS D1.1/D1.1M.

PART 2 PRODUCTS

* 1. SYSTEM DESCRIPTION

Provide the structural steel system, including shop primer, complete and ready for use. Structural steel systems including design, materials, installation, workmanship, fabrication, assembly, erection, inspection, quality control, and testing must be provided in accordance with AISC 360, AISC 341, UFC 3-301-01 and UFC 3-310-04 except as modified in this contract.

* 1. STEEL
     1. Structural Steel

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

* + 1. Structural Steel Tubing

ASTM A500/A500M, Grade C.

* + 1. Steel Pipe

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

* 1. 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.

* + 1. Common Grade Bolts
       1. Bolts

ASTM A307, Grade A. The bolt heads and the nuts of the supplied fasteners must be marked with the manufacturer's identification mark, the strength grade and type specified by ASTM specifications.

* + - 1. Nuts

ASTM A563M, Grade A, heavy hex style. 2.3.1.3 Self-Locking Nuts

Provide nuts with a locking pin set in the nut. The locking pin must slide along the bolt threads, and by reversing the direction of the locking pin, the nut must be removed without damaging the nut or bolt. Provide stainless steel locking pins.

2.3.1.4 Washers ASTM F844.

* + 1. High-Strength Bolts
       1. Bolts

ASTM A325M ASTM A325, Type 1 ASTM A490M ASTM A490, Type 1 or 2.

* + - 1. Nuts

ASTM A563M ASTM A563, Grade and Style as specified in the applicable ASTM bolt standard.

* + - 1. Direct Tension Indicator Washers

ASTM F959/F959M.

* + - 1. Washers

ASTM F436, plain carbon steel.

* + 1. Tension Control Bolts

ASTM F1852, Type 1, heavy-hex head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon steel nuts, and hardened carbon steel washers. Assembly finish must be plain.

* + 1. Foundation Anchorage
       1. Anchor Rods

ASTM F1554 Gr 36 Class 1A.

* + - 1. Anchor Nuts

ASTM A563 Grade A, hex style.

* + - 1. Anchor Washers

ASTM F844.

* + - 1. Anchor Plate Washers

ASTM A36/A36M

* 1. STRUCTURAL STEEL ACCESSORIES
     1. Welding Electrodes and Rods

AWS D1.1/D1.1M.

* + 1. Non-Shrink Grout

ASTM C1107/C1107M, with no ASTM C827/C827M shrinkage.

* + 1. Welded Shear Stud Connectors

AWS D1.1/D1.1M.

ASTM F2329 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 13 micrometer 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 Contracting Officer.

2.6.1 Markings

Prior to erection, members must be identified 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.

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 is to be welded). If flash rusting occurs, re-clean the surface prior to application of primer. Apply primer to a minimum dry film thickness of 2.0 mil.

Slip critical surfaces must be primed with a Class B coating in accordance with AISC 325. Submit test report for Class B coating.

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 7 degrees C or over 35 degrees C 45 degrees F or over 95 degrees F; or when the primer may be exposed to temperatures below 4 degrees C 40 degrees F within 48 hours after application, unless approved otherwise by the Contracting Officer. 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.

PART 3 EXECUTION

* 1. ERECTION
     1. Erection of structural steel, except as indicated in item b. below, must be in accordance with the applicable provisions of AISC 325.
     2. For low-rise structural steel buildings 60 feet tall or less and a maximum of 2 stories), the structure must be erected 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

Material must be stored out of contact with the ground in such manner and location as will minimize deterioration.

* 1. CONNECTIONS

Except as modified in this section, connections not detailed must be designed 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.

* + 1. Common Grade Bolts

ASTM A307 bolts must be tightened to a "snug tight" fit. "Snug tight" is the tightness that exists when plies in a joint are in firm contact. If firm contact of joint plies cannot be obtained with a few impacts of an impact wrench, or the full effort of a man using a spud wrench, contact the Contracting Officer for further instructions.

* + 1. High-Strength Bolts

Provide direct tension indicator washers in all ASTM A325M ASTM A325 and ASTM A490M ASTM A490 bolted connections. Bolts must be installed in connection holes and initially brought to a snug tight fit. After the initial tightening procedure, bolts must then be fully tensioned, progressing from the most rigid part of a connection to the free edges.

3.2.2.1 Installation of Direct Tension Indicator Washers (DTIW)

Where possible, the DTIW must be installed under the bolt head and the nut must be tightened. 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 LIW, provide flat washers under both the bolt head and nut when ASTM A490M ASTM A490 bolts are used.

3.2.3 Tension Control Bolts

Bolts must be installed in connection holes and initially brought to a snug tight fit. After the initial tightening procedure, bolts must then be fully tensioned, progressing from the most rigid part of a connection to the free edges.

* 1. GAS CUTTING

Use of gas-cutting torch in the field for correcting fabrication errors will not be 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.

* 1. WELDING

Welding must be in accordance with AWS D1.1/D1.1M. Grind exposed welds smooth as indicated if exposed to view. 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.

Prequalified procedures may be submitted for information only; however, procedures that are not prequalified must be submitted for approval.

3.4.1 Removal of Temporary Welds, Run-Off Plates, and Backing Strips

Remove only from finished areas.

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

Steel exposed to the weather, or located in building areas without HVAC for control of relative humidity must be field primed. 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 FIELD QUALITY CONTROL

Perform field tests, and provide labor, equipment, and incidentals required for testing. The Contracting Officer must be notified in writing of defective welds, bolts, nuts, and washers within 7 working days of the date of the inspection.

* + 1. Welds
       1. Visual Inspection

AWS D1.1/D1.1M. Furnish the services of AWS-certified welding inspectors for fabrication and erection inspection and testing and verification inspections.

Inspect proper preparation, size, gaging location, and acceptability of welds; identification marking; operation and current characteristics of welding sets in use.

3.6.1.2 Nondestructive Testing

Nondestructive testing must be in accordance with AWS D1.1/D1.1M. Test locations must be selected by the Contracting Officer. If more than 20 percent of welds made by a welder contain defects identified by testing, then all welds made by that welder must be tested by ultrasonic testing, as approved by the Contracting Officer. When all welds made by an individual welder are required to be tested, magnetic particle testing must be used only in areas inaccessible to ultrasonic testing. Retest defective areas after repair. Submit weld inspection reports.

* + 1. Direct Tension Indicator Washers
       1. Direct Tension Indicator Washer Compression

Direct tension indicator washers must be tested in place to verify that they have been compressed sufficiently to provide the 0.38 mm 0.015 inch gap when the direct tension indicator washer is placed under the bolt head and the nut is tightened, and to provide the 0.13 mm 0.005 inch gap when the direct tension indicator washer is placed under the turned element, as required by ASTM F959/F959M. Submit direct tension indicator washer inspection reports.

3.7.3 High-Strength Bolts

* + - 1. Inspection

Inspection procedures must be in accordance with AISC 360. Confirm and report to the Contracting Officer that the materials meet the project specification and that they are properly stored. Confirm that the faying surfaces have been properly prepared before the connections are assembled. Observe the specified job site testing and calibration, and confirm that the procedure to be used provides the required tension. Monitor the work to ensure the testing procedures are routinely followed on joints that are specified to be fully tensioned.

3.7.3.3 Testing

The Government has the option to perform nondestructive tests on 5 percent of the installed bolts to verify compliance with pre-load bolt tension requirements. Provide the required access for the Government to perform the tests. The nondestructive testing will be done in-place using an ultrasonic measuring device or any other device capable of determining in-place pre-load bolt tension. The test locations must be selected by the Contracting Officer. If more than 10 percent of the bolts tested contain defects identified by testing, then all bolts used from the batch from which the tested bolts were taken, must be tested at the Contractor's expense. Retest new bolts after installation at the Contractor's expense.

End of Section --