How Big? *(continued)*

Table 2.2

Table of Formulas for Calculating Physical Quantities Related to Sound for a Traveling Plane Wave

	ξ	v	a	p	I	E	P_{ac}
ξ (particle displacement)	—	$\frac{v}{\omega}$	$\frac{a}{\omega^2}$	$\frac{p}{\omega \cdot Z}$	$\frac{1}{\omega}\sqrt{\frac{I}{Z}}$	$\frac{1}{\omega}\sqrt{\frac{E}{\rho}}$	$\frac{1}{\omega}\sqrt{\frac{P_{ac}}{Z \cdot A}}$
v (particle velocity)	$\xi\,\omega$	—	$\frac{a}{\omega}$	$\frac{p}{Z}$	$\sqrt{\frac{I}{Z}}$	$\sqrt{\frac{E}{\rho}}$	$\sqrt{\frac{P_{ac}}{Z \cdot A}}$
a (particle acceleration)	$\xi \cdot \omega^2$	$v \cdot \omega$	—	$\frac{p \cdot \omega}{Z}$	$\omega\sqrt{\frac{I}{Z}}$	$\omega\sqrt{\frac{E}{\rho}}$	$\omega\sqrt{\frac{P_{ac}}{Z \cdot A}}$
p (sound pressure)	$\xi \cdot \omega \cdot Z$	$v \cdot Z$	$\frac{a \cdot Z}{\omega}$	—	$\sqrt{I \cdot Z}$	$c\sqrt{\rho \cdot E}$	$\sqrt{\frac{P_{ac} \cdot Z}{A}}$
I (sound intensity)	$\xi^2 \cdot \omega^2 \cdot Z$	$v^2 \cdot Z$	$\frac{a^2 \cdot Z}{\omega^2}$	$\frac{p^2}{Z}$	—	$E \cdot c$	$\frac{P_{ac}}{A}$
E (sound energy density)	$\xi^2\,\omega^2 \cdot \rho$	$v^2 \cdot \rho$	$\frac{a^2 \cdot \rho}{\omega^2}$	$\frac{p^2}{Z \cdot c}$	$\frac{I}{c}$	—	$\frac{P_{ac}}{c \cdot A}$
P_{ac} (sound power)	$\xi^2\,\omega^2 \cdot Z \cdot A$	$v^2 \cdot Z \cdot A$	$\frac{a^2 \cdot Z \cdot A}{\omega^2}$	$\frac{p^2 \cdot A}{Z}$	$I \cdot A$	$E \cdot c \cdot A$	—

Angular frequency $\omega = 2\pi f$ Area A in m^2

Force in newtons $1\ \mathrm{N} = 1\frac{\mathrm{kg \cdot m}}{\mathrm{s}^2}$ Density of air $\rho = 1.204\frac{\mathrm{kg}}{\mathrm{m}^3}$ at 20°C

Sound pressure ρ in pascals $1\frac{\mathrm{N}}{\mathrm{m}^2} = 1\ \mathrm{Pa}$

$Z = \rho \cdot c =$ specific acoustic impendance of air $= 420\frac{\mathrm{Pa \cdot s}}{\mathrm{m}}$ at 20°C

Sound power P in watts $\left(1\ \mathrm{watt} = 1\frac{\mathrm{kg \cdot m}^3}{\mathrm{s}^3} = 1\frac{\mathrm{N \cdot m}}{\mathrm{s}} = 1\ \mathrm{joule/s}\right)$

Speed of sound $c = 343\frac{\mathrm{m}}{\mathrm{s}}$ at 20°C