

ULTRASONIC REFERENCE DATA

VELOCITY AND ACOUSTIC IMPEDANCE TABLE					
Material	Longitudinal Velocity		Shear Velocity		Acoustic Impedance
	$\frac{\text{in}}{\text{sec}} \times 10^6$	$\frac{\text{km}}{\text{sec}}$	$\frac{\text{in}}{\text{sec}} \times 10^6$	$\frac{\text{km}}{\text{sec}}$	$\frac{\text{gm}}{\text{cm}^2 \text{sec}} \times 10^5$
Air	.013	.33	-	-	.0004
Aluminium	.25	6.3	.12	3.1	17.0
Al. Oxide	.39	9.9	.23	5.8	32.0
Beryllium	.51	12.9	.35	8.9	23.0
Boron Carbide	.43	11.0	-	-	26.4
Brass	.17	4.3	.08	2.0	36.7
Cadmium	.11	2.8	.059	1.5	24.0
Copper	.18	4.7	.089	2.3	41.6
Glass (crown)	.21	5.3	.12	3.0	18.9
Glycerin	.075	1.9	-	-	2.42
Gold	.13	3.2	.047	1.2	62.6
Ice	.16	4.0	.08	2.0	3.5
Inconel	.22	5.7	.12	3.0	47.2
Iron	.23	5.9	.13	3.2	45.4
Iron (cast)	.18	4.6	.10	2.6	33.2
Lead	.085	2.2	.03	.7	24.6
Magnesium	.23	5.8	.12	3.0	10.0
Mercury	.057	1.4	-	-	19.6
Molybdenum	.25	6.3	.13	3.4	64.2
Monel	.21	5.4	.11	2.7	47.6
Neoprene	.063	1.6	-	-	2.1
Nickle	.22	5.6	.12	3.0	49.5
Nylon, 6-6	.10	2.6	.043	1.1	2.9
Oil (SAE 30)	.067	1.7	-	-	1.5
Platinum	.13	3.3	.067	1.7	69.8
Plexiglass	.11	2.7	.043	1.1	3.1
Polyethylene	.07	1.9	.02	.5	1.7
Polystyrene	.093	2.4	.04	1.1	2.5
Polyurethane	.070	1.9	-	-	1.9
Quartz	.23	5.8	.087	2.2	15.2
Rubber, Butyl	.07	1.8	-	-	2.0
Silver	.14	3.6	.06	1.6	38.0
Steel, mild	.23	5.9	.13	3.2	46.0
Steel, stainless	.23	5.8	.12	3.1	45.4
Teflon	.06	1.4	-	-	3.0
Tin	.13	3.3	.07	1.7	24.2
Titanium	.24	6.1	.12	3.1	27.3
Tungsten	.20	5.2	.11	2.9	101.0
Uranium	.13	3.4	.08	2.0	63.0
Water	.0584	1.48	-	-	1.4B
Zinc	.17	4.2	.09	2.4	29.6

Near Field Length (N) • Water (Inches)				
Frequency (MHz)	Element Diameter (Inches)			
	1.00	.75	.50	.25
1.0	4.3	2.4	1.07	.27
2.25	9.6	5.4	2.4	.60
5.0	21.4	12.0	5.4	1.3
10.0	43	24	10.7	2.7

To find the approx. length in steel, divide the above values by 4

$$\text{NEAR FIELD} = \frac{D^2 F}{4 C} \quad \text{SNELL'S LAW} = \frac{\sin \alpha}{\sin \beta} = \frac{C_1}{C_2}$$

$$\text{dB} = 20 \text{ LOG } (A_1 / A_2)$$

$$\text{SKIP DISTANCE} = 2T \times \tan \beta$$

$$\text{V-PATH} = 2T / \cos \beta$$

$$\text{SURFACE DISTANCE} = \text{S.P.} \times \sin \beta$$

$$\text{DEPTH (1ST LEG)} = \text{S.P.} \times \cos \beta$$

$$\text{DEPTH (2ND LEG)} = 2T - (\text{SP} \times \cos \beta)$$

dB vs. Amplitude Ratio Chart			
dB	Ratio	dB	Ratio
0	1.00:1	11	3.55:1
.5	1.06:1	12	3.98:1
1	1.12:1	13	4.47:1
2	1.26:1	14	5.01:1
3	1.41:1	15	5.62:1
4	1.58:1	16	6.31:1
5	1.78:1	17	7.08:1
6	2.00:1	18	7.94:1
7	2.24:1	19	8.91:1
8	2.51:1	20	10.00:1
9	2.82:1	40	100.00:1
10	3.16:1	60	1000.00:1

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