

Engineering Noise Control 4th edn.
Errata and Clarifications
Second Printing

June 16, 2024

ERRATA FOR “ENGINEERING NOISE CONTROL” 2nd Edn., 1st printing.

p16, bottom line, change “static” to “absolute”.

p24, Eq. 1.32 should not have the \pm symbol on the RHS.

p29, two lines under Figure 1.5, the expression, $e^{j\omega t+\beta}$ should be $e^{j(\omega t+\beta)}$.

p36, 3 lines from the bottom of the page, replace $\cos b$ with $\cos \beta$.

p68, In Equation (2.14), change K to C , where C is the viscous damping constant and define κ as the segment stiffness.

p81, Near the bottom of the page, items labelled 1 and 2 should be items (a) and (b).

p97, Line following Equation (3.10), the correct units of dynamic viscosity are N-s/m².

p99, Line under Equation (3.18), replace “Equation (3.13)” with “Equation (3.8b)”.

p112, 7 lines below Section 3.10 heading, change $E_{A,T}$ to L_{AE} or SEL .

p112, 8 lines below Section 3.10 heading, change “type II” to “class 2”.

p120, In Equation (3.29), remove the “-” sign following the “=” sign.

p121, In Eq. (3.35), $P_1 P_2$ should be $p_{01} p_{02}$ and I_n should be I .

p136, In Equation (3.70b), the sum should be from ℓ to L .

p136, In Equation (3.71), r_i should be r_ℓ .

p149, Line above table 4.1 caption, change L to L_0 .

p149, Table 4.1 caption, change $N_{0,50}$ to N_{50} and change L to L_0 .

p168, Replace table 4.6 with the following table.

Recommended A-weighted ambient sound levels and reverberation times (arithmetic average of the 500 Hz and 1000 Hz octave bands) for different indoor spaces (space furnished but unoccupied, data mainly from AS/NZS 2107(2000), where V = room volume in m^3)

Type of space	Recommended L_{Aeq} (dBA)	Recommended reverberation time at 500 to 1000 Hz (sec)
EDUCATIONAL BUILDINGS		
Art studio	40 – 45	<0.8
Assembly Hall (<250 m^3)	30 – 40	0.6 – 0.8
Assembly Hall (>250 m^3)	30 – 40	$0.367 \log_{10} V - 0.132$
Audio-visual areas	35 – 45	0.6 – 0.8
Churches	30 – 35	—
Computer rooms (teaching)	40 – 45	0.4 – 0.6
Computer rooms (working)	45 – 50	0.4 – 0.6
Conference rooms, seminar rooms	35 – 40	0.6 – 0.7
Corridors and lobbies	<50	<0.8
Drama studios	25 – 30	$0.367 \log_{10} V - 0.132$
Lecture theatres	30 – 35	$0.450 \log_{10} V + 0.065$
Libraries	40 – 50	<0.6
Music studios	30 – 35	$0.367 \log_{10} V - 0.132$
HEALTH BUILDINGS		
Emergency areas	40 – 45	<0.6
Consulting rooms	40 – 45	0.4 – 0.6
Intensive care wards	40 – 45	<0.6
Operating theatres	40 – 50	Short as possible
Ward bedrooms	35 – 40	0.4 – 0.7
INDUSTRIAL BUILDINGS		
Packaging and delivery	<60	Short as possible
Labs and test areas	40 – 50	<0.8
Foreperson's offices	45 – 50	0.4 – 0.7
SPORTS		
Indoor sports	<45	$0.745 \log_{10} V - 0.980$
OFFICE BUILDINGS		
Board and conference rooms	30 – 40	0.6 – 0.8
Professional and admin. offices	35 – 40	0.6 – 0.8
Executive offices	35 – 40	0.4 – 0.6
Open plan office areas	40 – 45	Short as possible
Reception areas	40 – 45	0.6 – 0.8
PUBLIC BUILDINGS		
Airport terminals	45 – 50	Short as possible
Cinemas	30 – 35	$0.367 \log_{10} V - 0.132$
Restaurants	40 – 50	Short as possible
Hotel bar	45 – 50	0.6 – 1.0
Shopping Malls and supermarkets	<55	Short as possible
RESIDENTIAL		
Houses and apartments – inner city (sleeping)	35 – 40	—
Houses and apartments – inner city (living)	35 – 45	—
Houses and apartments – suburban (sleeping)	30 – 35	—
Houses and apartments – suburban (living)	30 – 40	—
Houses in rural areas	25 – 30	—

p172, 5 lines under the RC curves heading, change 70 to 65.

p180, 1 and 2 lines above Table 4.10, change 30 to 35, change the reference to ASHRAE (2015) Handbook, Applications, Chapter 48 and change the table reference to 4.10.

p182, Table 4.12 caption should read,
 “Estimated public reaction to noise when the measured sound pressure level exceeds the adjusted base sound pressure level (see Table 4.11 for adjustments to the base level of 40~dBA)”.

p185, First dot point, remove the text, “(regulation usually)”.

p195, Equation (5.33) should be:

$$Q_0 = 4\pi a^2 \left[\frac{A^2}{a} + \frac{jkA}{a} \right] e^{-jka} = 4\pi A(1 + jka)e^{-jka}$$

p196, Equation (5.36) should be:

$$\begin{aligned} p(\mathbf{r}, \theta, t) &= \frac{jk\rho c Q_0}{(1 + jka)} [-G(r_1, h, \omega) + G(r_2, -h, \omega)] e^{j(\omega t + ka)} \\ &= \frac{jk\rho c Q_0}{(1 + jka)} [-G(r - h \cos \theta, h, \omega) + G(r + h \cos \theta, -h, \omega)] e^{j(\omega t + ka)} \end{aligned}$$

p196, In Equations (5.37) and (5.38a), remove the minus sign that follows the equals sign.

p197, In Equations (5.42), (5.43) and (5.44), remove the minus sign that follows the equals sign.

p198, In Equation (5.51), remove the minus sign following the equals sign.

p204, In Equation (5.72), change $r_0^2 + n^2 b^2$ to r_n^2 .

p204, In the line following Equation (5.73), replace “(5.72)” with (5.73)”.

p204, 4 lines under Equation (5.73), replace “(5.73)” with (5.72)”.

p218, Figure 5.11 caption, change “Equations (5.111)” to “Equation (5.119)” and “Equation (5.110)” to “Equation (5.117)”.

p227, line above Equation (5.144a,b), change “Equation (5.140b)” to “Equation (5.142b)”.

p228, In Eq. 5.153, replace $\frac{1}{2}(1 - j)$ to $\frac{1}{\sqrt{2}}(1 - j)$

p229, Replace Equation (5.155) to Section 5.10.4 with the following:

$$G(w) = 1 + j\sqrt{\pi}wg(w)$$

where

$$g(w) = g(w_r, jw_i) = e^{-w^2} \operatorname{erfc}(-jw)$$

where $g(w) = g(w_r, jw_i)$ is the scaled complementary error function, $\operatorname{erfc}(\)$ is the complementary error function.

$$g(w) = \frac{h}{\pi(-jw)} + \frac{2h(-jw)}{\pi} \sum_{n=1}^N \frac{e^{-n^2h^2}}{n^2h^2 - w^2} - \epsilon P - E(h)$$

where

$$\epsilon = \begin{cases} 1; & \text{if } \operatorname{Im}\{w\} < \pi/h \\ \frac{1}{2}; & \text{if } \operatorname{Im}\{w\} = \pi/h \\ 0; & \text{if } \operatorname{Im}\{w\} > \pi/h \end{cases}$$

and

$$P = \frac{2e^{-w^2}}{e^{2\pi(-jw)/h} - 1}$$

The error bound can be estimated from:

$$E(h) \leq \frac{2| -jw | e^{-(\pi^2/h^2)}}{\sqrt{\pi} (1 - e^{-(\pi^2/h^2)}) |\operatorname{Im}\{w\}^2 - \pi^2/h^2|}$$

If $h = 0.5$, then summing the series to $N = 14$ will produce an error of $|E(h)| < 10^{-15}$.

When $\operatorname{Re}\{w\} \approx nh$, where n is a positive integer, the previous equation for $g(w)$ cannot produce a valid result and the following equation should be used.

$$g(w) = \frac{2h(-jw)}{\pi} \sum_{n=0}^N \frac{e^{-(n+\frac{1}{2})^2h^2}}{(n+\frac{1}{2})^2h^2 - w^2} + \epsilon P' + E(h)$$

where

$$P' = \frac{2e^{-w^2}}{e^{2\pi(-iw)/h} + 1}$$

Note the $n = 0$ lower limit on the sum, in contrast to the previous equation for $g(w)$.

The Equation just above cannot produce a valid result if $\operatorname{Re}\{w\} = (n + 1/2)h$, so the following procedure can be used to evaluate $g(w)$:

1. if $0.1 < \varphi [\operatorname{Re}\{w\}/h] < 0.9$, use the first equation above to evaluate $g(w)$;
2. otherwise, use the equation immediately above.

The function $\varphi [\operatorname{Re}\{w\}/h]$ means that the quantity to be used in the evaluation is the non-integer part of $[\operatorname{Re}\{w\}/h]$. For example, if $[\operatorname{Re}\{w\}/h] = 4.3$, then $\varphi [\operatorname{Re}\{w\}/h] = 0.3$.

The above procedure is only valid if $\text{Im}\{w\} > 0$. If the imaginary part of w is negative (which seems to be always when positive time dependence is used), replace w in the preceding equations with $w_a = -w$. Then calculate $g(w_a)$. After calculating $g(w_a)$, calculate $g(w)$ using:

$$g(w) = 2 \exp(-w_a^2) - g(w_a)$$

The attenuation (or reflection loss, A_{rf} in dB) of a sound wave incident on the ground is related to the reflection coefficient as:

$$A_{rf} = -20 \log_{10} |Q|$$

p231, Replace the paragraph beginning with “The effect of turbulence” (including Equation (5.167) and the 3 lines following it) with the following:

The effect of atmospheric turbulence on sound propagation over an acoustically smooth surface has been investigated by Clifford (1983) and by Raspet (1995). The presence or absence of turbulence may be included by a generalisation of their results to give the following general expression for the mean square sound pressure at a receiver located at a distance, d_{SR} , from the source for a spherically symmetric sound source having unit far field mean square sound pressure at 1 m:

$$\begin{aligned} \langle p^2 \rangle_t &= \frac{1}{d_{SR}^2} \left| 1 + \left(\frac{d_{SR}}{r_S + r_R} \right) T_t Q e^{-jk(r_S + r_R - d_{SR})} \right|^2 \\ &= \frac{1}{d_{SR}^2} + \frac{|Q|^2}{(r_S + r_R)^2} + \frac{2|Q|}{d_{SR}(r_S + r_R)} T_t \cos[\alpha_s - k(r_S + r_R - d_{SR})] \quad (\text{Pa}^2) \end{aligned}$$

$$\text{where: } \alpha_s = \tan^{-1} \frac{\text{Im}\{R_s\}}{\text{Re}\{R_s\}}$$

and where the sign of k has been changed here to reflect that positive time dependence is used in this book, whereas negative time dependence has been used by Clifford (1983) and by Raspet (1995).

p231, Delete the last sentence in the paragraph following Equation (5.169).

p247, Replace Equation (5.195) with:

$$A_g = -10 \log_{10} \left[1 + \left(\frac{r}{r_1 + r_2} \right)^2 |R_s|^2 + \left(\frac{2r}{r_1 + r_2} \right) |R_s| T \cos[\alpha_s - k(r_1 + r_2 - r)] \right] \quad (\text{dB})$$

p248, 4 lines under Equation (5.197), Z_s should be Z_m .

p249, 2nd paragraph, 2nd line, change “diffracted” to “refracted”.

p250, Table 5.6 caption, change “empirical constant, ξ ” to “wind shear coefficient, ξ ”.

p255, Table 5.9, column 2, change the heading from “slight” to “strong” and change the bottom entry from “D” to “C”.

p255, Table 5.9, column 4, change the heading from “strong” to “slight”.

p255, Table 5.9, Footnote *a*, change “close to ground” to “10 m above the ground”.

p258, 4 lines above Eq. 5.206, change “added” to “subtracted”.

p265, Delete the sentence beginning 13 lines from the top of the page.

p274-6, the standards ISO 3743/2, ISO 3747 and ISO 3741 are not listed at the end of the book. The references are:

ISO 3741:2010, “Acoustics – Determination of sound power levels and sound energy levels of noise sources using sound pressure – Precision methods for reverberation test rooms.”

ISO 3743–1:2010, “Acoustics – Determination of sound power levels and sound energy levels of noise sources using sound pressure – Engineering methods for small movable sources in reverberant fields – Part 1: Comparison method for a hard-walled test room.”

ISO 3743–2:1994, “Acoustics – Determination of sound power levels of noise sources using sound pressure – Engineering methods for small, movable sources in reverberant fields – Part 2: Methods for special reverberation test rooms.”

ISO 3747:2010, “Acoustics – Determination of sound power levels and sound energy levels of noise sources using sound pressure – Engineering/survey methods for use in situ in a reverberant environment.”

p281, Replace the first sentence in the second paragraph following Table 6.4, with “A more accurate method of determining Δ_1 is to measure the average sound pressure level on two imaginary test surfaces surrounding the machine, which correspond roughly to the shape of the machine.
”

p293, Equation (7.6), k^2 should be k_z^2 .

p329, Equation (7.95), remove “2” from the second term in brackets.

p356, Replace Equation (8.8) with
$$\frac{E_1 h_1^2 + E_2 h_2 (2h_1 + h_2)}{2(E_1 h_1 + E_2 h_2)}$$

p358, Replace Equation (8.12) with
$$B = \frac{E h^3}{12(1 - \nu^2)} .$$

p358, line following Figure 8.3 caption, replace z_n with z_i .

p364, fig 8.5, the horizontal part of the IIC 50 curve should extend down to 100 Hz.

p364, 7 lines from the top of the page add “curvature of” immediately before “500”.

p365, delete sentence beginning 4 lines above Eq. (8.21) and replace with “Both IIC and ISO specify a 1/3 octave band frequency range from 100 Hz to 3150 Hz inclusive.”

p367, In Equation (8.24), the last term in brackets should be multiplied by 2.

p371, Equation (8.41), LHS should be ω_0 OR RHS should be divided by 2π (see page 281 in the reference).

p372, Figure 8.8 caption, second line, remove “ f_c ”.

p372, In part (b) of the caption, replace the sentence beginning with “For a well damped panel”, with the following, “For a well damped panel, see the discussion in the last paragraph on page 375.”

p373, In Equation (8.45), replace $\left[1 - \left(\frac{f}{f_{ci}}\right)^2\right]$ with 1.

p378, line 2, replace “8.39” with “8.38”.

p379, The existing equation for TL_{B1} is only valid for $f_{c1} \geq 2\pi f_\ell$.
For $f_{c1} < 2\pi f_\ell$, we use: $TL_{B1} = TL_A + 20\log_{10}(f_{c1} / f_0) - 6$ (dB)

p381, To reflect Davy’s latest model, beginning the paragraph above Equation (8.61) on page 381, and ending just above Example 8.1 on page 383, replace everything with the following.

The transmission loss is found by calculating the transmission coefficients due to airborne sound, t_{Fa} , and structure borne transmission, t_{Fc} , respectively and then substituting those values into Equation (8.61a).

$$TL = -10\log_{10}(\tau_{Fa} + \tau_{Fc})$$

In the most recent Davy model, the mass-air-mass resonance frequency is calculated in a different way to how it is done in the Sharp model. First, the fundamental resonance frequencies of the panels on either side of the cavity are calculated by treating the leaves of the wall as rectangular plates that are simply supported on two opposite edges (the edges attached to the studs) and free on the other two edges. The expression used for the resonance frequency of the first bending mode for leaf i is:

$$f_i = \frac{\pi}{2b^2} \sqrt{\frac{E_i h_i^2}{12\rho_{mi}(1 - \nu_i^2)}}, \dots i = 1, 2$$

where b is the spacing between the studs and ρ_{mi} is the density of leaf, i .

In the following analysis, the panels are numbered so that $f_{c1} \leq f_{c2}$. The transmission loss is found by calculating the transmission coefficients, τ_{Fa} and τ_{Fc} , due to airborne

and structure-borne sound respectively, and then substituting these values into the TL equation above:

$$TL = -10 \log_{10}(\tau_{Fa} + \tau_{Fc}) \quad (\text{dB})$$

In the most recent Davy model, the mass-air-mass resonance frequency is calculated in a different way to how it is done in the Sharp model. First, the fundamental resonance frequencies of the panels on either side of the cavity are calculated by treating the leaves of the wall as rectangular plates that are simply supported on two opposite edges (the edges attached to the studs) and free on the other two edges. The expression used for the resonance frequency of the first bending mode for leaf i is:

$$f_i = \frac{\pi}{2b^2} \sqrt{\frac{E_i h_i^2}{12\rho_{mi}(1 - \nu_i^2)}}, \quad \dots i = 1, 2$$

where b is the spacing between the studs and ρ_{mi} is the density of leaf, i . When the two leaves making up the double wall are identical, the Davy model calculates and uses a modified value, f'_0 for the mass-air-mass resonance frequency:

$$f'_0 = \sqrt{\frac{\rho c^2(m_1 + m_2)}{4\pi^2 d m_1 m_2} + f_1^2}$$

When the panels are not identical, the calculation is slightly more complex. In this case:

$$f'_0 = \sqrt{-0.5p + 0.5\sqrt{p^2 - 4q}}$$

where $p = -(f_1^2 + f_2^2 + f_{a1}^2 + f_{a2}^2)$ and $q = f_1^2 f_2^2 + f_1^2 f_{a2}^2 + f_2^2 f_{a1}^2$ and

$$f_{ai} = \frac{1}{2\pi} \sqrt{\frac{\rho c^2}{d m_i}}$$

Davy also proposes various multipliers for f_1 and f_2 that allow his theory to fit experimental data. For all thicknesses of the steel studs greater than 0.5 mm, the best multiplier is 1.7 and for steel studs with a thickness less than 0.5 mm, the best multiplier is 0.8. Davy indirectly measured loss factors for gypsum plaster board that ranged from 0.03 to 0.04. These were the factors that resulted in best agreement with his TL model in the vicinity of the panel critical frequencies.

Below the adjusted mass-air-mass resonance frequency, f'_0 , the double wall behaves like a single wall of the same mass and the single wall procedures may be used to estimate the TL below and including the frequency, $f = 2f'_0/3$. Between $f = 2f'_0/3$ and f'_0 , a straight line is drawn on a plot of TL vs $\log_{10} f$ between the TL calculated at $f = 2f'_0/3$ and the TL calculated at $f = f'_0$.

Above f'_0 , the transmission from one leaf to the other consists of airborne energy through the cavity and structure-borne energy through the studs. For point connections, the structure-borne sound transmission coefficient for all frequencies equal to and above f'_0 is:

$$\tau_{Fc} = \frac{16n\rho^2 c^4 Q R}{\pi^5 f^2 [(m_1 f_{c2} + m_2 f_{c1})^2 + 64f^2 m_1^2 m_2^2 c^4 C_M^2]}$$

where n is the number of point connections per square metre, C_M is the stud compliance (m/N) and

$$Q = \begin{cases} 1 + e & f < f_{c1} \\ e & f \geq f_{c1} \end{cases} \quad \text{and} \quad R = \begin{cases} 1 + r & f < f_{c2} \\ r & f \geq f_{c2} \end{cases}$$

where $e = \pi f_{c1} \sigma_1 / (4f\eta_1)$, $r = \pi f_{c2} \sigma_2 / (4f\eta_2)$, f_{c1} and f_{c2} are the critical frequencies of panels 1 and 2 respectively, η_1 and η_2 are the loss factors, σ_1 and σ_2 are the panel radiation efficiencies, P is the overall length of the panel perimeter plus twice the length of all the studs. A line of point connections can be treated as a stud. When wall leaves are nailed or screwed to the studs, point connections may be assumed. When the wall leaves are bonded to the studs or bonded plus nailed, then line connections may be assumed.

For line connections, the structure-borne sound transmission coefficient for all frequencies equal to and above f'_0 is:

$$\tau_{Fc} = \frac{8\rho^2 c^3 Q R}{\left[g^2 + (8\pi f^{3/2} m_1 m_2 c C_M - g)^2 \right] b \pi^3 f^2}$$

where b is the spacing between the studs, $f_{c1} \leq f_{c2}$, $e = \frac{\sigma_1}{2\eta_1} \sqrt{\frac{f_{c1}}{f}}$, $r = \frac{\sigma_2}{2\eta_2} \sqrt{\frac{f_{c2}}{f}}$ and these values are used together with Equation () to calculate Q and R . Also:

$$g = m_1 (f_{c2})^{1/2} + m_2 (f_{c1})^{1/2}$$

Davy has found that for wooden studs, the point connection model works best in all cases and the line connection model should not be used. For steel studs where the leaves are screwed to the studs, the line connection model should be used at frequencies for which the screw spacing is less than one-quarter of the leaf bending wavelength and the point connection model should be used at frequencies for which the screw spacing is greater than one-quarter of the leaf bending wavelength. The leaf bending wavelength may be calculated using $\lambda_B = c_B / f$.

Based on all of his and his co-workers work on developing empirical compliance models, Davy recommends that the most recent model, as described in his 2019 paper, is the one that should be used for all steel studs, even though the model was derived only using steel C-section studs, 92 mm wide. There are two different models provided; one for point connections and one for line connections.

For the line connection model, the compliance, C_M is given by:

$$C_M = A f^{x_f} m_r^{x_m} b^{x_b} g^{x_g} S^{x_s}$$

where m_r is defined as:

$$m_r = \frac{m_1 m_2}{m_1 + m_2}$$

where m_1 and m_2 are the mass per unit areas of leaves 1 and 2, respectively, b is the stud spacing, g is the gauge of steel used in the stud and S is the area of one side of the wall.

For the point connection model, the compliance, C_M is given by:

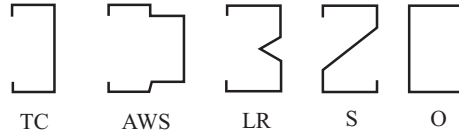
$$C_M = A f^{x_f} m_r^{x_m} n^{x_n} g^{x_g} S^{x_s}$$

Values of the coefficients listed in previous equations for TC type studs for two different frequency ranges

Coefficient	Line connection		Point connection	
	63 Hz–250 Hz	250 Hz–5000 Hz	63 Hz–250 Hz	250 Hz–5000 Hz
A	6.07×10^{-4}	2.58×10^{-4}	4.06×10^{-5}	4.94×10^{-7}
x_f	-1.04	-1.52	-0.76	-1.16
x_m	-1.4	-1.12	-1.96	-1.18
x_b	0.0	-0.257	0.0	0.0
x_n	0.0	0.0	0.0	0.747
x_g	0.666	1.52	1.68	2.49
x_S	0.0	0.0	0.0	0.355

where n is the number of point connections (number of screw connections) per square metre, Values of the constant, A and exponents corresponding to Equations () and () are listed in the following table.

Davy investigated the effect of using different steel stud sections (see Figure ??). They concluded that the compliance corresponding to these stud types can be obtained by multiplying the value of C_M for TC type studs by the factors listed in the following table, which indicates that AWS section studs will result in the highest TL values.



Cross sections of various steel stud types. The wall panels are attached to the top and bottom of the stud sections shown in the figure.

Factor by which to multiply the TC compliance to obtain the compliance for the other stud sections illustrated in the preceding figure

Cross section	AWS	LR	S	O
Multiplying factor	3.39	1.96	0.98	0.73

The field incidence transmission coefficient for airborne sound transmission through a double panel (each leaf of area A), for frequencies between f'_0 and $0.9f_{c1}$ (where f_{c1} is the lower of the two critical frequencies corresponding to the two panels), is:

$$\tau_{Fa} = \frac{1 - \cos^2 \theta_L}{\left[\frac{m_2^2 + m_1^2}{2m_1m_2} + a_1a_2\bar{\alpha} \cos^2 \theta_L \right] \left[\frac{m_2^2 + m_1^2}{2m_1m_2} + a_1a_2\bar{\alpha} \right]}$$

where

$$a_i = \left[\frac{\pi f m_i}{\rho c} \right]; \quad i = 1, 2$$

and the limiting angle, θ_L , is given by Davy as:

$$\cos^2 \theta_L = \begin{cases} 0.9; & \text{if } \frac{\lambda}{8\pi A/P} > 0.9 \\ \frac{\lambda}{8\pi A/P}; & \text{if } \cos^2(61^\circ) \leq \frac{\lambda}{8\pi A/P} \leq 0.9 \\ \cos^2(61^\circ); & \text{if } \frac{\lambda}{8\pi A/P} < \cos^2(61^\circ) \end{cases}$$

where $\lambda = c/f$ is the wavelength of sound in air, A is the panel area and P is its perimeter.

In the preceding equations, m_1 , m_2 are the surface densities of panels 1 and 2 and $\bar{\alpha}$ is the cavity absorption coefficient, generally taken as the minimum of 1.0 or kd , for a cavity filled with sound-absorbing material, such as fibreglass or rockwool at least 50 mm thick. For cavities containing no sound-absorbing material, a value between 0.1 and 0.15 may be used for $\bar{\alpha}$, but it should not exceed kd .

At frequencies above $0.9f_{c1}$, the following equations may be used to estimate the field incidence transmission coefficient for airborne sound transmission:

$$\tau_{Fa} = \frac{\pi(\eta_2\xi_1 + \eta_1\xi_2)}{2\hat{a}_1^2\hat{a}_2^2\eta_1\eta_2(q_1^2 + q_2^2)\bar{\alpha}^2}$$

$$\hat{a}_i = \frac{\pi f m_i}{\rho c}; \quad \xi_i = \left(\frac{f}{f_{ci}}\right)^{1/2}; \quad i = 1, 2$$

$$q_1 = \eta_1\xi_2 + \eta_2\xi_1$$

$$q_2 = 2(\xi_1 - \xi_2)$$

The quantities η_1 and η_2 are the loss factors of the two panels and f is the 1/3-octave band centre frequency.

The overall transmission coefficient is:

$$\tau_F = \tau_{Fa} + \tau_{Fc}; \quad f \geq f'_0$$

f'_0 is discussed on page 8 of these errata.

p397, The second term in brackets in Eq (8.76) is missing a minus sign - it should be $10^{-TL/10}$.

p404, Line 3 of item 2 in the solution, change “27.1” to “33.7”.

p413, 3 lines below Eq. (8.103), the reference to Eq (8.100) should be Eq. (8.101).

p417, In Equations (8.113) and (8.114), replace X_S with $\sqrt{X_S^2 + (Y_B - Y_S)^2}$ and replace X_R with $\sqrt{X_R^2 + (Y_B - Y_R)^2}$.

p422, Item 3, “ $N = (2/\ell)(2.5)$ ” should be “ $N = (2/\lambda)(2.5)$ ”.

p422, Add the following to the end of item 3, “As there are 3 diffracted paths around the building for sound arriving at the rear wall, the power level on the rear wall should be increased by $10\log_{10}(3)=4.8$ dB, so the total power on the rear wall becomes 71.8 dB.”

p422, Two lines from the bottom, change 67 to 71.8 and change 79 to 80.

p423, Line 1, change 80 to 81.

p423, first equation, change 80 to 81 and change 74 to 75.

p426, In Equation (8.127), replace “ b ” with “ e ”.

p426, Line immediately above Figure 8.20, replace “ b ” with “ e ”.

p430, In Equations (8.137) and (8.140), there should be an additional “(” following the “/” in the last term.

p443, In Equations (9.27) and (9.28) and on the line between them “ Re ” should be in italics font as it represents the Reynolds number, not the real part of a complex number.

p445, Line under Equation (9.34), change “static (atmospheric)” to “absolute”.

p446, The last + sign on the RHS of Equation (9.38b) should be replaced with a – sign.

p446, line above Equation (9.39), remove the words, “or through the tube”.

p449, Replace Equation (9.44) with the following equation, where S_V is the cross sectional area of the volume.

$$\omega_0 = c \sqrt{-\frac{3 \ell_e S_V + \ell_V S}{2 \ell_e^3 S_V}} + \sqrt{\left(\frac{3 \ell_e S_V + \ell_V S}{2 \ell_e^3 S_V}\right)^2 + \frac{3 S}{\ell_e^3 S_V \ell_V}}$$

p450, line immediately following Equation (9.49a,b), add “of the neck” after the word, “area”.

p454, Last term in Equation (9.65), replace A_T with (A_T/Z_s) .

p471, 2nd and 5th lines from the top, change “undamping” to “nonlinear”.

p473, In Eq. (9.124), the right hand side should be multiplied by the gas density.

p477, Top label in Figure 9.14, change “quadruple” to “quadrupole”.

p478, Line 8 under heading 9.8, change “undamping” to “non-linear”.

p481, 4 lines under Equation (9.130), replace $P/100$ with $PS_p/100$ where S_p is the area of one side of the perforated panel

p482, line 21, change “height” to “width”.

p482, last line, change element C to element D.

p490, bottom line, $2h/\ell$ should be $2h/\lambda$.

p494, Figure 9.23 caption should have the following sentence added. “Note that for a silencer with multiple baffles, S is the cross-sectional area of one airway, not the totalsilencer.”

p497, 2 lines from the bottom of the page, change “doubled” to “double”.

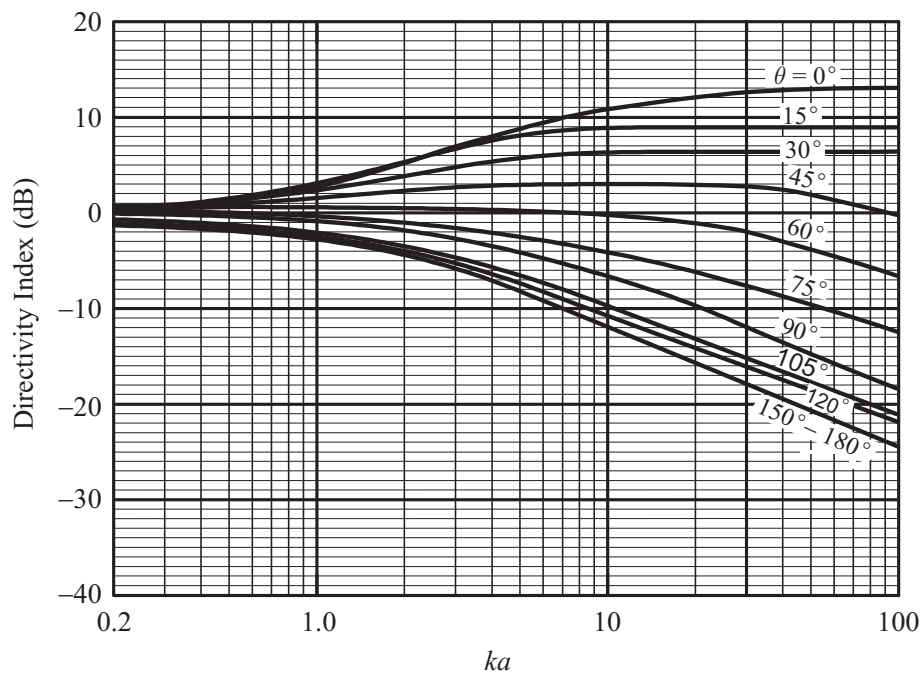
p498, 4th line under Section 9.11, change “9.5” to “9.7”.

p503, line above Table 9.8, remove the word, “not”.

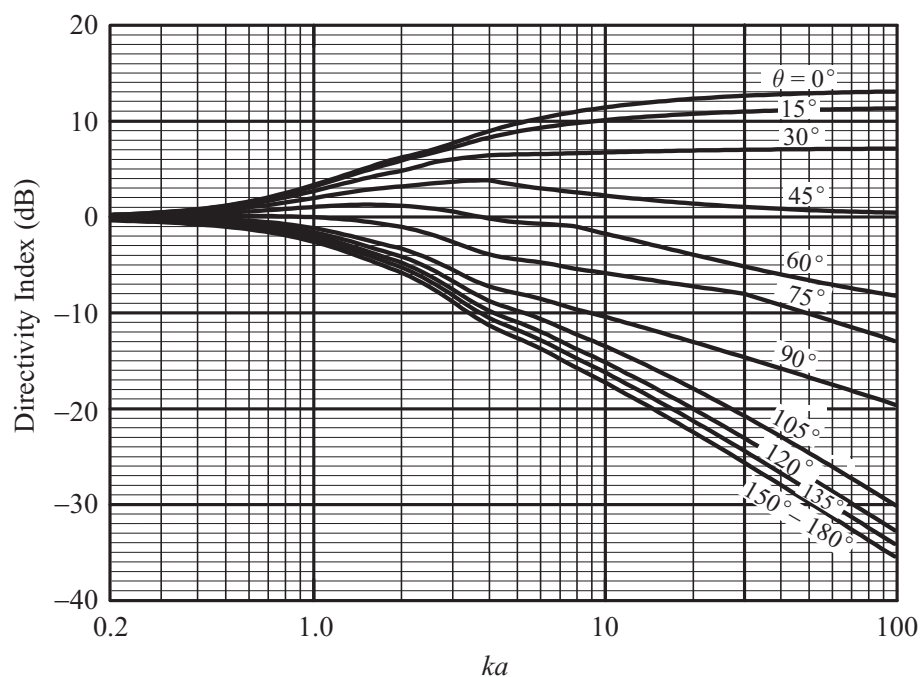
p504, line above Table 9.9, add the word, “not” after “numbers”.

p506, replace third sentence under the heading, “9.15 DIRECTIVITY OF EXHAUST DUCTS” with “To get the rectangular section data to collapse on to the ka axis for circular ducts, where $2a$ is the duct diameter, it was necessary to multiply the rectangular duct dimension ($2d$) in the direction of the observer by $4/\pi$ to get $2a$.”

p508, this page should be replaced by the following two figures:



Exhaust stack directivity index measured in the field vs ka where a is the stack radius. Curves fitted to data reported by Day and Bennett (2008).



Exhaust stack directivity calculated using Davy's theory for a $2a = 605$ mm diameter duct. The curves do not change significantly with duct diameter for diameters between 100 mm and 2 m.

p509, first line, change 2π to π .

p510, Equation (9.170) should have an additional bracket after φ in the numerator.

p518, In equation (10.5) and in the two lines immediately following it, and in Equation(10.6), change u_m to v_m .

p519, The spring helix angle, α , can be included in Eq. 10.11 to give a more accurate result as follows (E is the modulus of elasticity):

$$k = \frac{d^4 \cos \alpha}{8n_C D^3} \left[\frac{\cos^2 \alpha}{G} + \frac{2 \sin^2 \alpha}{E} \right]^{-1}$$

p528, 5 lines above Equation (10.36), change “Equation (10.10)” to “Equation (10.12)”.

p531, Equation (10.45) should be:

$$M_f = j (k_f/\omega - \omega m_f)^{-1}$$

p536, 6 lines under the figure, change “undamping” to “nonlinear”.

p539, Equation (10.53) has a square missing on the second term in the numerator. The correct equation is:

$$\frac{|y_1|}{|F|} = \frac{1}{k_1} \sqrt{\frac{\left(\frac{2\zeta_2 \Omega m_1}{m_2}\right)^2 + \left(\Omega^2 - \frac{k_2 m_1}{k_1 m_2}\right)^2}{\left(\frac{2\zeta_2 \Omega m_1}{m_2}\right)^2 \left(\Omega^2 - 1 + \frac{m_2 \Omega^2}{m_1}\right)^2 + \left[\frac{k_2}{k_1} \Omega^2 - (\Omega^2 - 1) \left(\Omega^2 - \frac{k_2 m_1}{k_1 m_2}\right)\right]^2}}$$

However, this equation is only valid for zero damping on the main mass, although it gives quite accurate results provided the damping is relatively small. The equation that includes damping on the main mass is Equation (10.42) in the third edition with the “ d ” removed from the denominator on the RHS. So if damping, ζ_1 , is included on the main mass, the above equation becomes:

$$|y_1| = \frac{|F|}{k_1} \left[\left(1 - \Omega^2 - r/q\right)^2 + \left(2\zeta_1 \Omega + s/q\right)^2 \right]^{-1/2}$$

and

$$|y_2| = |y_1| \left[(a/q)^2 + (b/q)^2 \right]^{1/2}$$

where, $\Omega = \omega \sqrt{m_1/k_1}$, θ_1 and θ_2 are phase angles of the motion of the masses relative to the excitation force, $|F|$ is the amplitude of the excitation force and:

$$\begin{aligned} a &= (k_2/k_1)^2 + 4\zeta_2^2 \Omega^2 - (m_2/m_1)(k_2/k_1) \Omega^2 \\ b &= -2\zeta_2 (m_2/m_1) \Omega^3 \\ q &= \left(\frac{k_2}{k_1} - \frac{m_2 \Omega^2}{m_1}\right)^2 + 4\zeta_2^2 \Omega^2 \\ r &= (m_2/m_1)(k_2/k_1)^2 \Omega^2 - (m_2/m_1)^2 (k_2/k_1) \Omega^4 + 4\zeta_2^2 (m_2/m_1) \Omega^4 \\ s &= 2\zeta_2 (m_2/m_1)^2 \Omega^5 \end{aligned}$$

p541, Replace equation (10.63) with:

$$\zeta_{2,opt}^2 = \left(\frac{C_2}{C_{c2}} \right)_{opt}^2 = \frac{3(m_2/m_1)}{8(1 + m_2/m_1)}.$$

p572, Figure 11.3 caption, although Heitner did use a similar figure to this, it was based on the earlier work published by Ingard so the correct reference should be “Ingard, 1959”.

p575, 3 and 4 lines beneath the “Control Valves” heading, change “static” to “absolute”.

p575, 6 lines beneath the “Control Valves” heading, remove “static”.

p576, 1, 2, 9, 10 and 15 lines above Equation (11.27), change “static” to “absolute”.

p577, First line, Figure 10.5 caption, change “static” to “absolute”.

p577, change the label on the vertical axis in Figure 10.5 from “Static pressure” to “Absolute pressure”.

p584, Line above Equation (11.51), change “stream Mach number” to “freely expanding jet Mach number”.

p584, Equation (11.51) is only valid for regimes II, III and IV. The Mach number in the vena contracta for regime I is $M_0 = (10^4 \eta)^{(1/3.6)}$. For regime V, the freely expanding jet Mach number is, $M_j = \sqrt{\left(\frac{2}{\gamma - 1} \right) [(22)^{(\gamma-1)/\gamma} - 1]}$

p585, 4 lines above equation (11.55), change the Howe and Baumann reference to Baumann and Coney, 2006.

p585, 2 lines above equation (11.55), remove “Howe and”.

p585, Line following Equation (11.55), replace “A-weighted internal level” with “unweighted internal level”.

p586, Line following Equation (11.59), replace “A-weighted internal level” with “unweighted internal level”.

p600, Replace the paragraph following Equation (11.94) with the following:

where the values of C for relevant octave bands that are listed in Table 11.27 should have 2.4 dB subtracted from them. The measurement surface area used to obtain N_R is given by, $S = 1.25 \ell_m h$ (m²), where h is the height of the transformer tank and ℓ_m is the length of the horizontal measurement contour along which the average overall A-weighted sound pressure level was measured to obtain N_R . The measurement contour is typically located 2 m laterally from a horizontal contour made by a tight string placed around the transformer tank and touching the tank or its pro-

trusions in various places (IEEE Std C57.12.90, 2015). For a measurement contour located 2 m from the transformer tank, the contour length, ℓ_m , may be approximated as, $\ell_m = 2L + 2W + 11.2$ (m), where L is the transformer length and W is the width (or depth). The NEMA rating (A-weighted overall audible sound level), N_R , is the A-weighted sound pressure level averaged logarithmically along one or two measurement contours at different heights and maximum acceptable values are listed in Table 11.28. Where possible, values of N_R supplied by the manufacturer should be used.

p643, In Equation (12.36), change ψ to φ .

p644, In Equation (12.40), change φ to ψ

p644, In Equation (12.40) and in the text in 3 places following the equation, change (x_b, y_b) to (x_b, y_b, z_b) .

p644, 2 lines below Equation (12.40), change φ to ψ .

p652, Third line of footnote, ρ should be ρ_m .

p652, Last line of footnote, in the equation for k_B , ω should be replaced with ω^2 .

p653, Equation (12.59), replace π with 2.

p654, In Equation (12.61), m_p should be M_p .

p654, 1st line under 12.3.2, change “equations” to “equation”.

p657, In step 6, the equation reference should be 12.62.

p657, In the example table, the column header σ (dB) should be $10 \log_{10} \sigma$ (dB).

p660, Eq. A.9 should be

$$F = -\nabla P_{tot} V = \rho_{tot} V \frac{d\mathbf{U}_{tot}}{dt}$$

p668, 4 lines above the page bottom, change “static” to “absolute”.

p669, 4 lines above Eq. C1, change “undamping” to “nonlinear”.

p669, Equation C.1 could be written in a less ambiguous way as

$$R_1 = \rho \Delta PA / (\dot{m} \ell) = \Delta PA / (V_0 \ell)$$

p671, In Equation (C.3), change the minus sign to a plus sign.

p671, In Equation (C5), and add a minus sign before “j” to the first term on the RHS.

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- p673, Two lines above Eq. C.9 (and 2 and 3 lines from the top of the page), replace “complex density” with “complex density (normalised with respect to the density of of the gas in the porous material)”.
- p673, One and two lines above Eq. C.9 (and 3 lines from the top of the page), replace “complex compressibility” with “complex compressibility (normalised with respect to the compressibility of the gas in the porous material)”.
- p674, Second line following Equation (C.21), replace (C.9)-(C.14) with (C.15)–(C.20).
- p679, In Equation (C.24), replace $L_{D1} - L_{D2}$ with $L_{D2} - L_{D1}$.
- p682, in Equation (C.45), change φ to ϑ and add immediately after the equation, “where the angles are defined in Figure 8.7”.
- p683, Line above Equation (C.48), replace Z_N with $Z_N/\rho c$.
- p684, Line under Eq. (C.50), add after “cavity” the following: “, the impedance, Z_L for a wave incident at angle, θ , is” .
- p684, Line above Eq. (C.52), change C.38 to C.49.
- p685, Line immediately above Equation (C.53), replace “furthest from” with “closest to”.
- p686, 3 lines under Equation (C.55), change “9.22” to “9.25”.
- p697, Delete the third sentence following the heading, “Uncertainty Principle”.
- p715, Remove the 2009 reference for Jacobsen and de Bree.