Scanstar Inspection Technology Private Limited

New # 7, Old # 11-A, 1st Main Road, Officers Colony,
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Ultrasonic Testing Formulas

Longitudinal Wave Velocity

$$V_L = \sqrt{\frac{E(1-\mu)}{\rho(1+\mu)(1-2\mu)}}$$

Where:

V_L = Longitudinal Wave Velocity
E = Modulus of Elasticity
ρ = Density
μ = Poisson's Ratio

Shear Wave Velocity

$$V_S = \sqrt{\frac{E}{2\rho(1+\mu)}} \text{ or } \sqrt{\frac{G}{\rho}}$$

Where:

V_s = Shear Wave Velocity
E = Modulus of Elasticity
ρ = Density
μ = Poisson's Ratio
G = Shear Modulus

Wavelength

$$\lambda = \frac{V}{f}$$

Where:

λ = Wavelength
V = Velocity
F = Frequency

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Ultrasonic Testing Formulas

Refraction (Snell's Law)

$$\frac{\sin\theta_I}{\sin\theta_R} = \frac{V_1}{V_2}$$

Where:

θ_I = Angle of the Incident Wave

θ_R = Angle of the Reflected Wave

V_1 = Velocity of Incident Wave

V_2 = Velocity of Reflected Wave

Acoustic Impedance

$$Z = \rho \times V$$

Where:

Z = Acoustic Impedance
ρ = Density
V = Velocity

Reflection Coefficient

$$R = \frac{(Z_2 - Z_1)^2}{(Z_2 + Z_1)^2}$$

Where:

R = Reflection Coefficient

Z_1 = Acoustic Impedance of Medium 1

Z_2 = Acoustic Impedance of Medium 2

Near Field

$$N = \frac{D^2}{4\lambda} \quad \text{or} \quad N = \frac{D^2 F}{4V}$$

Where:

N = Near Field
D = Transducer Diameter
λ = Wavelength
V = Velocity

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Ultrasonic Testing Formulas

Beam Spread
Half Angle

$$Sin\theta = 1.2\frac{\lambda}{D} \text{ or } Sin\theta = 1.2\frac{V}{DF}$$

Where:

λ = Wavelength
D = Transducer Diameter
V = Velocity
F = Frequency

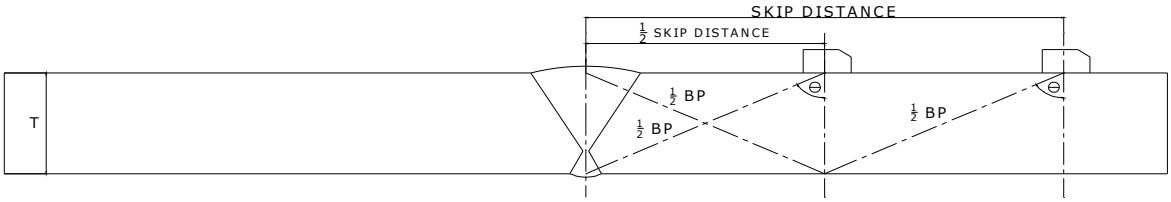
Decibel (dB)
Gain or Loss

$$\Delta I(dB) = 20\log\frac{P_2}{P_1}$$

Where:

dB = Decibel
P_1 = Presure Amplitude 1
P_2 = Presure Amplitude 2

Angle Beam Probe Calculations



1/2 Skip Distance – T x Tan θ

Skip Distance – 2T x Tan θ

1/2 Beam Path – T/ Cos θ

Beam Path – 2T/ Cos θ

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Ultrasonic Testing Formulas

Surface Distance – Beam Path X Sin θ

Half Skip Depth - Beam Path X Cos θ

Skip Depth – { 2T – (Beam Path X Cos θ)}

Where:

T – Thickness of the Job.

Θ – Angle of the Probe.

BP – Beam Path.