Quality Assurance
Procedure QAP 5950

Method of Test For

Procedure for Determining the Characteristics of an Ultrasonic Search Unit

1. SCOPE

1.1 This purpose of this procedure is to empirically establish the beam characteristics of a specific search unit. Establishing the depth of resolution (dead zone) and the beam spread is necessary for meaningful critical flaw assessment.

Assuming rectilinear propagation of ultrasound using ray diagrams and geometric plots does not accurately provide information to determine the diffraction, scattering, interference, reflection and mode conversion that takes place in a geometrical test specimen.

2. REFERENCE

2.1 Ultrasonic Testing of Materials, Krautkramer.
2.2 Procedures and Recommendations for the Ultrasonic Testing of Butt Welds, Welding Institute.

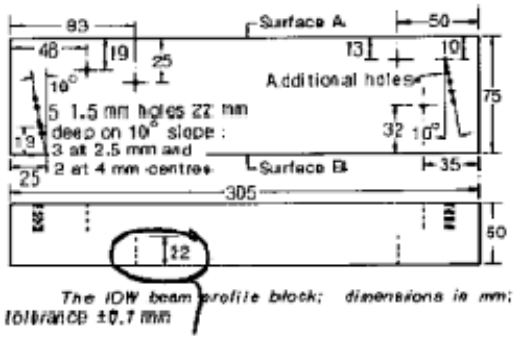
3. APPARATUS

3.1 Search unit wedge and transducer used for testing.
3.2 Dead zone calibration block.
3.3 Beam profile block.

4. PROCEDURE

4.1 Dead zone assessment.

4.1.1 The dead zone is that depth from the reflector in the dead zone block (Fig. 1) which produces a clearly distinguishable signal.

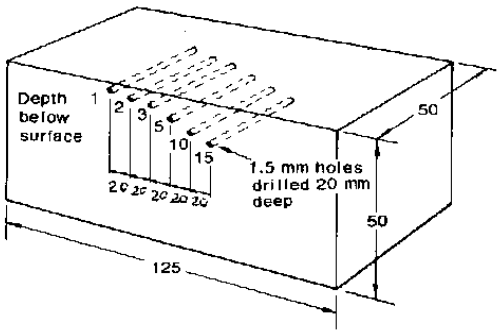


The IDW beam profile block; dimensions in mm; tolerance ±0.1 mm

Figure 1

4.2 Beam Profile.

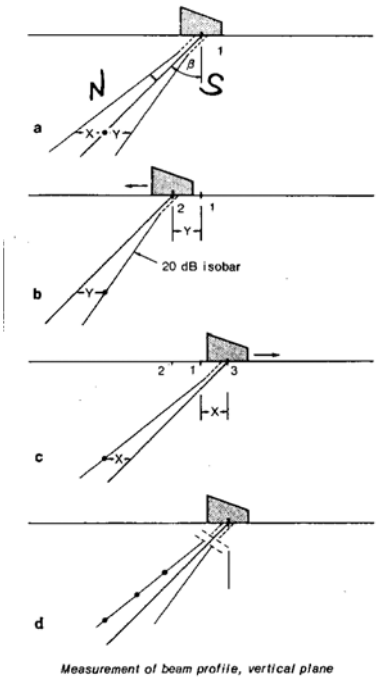
4.2.1 The beam profile is measured in the vertical and horizontal axis. Measurement of the 6 dB drop in amplitude (used in D 1.5, though the 20 dB drop may be used as well in assessing flaw height and length) is made on the side drilled holes of the beam profile block (Fig. 2).



Measurement of dead zone; dimensions in mm

Figure 2

4.2.2 Vertical beam profile - The successive 0.060 inch holes are measured in succession from surfaces A and B. In each case, the position of the search unit index is marked on the block. The search unit is moved forward and backward to the points of a 6 dB drop in amplitude. In the forward position, the lower portion of the beam is measured and vice versa in the back position (Fig. 3). Fig. 3d illustrates the completed vertical plane of the beam plot in the forward position. The same would be measured for the lower portion of the beam and collated for the entire vertical profile.



Measurement of beam profile, vertical plane

Figure 3

Similar measurements are made at each target hole which are plotted on the beam profile diagram. The plot ends at the apparent end of the near field. With the previously measured beam angle, the centerline of the beam is drawn from the entry point giving maximum amplitude for the hole measured.

The Y reading (forward position) is marked off behind the beam axis. The X reading is likewise marked off in front of the beam axis. All plotting is to scale.

4.2.3 Horizontal beam profile - The search unit is placed on surface A or B to obtain signals from the side drilled flat bottom holes in the beam profile block.

The standoff is calculated for the entry point of the search unit and an offset straight-edge is placed as a guide at the heel of the search unit to provide constant standoff.

The search unit is then moved laterally toward the end of the side drilled hole until a 6 dB drop in amplitude is measured.

The half beam spread at this range (depth of the target hole being measured) is calculated by subtracting the drilled depth (to the end of the flat bottom hole) from the distance between the edge of the block and the beam axis, which is X in Fig. 3e.

The probe direction, with respect to the axis of the hole, is reversed and the same procedure is followed. These points are then plotted for the horizontal axis (to scale).

This plot should be performed within the working amplitude range, particularly at or near reference level. Also, when adjustable, it should be performed at or near the pulse length and strength.

The beam angle should be measured for use in second leg for length determinations when testing in leg II.

Figure 3e