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## FYI: Reference and Calibration Standards

To ensure accurate and repeatable inspection, ultrasonic testing equipment must be standardized and calibrated so that data taken by different operators are comparable and can be matched against inspection norms. This is accomplished through the use of reference and calibration standards or test blocks.

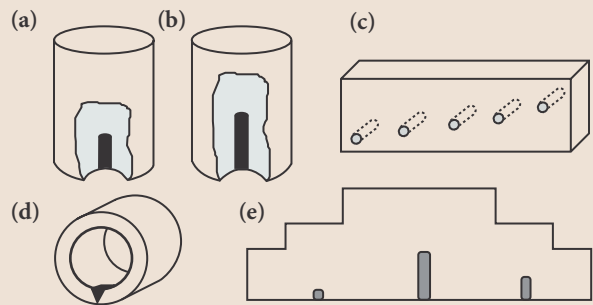
**Selecting a Reference Standard.** Selection of a reference standard is determined by testing technique, type of material to be inspected and form, type of discontinuity to be detected, and specification requirements. Reference standards, such as those designed to ASTM, ASME or AWS specifications, are used to standardize equipment responses. Blocks with flat bottom holes (Fig. 1) are often used to standardize amplitude of the detected signal with respect to the effective area or distance of known reflectors. Area (amplitude or distance) amplitude curves are usually constructed using such blocks. In some cases, blocks with side drilled holes are also used for such standardizations. Reference standards varying acoustically from the test object by more than 6 decibels are usually considered unacceptable for use.

**Preparing a Reference Standard.** Sometimes, it is preferable or required to prepare a reference standard from a piece of the same material as that to be tested, by introducing notches or holes into a sample or into the actual test object. The advantage of such a reference standard is that the test object and the standard will have the same composition, manufacturing history, surface condition and geometry. The disadvantages are that usually there will be fewer artificial reflectors and it may not be possible to manufacture the reflectors as accurately as might be done with a separate standard.

Other types of standard test blocks (and some of the above reference blocks) are used to calibrate the ultrasonic testing equipment with respect to essential variables such as sweep length, pulse energy and amplification, search unit characteristics, sensitivity, resolution and linearity. Typical calibration blocks include IIW type blocks, DC, SC, DSC and MAB blocks. Two uses of the IIW type blocks are shown in Fig. 2a and b.

**Conclusion.** In all cases, reference standards must be prepared and used in strict accordance with well designed specifications that cover the material, the fabrication and the application of the blocks. ■

**Figure 1.** Reference block diagrams (a) and (b) illustrate flat bottom hole for area and distance amplitude blocks, (c) side drilled, (d) known dimension notch and (e) flat bottom holes in block manufactured from actual part.



**Figure 2.** Two uses of the IIW type block include (a) IIW verification of angle beam search unit beam index point and (b) IIW determination of straight beam depth resolution.

