

Useful Formulae for Noise

1 Reference quantities

$$\begin{aligned} p_0 &= 2 \times 10^{-5} \text{ Pascals} \\ I_0 &= 10^{-12} \text{ Watts/m}^2 \\ W_0 &= 10^{-12} \text{ Watts} \end{aligned}$$

2 Room acoustics

$$\tau = \frac{0.161V}{S\alpha} \qquad Q = \frac{4\pi r^2}{S} \qquad R = \frac{S\alpha}{1-\alpha}$$

$$L_p = L_w + 10\log_{10} \left[\frac{Q}{4\pi r^2} + \frac{4}{R} \right] \qquad I = \frac{p^2}{\rho_0 c} = \frac{W}{S}$$

3 Energy levels

$$L_{EP,d} = 10\log_{10} \left[\frac{1}{T_0} \int_0^{T_e} \left[\frac{p_A(t)}{p_0} \right]^2 dt \right] \qquad L_{EP,d} = L_{Aeq,Te} + 10\log_{10} \left[\frac{T_e}{T_0} \right]$$

$$L_{EP,w} = 10\log_{10} \left[\frac{1}{5} \sum_{k=1}^{k=m} 10^{0.1(L_{EP,d})_k} \right] \qquad SEL = L_{Aeq} + 10\log_{10} \left[\frac{t}{1\text{sec}} \right]$$

4 Barrier transmission

$$TL = 20\log_{10}(Mf) - 43 \qquad TL_{ave} = TL_{max} - 10\log_{10} \left[1 - k + k \cdot 10^{\frac{TL_{max} - TL_{min}}{10}} \right]$$

$$\text{Attenuation (dB)} \approx 13 + 10\log_{10} \left[\frac{2\delta}{\lambda} \right] \qquad \text{Attenuation (dB)} \approx 10\log_{10} \left[\frac{20H^2}{\lambda D} \right]$$

5 Ducts

$$\text{Attenuation (dB/m)} \approx 1.05 \alpha^{1.4} \frac{P}{A}$$

6 Single expansion chamber

$$TL = 10\log_{10} \left[1 + 0.25(m - m^{-1})^2 \sin^2 kL \right]$$

7 Plenum chamber

$$TL = -10\log_{10} \left[S \left(\frac{h}{2\pi d^3} + \frac{1-\alpha}{\alpha S_L} \right) \right]$$

All terms have their usual meaning