Quality Assurance Procedure QAP 5920

Method of Test For

Visual Inspection of Bolted Joints

1. SCOPE

1.1 The purpose of this procedure is to assure conformance of bolted connections to project specifications.

2. PERSONNEL

2.1 Visual inspection shall be performed by a CWI or an assistant under the supervision of the CWI; as defined in Section 6, AASHTO/ AWS D1.5M/D1.5 Bridge Welding Code, current edition.

3. REFERENCE

3.1 The latest edition of AASHTO/AWS D1.5M/D1.5 Bridge Welding Code, current edition.

3.2 The Standard Specifications for Highway Bridges.

4. PROCEDURE

4.1 All shop connections, secondary to secondary or main member connections, and all main member field splices shall be randomly inspected for conformance of the following:

4.1.1 Splices shall be checked for offset, re-entrant corners, gap and condition of the adjacent base metal. This shall be verified two times during fabrication.

4.1.2 Hole dimensions, offset and clearances. Check two times during fabrication.

4.1.3 Fasteners shall be inspected for domesticity, tensioning, orientation of the turned element and proper location and type of washer. The Rotational Capacity Lot number, bolt dimensions, component manufacturers, and required test results shall be verified both on the Certified Mill Test Report, and from random inspection of the bolt containers. This shall be performed prior to bolt installation.

4.1.4 The area of the bolt pattern shall be visually inspected for evidence of repair to mislocated holes. Areas indicating grinding other than deburring of holes shall be investigated. This shall be performed randomly.

Acceptance Criteria

4.2 Fit-up of connections

4.2.1 All faying surfaces of a connection shall be free from oil, dirt, drilling chips, paint overspray, or any other foreign matter that would interfere with the friction connection. The member shall not be twisted or bent.

4.2.2 The dimensions of the hole pattern for field connections shall be established from a template. Match marks are required unless the system provides universality of all like connections.

4.3 Criteria for holes:

4.3.1 All holes shall be as shown on the plans or shop drawings. Standard sized holes shall be used unless otherwise approved by the Engineer.

4.3.2 Description of holes and sizes shall be as follows: see Table 1.

4.3.3 The nominal dimension of each type hole shall not be greater than that shown in the table, except:

4.3.3.1 Holes not more than 1/32 in. larger in diameter than the true decimal equivalent of the nominal diameter that may result from a drill or reamer of the nominal diameter shall be considered acceptable.

4.3.3.2 The slightly conical hole left from the punch (secondary members only) is acceptable.

4.3.3.3 The width of slotted holes which are produced from flame cutting or a combination of flame cutting and drilling holes or punching holes (punched holes only in a secondary member) shall not, in general, be more than 1/32 in. greater in nominal width. The flame cut surface shall be ground smooth.

4.3.4 The minimum distance between fasteners shall not be less than the following:

For 1-inch fasteners, 3 1/2 in. For 7/8 in. fasteners, 3 in. For 3/4 in. fasteners, 2 1/2 in. For 5/8 in. fasteners, 2 1/4 in.

4.3.5 The minimum distance from the centerline of the hole to the edge in a sheared or flame cut edge shall not be less than the following:

For 1-inch fasteners, 1 3/4 in. For 7/8 in. fasteners, 1 1/2 in. For 3/4 in. fasteners, 1 1/4 in. For 5/8 in. fasteners, 1 1/8 in.

4.3.6 The minimum distance from the centerline of the hole to the edge of rolled or planed edges, except in beams and channels, shall not be less than the following:

For 1-inch fasteners, 1 1/2 in. For 7/8 in. fasteners, 1 1/4 in. For 3/4 in. fasteners, 1 1/8 in. For 5/8 in. fasteners, 1 in.

4.3.7 The minimum distance from the centerline of the hole to the edge of rolled beams and channels shall be no less than the following:

For 1-inch, 1 1/4 in. For 7/8 in., 1 1/8 in. For 3/4 in., 1 in. For 5/8 in., 7/8 in.

The maximum distance from the edge to a fastener shall not be greater than eight times the thickness of the thinnest plate, but, in any case shall not exceed 5 in.

4.3.8 When oversized holes or short slots are used, the distance between the edges of adjacent holes shall not be less than permitted with standard holes.

4.3.9 All holes shall be deburred.

4.3.10 Beveled washers shall be utilized on American Standard Beams and Channels (the legs of the channel or flange of the beam) or any material that has a 1:20 slope or greater (diaphragms using channel with tapered legs).

4.3.11 Washers shall be installed as follows:

4.3.11.1 Hardened washers under the element turned in tightening.

4.3.11.2 Hardened washers under both elements (head & nut) on all A490 fasteners.

4.3.11.3 Where A325 bolts of any diameter or A490 bolts equal to or less than 1inch in diameter are to be installed in an oversized or short hole in an outer ply, a hardened washer conforming to ASTM F436 shall be used..

4.3.11.4 A plate washer or continuous bar 5/16 in. thick with standard holes shall be installed on all long slots on the outer ply side. These plates shall completely cover the slot and shall be steel of structural grade, except for A490 fasteners, in which case the steel shall meet the requirements of ASTM A436.

4.3.12 The accuracy of reamed or drilled holes shall be such that no more than 85% in any contiguous group, e.g., web and two splice plates, show an offset no greater than 1/32 in.

4.3.13 All fasteners shall be verified as domestic and tensioned (unless to be tightened in the field).

4.3.14 Any area within or adjacent to the bolt pattern that exhibits grinding other than that normally performed for the deburring of holes shall be investigated. Misplaced holes, other than those approved by the Engineer to be repaired with an approved procedure, shall be rejected and reported to the Engineer for disposition. Weld repairs are verified by acid etching the area to resolve a heat affected zone from the weld repair. Picric acid or 50% HCL heated to 160 degrees shall be used.

TABLE 1 Criteria for Holes

TABLE 1 Criteria for Holes Hole Dimensions				
Bolt Diameter	Std Hole Dia.	Oversized Dia.	Short Slot w x 1	Long Slot w x 1
1/2	6/16	5/8	9/16 x 11/16	9/16 x 1 1/4
5/8	11/16	13/16	11/16 x 7/8	11/16 x 1 9/16
3/4	13/16	15/16	13/16 x 1	13/16 x 1 7/8
7/8	15/16	1 1/16	15/16 x 1 1/8	15/16 x 2 13/16
1	1 1/16	1 1/4	5/16 x 1 1/16	1 1/16 x 2 1/2