



PROCEDURE FOR CHARPY TESTING OF THE BOND LINE OF HFW PIPE

Rev. 2020

GENERAL / SCOPE

The purpose of this procedure is to provide a reliable method for notch positioning for Charpy (CVN) impact testing of the bond line of EW1 pipes in order to ensure that the target area is sampled. Positioning the notch is especially difficult in this case as the bond line is significantly smaller in width than the radius of the Charpy V notch. The limits described herein have been shown to give consistent results representative of the material properties of the bond line.

The procedure describes practices for specimen preparation, notch positioning and documentation of the notch position for bond line Charpy impact testing of EW¹ pipe

Note: The bond line should not be confused with any heat affected zone resulting from localized heat treatment; see Figure 1.

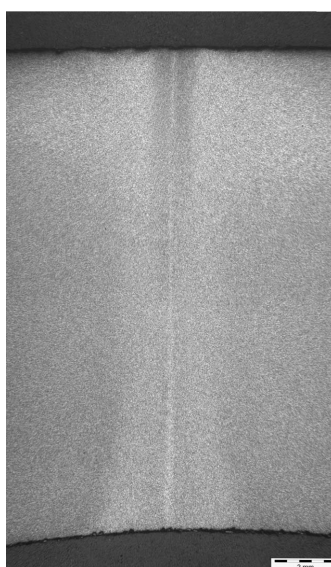


Figure 1 Typical bond line and heat affected zone; nominal wall thickness 16 mm.

LIMITS ON APPLICATION OF THE PROCEDURE

- The applicable product standard is ISO 3183 or API 5L
- Charpy impact testing shall be performed in accordance with ISO 148-1 or ASTM A370 and ASTM E23.
- Striker radius and test temperature shall be in accordance with product specification or customer requirements
- Dimensional tolerances of impact specimens shall be according to ISO 148-1 / ASTM A370

Note: The minimum specimen thickness used in validation of this procedure was 5 mm, but the procedure is considered to be applicable to all specimen thicknesses.

¹ The description Electric Welded is used by current standards to refer to any welding process where the "heat for welding is generated by the resistance to flow of electric current applied by conduction or induction". It covers both electric resistance welding and low and high frequency induction welding.

MACHINING

Specimen preparation and machining shall ensure that the bond line will be centred within ± 0.250 mm of the centre of the notch radius of the finished specimen (see Figure 2).

The bond line shall be positively identified by metallurgical etching to ensure that the notch and bond line are located to within the required tolerance.

Note: The notch location tolerance in ISO 148 with respect to the end of the specimen is more restrictive than that of ASTM A370.

ETCHING AND NOTCH POSITIONING

The bond line shall be positively identified by metallurgical etching to ensure that the bond line is located relative to the notch within the limits below:

- The distance between the centre of the Charpy V notch and the centre of the bond line shall be less than 250 μm when measured on one surface of the specimen (Figure 2).
- In case of a tilt angle bond line the bond line shall cross the centreline of the notch within the central third of the specimen thickness.

Note 1: A fine scribe or a scalpel blade have been found suitable for a permanent marking of the bond line position.

Note 2: The bond line can be assumed to be tilted if the tilt angle between the surface of the specimen and the bond line exceeds 6° .

Note 3: Where the bond line is tilted it may be necessary to etch both sides of the specimen to ensure correct location of the V notch.

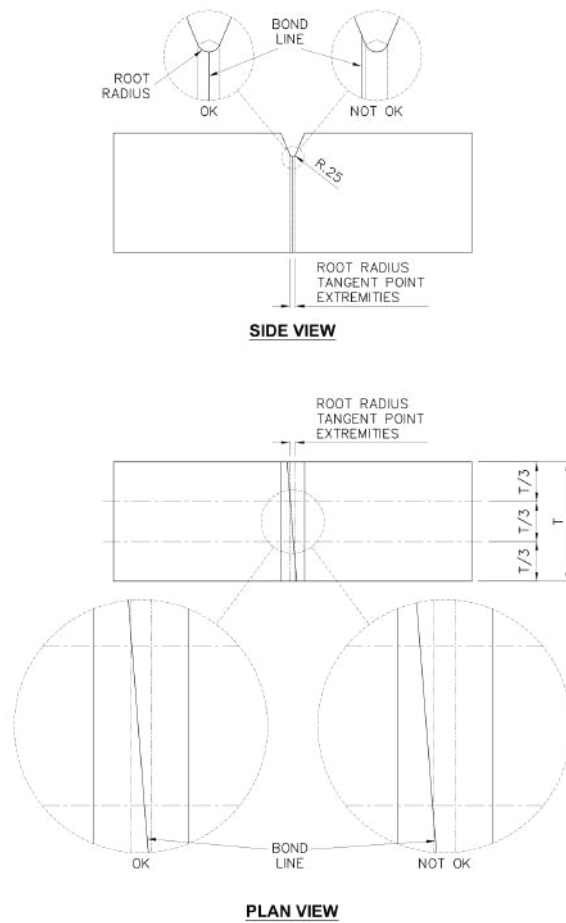


Figure 2: Distance between the middle of the Charpy V notch and the middle of the bond line

CONFIRMATION OF NOTCH POSITION

After machining or before testing the position of the notch to the bond line shall be verified at one side the specimen. Visual examination is generally sufficient to determine whether the bond line is within the radius of the notch. An appropriate enlarger might be necessary to adequately discern the bondline.

TESTING

Testing shall be performed in accordance with the prevailing test standard.

PROCEDURE

The test laboratory shall have a written procedure for notch location, specimen machining and verification of the bond line position which can be provided on request.

REFERENCES

Standards

API: *Specification for linepipe API 5L 46th Edition including Errata to May 2018* Washington: American Petroleum Institute, 2018.

ASTM: *Standard Test Methods and Definitions for Mechanical Testing of Steel Products ASTM A370 - 17*. West Conshohocken, PA: American Society for Testing and Materials, 2017.

ASTM: *Standard Test Methods for Notched Bar Impact Testing of Metallic Materials ASTM E23-16b*. West Conshohocken, PA: American Society for Testing and Materials, 2016.

ISO: *Metallic materials – Charpy pendulum impact test – Part 1: Test Method ISO 148-1:2016*. Geneva, International Organization for Standardization, 2016.

ISO: *Petroleum and natural gas industries – Steel pipe for pipeline transportation systems ISO 3183:2012 + Amd 1:2017*. Geneva, International Organization for Standardization, 2017.

Background Information

Gallon N, Andrews R, Boothby P, Perez C and Lobbe H: *Development of a Procedure for Charpy Impact Testing of the Bond Line of Electric Welded Pipe*. To be submitted to: International Journal of Pressure Vessels and Piping, 2020.

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