DS-01065
(New)

Iowa Department of Transportation

DEVELOPMENTAL SPECIFICATIONS

FOR

HIGH PERFORMANCE STEEL FOR BRIDGE APPLICATIONS

Effective Date
October 18, 2005

THE STANDARD SPECIFICATIONS, SERIES 2001, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE DEVELOPMENTAL SPECIFICATIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

01065.01 DESCRIPTION OF WORK.

Under this work, the Contractor shall fabricate, furnish, and erect structural steel in accordance with the contract documents.

This specification applies to the fabrication of structural components for bridges using high performance steel plates furnished in one of the following conditions: as-rolled, controlled rolled, thermo-mechanical-controlled-processed (TMCP) with or without accelerated cooling, or quenched and tempered (Q&T), or hybrid/mixed design structural components using high performance steel plates in combination with high strength, low alloy steel plates and shapes, for welded or bolted applications in bridge construction.

All provisions of Section 2408 of the Standard Specifications shall apply, except as modified in the contract documents.

01065.02 MATERIALS.

All steel, including high performance steel, must comply with all provisions of ASTM A 709/A 709M-01, Standard Specification for Carbon and Low Alloy Structural Steel Shapes, Plates and Bars, and Quenched and Tempered Alloy Structural Steel Plates for Bridges, or later, except as modified herein. Supplementary Requirement S83, Non-Fracture Critical Materials Toughness Tests and marking, or S84, Fracture Critical Materials Toughness Tests and marking will apply, as appropriate, and must be specified with the mill order.

The Contractor is advised that quenched and tempered ASTM A 709/A 709M, Grade HPS 70W (HPS 485W) and Grade HPS 50W (HPS 345W) steel plates are limited to a 50 foot (15.24 m) maximum delivery length from the mill.

A. Fabrication.

All fabrication shall conform to the latest edition of the AASHTO Guide Specification for Highway Bridge Fabrication with HPS 70W (HPS 485W) Steel, an addendum to ANSI/AASHTO/AWS D1.5-95, except as modified herein.

1. Restrictions.

Short term application of heat for purposes of heat curving, heat straightening, camber and sweep adjustment, or other reasons, is limited and shall not to exceed 1100ºF (590°C). All applications of heating shall be done by procedures approved by the Engineer.

B. Welding.

1. Welding shall conform to the most stringent requirements of the following:

   a. Standard Specifications.

   b. 1995 edition of the AASHTO/AWS D1.5 Bridge Welding Code, except as modified herein.

   c. Latest edition of the AASHTO Guide Specification for Highway Bridge Fabrication with HPS 70W (HPS 485W) Steel, an addendum to ANSI/AASHTO/AWS D1.5-95.

Caution: The submerged arc welding consumables ESAB ENi4 electrode in combination with Lincoln Mil800H, recommended as matching consumables for welding HPS 70W steel in Appendix A of the AASHTO Guide Specifications for Highway Bridge Fabrication with HPS 70W Steel, has produced weldments containing unacceptable discontinuities in a substantial number of complete penetration groove welds in one structure, based on the parameters used and experience of one fabricator. In September 2000, the HPS Steering Committee rescinded its recommendation of this combination of welding consumables. Therefore, the ESAB ENi4 electrode in combination with Lincoln Mil800H flux will not be allowed. See paragraph 5 below for allowable submerged arc welding consumables.

2. Only submerged arc and shielded metal arc welding processes will be permitted when welding high performance steel. Consumable handling requirements shall be in accordance with AWS D1.5, Sections 12.6.5 and 12.6.6, except that SAW consumables shall meet the hydrogen control level of H4 as discussed in AWS D1.5, Section 12, Article 12.6.2. SMAW consumables can meet either H4 or H8 except the higher preheat and interpass temperatures as noted in Table 3 of the AASHTO Guide Specifications for Highway Bridge Fabrication with HPS 70W Steel apply to H8 conditions.

3. Filler metals used to make single pass fillet welds for web to flange applications which join Grade HPS 70W (HPS 485W) or Grade HPS 50W (HPS 345W) steel plates, and for attaching stiffeners and connection plates to Grade HPS 70W (HPS 485W) and Grade HPS 50W (HPS 345W) webs and flanges, must be in conformance with AWS D1.5, Table 4.1 for ASTM A 709/A 709M Grade 50W (345W) base metal. Filler metals for single pass 5/16 inch (8 mm) fillet welds need not meet the requirements for exposed bare applications.

4. Filler metals used for all complete penetration groove welds joining Grade HPS 70W (HPS 485W) plate to ASTM A 709/A 709M, Grade HPS 50W (HPS 345W) or Grade 50W (345W) plate shall conform to the requirements for welding Grade 50W (345W) base metal.

5. Filler metals used for all complete penetration groove welds joining Grade HPS 70W (HPS 485W) plates to Grade HPS 70W (HPS 485W) plates shall conform to the requirements for Grade HPS 70W (HPS 485W) base metal as follows:

a. Submerged Arc Welding process:
Wire – LA85 by Lincoln Electric Company
Flux – MIL800HPNi by Lincoln Electric Company

b. Shielded Metal Arc Welding process:
Matching – E9018MR*
Undermatching – E7018MR*

*The designator 'MR', for moisture resistant coating, is required for all SMAW electrodes used for welding Grade HPS 70W (HPS 485W) steels.

6. The Contractor may request approval of alternate consumables in lieu of the above filler metals for SAW. The request for approval shall include documentation of successful welding in accordance with the AWS D1.5 Bridge Welding Code, and include diffusible hydrogen tests as described in AWS D1.5, Article 12.6.2 indicating the deposited weld metal under proposed fabrication shop conditions has a diffusible hydrogen level equivalent to H4 or less.

7. All welding procedures shall be qualified in accordance with AWS D1.5, Section 5, Qualification. In general, the provisions of Article 5.12 shall apply. Qualification tests shall measure strength, toughness and ductility, with results evaluated in accordance with Article 5.19. If specified on the plans, additional tests shall measure the Charpy V-notch toughness of the coarse grained area of the heat affected zone (HAZ). The notch in the specimens shall be carefully located in the coarse grained area of the HAZ, as determined by macroetching the specimens prior to machining and testing. The toughness requirement for the HAZ shall be the same as the weld metal.

8. All procedure qualification tests shall be ultrasonically tested in conformance with the requirements of AWS D1.5-95, Section 6, Part C. Evaluation must be in accordance with AWS D1.5-95, Table 9.1, Ultrasonic Acceptance – Rejection Criteria – Tensile Stress. Indications found at the interface of the backing bar may be disregarded, regardless of the defect rating.

9. The Engineer shall be afforded the opportunity to witness all welding procedure specification qualification tests.

10. Results of the welding procedure specification qualification tests and final welding procedure specifications shall be submitted to the Engineer for review and approval.

11. In general, post weld heat treatment shall not be required. The use of such post weld heat treatment shall require additional qualification testing.

12. Welders and welding operators shall be qualified in accordance with the Standard Specifications.

01065.03 CONSTRUCTION DETAILS.

Structural steel work, including but not limited to shop drawings, fabrication, inspection, transportation and erection shall be done in accordance with the Standard Specifications, except as modified by the contract documents.

Only fabricators meeting the requirements of the AISC Quality Certification Program, "Major Steel Bridges (Cbr)" with "Fracture Critical Members Endorsement (F)", or approved equal, may be used to fabricate using high performance steel conforming to ASTM A 709/A 709M, Grade HPS 70W (HPS 485W) or Grade HPS 50W (HPS 345W). Prior to approval for fabrication, the results of the latest AISC certification

review shall be made available to the Engineer to determine if items critical to successful fabrication meet the needs of the specific work.

Whenever magnetic particle testing is done, only the yoke technique will be allowed, as described in Section 6.7.6.2 of the AASHTO/ AWS D1.5 Bridge Welding Code, modified to test using alternating current only. The prod technique will not be allowed.

01065.04 METHOD OF MEASUREMENT.

Article 2408.45, C, of the Standard Specifications shall apply.

01065.05 BASIS OF PAYMENT.

Article 2408.46, C, of the Standard Specifications shall apply.