

## Appendix

### Reflectivity Diagram Calculations: Flat Bottom Holes (FBH)

#### Scenario 1: Table 1: Scenario 1 Calculations (Back Wall Echo Reference)

Probe Diameter (mm)	$d_c$	24
Probe Frequency (MHz)	$f$	2
Materials Velocity (m/s)	$v$	5920
Reference Echo Type	BWE / Known Reflector (FBH)	BWE
Reference Reflector Diameter (mm)*	$s_{ref}$	N/A
Reference Reflector Beam Path (mm)	$d_{ref}$	500
Indication Beam Path (mm)	$d_{ind}$	300
Indication dB difference to reference	$G$	-18
<b>Calculations:</b>		
Wavelength (mm)	$\lambda = \frac{V}{f}$	2.96
Near Zone (mm)	$N_c = \frac{d_c^2}{4\lambda}$	49
Reference Position Near Zones	$D_{ref} = \frac{d_{ref}}{N_c}$	10.3
Indication Position Near Zones	$D_{ind} = \frac{d_{ind}}{N_c}$	6.2
Reference Reflector Relative Size*	$S_{ind} = \frac{s_{ref}}{d_c}$	N/A
<b>Plot Both Positions on Graph</b> Using reference position as initial point and plotting indication point after adjusting for Distance and Amplification	<ul style="list-style-type: none"> <li>• Reference Position</li> <li>• Indication Position</li> </ul>	Reference x = 10.3 , y = -16.5 Indication x = 6.2, y = -34.5
Determine Indication Relative Size from Graph	$S_{ind}$	Approx 0.25
<b>Calculate FBH Size</b>	$d_f = S_{ind} \times d_c$	Approx 6mm

\*Not applicable when using BWE as reference