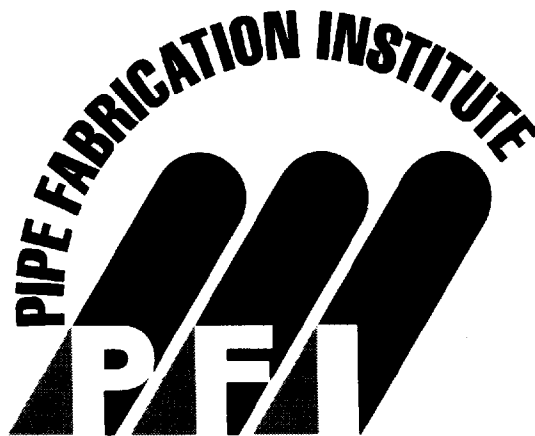


WALL THICKNESS MEASUREMENT BY ULTRASONIC EXAMINATION

Prepared by
Pipe Fabrication Institute Engineering Committee



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METRIC CONVERSIONS

The conversion of quantities between systems of units involves a determination of the number of significant digits to be retained. All conversions depend upon the intended precision of the original quantity and are rounded to the appropriate accuracy.

Pipe sizes together with applicable wall thickness' are not shown with metric equivalents.

The SI (Metric) values where included with the customary U.S. values in this Standard are the rounded equivalents of the US values and are for reference only.

Metric units were derived utilizing the following conversion factor:

<u>Conversion</u>	<u>Factor</u>
inches to millimeter	25.4

1.0 Scope

- 1.1 This Standard establishes the requirements for measuring the wall thickness of plate, pipe, fittings and pipe bends by ultrasonic means.
- 1.2 The resonance or pulse echo method may be employed to verify the wall thickness measurements. The data presented in this Standard pertains to the pulse echo method.

2.0 General

- 2.1 Wall thickness measurements may be taken at the discretion of the fabricator for information or when required by the Customer's Specification or Purchase Order.
- 2.2 The person taking the measurement readings shall read the operating instructions of the equipment and receive sufficient training to operate the equipment and obtain a correct reading. The training shall include the information necessary for the person taking the thickness measurements to determine if an erroneous reading is being obtained (i.e., double reading from thin wall material, poor contact, C bore, lamination, etc.).
- 2.3 Measurements shall be taken in the Fabricator's shop prior to shipment.

3.0 Surface

- 3.1 The finished contact surfaces (i.e., weld or base material) shall be free from weld spatter, dirt, loose scale, foreign material, and any roughness that would interfere with the contact of the transducer or impair the transmission of the ultrasonic vibrations. Unless otherwise specified in the Customer's Specification or Purchase Order, only the area in contact with the transducer need to be cleaned to this extent.

4.0 Equipment

4.1 Pulse-Echo Method

- 4.1.1 An electronic system capable of producing, receiving and displaying high frequency electrical impulses at various frequencies and energy levels. Some systems use a cathode ray tube (CRT) presentation, a digital display, or dial indicator readout.

4.2 Transducers

- 4.2.1 Transducers shall be capable of transmitting and receiving ultrasonic sound waves in the part to be measured. On pipe or fittings of small diameters, curved transducers or shoes may be used.

5.0 Couplant

- 5.1 A liquid couplant such as water, oil, glycerin etc. capable of conducting ultrasonic sound waves from the transducer to the part shall be used.
- 5.2 Couplants may be removed from the part at the discretion of the fabricator.

6.0 Calibration

- 6.1 The instrument shall be calibrated in accordance with the Manufacturer's recommended practice on a test specimen of similar surface condition, similar metallurgical structure and the same or equivalent P-Number. P-Numbers 1, 3, 4 and 5 materials are considered equivalent. The thickness of the test specimen should be accurately measured with a micrometer and recorded. The part to be measured may be considered as the test specimen.

7.0 Measuring Procedure

7.1 Pulse-Echo Method

- 7.1.1 Clean surface in accordance with Paragraph 3.
- 7.1.2 Calibrate instrument in accordance with Paragraph 6.
- 7.1.3 Apply couplant to surface to be measured in accordance with Paragraph 5.
- 7.1.4 Place transducer firmly on part and read the thickness of the part on the CRT screen, direct digital or dial indicator readout.

- 7.2 For pipe bends, thickness measurement shall be taken at points approximately 15 degrees apart with 3 readings minimum along the length, on the tension side of the bend arc, beginning at either tangent location. For pipe and fittings, the fabricator may select the location for the measurement to be taken. All readings shall show compliance with the specified minimum wall thickness.

8.0 Records

- 8.1 A record of the examination shall be made on the fabricator's Standard Report Form as approved by the client. Changes to the Report Form shall be a matter of prior agreement between the Fabricator and his client. The following are examples of data that may be recorded on the Report Form:
 - a. Date of Measurement
 - b. Location
 - c. Customer
 - d. Acceptance Criteria
 - e. Material Specification
 - f. Product Form
 - g. Surface Preparation
 - h. Method or Procedure
 - i. Type and Model of Equipment
 - j. Distance Between Points
 - k. Results of Thickness Readings

A current index of the latest revised ES Standards and Technical Bulletins is available from the Pipe Fabrication Institute.

PFI Standards and Technical Bulletins are published to serve proven needs of the pipe fabricating industry at the design level and in actual shop operations. Hence, such needs are continually considered and reviewed by the Engineering Committee of the Pipe Fabrication Institute to provide recommended procedures which have been demonstrated by collective experiences to fulfill requirements in a manner for Code compliance. However, as the PFI Standards are for minimum requirements the designer or fabricator always has the option of specifying supplementary conditions in the form of requirements beyond the scope of the PFI publications.