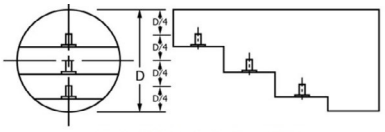
# Ultrasonic Reference Standards

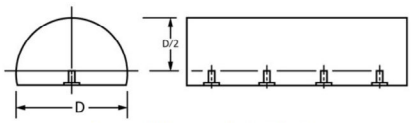



NOTE 1—All holes are the same diameter.

**FIG. 1 Typical Distance-Amplitude Reference Block Configuration for the Ultrasonic Testing of Large Metal and Metal Alloy Bars of from 1 to 10 in. (25.4 to 254.0 mm) Diameter and Larger**

## ASTM E1158 Distance Amplitude Blocks

This specification governs the material selection and fabrication of reference blocks for the pulsed longitudinal wave contact or immersion ultrasonic examination of metal and metal alloy production round bar stock between 1" and 10" in diameter. It is recommended that the blocks be fabricated from material representative of the production material to be examined. The Figure 1 block contains a number of holes of the same diameter at various distances from the scan surface. Typical hole diameter is 5/64" or larger. Figure 3 block for square or rectangular bar over 1" is also available.

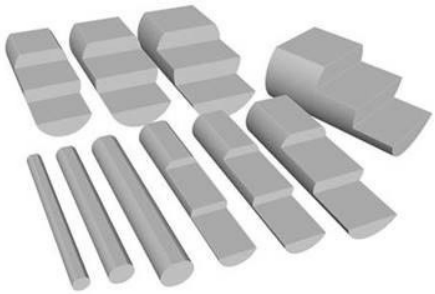



NOTE 1—Holes are of different diameters.

**FIG. 2 Typical Area-Amplitude Reference Block for use in Ultrasonic Testing of Round Bars as in Fig. 1**

## ASTM E1158 Area Amplitude Blocks

This specification governs the material selection and fabrication of reference blocks for the pulsed longitudinal wave contact or immersion ultrasonic examination of metal and metal alloy production round bar stock between 1" and 10" in diameter. It is recommended that the blocks be fabricated from material representative of the production material to be examined. The Figure 2 block contains holes of different diameters at the same distance from the scan surface. Typical hole diameters range from 2/64" and 8/64" or larger. Figure 4 block for square or rectangular bar over 1" is also available.

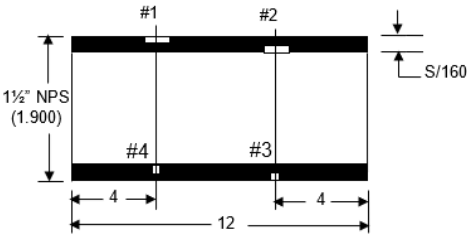


## ASTM E2375 UT Reference Blocks

The following UT Reference Blocks from ASTM E2375 are available:

- Convex Surface Reference Standard Configuration for Longitudinal Wave Inspection
- Standard Ultrasonic Test Block for Angle Beam Examination
- Hollow Cylindrical Standards
- Side-drilled Hole Reference Blocks

This spec is equivalent to AMS-STD-2154 and the older MIL-STD-2154. Similar blocks are also found in Boeing BSS 7055.



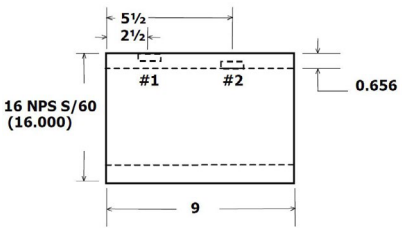

## ASME Sec. III NB-2552.3 Standards

Used for ultrasonic examination of pipe and tubing in both circumferential and axial directions. The reference specimen shall be of the same nominal diameter, wall thickness, nominal composition and heat treated condition as the product being examined. Contains four (4) notches of square, U or V shape at a depth not greater than the larger of 0.004" or 5% of nominal wall by 1" long max. Defects are located so that indications are separate and distinct. In accordance with ASME Section III, Division 1, NB-2552.3. Sample sketch at left shows a 1-1/2" NPS Schedule 160 pipe section with four EDM notches.

# Ultrasonic Reference Standards

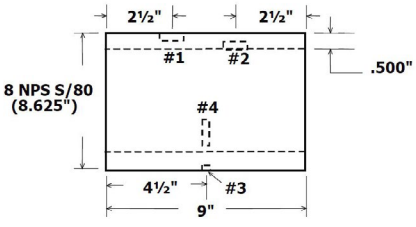
## PDI Contoured Calibration Blocks for Dissimilar Metal (DM) Welds

Contoured calibration blocks are used in the manual examination of dissimilar metal (DM) welds and base materials including piping susceptible to Stress Corrosion Cracking (SCC).The blocks are used to establish a reference sensitivity level from which subsequent exams may be compared. The blocks are precisely machined to fit contoured search units for axial and circumferential scanning directions. Customer specifies block contour radius based on diameter of material being inspected. Blocks are manufactured in Type 304 or Type 316 Stainless Steel and are certified to meet Performance Demonstration Initiative PDI-UT-10 and PDI-UT-8.




## 2-Notch Pipe Standard

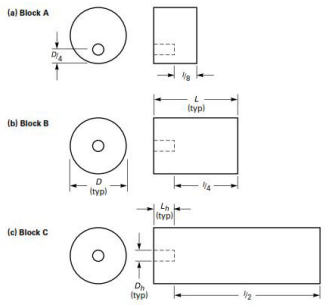
Typical standard for circumferential scanning containing two (2) notches, one (1) OD longitudinal and one (1) ID longitudinal. The material shall be of the same diameter, wall thickness, material spec, and heat treatment as the material being inspected. Can be customer-supplied or PH Tool-supplied. Typical length required is 9 to 12" for contact testing, and 36 to 48" for immersion testing. Notch location can be customer-specified. Standards can be made 360° (full diameter), however, arc lengths of 90° to 180° are common for larger diameters. This design is typical of many UT specifications including: ASTM E-213, ASME Sections III and V, GE P3C-AL-0300, MIL-T-16420K, ASME SA-655, MIL-STD-271F, MIL-STD-2132, among others.




## 4-Notch Pipe Standard

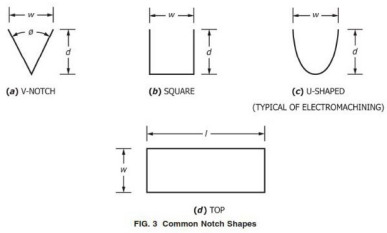
Typical standard for circumferential and longitudinal scanning containing four (4) notches, one (1) OD longitudinal, one (1) ID longitudinal, one (1) OD circumferential, and one (1) ID circumferential. The material shall be of the same diameter, wall thickness, material spec, and heat treatment as the material being inspected. Can be customer-supplied or PH Tool-supplied. Typical length required is 9 to 12" for contact testing, and 36 to 48" for immersion testing. Notch location can be customer-specified. Standards can be made 360° (full diameter), however, arc lengths of 90° to 180° are common for larger diameters. This design is typical of many UT specifications including: ASTM E-213, ASME Sections III, V and XI, MIL-T-16420K, ASME SA-655, MIL-STD-271F, among others.

# Ultrasonic Reference Standards




## ASME Sec. V Art. 5 Straight Beam Calibration Blocks for Bolting

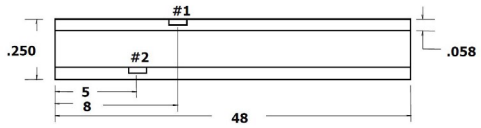
These calibration blocks are manufactured in accordance with Figure T-534.3 and contain FBHs drilled in the axial direction of the block. Block material and examination surface finish shall be the same or equivalent to the bolting under examination. Block designations A, B, and C are available. Contains one (1) FBH from 1/16" to 3/8" diameter depending on examination material diameter. In accordance with ASME Section V, Article 5, Figure T-534.3, Straight Beam Calibration Blocks for Bolting.




## ASME Sec. V Art. 23 Ultrasonic Standards

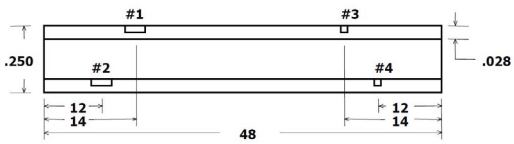
All calibration and reference standards identified in Article 23 are available. Specifications include SA-388, SA-435/SA-435M, SA-577/SA-577M, SA-578/SA-578M, SA-609, SA-745, SB-548, SE-317, SE-797, SE-2491, SE-2700, SE-213, SE-214, and SE-273.

Inset shows SE-213, Figure 2 Common Notch Shapes, including V-Notch, Buttress (square), and U-Shaped.




## 2-Notch Pipe Standard (Tube)

Typical standard for circumferential scanning containing two (2) notches, one (1) OD longitudinal and one (1) ID longitudinal. Typical length required is 48". Notch depth, width, and length vary by specification. Notch location can be customer-specified. ID notch location can be 12" from end on IDs over approximately 0.180". Reduces to 6" from end on 0.080" ID. This design is common to many UT specifications including MIL-T-16420K and MIL-T-23226.




## 4-Notch Pipe Standard (Tube)

Typical standard for circumferential and longitudinal scanning containing four (4) notches, one (1) OD longitudinal, one (1) ID longitudinal, one (1) OD circumferential, and one (1) ID circumferential. Typical length required is 48". Notch depth, width, and length vary by specification. Notch location can be customer-specified.

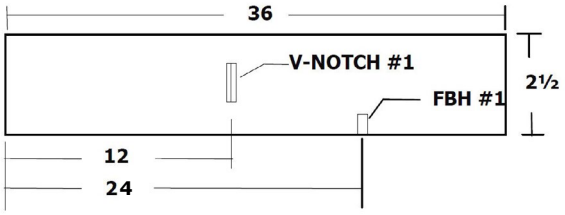
ID notch location can be 12" from end on IDs over approximately 0.180". Reduces to 6" from end on 0.080" ID. This design is common to many UT specifications including Pratt & Whitney's PWA SIM 4E SIS 26B.

# Ultrasonic Reference Standards

## Unique Tube Standards for UT

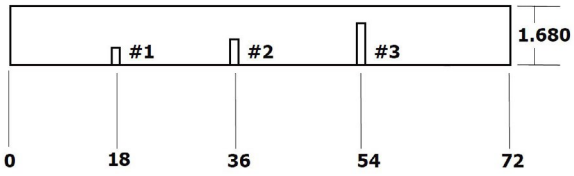
PH Tool is the go-to source for application-specific UT standards for critical tubing producers around the globe. Custom variations are available containing EDM notches, FBHs (OD and ID,) wall thinning, simulated ID pitting, and other unusual discontinuities. Our shop is equipped to handle variations such as extra-long lengths, very small IDs, and exotic alloys such as tantalum and iridium.

Send us your sketch of any unique standard and we'll provide a quick quote.




## V-Notch and FBH Bar Standard

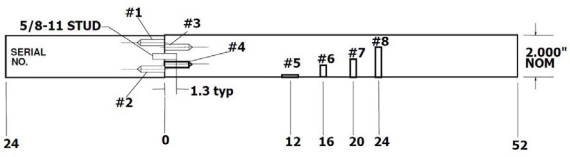
Popular standard for round bar inspection containing one (1) circumferentially oriented V-Notch (normally 60° included angle), and one (1) FBH. Notch depth and length, and FBH depth and diameter vary by specification. V-Notches are uniformly deep relative to the diameter. V-Notch angles other than 60° are available.




## 3-FBH Bar Standard

Popular standard for round bar inspection containing three (3) FBHs of the same diameter at different depths. FBH depths on this standard are 1/4D (25% of diameter), 1/2D, and 3/4D.

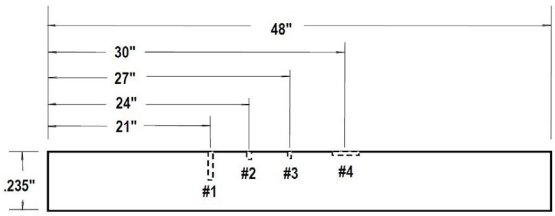
FBH diameters are normally from 1/64" through 5/64", with 3/64" being most common. More complex standards containing additional holes and/or notches are available.




## 2-Piece Round Bar Standard

Standard consists of two sections of round bar joined either by welding or drilling/tapping/bolting, depending on diameter. The parting and subsequent joining allows for the machining of axially-oriented side-drilled holes (SDHs) at prescribed metal travel distances from the diameter of the bar. Normally two (2) or four (4) SDHs are used. SDH diameter is typically 1.0 mm (0.0394") or 3/64" (0.047"). Standard also contains three (3) FBHs (radially-oriented) at 1/4D, 1/2D, and 3/4D. FBH diameters are normally from 1/64" through 5/64", with 3/64" being most common. An axial EDM notch is often included in this design.

# Ultrasonic Reference Standards




## PWA SIS-315A; SIM-1 Standard

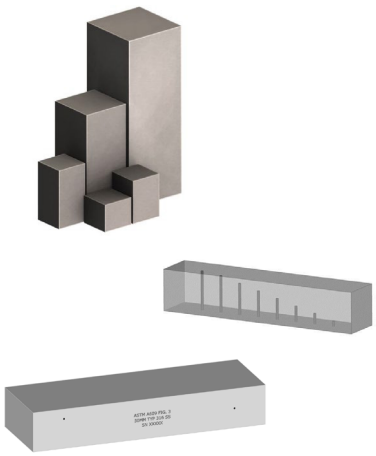
Pratt & Whitney Aircraft standard for round bar/rod inspection. Variation depicted at left shows standard containing one (1) 3/64" diameter FBH at 50% depth; one (1) 3/64" dia. at 10%; one 1/32" dia. at 10%; and one (1) axial EDM notch at 3% deep by 1/4" long.

## Projectile Body UT Standards

Typical projectile body and/or base standard will include OD and ID notches oriented both longitudinally and circumferentially. Notches can be uniformly deep across length, or thumbnail profile. Notch depth, width, length, and location are normally customer specified. Standards often contain FBHs also.

## API RP 2X Reference Standard

American Petroleum Institute Reference Standard for Level "C" Examination for Recommended Practice 2X (RP 2X), Ultrasonic Examination of Offshore Structural Fabrication and Guidelines for Qualification of Ultrasonic Technicians. Set of four (4) blocks required. One block containing a square (buttress) notch and one each with V-notches for 45°, 60°, and 70° orientations for establishing scanning sensitivity for root reflectors. Note: Simulated references for rejectable flaws established by the Operator's UT specialist should be added to this block for the calibration of internal reflectors, i.e. 3/32" diameter side-drilled hole. In accordance with API RP 2X, Figure D-8.



## ASTM A609 Straight Beam and Angle Beam Blocks for Inspection of Castings

ASTM A609 Blocks are used for ultrasonic inspection of cast materials. The standard set of FBH blocks from Figure 1 includes five blocks of various metal travel distances, each with a 1/4" (0.250") diameter FBH drilled into one end. We also offer the Dual-Search Unit Block from Figure 2, and the Basic Calibration Blocks for angle beam testing from Figure 3. A609 blocks are made from cast materials to ensure acoustic similarity with the component under test. PH Tool maintains a large stock of cast carbon steel so we can make blocks sets quickly without waiting for a foundry to pour the steel.