

*Formulae and constants you may need*

$$t = 1/f$$

$$\begin{array}{ll} \text{Speed sound} = & 1130 \text{ ft/sec @ 70F} \\ & 344 \text{ m/s @ 70F} \end{array}$$

$$c = \lambda \times f$$

$$W = A \times I$$

$$\rho_{\text{air}} = 1.2 \text{ Kg/m}^3 \text{ at 700F}$$

$$I = P^2/(\rho \times c) \quad P = (I \times \rho \times c)^{1/2}$$

$$W_0 = 1\text{E-}12$$

$$L_{P2} = L_{P1} + 20 \log_{10}(d_1/d_2)$$

$$P_0 = 0.00002 \text{ N/m}^2$$

$$L_{pt} = 10 \log_{10}[\sum_{i=1-n} 10^{L_{pi}/10}]$$

$$I_0 = 1\text{E-}12 \text{ watts/m}^2$$

$$L_w = 10 \log_{10} (W/W_0)$$

$$A_{\text{sphere}} = 4\pi r^2$$

$$L_p = 20 \log_{10} (P/P_0)$$

$$L_p = L_w - 20 \log_{10}(r) - K + T$$

$$P = [(W \times \rho \times c)/4\pi r^2]^{1/2}$$

$$DI = 10 \log_{10} Q$$

$$\text{Dose} = (T_{\text{actual}} / T_{\text{allowable}}) \times 100\%$$

$$\text{TWA} = 90 + 16.61 \log_{10} (\text{dose}/100)$$

$$D = 100 [C_1/T_1 + C_2/T_2 + \dots + C_n/T_n]$$

$$T_{\text{allowed}} = 480/[2^{(L-90)/5}]$$

**NRR determination using dBC and dBA**

$$\text{If dBC: } \text{SPL}_{\text{lear}} = \text{SPL}_{\text{dBC}} - \text{NRR}$$

$$\text{If dBA: } \text{SPL}_{\text{lear}} = \text{SPL}_{\text{dBA}} - (\text{NRR} - 7)$$

$$\text{if dBA: } \text{SPL}_{\text{lear}} = \text{SPL}_{\text{dBA}} - \text{NRR(SF)}$$

$$L_p = L_w + 10 \log \left[ \frac{Q}{4\pi r^2} + \frac{4}{R} \right] + k, \text{ dB}$$

$$L_{p_r} = L_{w_s} - TL_{wall} + 10 \log \left[ \frac{S_{wall}}{S_r \alpha_r} \right] + 10 \log \left[ \frac{4}{R_s} \right] + k, \text{ dB}$$

$$L_{p_r} = L_{p_s} - TL + 10 \log \left[ \frac{1}{4} + \frac{S_{wall}}{R_r} \right], \text{ dB}$$

$$NR = TL - 10 \log \left[ \frac{1}{4} + \frac{S_{wall}}{R_{enclosure}} \right], \text{ dB}$$

$$\bar{\alpha} = \frac{\sum_1^N S_i \alpha_i}{\sum_1^N S_i} \quad R = \frac{S \bar{\alpha}}{1 - \bar{\alpha}} \quad TL_{combined} = 10 \log \frac{\left[ \sum_1^n S_i \right]}{\sum_1^n S_i (10^{-TL_i/10})}, \text{ dB}$$

$$IL = TL + 10 \log(\bar{\alpha}) \quad NR = IL = 10 \log \left[ \frac{1}{1 - \text{Fraction Enclosed}} \right], \text{ dB}$$

<b>Octave freq bands</b>	<b><u>125</u></b>	<b><u>250</u></b>	<b><u>500</u></b>	<b><u>1000</u></b>	<b><u>2000</u></b>	<b><u>4000</u></b>	<b><u>8000</u></b>
A-weighting	-16.1	-8.6	-3.2	0	1.2	1	-1.1

*Absorption Coefficients*

Material	125	250	500	1k	2k	4k	NRC
Brick, unpainted	0.02	0.02	0.03	0.04	0.05	0.05	0.04
Brick, unglazed	0.03	0.03	0.03	0.04	0.05	0.07	0.04
Brick, unglazed,	0.01	0.01	0.02	0.02	0.02	0.03	0.02
Carpet, heavy, on	0.02	0.06	0.14	0.37	0.6	0.65	0.29
carpet on 40oz	0.08	0.27	0.39	0.34	0.48	0.63	0.37
Concrete block,	0.36	0.44	0.31	0.29	0.39	0.25	0.36
Concrete block,	0.1	0.05	0.06	0.07	0.09	0.08	0.07
Floors							
concrete or	0.01	0.01	0.02	0.02	0.02	0.02	0.02
linoleum or	0.02	0.03	0.03	0.03	0.03	0.02	0.03
wood	0.15	0.11	0.1	0.07	0.06	0.07	0.09
wood parquet in	0.04	0.04	0.07	0.06	0.06	0.07	0.06
Foams:							
1", 2 lb/cuft	0.23	0.54	0.6	0.98	0.93	0.99	0.76
2", 2 lb/cuft	0.17	0.38	0.94	0.96	0.99	0.91	0.82
Glass							
large panes of	0.18	0.06	0.04	0.03	0.02	0.02	0.04
ordinary window	0.35	0.25	0.18	0.12	0.07	0.04	0.16
Glass fiber							
1", 3 lb/cuft	0.23	0.5	0.73	0.88	0.91	0.97	0.76
1", 6 lb/cuft	0.26	0.49	0.63	0.95	0.87	0.82	0.74
Gypsum board, .5"	0.29	0.1	0.05	0.04	0.07	0.09	0.07
Sprayed on							
1" cellulose appl. To	0.47	0.9	1.1	1.03	1.05	1.03	1.02
Plywood paneling	0.28	0.22	0.17	0.09	0.1	0.11	0.15

*Transmission Loss, dB*

	125	250	500	1k	2k	4k	8k	STC
Plywood, 3/4"	24	22	27	28	25	27	35	26
Plywood, 1/4"	17	15	20	24	28	27	25	25
5/8" gypsum on	23	28	33	43	50	49	50	38
2"x2" studs								
Concrete, 4" thick	29	35	37	43	44	50	55	42
Concrete block, 6" thi	33	34	35	38	46	52	55	40
1-3/4" wood door	23	28	27	25	30	32		
5-3/8" wall with 5/8"	29	40	51	55	48	58		

gyp board on resilient channel and 1/2" gypsum  
 on other side of wood studs with  
 3.5" fiberglass in between gypsum