



**5130 - SPECIFICATION FOR SUPPLY, FABRICATION
AND DELIVERY OF ATMOSPHERIC CORROSION
RESISTANT WELDABLE STRUCTURAL STEEL**

5130 - 1 DESCRIPTION

- 1.01 The work shall consist of the supply, fabrication and delivery of all the structural steel bridge components identified in the contract special provisions. When required, galvanizing shall be included as part of the fabrication.
- 1.02 Fabrication and delivery shall be completed according to the schedule identified in the contract special provisions.

5130 - 2 MATERIALS

Structural Steel

- 2.01 Steel plate required for the girders shall conform to the requirements of CSA Standard CAN/CSA G40.21-M, Grade 350AT, and shall have impact properties conforming to Category 2.
- 2.02 Rolled structural steel sections shall be fabricated with steel conforming to the requirements of CSA Standard CAN/CSA G40.21-M, Grade 350A.
- 2.03 Steel referred to on the plans as 300W shall conform to the requirements of CSA Standard CAN/CSA G40.21-M, Grade 300W.
- 2.04 Mill certificate data, including the results of the impact tests, for the 350AT and 350A steels shall be reviewed by the Department or its Inspector before the steel is incorporated into the work.

Filler Metal for Welding

- 2.05 Electrodes for use in the welding of 300W steel by the shielded metal arc welding process shall be E48018 or approved equivalent.
- 2.06 Electrodes for use in the welding of 350A and 350AT steel by the shielded metal arc welding process shall be E55018-C3 or approved equivalent.
- 2.07 Wire and flux for use in the welding of 350AT steel by submerged arc welding process shall be Classification F7A4-EM12K3 or approved equivalent.

High Strength Bolts

- 2.08 High strength bolts, nuts and washers shall conform to the requirements of ASTM Standard A325, Type 3.

Shear Connector Studs

- 2.09 Shear connector studs shall conform to the requirements of Appendix H, CSA Standard W59.

5130 - 3 CONSTRUCTION

General

- 3.01 All standards which are referenced in this specification are considered to be the current edition of the standard, unless noted otherwise. The following list is an identification of the abbreviations used in this specification.

ASTM - American Society for Testing Materials
AWS - American Welding Society

CSA - Canadian Standards Association
CWB - Canadian Welding Bureau

Shop Fabrication Drawings

- 3.02 The Fabricator shall provide detailed shop fabrication and erection identification drawings for all components to be supplied under this contract.
- 3.04 Two sets of fabrication drawings shall be submitted for review by the Department, and one set containing suggestions for any revisions will be returned to the Fabricator. The review of the drawings by the Department is for the Fabricator's assistance, and is not to be construed as relieving the Fabricator of his responsibility for errors, omissions and accurate fabrication according to these drawings.
- 3.05 The Fabricator shall provide the Department with eight copies of the final shop fabrication and erection identification drawings. Fabrication shall not proceed until the Department's Inspector is in possession of a set of the final drawings.

Fabrication Sequence and Schedule

- 3.06 At the time the shop fabrication drawings are submitted, the Fabricator shall also provide an outline of the proposed fabrication sequence and identify the proposed welding procedures. The fabrication sequence outline shall describe the order of make-up and assembly of all component parts of the bridge girders. The welding procedure list shall identify by number the welding procedures to be used for all welded joints incorporated within the work, and shall also identify the source of qualification for the procedure.
- 3.07 Copies of all weld data qualification sheets and the detailed weld procedures shall be submitted for review by the Department prior to the start of fabrication.
- 3.08 The Fabricator shall prepare and keep current a complete fabrication schedule for the work. The Department and its Inspector shall be provided with the proposed schedule prior to commencement of fabrication, and shall be advised of any revisions to the schedule as they occur.

Fabrication

- 3.09 Structural steel components shall be fabricated using procedures which provide a quality consistent with the assumptions made in CSA Standard CAN/CSA S6, Design of Highway Bridges.
- 3.10 Steel plate shall be marked in conformance with the requirements of Clause 13, CSA Standard CAN/CSA-G40.20M, except that die-stamping shall not be used as a means of marking the plate. As the web and flange plates are subdivided for use in the girders, all heat numbers shall be transferred to each individual plate section, and the marks shall remain legible until the plate location within the girders has been documented. All the plate identification marks shall be removed by the blast cleaning operation.
- 3.11 All flange plates and flange splice plates shall be cut so that the direction of applied stress will be parallel to the direction of plate rolling.
- 3.12 All bolt holes shall be fabricated by drilling full size or by sub-drilling and reaming. All holes shall be deburred to provide an acceptable faying surface.
- 3.13 High strength bolts installed in the Fabricator's plant shall be tightened by the turn-of-nut method. After installation, exposed surfaces of the bolts, nuts and washers shall be cleaned to remove all traces of oil.
- 3.14 Flame cutting shall be done in accordance with the requirements of AWS D1.5. In addition, the flame cut edges of girder flanges shall have a maximum Brinell Hardness number of 220. If the hardness exceeds this requirement, the Fabricator shall submit for approval a procedure which will reduce the hardness to the acceptable level. The Department's Inspector will do hardness tests on a random basis. The Fabricator shall ensure that the surface of the entire length of flange edge is smooth enough to permit these tests to be done.
- 3.15 The Fabricator shall immediately advise the Department concerning all blow backs or other signs of lamination observed during the cutting of the plate.

- 3.16 The location of welded web or flange splices in addition to those identified on the plans shall be approved by the Department. The Fabricator shall be responsible for the cost of any inspection associated with these splices.
- 3.17 The bolt holes for the girder field splices shall be located by the Progressive Girder Assembly Method using only two girder sections, except that the Department will permit the use of templates only (no shop assembly) when the Fabricator can demonstrate experience and/or a high degree of competence with this technique, or when the Fabricator uses numerically-controlled drilling equipment.
- 3.18 When shop assembly is used, a procedure outlining the sequence of assembly, location of points of support, dimensional checks, method of trimming to length, and marking and drilling of bolt holes shall be submitted to the Department for review.
- 3.19 Girder sections shall be supported within 2 m of the end of each section and in such a manner as to provide the correct angular relationship at the splice between the sections. The splice points shall be located on the theoretical camber line or at a specified amount from the camber line should a correction be necessary to compensate for shop camber deviations. The fabricated camber of each individual girder section must be known for the next two girder sections in the girder line prior to shop assembly to allow adjustments which will reduce the effect of any camber deviations.
- 3.20 Splice plates and girders shall be clearly match marked to facilitate the proper location and orientation of the splice plates in the field. The match marking system shall be shown on the drawings.
- 3.21 Welded sections shall be fabricated to the dimensions and camber given on the plans within the tolerances specified in CSA Standard W59 and as follows:
- (a) Unless otherwise approved, the difference between similar dimensions of adjoining girder sections at field splice locations shall not exceed ± 2 mm.
 - (b) The maximum variation from flatness for the girder webs shall be 20 mm. When the distortion is convex in one panel and concave in the adjacent panel, the sum of the web distortions shall not exceed 20 mm.
 - (c) The tolerance in camber of a girder section or portion thereof shall be within plus or minus $(.2L + 3)$ in mm where L is the test length in metres.
 - (d) The surface of the flange which is to mate with a bearing shall fit within 0.25 mm for 100% of the projected area of the web and bearing stiffeners, and not more than 0.80 mm for the remaining contact area with the bearing.
 - (e) Rolled structural shapes shall be fabricated within the tolerances specified in CSA Standard CAN/CSA-G40.20-M.
 - (f) Bolt hole groups shall be located within ± 3 mm.
 - (g) Expansion assemblies shall have a maximum deviation of 6 mm. The Contractor shall be responsible for any on-site jacking or other modifications required to meet this tolerance.
- 3.22 The girders shall be handled using devices that prevent damage or distortion to the girder elements. The girders shall be stored in an upright position, positively supported on sufficient skids and adequately braced to prevent distortion to any of the girder elements.
- 3.23 The corners of all plate girder flanges shall be ground to a 2 mm chamfer.

Welding

- 3.24 Fabrication involving welding shall conform to the requirements of CSA Standard W59, as modified or supplemented by this specification.
- 3.25 Welding processes other than the shielded metal-arc and submerged arc processes shall not be used for this contract, unless prior written approval has been obtained from the Department.
- 3.26 The Fabricator shall prepare a written weld procedure for each type of weld used in the fabrication, and shall submit these procedures to the Department for review prior to the start of the welding. Each procedure shall have the approval of the Canadian Welding Bureau.
- 3.27 All welders and welding operators (including tackers) shall have a current approval from the Canadian Welding Bureau to weld with the process and filler metal to be used in the fabrication of the girders. A copy of the CWB Identification Card shall be provided to the Department.
- 3.28 The procedure for stud welding shall conform to the requirements of CSA Standard W59.
- 3.29 The storage and conditioning of electrodes and fluxes shall conform to the requirements of CSA Standard W59.
- 3.30 Tack or temporary welds are permitted only where they are to be incorporated into the final welds. They shall be subject to the same quality requirements as the final welds. Tack welds shall have a minimum length equal to four times the nominal size of the final weld. When a crack occurs in a tack weld, the weld shall be completely removed prior to starting the final weld.
- 3.31 Joint surfaces to be welded shall be clean, free of mill scale, dirt, grease, etc. and be preheated immediately prior to welding when required.
- 3.32 Preheat and interpass temperatures shall conform to the requirements of CSA Standard W59, except that the preheat and interpass temperature for flange to flange and flange to web welds shall be a minimum of 100°C for all flange plate thicknesses under 65 mm. For the web to flange joint, the temperature shall be measured at a point located 80 mm from the centreline of joint and on the face of the flange opposite to the side on which the weld is being placed.
- 3.33 Run-off tabs having the same geometry as the joint shall be used for all butt welds in the flanges and webs unless the welding operation starts and stops in material which will not remain a part of the structure. Run-off plates shall also be used for the flange to web joint and sufficient length shall be provided at the start-up end to enable an acceptable weld to be placed prior to welding on the girder joint. The run-off tabs shall be attached by tack welding to material which will not remain a part of the structure or where the tack will be incorporated into the final weld. After removal of the tabs, the end of the weld shall be made smooth and flush with the abutting parts.
- 3.34 Arc strikes will not be permitted on any portion of the steel which is not part of a welded joint. In the event of an accidental arc strike, the Fabricator shall report the incident to the Department, and shall also submit for approval his proposed repair procedure. As a minimum repair, the crater shall be completely ground to remove any affected material. All repairs shall be inspected at the Fabricator's cost prior to their acceptance by the Department.
- 3.35 The flange butt welds so specified on the plans shall be ground flush or to the specified slope on both faces. Other welds which do not have an acceptable profile shall be ground to the proper profile without removal of the base metal. The final grinding pass shall be parallel to the direction of stress.
- 3.36 All welding of the butt joints in the flanges and the web shall be fully completed, inspected, and where necessary, repaired prior to assembly of flanges with the web.
- 3.37 Fillet welds used to attach stiffeners and gusset plates to the girders may be returned completely around the edge where material and access are available, or may be stopped 5 mm short of the plate edge.
- 3.38 The Fabricator shall submit to the Department for approval procedures for the repair of defective or unsound welds and base metal. The Fabricator shall be responsible for the cost of all inspection of the repaired areas.

Inspection

- 3.39 All inspection, except that which may be necessitated by faulty work or by additional unspecified material splices, will be arranged for and paid by the Department. Normal quality control within the shop shall be the Fabricator's responsibility.
- 3.40 Radiographic inspection will be conducted on all flange butt welds which are designated on the plans as having a ground finish. In addition, radiographic inspection will be conducted on a minimum of ten percent of all other flange and web butt welds of the main girders and these shall have a smooth finish before radiographing. The location and length of this undesignated percent of butt welds chosen to be radiographed shall be at the discretion of the Department's Inspector, and should ten percent of the radiographs indicate unacceptable defects in the welds, the remaining length of butt weld may be radiographed. Radiographic examination of welds will conform to the requirements of CSA Standard W59.
- 3.41 Ultrasonic examination of welds, when required, shall conform to the requirements of CSA Standard W59.
- 3.42 Magnetic particle inspection of the welded plate girders will be done as follows:
- (a) 50 percent of the web to flange welds and any other fillet welds placed on flange plates.
 - (b) 10 percent of the web to stiffener welds.
- The procedure and technique for the magnetic particle inspection shall be in accordance with the requirements of ASTM E109.
- 3.43 Dye penetrant inspection will be done on the ends of all flange butt welds after the removal of the run-off tabs, and elsewhere as deemed necessary by the Inspector. The procedure for dye penetrant testing shall be in accordance with the requirements of ASTM E165.
- 3.44 The procedure for hardness testing shall be in accordance with the requirements of ASTM E103.
- 3.45 The Fabricator shall schedule his operation to allow the Inspector free access and sufficient time to complete his inspections. To ensure that each stage of inspection of the welded girder is performed in an orderly manner, Inspection Stations shall be established by the Fabricator during which the inspection will be done and any repairs undertaken. Subsequent fabrication on any portion of the girder shall not start until the material has passed through the Inspection Station. The Department reserves the right to stop detrimental fabrication practises at any stage of the fabrication.
- 3.46 When required, the Fabricator shall assist the Department's Inspector in checking layout and performing inspection duties.

Cleaning of Surfaces

- 3.47 Upon completion of fabrication, steel surfaces contaminated with oil or grease shall be cleaned with a solvent. All surfaces shall then be blast cleaned in accordance with the requirements of the Steel Structures Painting Council Surface Preparation Specification SSPC-SP6, No. 6 Commercial Blast Cleaning, which is to be interpreted to mean that all foreign matter and mill scale is removed except for slight shadows, streaks or discolorations caused by rust stain or mill scale oxide binder.
- 3.48 Subsequent to blast cleaning, the Fabricator shall protect all surfaces from contamination by oil, grease or paint. Any incidental contamination shall be removed before shipping.

Galvanizing

- 3.49 Galvanizing, when required, shall be done by the hot-dipped method conforming to the requirements of CSA Standard G164. Galvanized areas damaged during handling and shipping shall be repaired by the Fabricator using a procedure which has been approved by the Department.

Marking and Shipping

- 3.50 Each member shall be identified with an erection mark located on a surface which will not be visible in the completed structure. The erection marks shall correspond to those shown on the erection drawings.
- 3.51 All material which has been fabricated in the Fabricator's plant shall be inspected and accepted before shipping.
- 3.52 All girders shall be shipped in the upright position with sufficient support to prevent possible distress in the girders. When a point of support occurs adjacent to a transverse stiffener which does not fit tightly against the bottom flange, the stiffener shall be blocked to the flange. Wood blocking shall be untreated. Other structural members shall be shipped in such a manner that they arrive on the site in an undamaged condition. All material shall be protected from contamination by roadway deicing chemicals.
- 3.53 Members with a mass of more than 300 kg shall have the mass shown on the member in a location which will not be visible in the completed structure.
- 3.54 Bolts of one length and diameter, and loose nuts or washers for each size shall be packaged separately. Pins, small parts and packages of bolts, washers and nuts shall be shipped in boxes, crates, kegs or barrels, but the gross mass of any package shall not exceed 150 kg. A list and description of the contained material shall be plainly marked on the outside of each shipping container.
- 3.55 The Fabricator shall be responsible for the repair or replacement of any material damaged or lost during shipping, and for the cleaning required to remove all salt contamination.

5130 - 4 MEASUREMENT

5130 - 5 PAYMENT

- 5.01 Payment for SUPPLY AND FABRICATION OF ATMOSPHERIC CORROSION RESISTANT WELDABLE STRUCTURAL STEEL will be at the contract lump sum price. The lump sum price will be full compensation for the supply of materials, fabrication, blast cleaning, galvanizing, and delivery of all material F.O.B. destination.