Quality Assurance
Procedure QAP 5915

Method of Test For

Visual Test Procedure of Base Metal Discontinuities

1. SCOPE

1.1 This written procedure shall be used to assure that plate edges, weld joint fit-up, and base metal surfaces meet the requirements AASHTO/AWS D1.5M/D1.5 current edition.

1.2 Perform visual inspection of base metals, plate cut edges and weld joints after fit-up, but prior to welding.

1.3 Perform these inspections prior to welding.

2. PERSONNEL

2.1 Personnel performing this examination shall be qualified in accordance with the American Welding Society QC-1.

3. REFERENCE

3.1 AASHTO/AWS D1.5M/D1.5 Sections 2, 3, and 6.

4. APPARATUS

4.1 Double - Convex Coddington 10X magnifier with a working range of 3/4" to 6" and a resolving power of .0050".

4.2 30X hand held microscopic wide-field tube with a field view of at least .125" and a working

distance up to .25" with resolving power of .0001".

4.3 AWS C4.1-G or General Electric surface roughness gauge.

4.4 Cambridge weld gauge.

4.5 Rule with 1/64" increments.

4.6 Flashlights, 30fc for general inspection and 50 fc for evaluation of small anomalies.

4.7 Jaeger Eye Chart

4.8 Brushes, fiber and wire

4.9 Lintless cloths

4.10 Cleaning solvent

4.11 Protractor capable of measuring normal, acute, and obtuse angles.

4.12 Mirror

4.13 Nitric acid and methanol

4.14 Knife or pick

4.15 Grinder

5. PROCEDURE

5.1 Base Metal Discontinuities and Preparation for welding

5.1.1 All visual tests shall be performed under 30 fc minimum for general visual and macroscopic evaluation (to 10X magnification) and 50 fc for microscopic evaluation (30X).

5.1.2 Plate cut edges - Visually spot check plate cut edges and UM (Universal Milled) edges, preferably prior to fit-up, but after welding for laminations, panel cracks, pipe and other stringer- like oxide inclusions. Any indications that can not be resolved visibly or with 10X magnification shall be evaluated with both 30X magnification and liquid penetrant inspection. Note that the area of any material discontinuities exposed by oxygen cutting e.g., significant nonmetallic oxide inclusions, shall be established by ultrasonic or radiographic testing (AASHTO/AWS D1.5M/D1.5 - 3.2.2.1). Repair of flaws shall be in accordance with an approved procedure. Repaired areas must be magnetic particle or dye penetrant tested. These repairs shall be ultrasonically and hardness tested if the repair area is in a tension or stress reversal zone. The depth of any discontinuities removed shall be measured by the Cambridge weld gauge, carefully maintaining the relative position of the gauge legs in the same plane for both calibration and depth measurement.

6. EVALUATION

6.1 Indications shall be evaluated as follows:

6.1.1 Laminar type discontinuities parallel to the surface are acceptable without repair if they do not exceed 1 inch in length. The extent of ten per cent of all laminar indications exceeding 1 inch in length on each plate cut edge shall be determined by grinding or ultrasonic testing in accordance with the CDOT procedure "Straight Beam Ultrasonic Examination of Steel Plates".

6.1.1.1 If the depth of any one of the discontinuities exceeds 1/8 inch in depth, then all of the remaining discontinuities on that edge shall be explored as to their depth.

6.1.1.2 Indications exceeding 1 inch in length and 1/8 inch in depth, but not greater than 1/4 inch in depth requires removal by grinding.

6.1.1.3 Indications exceeding 1 inch in length with depth over 1/4 inch and less than 20% of the length of the plate edge shall be repaired by welding to a depth of 1 inch from the plate, except for Y type discontinuities, in which case, they shall be removed by grinding if no more than 2% of the net cross-sectional area (based on nominal dimensions) is removed.

6.1.1.4 For discontinuities over 1 inch in length and greater than 1 inch deep ultrasonic testing in accordance with "Straight Beam Examination of Steel Plates" shall be performed. The acceptance criteria is detailed in that procedure.

The foregoing does not apply to laminations that occur in an area under an attachment. These locations

need to be brought to the attention of the Design Engineer of Record (EOR) and to determine if through thickness tension exists in this area (see D1.5, 3.2.3, Note).

6.1.2 ASTM Mill criteria - Surfaces of plate edges from the mill shall be visually inspected as follows:

6.1.2.1 Imperfections on the surfaces or rolled edges (e.g. scabs, blisters) that require removal for proper welding (D1.5 - 3.2.1) shall be removed by grinding, provided the area ground is well faired and the plate is not reduced in thickness by more than 7% under the nominal thickness or in any case 1/8"; or below the minimum allowed thickness for the nominal size (Table 1 - AASHTO M160).

6.1.2.2 Imperfections top and bottom surfaces may be removed by grinding and welded in accordance with the Welding Procedure Specification, provided removal does not exceed
2% of the nominal area and the removal does not extend beyond 30% of the depth of the material.

Edges may be repaired by grinding and rewelding provided, the depth of the excavation does not exceed the thickness of the plate, with a maximum depth of 1 inch. The remaining prepared joint, after excavation, shall meet the criteria of an approved Welding Procedure Specification and/or the details of prequalified joints (AASHTO/AWS D1.5M/D1.5 Section 2).

6.1.3 Surfaces of shapes shall be visually inspected as follows:

6.1.3.1 Imperfections repaired by grinding shall not exceed 1/32 inch in depth for material less than 3/8 inch in thickness; 1/16 inch in thickness for material 3/8 - 2 inches in thickness; or 1/8 inch for material over 2 inches inclusive in thickness. Imperfections greater than these depths may be removed and welded provided the removed area does not exceed 2% of the area, the thickness is not reduced more than 30% nor 1 1/4 inch, except for the toes of angles, beams and channels, in which case the depth of excavation, measured from the toe inward, shall not exceed the thickness, with a maximum depth of 1/2 inch.

6.1.4 Arc strikes found by visual inspection in areas subject to tension or stress reversal, after being ground, shall be spot checked using 30X magnification and liquid penetrant testing. Rockwell tests shall be performed in accordance with "Procedure for Performing Rockwell Superficial Hardness Testing of Metallic Materials Using a Portable Hardness Testing Device". A Rockwell "C" value of greater than 30 shall require removal of the hardened area or tempering at no more than 1150 degrees F. The treated area shall be retested.

Cracks indicated by penetrant testing, shall require grinding and retesting to assure their removal. If the material thickness is reduced beyond 5% of the material thickness or 1/32 inch, the area shall be weld repaired in conformance to an approved Welding Procedure Specification. The weld repaired area shall be evaluated for soundness