

**QC Inspection and Qualification Procedure- TX-EDU-VT-1-07, Revision #6  
03-04-2016 by Richard J DePue, Supersedes IW-VT-1 Visual Inspection Procedure**

**1.0 Scope:**

The purpose of this procedure is to define and provide specific instructions on the techniques and acceptance criteria to be used when performing, evaluating and documenting visual examinations of welded products. This procedure may be used in lieu of or in conjunction with relevant codes, specifications and standards if acceptable to the engineering authority. The inspector using this procedure should have an eye exam at least every three years and should have documented whether their vision is best with or without correction.

**2.0 Responsibility and authority:**

The use of the latest revision and any printed copies of this procedure for the inspection of welded materials is the responsibility of the qualified inspector. This procedure shall be used by qualified inspectors for the inspection of welded materials with oversight and approval from the facility representative and the engineering authority.

**3.0 Visual Weld Inspection Procedure:**

Direct visual inspection may be made when access is sufficient to place the eye within 24 inches of the surface to be examined and at an angle not less than 30° to the surface to be examined. Mirrors may be used to improve the angle of vision, and aids such as magnifying lenses may be used to assist examinations. The specific part, component or section thereof, under immediate examination, shall be illuminated, if necessary, with a flashlight or other auxiliary lighting to attain a minimum of 15 foot candles (15 fc) for general examination and a minimum of fifty foot candles (50 fc) for the detection or study of small irregularities.

As applicable, special illumination instruments, tools or equipment such as those listed below may be used to assist in the examination. Tools, instruments, meters and other equipment requiring calibration shall be issued and controlled in accordance with manufacturer's instructions and applicable procedures.

- Fillet weld, V-WAC, Hi/Lo, reinforcement and other weld inspection gauges
- Scale rule, micrometers, calipers and other linear measuring devices
- Temperature, light, magnetism and other indicating devices

Prior to all visual examination, the surface to be examined shall be free of dirt, grease, oil, scale, welding flux, weld spatter and other matter that could obscure the surface or otherwise interfere with the examination. Cleaning may be accomplished using detergents, organic solvents, descaling solutions, paint removers, vapor degreasing, grinding, brushing or filing, sandblasting or other methods as required or allowed by contract specification.

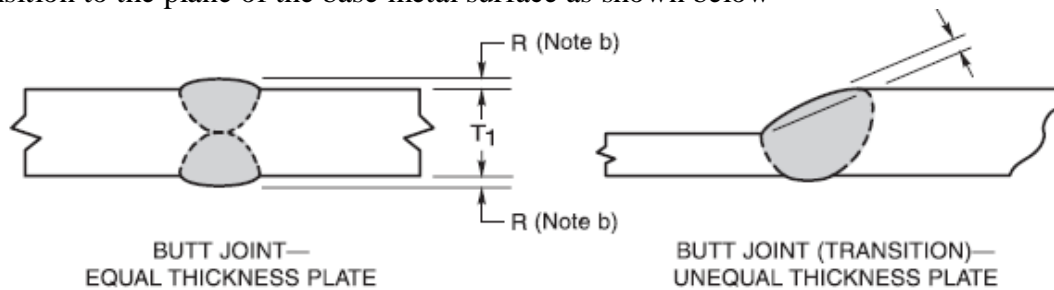
Visual examination is used to determine such things as surface condition of the part, alignment of mating surfaces, shape or evidence of leakage. The area of interest for the visual examination of a weld shall extend 1 inch beyond the fusion line (toe or root). When the interior surface of a weld is accessible the weld root shall be visually examined.

When doubt exists as to the capabilities of an examination being performed, examination procedures shall be demonstrated to prove adequacy. In general, a fine line of 1/32 of an inch or less in width, or some other artificial flaw located on the surface or a similar surface to that being examined, such as the lines on a 6 inch ruler, may be considered a test method for this demonstration. The line or article flaw shall be in the least discernable location on the area being examined to prove the capabilities of the examination procedure.

Acceptance criteria shall be in accordance with applicable contract specification requirements and/or code requirements below.

**4.0 AWS D1.1 Structural Welding Code- Steel: Visual inspection of completed full length welds**

Groove welds shall be preferably made with slight or minimum face reinforcement. In the case of butt and corner joints, the face reinforcement shall not exceed 1/8 of an inch in height and shall have gradual transition to the plane of the base metal surface as shown below

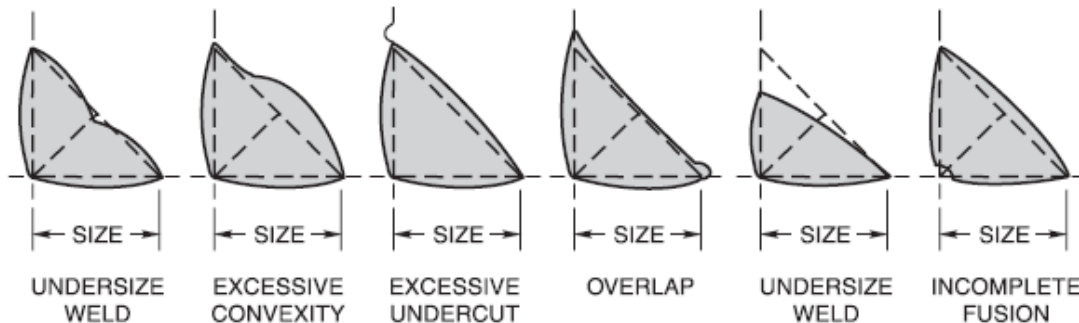


<sup>b</sup> Reinforcement R shall not exceed 1/8 in [3 mm] (see 5.24.4).

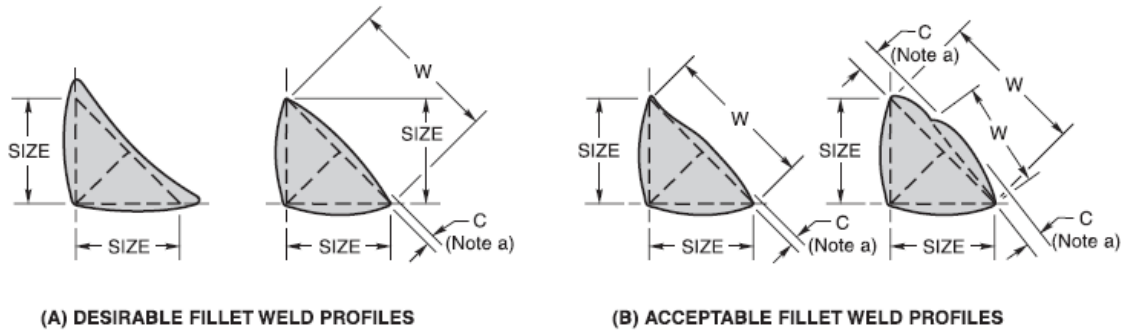
When the surfaces of butt joint welds are required to be flush, such as the removal of reinforcement for bend testing, surfaces shall be finished so as not to reduce the thickness of the thinner base metal or weld metal by more than 1/32 of an inch or 5% of the thickness whichever is smaller or leave reinforcement that leaves more than 1/32 of an inch. Any reinforcement must blend smoothly into the plate surfaces with transition areas free from undercut.

Ends of butt joints shall be flush so that one member does not extend beyond the other by more than 1/8 inch or that weld metal does not extend beyond joint members by more than 1/8 inch. The ends of welded butt joints shall be sloped to adjacent plate or shape edges to provide gradual transition between members at a slope not to exceed 1 in 10.

The faces of fillet welds should be slightly convex, flat or slightly concave, with none of the unacceptable profiles shown below.



Fillet weld convexity shall be measured and conform as shown below:



<sup>a</sup> Convexity, C, of a weld or individual surface bead with dimension W shall not exceed the value of the following table:

WIDTH OF WELD FACE OR INDIVIDUAL SURFACE BEAD, W	MAX. CONVEXITY, C
W ≤ 5/16 in [8 mm]	1/16 in [2 mm]
W > 5/16 in [8 mm] TO W < 1 in [25 mm]	1/8 in [3 mm]
W ≥ 1 in [25 mm]	3/16 in [5 mm]

All welds shall be free from overlap.

All welds shall be free from cracks.

In all welds, thorough fusion shall exist between adjacent layers of weld metal and base metal.

All craters are to be filled to the full cross section of the weld.

In all welds undercut shall be no more than 1/32 of an inch deep.

The maximum size porosity in fillet welds shall not exceed shall not exceed 3/32 of an inch in diameter. The sum of all diameters shall not exceed 3/8 inch in any linear inch of weld, and shall not exceed 3/4 inch in any 12 inches of weld length.

Any continuous fillet weld may be smaller than the size specified by 1/16 of an inch with out correction, provided that the undersize portion of the weld does not exceed 10% of the length of the weld.

The maximum length of any tack weld is 1 inch.

The minimum size of a fillet weld is 4 times the specified size.

All welds shall be free from overlap.

Arc strikes outside the groove or fusion faces to be welded are prohibited.

## **5.0 AWS D9.1 Sheet Metal Welding code: Visual inspection of completed full length welds**

Inspection of welder qualification test welds shall be visual and, except for required eye sight corrective lenses, without the aid of magnification.

Except for the first and last 1/2 inch of a completed qualification test weld, all welds shall exhibit the following:

Complete fusion shall exist in all welds.

Complete joint penetration is required for all groove welds.

Groove weld reinforcement shall not exceed 1/8 inch.

Fillet weld convexity shall not exceed 1/8 inch.

Not more than 1 hole (porosity) or inclusion (slag) in any 1 inch of weld. No hole or inclusion can exceed 0.25 times the thickness of base metal.

Undercut shall not exceed 0.15 times the thickness of the base metal when welding material 0.187 inch or thinner. Undercut shall not exceed 0.25 times the thickness of the base metal when welding material over 0.187 inch in thickness

Welds shall be free from cracks.

Welds shall be free from overlap.

Arc strikes outside the area of welding are prohibited.

Tightly adhered spatter is not a cause for rejection providing it does not interfere with subsequent destructive or non-destructive weld testing. In such cases, spatter shall be removed.

## **6.0 Quality Control and Material Storage**

All materials to be welded shall be free from moisture, grease, oil, dirt, scale, rust, slag or any other material that can effective the quality of welding.

Preheat and interpass temperatures shall be in accordance with AWS D1.1 Table 3.2

All electrodes, filler wires and welding consumables shall be stored according to manufacturers recommendations.

Flux covered electrodes shall be kept dry, free from moisture and damage.

Low hydrogen electrodes (E7018) should be stored in an oven at approximately 250°F. All other carbon and low alloy electrodes should be stored at ambient temperature.

Only electrodes with classification and specification numbers complying with AWS D1.1 shall be used for welding qualification test weldments.

When purchasing new materials for the qualification and certification of welding personnel, Material Test Reports, or other material identification documentation should be obtained.

Following qualification and certification testing of welding personnel, and the subsequent destructive and non-destructive testing of welded specimens, accepted and rejected test plate, pipe or tube specimens should be destroyed.

All stenciling, stamping, sectioning and testing of welded specimens shall be performed under the direct supervision of the welding authority (instructor, test supervisor or their designee).

Only personnel approved by the facility representative, and those appropriately accepted by the educational institution may be permitted to participate in welder qualification and certification testing. All documentation received for such testing will be under the name of the educational institution.

## **7.0 Test Plate Configuration and Qualification Instructions**

### **Related and Support Documentation**

AWS Structural Steel Welding Code, D1.1: 2008

AWS Sheet Metal Welding Code, D9.1: 2006

AWS A3.0 Standard Terms and Definitions

Written Practice #IW-WP-01

ASNT-SNT-TC-1A: Recommended Practice for Company Certification of NDE Personnel

IW-WP-1-07: Guidelines and Requirements for the Qualification of Welding Inspectors

IW-VT-1-07: Visual Weld Inspection Procedure