

Engineering Noise Control 5th edn.
Errata and Clarifications

July 22, 2022

p14, two lines below Equation (1.6), change “static” to “absolute”.

p24, two lines under Figure 1.5, the expression, $e^{j\omega t + \beta}$ should be $e^{j(\omega t + \beta)}$.

p26, Equation (1.61), replace p_{RMS} with $p_{\text{RMS}}(\mathbf{r})$.

p26, line immediately following Equation (1.61), replace “example” with “equation”.

p26, Equation (1.63), replace p_{rms} with p_{RMS} .

p27, last line, replace $f(t)$ with $F(t)$.

p28, first line, replace $g(t)$ with $G(t)$.

p42, In Equation (1.108) and 3 lines above the equation, change f to f_C .

p43, In Table 1.2, band number 17, the 1/3-octave band centre frequency should be 50 Hz.

p71, Near the bottom of the page, items labelled 1 and 2 should be items (a) and (b).

p95, Line 6, change $L_{Aeq,8h}$ to $L_{EX,8h}$.

p95, Line following Equation (2.54), change (2.45) to (2.54).

p95, Line above table 2.4 caption, change L to L_0 .

p95, Table 2.4 caption, change $N_{0,50}$ to N_{50} and change L to L_0 .

p95, Equation (2.55) should be:

$$N_{50} = \frac{\log_{10}(\Theta + 1)}{\log_{10} 11} N_{50:\Theta=10}$$

where $N_{50:\Theta=10}$ is the value of N_{50} for an exposure time of 10 years.

p116, 8 lines from the top of page, change 1.5 m to 0.8 m.

p116, 8 lines from the top of page, change 2 m to 1.5 m.

p118, Replace Table 2.14 with the following table

Table 2.14 Recommended ambient sound levels and reverberation times (average of the 500 Hz and 1000 Hz octave bands) for different areas of occupancy in buildings (space furnished but unoccupied, data mainly from AZ/NZS 2107 (2000))

Types of occupancy/activity	Recommended sound level (dBA)	Recommended reverberation time at 500 to 1000 Hz (sec)
Lecture rooms, assembly halls, tutorial rooms	30–35	0.72 for 50 m ³ to 1.0 for 10 000 m ³ varying linearly with log ₁₀ (room volume in m ³)
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	45–50	0.6–0.8
Drama studios	25–30	10% to 20% higher than lecture rooms above
Libraries (reading)	40–45	0.4–0.6
Libraries (stack area)	45–50	0.6–0.8
Music studios and concert halls	30–35	1.05 for 50 m ³ to 1.6 for 5 000 m ³ , varying linearly with log ₁₀ (room volume in m ³)
Professional and admin. offices	35–40	0.6–0.8
Design offices, drafting offices	40–45	0.4–0.6
Executive offices	35–40	0.4–0.6
Open plan office areas	40–45	Low as possible
Reception areas	40–45	0.6–0.8
Hospitals, Doctors surgeries	40–45	0.4–0.7
Airport terminals	45–55	Low as possible
Restaurants	40–50	Low as possible
Hotel bar	45–50	0.6–1.0
Private house (sleeping)	30–35	0.4–0.5
Private house (recreation)	35–45	0.4–0.5

p122, line 2, change 70 to 65.

p128, 1 and 2 lines above Section 2.14, change 30 to 35, change the reference to ASHRAE (2015) and change the table reference to 2.16.

p129, 6 lines above Example 2.10, replace the sentence beginning with “In the absence...” and the following sentence with

“Generally acceptable sound pressure levels (L_{A90}) for various environments are summarised in Table 2.19. A base level of 40 dBA is used and corrections are made to the measured noise level, based on the character of the neighbourhood in which the noise is measured, the character of the noise, and the time of day.

p131, Table 2.20 caption should read,

“Estimated public reaction to noise when the measured sound pressure level exceeds the adjusted base sound pressure level (see Table 2.19 for adjustments to the base level of 40 dBA)”.

p132, First dot point, remove the text, “(regulation usually)”.

p138, Line following Equation (3.10), the correct units of dynamic viscosity are N-s/m².

p138, Equation (3.13) should be $C_c = V_c/(\gamma P)$.

p147, ten lines below Section heading 3.5.7, change “static” to “absolute”.

p150, 5 lines above dot point 1, replace “ $E_{A,T}$ ” with “ L_{AE} or SEL”.

p150, 4 and 5 lines above dot point 1, replace “type II” with “Class 2”.

p150, 9 lines above the bottom of the page, change “87” to “85”.

p156, Equation (3.33), in line 1 of the equation replace $\frac{\vec{n}}{2\rho\omega\Delta}$ with $\frac{\vec{n}}{2\rho\Delta}$.

Chapter 4, In numerous places , replace Q_{rms} with Q_{RMS} .

p176, In Equations (4.18) and (4.21), replace hr with h/r .

p177, In Equation (4.25), replace hr with h/r .

p177, One and two lines above Equation (4.31), replace f with F in 3 places.

p178, 8th line following Equation (4.32), replace D_{rms} with D_{RMS} .

p180, 4 lines under heading 4.3.3, change U to u_0 .

p181, in Equation (4.52), remove the minus sign following the equals sign.

p182, In Equation (4.55), u_03 should be $u_0/3$.

p182, In Equation (4.56), U^6c^3 should be U^6/c^3 .

p185, In Equation (4.71), $U(ch)$ should be $U/(ch)$.

p186, In Equation (4.72), U^8c^5 should be U^8/c^5 .

p187, Change Equation (4.73) to $\langle p^2 \rangle = \rho c \frac{W}{4\pi} \sum_{n=-\infty}^{\infty} 1/r_n^2$.

p187, 4 lines after Equation (4.74), change (4.74) to (4.73).

p188, two lines under heading 4.5.2, change (4.66) to (4.73).

p188, two lines under Equation (4.81), change $r_0 \cos \alpha$ to $r_0 / \cos \alpha$.

p190, Equation (4.85) should be $A = Q_0 / (4\pi)$.

p191, Change Equation (4.96) to $k = \omega / c = 2\pi f / c$.

p193, In Equation (4.103), $(\alpha + \beta)2$ should be $(\alpha + \beta)/2$.

p193, Equation (4.105) should be replaced with:

$$r = \frac{(a/\lambda)^2 - n^2}{2n/\lambda}.$$

p193, In Equation (4.108), change $a^2\lambda$ to a^2/λ .

p194, In Figure 4.12, change dy to $d\psi$.

p197, In Equation (4.118), change the h symbol in the integration limits to h_R .

p197, two lines after Equation (4.118), in the expression for β , change h to h_R .

p198, Figure 4.15 caption, change “Equation (4.113)” to “Equation (4.121)” and “Equation (4.112)” to “Equation (4.120)”.

p205, third paragraph under heading 4.12, delete the last 2 lines.

p217, 6th line from the top, change “Table 4.2” to “Table 4.1”.

p219, Replace the first sentence in the second paragraph following Table 4.5, with
 “A more accurate method for 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.”

p226, 3 lines above section 5.2.2, change ωc_m to ω / c_m .

p230, second line, change $k = \omega c$ to $k = \omega / c$.

p230, line above Equation (5.18), change “Equation (5.13)” to “Equation (5.15)”.

p231, add the following notes for Equation (5.22). As Equation (5.22) in this form is

- provided in Attenborough's paper, which uses negative time dependence, the result is actually the complex conjugate of the spherical wave reflection coefficient used in this book. In addition, to be consistent with the use of negative time dependence in Equation (5.22), it is also necessary to use the complex conjugate of R_p in place of R_p in Equation (5.22).
- p232, In Equation (5.30), change $\frac{1}{2}(1 + j)$ to $\frac{1}{\sqrt{2}}(1 - j)$.
- p234, Remove item 2 at the top of the page and also following Equation (5.46)
- p234, At the beginning of the paragraph preceding Equation (5.47), replace $w = nh$ with $\text{Re}\{w\} \approx nh$.
- p235, Line 6, item 2, change "0.25" to "0.1" and "0.75" to "0.9"
- p235, Second paragraph, replace $w = (n + \frac{1}{2})h$ with $\text{Re}\{w\} = (n + \frac{1}{2})h$.
- p235, In Equation (5.54), change $\frac{1}{2}(1 + j)$ to $\frac{1}{\sqrt{2}}(1 - j)$.
- p236, Delete the last sentence in the paragraph following Equation (5.58).
- p239, In Equation (5.65), replace $d_{SR}D\alpha$ with $d_{SR}D/\alpha$.
- p239, 2 lines above Equation (5.70), replace (273.15) with (293.15).
- p246, 3rd line of the 3rd full paragraph following Equation (5.84), change dU/dh to dc/dh .
- p247, Figure 5.3, vertical axis should be labelled,
"Wind shear coefficient, ξ ".
- p247, Table 5.5 caption, change "empirical" to "wind shear".
- p249, Third line after Equation (5.89), replace "lower" with "higher".
- p250, In Equation (5.95), replace " h_0/z_0 " with " $(h_0/z_0) + 1$ ".
- p251, Delete the text and equations beginning just below Equation (5.100) and ending immediately above Equation (5.118) on page 253, and replace with the following:
"An approximate expression may also be used to calculate R_B , as given in earlier Harmonoise documentation (Nota and van Leeuwen, 2004). That is:

$$\frac{1}{R_B} \approx \frac{8}{d_{SR}} \sqrt{\frac{B_M}{2\pi c}}$$

where d_{SR} is the distance from the source to the receiver (see Figure 5.5).

The radius of curvature is used in the Harmonoise propagation model to calculate the path lengths and propagation times for sound travelling from the source to the receiver over a propagation path that has been curved as a result of atmospheric wind gradients and temperature gradients. Taking into account the ray curvature also allows more accurate calculation of barrier attenuation as discussed in Section 5.3.7.3.

A more accurate means for calculating the radius of curvature of the sound ray involves using Figure 5.5 to obtain the following equation for ψ_S in terms of R_c ”.

p253, Add the following text immediately after Equation (5.119).

“Equation (5.93) is then substituted into Equation (5.118) to obtain the following transcendental equation:

$$\psi_S = -\varphi + \arcsin \left[\left(\frac{\cos \psi_S}{c} \right) \left(\frac{A_m + B_m}{h + z_0} \right) \left(\frac{d}{2 \cos \varphi} \right) \right]$$

where z_0 is defined in Tables 5.6 and 5.7, and h is the mean height above the ground of a straight line drawn between the source and receiver (usually equal to $(h_S + h_R)/2$).

The preceding equation must be solved iteratively to obtain ψ_S . Once ψ_S is known, Equation (5.93) can be used to obtain R_c . The angle, ψ_R , may be calculated using Equation (5.126).”

p255, Delete the first, third and fourth paragraphs, including Equation (5.120).

p256, Delete the last paragraph.

p257, Delete the first 4 lines under the figure caption and add the following immediately after Equation (5.125).

“To be able to calculate the angle, θ , it is necessary to determine the location, (d_0, X) , shown in Figures 5.5 to 5.9. From the figures: $d_0 = R_c \sin \psi_S$ and $X = R_c \cos \psi_S$ ”.

p259, Include the following immediately before Section 5.3.4.5.

“Calculation of the location of the reflection point is needed in order to find the length of the reflected wave path from the source to the receiver. Calculation of this location requires the solution of a cubic equation and is discussed in Appendix D in the book, *Wind Farm Noise* by Hansen, Doolan and Hansen (ISBN 9781118826126). Once this location is found, the angle at which the reflected wave leaves the source and its path length can be found using the same techniques as for the direct wave. The path between the source and reflection point is analysed by treating the reflection point as a virtual receiver, while the path between the reflection point and the actual receiver is analysed by treating the reflection point as a virtual source.”

p262, In Equation (5.132), change R to R_c (radius of curvature of sound wave, which is negative by convention in a negative sonic gradient).

p263, top part of Figure 5.12, change r to d .

p263, Figure 5.13, change r/x to d/x .

p264, in Equation (5.134), change d to d_{SR} .

p265, Figure 5.15, change d to d_{SR} .

p265, in Equation (5.135), change d to d_{SR} .

p265, in Equation (5.137), change d_i to d_{SRi} .

p266, in Equation (5.141), change d to d_{SR} in 3 places.

p266, line above Section 5.3.7, replace “and the Fresnel number will be negative”. with
““Note that both the Kurze and Anderson method and the Menonou method cannot be used for cases where there is line-of-sight between the source and receiver, corresponding to negative Fresnel numbers.”

p269, In Equations (5.146), (5.147) and (5.148), replace X_S with $\sqrt{X_S^2 + (Y_B - Y_S)^2}$ and replace X_R with $\sqrt{X_R^2 + (Y_B - Y_R)^2}$.

p269, 4th line after Equation (5.148), change SQ' to S'Q'.

p270, in Equation (5.157), change d to d_{SR} .

p271, Figure 5.20, change d to d_{SR} .

p271, in Equation (5.160), change d to d_{SR} .

p273, Figure 5.21, change d to d_{SR} in two places.

p273, in Equation (5.161), change d to d_{SR} .

p282, First dot point: after the word, “Attenuation”, add , A_{site} .

p282, Second dot point: after the word, “Attenuation”, add , A_h .

p282, Paragraph beginning immediately above Equation (5.172), change “Table 5.13” to “Table 5.14” in two places.

p284, First line, change m/s^2 to kg/m^2 .

p284, 4 lines under Equation (5.179), change D_{zi} to A_b .

p284, The coefficient, C_3 in Equation (5.180) is equal to 1 for single edge diffraction (Figure 5.15). For double edge diffraction (Figure 5.20), C_3 is given by:

$$C_3 = \frac{1 + (5\lambda/e)^2}{1/3 + (5\lambda/e)^2}$$

p284, in Equations (5.181) and (5.182), change d to d_{SR} .

p284, Replace the 2 lines following Equation (5.180) with the following text.

“where λ is the wavelength of sound at the octave band centre frequency, $C_2 = 20$ if ground reflected paths over and around the barrier are included and $C_2 = 40$ if ground reflected paths are calculated separately.”

p285, in Equations (5.184). (5.185) and (5.186), change d to d_{SR} .

p285, Immediately after Equation (5.186), add

“where the dimension, e , is zero for single edge diffraction”.

p285, Table 5.15, last line, replace the data with the following numbers:

0.02, 0.03, 0.04, 0.05, 0.06, 0.08, 0.09, 0.12.

p285, bottom of page add the following text.

”5.6.5 Industrial Equipment Screening, A_{site} .

In the absence of measured data, the following table may be used as a guide for estimating the attenuation through process equipment in an industrial facility. To calculate the number of metres, $r_1 + r_2$, of travel of the sound wave through the industrial facility, use the same approach as used in Section 5.6.4 for attenuation through vegetation (see Figure 5.25).

Octave band attenuation, A_{site} , due to process equipment (after ISO9613)

	Octave band centre frequency (Hz)							
	63	125	250	500	1000	2000	4000	8000
A_{site} (dB/m)	0	0.015	0.025	0.025	0.02	0.02	0.015	0.015

5.6.6 Housing Screening, A_h .

The attenuation due to propagation through rows of houses may be calculated using, $A_h = 0.1Br_b - 10 \log_{10}[1 - (P/100)]$ (dB), where B is the density of buildings along the path (total plan area of buildings divided by the total ground area (including that occupied by the houses), r_b is the distance that the curved sound

ray travels through the houses and P is the percentage ($\leq 90\%$) of the length of housing facades relative to the total length of a road or railway in the vicinity. The second term in the above equation is only used if there are well defined rows of houses perpendicular to the direction of sound propagation. The second term may also not exceed the calculated Insertion Loss for a continuous barrier the same height as the building facades (see Chapter 7). The quantity, r_b is calculated in the same way as r_f ($= r_1 + r_2$) in Figure 5.25 for travel through foliage, except that the foliage is replaced by houses. Note that if A_h of the above equation is non zero, the ground attenuation through the built up area is set equal to zero, unless the ground attenuation with the buildings removed is greater than the first term in the above equation for A_h . In that case, the ground attenuation for the ground without buildings is substituted for the first term in the above equation.”

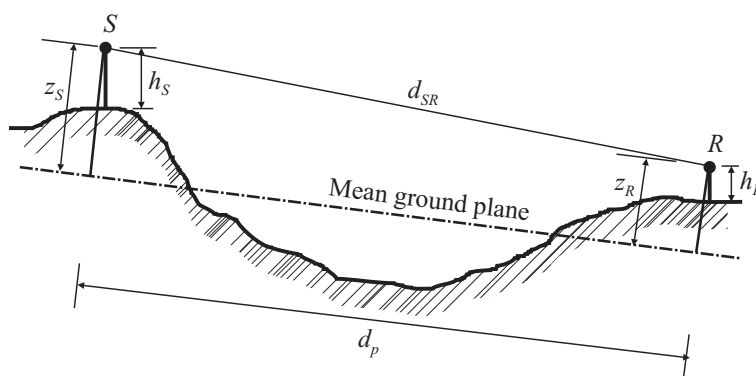
p286, Add the following statement after Equation (5.187).

“In Equation (5.187), r_S and r_R are defined in Figure 4.17, L_{\min} is the minimum dimension (length of height) of the reflecting surface and θ is the angle between the incident sound ray and the normal to the reflecting surface (see Figure 4.17).”

p286, Table 5.16, replace “180” with “90”.

p287, In Equation (5.189), replace A_{gr} with A_g .

p290, Replace Figure 5.26 with the following figure:



Source and receiver heights above the ground and the mean ground plane.

p291, Replace Equation (5.200) with $G_{\text{path}} = \frac{\sum_{i=1}^{\ell} G_i d_i}{\sum_{i=1}^{\ell} d_i}$.

p291, Line immediately above Equation (5.201), replace “, and:” with

“projected on the mean ground plane and d_p is the length between source and receiver of the mean ground plane:”

p291, Replace equation (5.201) with:

$d_p = \sqrt{(z_{mn} - z_{m1})^2 + (x_n - x_1)^2}$, where z_{m1} is the mean ground plane vertical coordinate at the source location, x_1 is the ground plane horizontal coordinate at the source location, z_{mn} is the mean ground plane vertical coordinate at the receiver location and x_n is the ground plane horizontal coordinate at the receiver location.

p291, In Equation (5.203), replace $A_{gr,H,\min}$ with $A_{g,H,\min}$.

p291, Second line from bottom of page, replace A_{gr} , with A_g , in 4 places.

p291, Bottom line, replace “LHS” with “RHS”.

p294, Immediately following Equation (5.219), add

“where in this particular equation, d_{SR} is the straight line distance between the source and receiver”.

p296, 11 lines from the bottom of the page, replace z_{PnR} with z_{PR} .

p300, In Equation (5.229), change $|p_t|$ to $|p_t|^2$.

p302, Equation (5.237), change the constant, -0.1365 , to -5.3888 .

p302, Change “Salomons and Janssen (2011)” to “Salomons et al. (2011)” (see new reference added to page 796 below).

p312, Item 5, change U_e to u_e .

p328, 2 lines above Equation (6.42), delete “and (6.41)”.

p333, 3 lines beneath Equation (6.65), replace(6.80) with (6.81).

p354, In Equation (6.115), replace Γ_1 with Γ , where Γ is defined in Equation (6.104).

p365, Replace Equation (7.8) with $y = \frac{E_1 h_1^2 + E_2 h_2 (2h_1 + h_2)}{2(E_1 h_1 + E_2 h_2)}$.

p367, line following Equation (7.10), replace z_n with z_i .

p374, Remove the “1.” for item 1, change item “2.” to “1.” and change item “3.” to “2.”

p375, In Equation (7.24), change C_1 to C_I .

p381, Figure 7.9(b), on the x -axis labels for points C and D, change f_{c1} to f_{c2} .

p381, Figure 7.9 caption, second line, remove “ f_c ”.

p381, 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 384.”

p381, Figure 7.9 caption, last line, replace πf_ℓ with $0.5f_{c1}$.

p382, In Equation (7.50), remove $\left[1 - \left(\frac{f}{f_{ci}}\right)^2\right]$.

p382, In Equation (7.51), remove “1+”.

p383, In Equation (7.55), change “0.964” to “-0.964”.

p389, The equation for TL_{B1} should be:

$$\begin{aligned} TL_{B1} &= TL_A + 20 \log_{10}(f_{c1}/f_0) + 20 \log_{10}(f_{c1}/f_\ell) - 22 \quad (\text{dB}): f_{c1} \geq 2\pi f_\ell \\ TL_{B1} &= TL_A + 20 \log_{10}(0.5f_{c1}/f_0) \quad (\text{dB}): f_{c1} < 2\pi f_\ell. \end{aligned}$$

p391, 2 lines above Equation (7.68), replace τ_F with τ_{Fa} .

p391, To reflect Davy’s most recent theory, replace the text (but not the figure nor Table 7.4) beginning with (and including) Equation (7.68) and ending 2 lines below Equation (7.75) with the following:

$$TL = -10 \log_{10}(\tau_{Fa} + \tau_{Fc}) \quad (1)$$

In the most recent Davy model (JASA, vol. 145, page 703, 2019) 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:

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

where b is the spacing between the studs and X_m is a multiplier, used only for the Davy double wall TL model, where $X_m = 1.7$ for steel studs with a thickness greater than 0.5 mm and $X_m = 0.8$ for steel studs with a thickness less than 0.5 mm.

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:

$$f'_0 = \sqrt{\frac{\rho c^2(m_1 + m_2)}{4\pi^2 d m_1 m_2} + f_1^2} \quad (3)$$

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

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

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

$$f_{ai} = \frac{1}{2\pi} \sqrt{\frac{\rho c^2}{dm_i}} \quad (5)$$

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 a frequency, $f = 2f'_0/3$. In this case, the TL is given by Equation (7.49) in the textbook, where m is the total mass per unit area of the double wall leaves ($m_1 + m_2$).

$$a = \left(\frac{\pi f (m_1 + m_2)}{\rho c} \right) \quad (6)$$

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 $f = f'_0$. The TL at $f = 2f'_0/3$ is calculated using Equation (7.49) in the textbook and Equation (6) above for a single panel, with the mass per unit area, m , being the total mass per unit area of the construction. At $f = f'_0$, the TL is calculated using Equation (2) above, Equation (7.76) in the textbook and Equations (7) (or (9)) below.

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:

$$\tau_{Fc} = \frac{16n\rho^2 c^4 QR}{\pi^5 f^2 [(m_1 f_{c2} + m_2 f_{c1})^2 + 64f^2 m_1^2 m_2^2 c^4 C_M^2]} \quad (7)$$

where n is the number of point connections per square metre and

$$Q = \begin{cases} 1 + e & f < f_{c1} \\ e & f \geq f_{c1} \end{cases} \quad \text{and} \quad R = \begin{cases} 1 + r & f < f_{c2} \\ r & f \geq f_{c2} \end{cases} \quad (8)$$

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, σ_1 and σ_2 are the radiation efficiencies of panels 1 and 2 respectively, calculated as described in Section 6.8.2, and m_1 and m_2 are the mass per unit area of panels 1 and 2 respectively. When calculating panel radiation efficiencies, the perimeter, 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.

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

$$\tau_{Fc} = \frac{8\rho^2 c^3 QR}{[g^2 + (8\pi f^{3/2} m_1 m_2 c C_M - g)^2] b \pi^3 f^2} \quad (9)$$

where b is the spacing between the studs, $e = \frac{\sigma_1}{2\eta_1} \sqrt{\frac{f_{c1}}{f}}$, $r = \frac{\sigma_2}{2\eta_2} \sqrt{\frac{f_{c2}}{f}}$, $f_{c1} \leq f_{c2}$ and

$$g = m_1(f_{c2})^{\frac{1}{2}} + m_2(f_{c1})^{\frac{1}{2}} \quad (10)$$

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 $\lambda_B = c_B/f$, where c_B is defined in Equation (7.1) in the textbook.

Based on all of his work on developing empirical compliance models, Davy recommends that the model described in his 2019 JASA 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:

$$C_M = A f^{x_f} m_r^{x_m} b^{x_b} g^{x_g} S^{x_S} \quad (11)$$

where m_r is defined as:

$$m_r = \frac{m_1 m_2}{m_1 + m_2} \quad (12)$$

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:

$$C_M = A f^{x_f} m_r^{x_m} n^{x_n} g^{x_g} S^{x_S} \quad (13)$$

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 (11) and (13) are listed in the following table.

Table 1 Values of the coefficients in Equations (11) and (13) for TC type stds 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

Davy investigated the effect of using different steel stud sections (see Figure 7.12 in the textbook). 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 Table 7.4 in the textbook, which indicates that AWS section studs will result in the highest TL values.

p393, In Equation (7.77), remove $\left[1 - \left(\frac{f}{f_{ci}}\right)^2\right]$.

p393, In Equation (7.78), change \sqrt{A} to $4A/P$, where P is the perimeter of the wall leaf.

p397, In Equation (7.91), remove the “4” in the numerator.

p422, In Equations (7.125) and (7.128), there should be an additional “(” following the “/” in the last term.

p434, In equations (8.31) and (8.32) 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.

p436, line following Equation (8.38), change “static” to “absolute”.

p437, 2 lines above Equation (8.43), remove the words, “or through the tube”.

p441, line immediately following Equation (8.54), add “of the neck” after the word, “area”.

p451, 2 lines from the page bottom, change S_1 to S_{duct} and change S_2 to S_{exp} .

p451, 7 lines from the page bottom, change “right and a left” to “left and a right”.

p452, In the denominator of Equation (8.110), change $\frac{S_{\text{exp}}}{S_{\text{exp}}}$ to $\frac{S_{\text{exp}}}{S_{\text{duct}}}$.

p467, line below Equation (8.153) and 2 lines below Equation (8.155), replace M with M_d , where M_d is the Mach number of the flow in the duct.

p467, In Figure 8.17(a), interchange S_1 and S_3 .

p470, In Equation (8.169), t_w is the wall thickness of the extension tubes.

p470, line above Example 8.2, change 0.2616 to 0.02616 and -5.435 to -5.425.

p482, 4 lines above Equation (8.225), change Z_L to Z_{L1} .

p482, In Equation (8.225), change Z_s to Z_{src} .

p486, top line, replace P_{open} with $P_{\text{open}}S_p$, where S_p is the area of one side of the perforated panel.

p494, 7 lines under Equation (8.233), $2h/\ell$ should be $2h/\lambda$.

p502, 4 lines below Equation (8.242), change L_D to L .

p503, Line above Equation (8.248), after the word “liner”, add “of length, L ”.

p503, 2 lines above Equation (8.249), after the word “muffler”, add “of length, L ”.

p506, Figure 8.41, in the figure and in the caption, replace d with ℓ in all places.

p507, Equation (8.250) should be:

$$K = 0.981 + \frac{0.0346L_{\text{eff}} [D^2/(D^2 - d^2)]^2}{(D - d)}.$$

p509, Equation (8.255) should be:

$$L_{WB} = 50 \log_{10} U + 30 \log_{10} D + 10 \log_{10} \Delta f - 21.5 \left[\log_{10} \left(\frac{fD}{U} \right) \right]^{1.268} + 12.$$

p509, 3 lines below Equation (8.255) replace “with the duct height, H ” with:
“ $\sqrt{4S/\pi}$, where S is the duct cross-sectional area”.

p510, Remove the paragraph beginning 2 lines under Equation (8.257).

p516, 3 lines above Equation (8.277), remove the word, “not”.

p516, 3 lines below Equation (8.277), add the word, “not” after “numbers”.

p520, 5 and 8 lines from the top of the page, change $4/\pi$ to $\sqrt{4/\pi}$.

p520, 2 lines from the bottom of the page, change 2π to π .

p523, Equation (8.286) should be:

$$w(\phi) = \left(\frac{\sin(ks_d \sin(\phi))}{ks_d \sin(\phi)} \right)^2 (1 - \alpha_{st})^{(L/2d) \tan|\phi|}$$

p529, 1 line and 6 lines above Equation (9.1), replace F with \hat{F} .

p529, 4 lines above Equation (9.1), replace y_1 with \hat{y}_1 .

p530, Figure 9.1, replace F with \hat{F} and y_1 with \hat{y}_1 .

p531, In equation (9.8) and in the two lines immediately following it, and in Equation (9.9), change u_m to v_m .

p532, line under Equation (9.16), replace F with \hat{F} .

p548, Replace equation (9.69) with:

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

p556, Replace equation (9.77) with:

$$L_v = 20 \log_{10}(v/v_{\text{ref}}); \quad v_{\text{ref}} = 10^{-9} \text{ m/s}$$

p568, In the line above equation (10.2), change δP_t to ΔP_t .

p571, Table 10.5, interchange the headings (only the headings) of the two right-most columns.

p579, 2 and 3 lines beneath the “Control Valves” heading, change “static” to “absolute”.

p579, 6 lines beneath the “Control Valves” heading, remove “static”.

p580, Line following Equation (10.29), replace “sound power” with “stream mechanical power”.

p580, 2 lines from the page bottom, delete “static”.

p581, 3 and 4 lines from the top, change “static” to “absolute”.

p581, First line, Figure 10.5 caption, change “static” to “absolute”.

p581, change the label on the vertical axis in Figure 10.5 from “Static pressure” to “Absolute pressure”.

p581, 4 lines below the figure caption, change “static” to “absolute” in 2 places.

p586, Line above Equation (10.54), change “stream Mach number” to “freely expanding jet Mach number”.

p586, Equation (10.54) 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:

$$M_j = \sqrt{\left(\frac{2}{\gamma - 1} \right) \left[\left(22 \right)^{(\gamma-1)/\gamma} - 1 \right]}$$

p587, 2 lines above equation (10.58), remove “Howe and”.

p587, 2 lines below equation (10.58), remove “static”.

p590, Line above equation (10.72), change 2015 to 1994 (the 2015 standard is different).

p599, In Equations (10.75) and (10.76) replace f_C with f in a total of 7 places.

p599, Equation (10.97) for the un-weighted octave band sound power level, should be, $L_W = N_R + 10 \log_{10} S + C(f)$, and values of $C(f)$ for each octave band are listed in the following table.

Values of the coefficient, $C(f)$ for transformer noise

Octave band centre frequency (Hz)	Octave band corrections (dB)		
	Location 1 ^a	Location 2 ^b	Location 3 ^c
31.5	-3.4	-3.4	-3.4
63	2.6	5.6	5.6
125	4.6	10.6	10.6
250	-0.4	5.6	9.6
500	-0.4	5.6	9.6
1000	-6.4	-3.4	3.6
2000	-11.4	-11.4	-1.4
4000	-16.4	-16.4	-6.4
8000	-23.4	-23.4	-13.4

^aOutdoors, or indoors in a large mechanical room with a large amount of mechanical equipment.

^bIndoors in small rooms, or large rooms with only a small amount of other equipment.

^cAny critical location where a problem would result if the transformer should become noisy above its NEMA rating, following installation.

p599, Replace the paragraph following Equation (10.97) and Equation (10.98), and the two lines following Equation (10.98) with the following. “where the measurement surface area used to obtain N_R is $S = 1.25\ell_m h$ (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 is 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 protrusions 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 overall sound pressure level averaged logarithmically along one or two measurement contours at different heights and maximum acceptable values are listed in Table 10.26. Where possible, values of N_R (and the associated measurement surface area, S) supplied by the manufacturer should be used.”

p601, The constant on the RHS of Equation (10.102) should be 74.9 and the constant on the RHS of Equation (10.103) should be 59.6.

p601, Equations (10.102) and (10.103) can be used for turbines with output powers greater than 200 kW.

p601, Change 2 MW to 0.2 MW in the heading, the third line under the heading, the fourth line under Equation (10.102), 2 lines above Figure 10.6 and in the caption of Figure 10.6.

p603, Equation (10.104) calculates sound power level per metre of road length so replace “dB re 10^{-12} W” with “dB re 10^{-12} W/m”.

p604, Line following Equation (10.107), replace \geq with \leq .

p604, Line following Equation (10.108), replace \geq with \leq .

p604, Equation (10.110), in the expression corresponding to $m = 1$, change “0.8” to “1.5”.

p604, Equation (10.112), change $L_{WP,i,m,road}$ to $\Delta L_{WP,i,m,road}$.

p606, Equation (10.115), change $L_{WR,m,temp}$ to $\Delta L_{WR,m,temp}$.

p606, Equation (10.118), change $L_{WR,i,m,road}$ to $\Delta L_{WR,i,m,road}$.

p614, 4 lines from the bottom, change “track segment” to “train position”.

p614, line 5 under the heading, “Train Sound Power Levels”, delete the words “each track segment,”.

p615 In Equation (10.133), L_{24} is the total passing train length in a 24-hour period.

p615, In Equation (10.135) delete one of the two ΔL_c quantities on the RHS.

p615, Following the three lines immediately after Equation (10.134), add the following:

“The calculation requires that the train length be divided into small segments and the sound pressure level at the receiver is then calculated for each segment (taking into account the segment length - see Equation (10.135)). The total sound pressure level at the receiver in each octave band, i , is then calculated by logarithmically summing the contributions from all train segments that contribute significantly to the total $L_{\max M,i}$ level. Also, the train position when undertaking the calculations for a particular receiver should be the one that results in the maximum overall $L_{A,\max M}$ level at the receiver. Each receiver will have a different train position that results in the maximum $L_{A,\max M}$ level.”

p615, After Equation (10.136), add the following statements.

“The track segment length is taken into account in Equation (10.135) by adding the term, $10 \log_{10}(L_{\text{track}})$ to the RHS, where L_{track} is the length of track in metres that is in the track segment under consideration. The train length is taken into account in Equation (10.136) by adding the term, $10 \log_{10}(L_{\text{train}})$ to the RHS, where L_{train} is the length of train in metres that is in the train segment under consideration.

p617, 1 line under the Geometrical Spreading heading, change “where $-A_{\text{div}}$ is” to “where A_{div} is”.

p617, 1 line under the Atmospheric Absorption heading, change “where $-A_a$ is” to “where A_a is”.

p617, 3 lines under the Ground Effect heading, change $\Delta L_g = A_g$ to $\Delta L_g = -A_g$.

p617, Line above Equation (10.137), delete the sentence, “The maximum sound pressure level, $L_{\text{maxM},i}$, in each octave band, i , is calculated using:”

p617, Equation (10.137) should be $\Delta h = d_1 d_2 / [16(d_1 + d_2)]$.

p618, Line following Equation (10.142), after façade (m), add “to the receiver”.

p620, In Equation (10.144), L is the length of the track section occupied by the idling train.

p620, Line above Equation (10.146), change “source line” to “source”.

p620, Line immediately following Equation (10.146), change “source line” to “source”.

p620, Last word in the paragraph following Equation (10.146), change “segment” to “section”.

p620, 3 lines from the bottom, replace $L_{W,0,\text{idling}}$ with $L_{W,\text{idling},i}$.

p622, first line, replace replace $L_{W,0,\text{idling}}$ with $L_{W,\text{idling},i}$.

p622, Table 10.39, in heading change “Electric multiple input” to “Electric multiple unit”.

p663, Equation (11.64), replace π with 2.

p689, Delete the third sentence following the heading, “Uncertainty Principle”.

p697, beginning with the paragraph immediately above Equation (12.79), replace the remainder of Section 12.3.15 with the following:

“If the two functions in the time domain are represented by sampled data, $x[n]$, $n =$

$0, 1, 2, \dots, (N-1)$ and $h[m], m = 0, 1, 2, \dots, (M-1)$, such as obtained by a digital data acquisition system, the output of the **convolution**, $y[k], k = 0, 1, 2, \dots, (N + M - 3)$, of the two signals at sample number, k , is given by:

$$y[k] = x[k] * h[k] = h[k] * x[k] = \sum_{n=0}^{N-1} x[n]h[k-n] \quad (14)$$

where terms in the sum are ignored if $[k-n]$ lies outside the range from 0 to $(M-1)$. As can be seen from the equation, each sample in the input signal contributes to many samples in the output signal.

Deconvolution is the process of obtaining a system impulse response from the measurement of a system input signal and the output signal that the system generates in the time domain. This discussed in Section 12.3.17 where an MLS signal is used as the input signal and the cross correlation (See Section 12.3.16) of the output and input signals is then the system impulse response function.

Alternatively, the impulse response of a system can be determined using a white noise spectrum as the input and taking the DFT of both the input, $x(k)$, and output, $y(k)$, to obtain $X(f_n)$ and $Y(f_n)$, as well as the transfer function in the frequency domain, $H(f_n) = Y(f_n)/X(f_n)$. However, as $X(f_n)$ and $Y(f_n)$ are obtained using a DFT, the inverse discrete Fourier transform (IDFT) in the frequency domain will no longer represent a linear convolution in the time domain, due to the periodicity of the DFT. Thus, $h(k) \neq \text{IDFT}\{H(f_n)\}$. In fact the result for $h(k)$ will be the circular convolution, which is not the same as the linear convolution just discussed. This problem can be avoided by the use of zero padding (see Section 12.3.7) where a number of zeros (equal to the number of samples in the data record) are added to the end of each of the two sampled data records, $x(k)$ and $y(k)$, prior to taking the DFT. If a DFT is then taken of the two sampled time signals, $x(k)$ and $y(k)$, each containing N samples and N zeros following the samples, then $h(k) = \text{IDFT}\{H(f_n)\}$, where $H(f_n) = Y(f_n)/X(f_n)$.”

p721, For the speed of sound in a rod of rubber material, change “190” to “95–190”

p721, 4 lines above the page bottom, change “static” to “absolute”.

p724, In Equation (D.3), change the minus sign to a plus sign.

p725, In Equation (D.5), add a minus sign before “j” to the first term on the RHS.

p727, second line following Equation (D.21), replace (D.9)–(D.14) with (D.15)–(D.20).

p731, in Equation (D.26), replace $L_{D1} - L_{D2}$ with $L_{D2} - L_{D1}$.

p734, in Equation (D.41), add an “=” sign following $\frac{Z_N}{\rho c}$.

p735, in Equation (D.48), change φ to ϑ and add immediately after the equation,
“where the angles are defined in Figure 7.8”.

-
- p735, Line above Equation (D.51), replace Z_N with $Z_N/(\rho c)$.
- p736, 2 lines from the bottom of the page, replace \bar{H} with H^M .
- p737, In Figure D.11, interchange the labels Ch1 and CH2 in the FFT analyser box.
- p737, Line immediately under Equation (D.58), replace the word, “factor” with “transfer function”.
- p737, Equation (D.60), add a superscript “M” to H_I and H_R on the RHS of the equation (not the LHS).
- p738, Equation (D.61), add a superscript “M” to H_I and H_R on the RHS of the equation (not the LHS).
- p739, In equations (D.70) and (D.71), change k_a to k in all places.
- p740, In Equation (D.72), change $(x_1 - x_2)$ to $(x_2 - x_1)$ and change $(x_3 - x_4)$ to $(x_4 - x_3)$.
- p740, In Equations (D.72), (D.73) and (D.74), Change k_a to k in all places.
- p744, Line immediately above Equation (D.95), replace “furthest from” with “closest to”.
- p796, Add the following reference:
Salomons, E., van Maercke, D., Defrance, J., and de Roo, F. (2011). The harmonoise sound propagation model. *Acta Acustica United with Acustica*, 97:62–74.
- p812, index entry for <Impedance><definitions>, change “460” to “45”.
- p812, index entry for <Transmission coefficient>. Add a sub-heading, <definition, 368>.