# Table of Contents

**Foreword** 0

**Part I  Introduction** 7

**Part II  Environmental** 9

1 General .................................................................................................................. 9
   CRTN Measurement to Source ........................................................................... 9
   CRTN Source to Receiver .................................................................................... 10
   EN 12354-4 Surface Lw to Lp ........................................................................... 11
   Facade Reflection ................................................................................................. 11
   ISO 9613 Calculation ......................................................................................... 12
   Lp to Lw Simple ................................................................................................... 13

2 Distance .................................................................................................................. 13
   CRTN Distance Correction ................................................................................... 13
   Line Source Distance Loss ................................................................................... 14
   Point Source Distance Loss .................................................................................. 15
   Plane Source Distance Loss .................................................................................. 16

3 Screening ............................................................................................................... 17
   CRTN Screening ................................................................................................... 17
   Maekawa Screening Loss ..................................................................................... 18
   Path Difference Calculator ................................................................................... 19
   Path Difference Calculator ................................................................................... 20

4 Radiation ................................................................................................................ 21
   Line Source Radiation ............................................................................................ 21
   Point Source Radiation ........................................................................................... 22

5 Construction .......................................................................................................... 23
   BS 5228 % of Period ............................................................................................ 23
   BS 5228 % On Time ............................................................................................... 24

6 Full Calcs ............................................................................................................... 25
   Point Source to Receiver ....................................................................................... 25
   Full CRN Calc ....................................................................................................... 26
   Full CRTN Calc ..................................................................................................... 28
   ISO 9613 calculation ............................................................................................. 30

**Part III  Sound Insulation** 33

1 General ................................................................................................................... 33
   Composite SRI .................................................................................................... 33
   Four Element SRI ............................................................................................... 34
   Separating Element with Area .......................................................................... 35

2 Conversion ............................................................................................................. 36
   DnT to DnTw ......................................................................................................... 36
   DnT(Tmf, max) to R'w ........................................................................................... 37
   LpRev to Lw (Mitigation) ..................................................................................... 38
   LpRev to Lw (Sep El) ............................................................................................ 39
   R' to DnT ............................................................................................................. 40
   R to DnTw OB ..................................................................................................... 41
   R to DnTw TO ..................................................................................................... 42
   R to R' OB .......................................................................................................... 43
   R to R' TO .......................................................................................................... 44
   SRI to TC .......................................................................................................... 45

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Part IV Room Acoustics

1 General
10 log S/A
A Calculator (V and T60)

Part V Building Services

1 General
Plant Item Surface Area Selector

2 Duct System Losses
Bend Loss
Circ Lined Duct Losses
Circ Unlined Duct Losses
Rect Lined Duct Losses
Rect Unlined Duct Losses
Split Loss
Split Percentage RC
Split Percentage RR
Two Branch Split - RC
Two Branch Split - RR

3 End Reflection
End Reflection - Circ Flush
End Reflection - Circ Flush
End Reflection - Circ Free Space
End Reflection - Rect Flush
End Reflection - Rect Flush
End Reflection - Rect Free Space

4 Directivity
External Grille Directivity

5 Air Flow
Air Volume to Face Velocity

6 Converters
Lp to Lw
Lw to LpRev (Src In Room)
Lw to Lp

7 Calculation Segments
Grille Lw to LpDirect
Grille Lw to LpRev

8 Break-Out
Duct Break-Out
Duct Break-Out
Duct Breakout Lw to Lp Direct

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1 Introduction

This document is a reference guide for the calculations database. It will be updated as and when more calculations are added into the database.
2 Environmental

2.1 General

2.1.1 CRTN Measurement to Source

Description
Calculation of noise levels at CRTN source position based on measured noise levels. Contains corrections for distance, ground attenuation or barrier, angle of view and facade incidence. Can be used in conjunction with CRTN Source to Receiver to calculate noise levels at a receiver location based on measured levels.

Inside the Container
2.1.2 CRTN Source to Receiver

Description

Basic CRTN calculation from the CRTN source position to a receiver position. Contains corrections for distance, ground attenuation or barrier, angle of view and facade incidence.

Inside the Container
2.1.3 EN 12354-4 Surface Lw to Lp

Description

Calculates Sound Pressure at receiver location based on the simplified model given in Annex E of EN 12354-4 to a receiver in line with the centre of the radiating surface.

2.1.4 Facade Reflection

Description

This correction takes account of the increase in noise levels arising from a reflection from a facade in close proximity to the measurement location.

Inside the Container
2.1.5 ISO 9613 Calculation

Description

Contains a basic ISO 9613 calculation. The user should be familiar with the standard and its intricacies before using this calc. The calculation takes account of geometrical divergence (Adiv), atmospheric attenuation (Aatm), ground attenuation (Agr) and barrier attenuation (Abar) only. The calc assumes free-field, so the directivity correction is set to Dc=0. Reflections and other effects (foliage etc.) are not included. If a barrier is used, it is assumed that the source and receiver are on a line perpendicular to the barrier face. The barrier assumes the path is over the top edge, so Agr is removed if a barrier is used. Wavelength is calculated using a speed of sound of 340m/s as presented in the standard.

Inside the Container
2.1.6 Lp to Lw Simple

Description

Converts Sound Pressure Level to Sound Power Level by accounting for point source geometrical divergence only.

2.2 Distance

2.2.1 CRTN Distance Correction

Description

Calculates the line-source level difference between a Measurement Position (MP) and Receiver Position (RP). The source is taken as 3.5m from the kerb and at 0.5m above ground level as detailed in CRTN. Heights are input relative to ground level.

Inside the Container
2.2.2 Line Source Distance Loss

Description

This correction provides the losses experienced by a line source as a result of energy spreading from one distance to another. It is based on the basic principle of $10\log(d_1/d_2)$.

Inside the Container
2.2.3 **Point Source Distance Loss**

Description

This correction provides the losses experienced by a point source as a result of energy spreading from one distance to another. It is based on the basic principle of $20 \log(d_1/d_2)$.

**Inside the Container**
2.2.4 Plane Source Distance Loss

Description

This container calculates the distance loss from a plane area source. It is based on work by E J Rathe (1969), and the full description can be found in R Watson and O Downey 'The Little Red Book of Acoustics' Second Edition on page 79.

Inside the Container
2.3 Screening

2.3.1 CRTN Screening

Description

Will calculate the noise level reduction arising from the use of a screen based on the input path difference according to CRTN. A positive path difference means the receiver is in the shadow zone, whereas a negative path difference means the receiver is in the illuminated zone.

Inside the Container
2.3.2 Maekawa Screening Loss

Description

Maekawa method to approximate attenuation produced by a thin rigid barrier. Taken from B J Smith, R J Peters and S Owen, 'Acoustics and Noise Control', 2nd Edition, Section 5.3, page 64. Limits are included in the calc to prevent amplification of sound in the illuminated zone at short wavelengths.

Inside the Container
2.3.3  Path Difference Calculator

Description

Contains a calculation of the difference between a direct path from source to receiver, and the path to the top of the barrier and to the receiver. Where the barrier does not provide at least line of sight screening, the path difference is shown as a negative number. The barrier height required to provide line of sight screening is also shown.

Inside the Container
2.3.4 Path Difference Calculator

Description

Contains a calculation of the difference between a direct path from source to receiver, and the path to the top of the barrier and to the receiver. Where the barrier does not provide at least line of sight screening, the path difference is shown as a negative number.

Inside the Container
2.4 Radiation

2.4.1 Line Source Radiation

**Description**

This correction takes account of the losses experienced when converting line source Sound Power to Sound Pressure at 1m. It is based on the equation $10\log(Q/S)$ where $Q =$ directivity factor, and $S = 2\pi r^2$. $Q$ is switched between 1, 2 and 4 to reflect the corresponding directivity factors.

**Inside the Container**
2.4.2 Point Source Radiation

Description

This correction takes account of the losses experienced when converting point source Sound Power to Sound Pressure at 1m. It is based on the equation $10\log(Q/S)$ where $Q =$ directivity factor, and $S = 4 \pi r^2$. $Q$ is switched between 1, 2 and 4 to reflect the corresponding directivity factors.

Inside the Container
2.5 Construction

2.5.1 BS 5228 % of Period

Description

Correction to take account of the % of a BS8233 period a construction noise source will be in use for.

Inside the Container
2.5.2 BS 5228 % On Time

Description

Correction to take account of the % on-time during a construction shift of a noise source.

Inside the Container
2.6  Full Calcs

Enter topic text here.

2.6.1  Point Source to Receiver

**Description**

Simple calculation from a point source to an external receiver. Includes radiation loss, distance loss, screening, and facade reflection.

**Inside the Container**
2.6.2 Full CRN Calc

![Full CRN Calc Diagram]
Description

Implements a Calculation of Railway Noise (CRN) calculation using the procedure described in The Department of Transport Calculation of Railway Noise 1995. Throughout this calc, horizontal distances should be input relative to the nearest rail (d), and vertical distances should be input relative to the top of the rail (h). Users of this calculation need to be familiar with the standard to understand how the various corrections apply. The CRN SEL Corrections Lookup Table needs to be loaded to use the CRN Sources part of the calculation. This includes the corrections given in CRN, and the additional values produced by DEFRA in 2007.
2.6.3 Full CRTN Calc

<table>
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<th>Parameter</th>
<th>Value</th>
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<tbody>
<tr>
<td>Traffic Flow</td>
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<tr>
<td>Traffic Flow</td>
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<tr>
<td>V</td>
<td>km/h</td>
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<tr>
<td>% HGV</td>
<td>-</td>
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<tr>
<td>Gradient, G</td>
<td>%</td>
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<td>Include delta V?</td>
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<td>ΔV</td>
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<td>External Receiver</td>
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</tr>
<tr>
<td>Resultant Levels</td>
<td>dBA</td>
</tr>
</tbody>
</table>
## Description

Implements a Calculation of Road Traffic Noise (CRTN) calculation using the procedure described in The Department of Transport Calculation of Road Traffic Noise. Throughout this calc, horizontal distances should be input relative to the edge of the nearside carriageway, and vertical distances should be input relative to the CRTN source position of 0.5m above the top of the road surface. Users of this calculation need to be familiar with the standard to understand how the various corrections apply.
### ISO 9613 calculation

**Description**

Contains a basic ISO 9613 calculation. The user should be familiar with the standard and its intricacies before using this calc. The calculation takes account of geometrical divergence (Adiv), atmospheric attenuation (Aatm), ground attenuation (Agr) and barrier attenuation (Abar) only. The calc assumes free-field, so the directivity correction is set to Dc=0. Reflections and other effects (foliage etc.) are not included. If a barrier is used, it is assumed that the source and receiver are on a line perpendicular to the barrier face. The barrier assumes the path is over the top edge, so Agr is removed if a barrier is used. Wavelength is calculated using a speed of sound of 340m/s as presented in the standard.
Sound Insulation
3 Sound Insulation

3.1 General

3.1.1 Composite SRI

Description

This container calculates a composite SRI for a basic arrangement of a primary facade element (e.g. brick), glazed elements and vents. An example of where this would be used is in BS8233 in section 6.7.2.

Inside the Container
3.1.2 Four Element SRI

Description

This calculation will calculate the composite SRI based on the four selected elements and the input areas.

Inside the Container
3.1.3 Separating Element with Area

Description

This container allows the selection of a separating element, and the input of the area of the element to feed into an SRI to TC container as part of a composite SRI calc.

Inside the Container
3.2 Conversion

3.2.1 DnT to DnTw

Description

Applies the weighting correction from ISO 717-1:1997 to the input DnT to return DnTw.

Inside the Container
3.2.2 DnT(Tmf,max)w to R'w

**Description**

Quick calculator to calculate conversion from DnT(Tmf,max)w to R'w for a rectangular room. Input the room dimensions, select the separating room boundary, and input the Tmf.

**Inside the Container**
3.2.3 **LpRev to Lw (Mitigation)**

**Description**

Used for converting LpRev to Lw as part of a noise break-out calculation. An example of its use would be calculating the noise break-out from a plant room through a louvre. Implements equn. 2 of EN 12354-4 2000.

**Inside the Container**
3.2.4 LpRev to Lw (Sep El)

Description

Used for converting LpRev to Lw as part of a noise break-out calculation. An example of its use would be calculating the noise break-out from a plant room through a louvre. Implements equn. 2 of EN 12354-4 2000.

Inside the Container
3.2.5  R’ to DnT

Description

Convert from R’ to DnT.

Inside the Container
3.2.6 R to DnTw OB

Description

This container will convert from octave band SRIs to DnTw.

Inside the Container
3.2.7 R to DnTw TO

Description

This container will convert from octave band SRIs to DnTw.

Inside the Container
3.2.8 **R to R' OB**

**Description**

Takes account of deviation in sound reduction from lab to site.

**Inside the Container**
3.2.9 R to R' TO

Description

Takes account of deviation in sound reduction from lab to site.

Inside the Container
3.2.10 **SRI to TC**

**Description**

This component converts Sound Reduction to Transmission Coefficient as required to calculate composite SRI, and includes the area correction.

**Inside the Container**
3.3 **Break-In**

Enter topic text here.

3.3.1 **Quick BS 8233 Break-In Calc**

Description

Contains a calculation of noise break-in from free-field noise levels at the location of the facade for a rectangular room with the specified dimensions and reverberation time. It is based on equn. 1 from section 6.7.2.1 of BS8233 1999. The rev time is assumed to be flat across the bands, however as shaper could be used to shape the rev time if required.

**Inside the Container**
3.3.2 BS 8233 Break-In Calc

Description

Contains a calculation of noise break-in from free-field noise levels at the location of the facade based on the input dimensions and selected materials. The room absorption is taken from the selected receiver. It is based on equn. 1 from section 6.7.2.1 of BS8233 1999.

Inside the Container
### 3.3.3 BS 8233 Break-In Calc with SRIs

<table>
<thead>
<tr>
<th>Noise Source</th>
<th>Noise Levels</th>
<th>63Hz</th>
<th>125Hz</th>
<th>250Hz</th>
<th>500Hz</th>
<th>1kHz</th>
<th>2kHz</th>
<th>4kHz</th>
<th>8kHz</th>
</tr>
</thead>
<tbody>
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</tbody>
</table>

**Description**
Contains a calculation of noise break-in from free-field noise levels at the location of the facade based on the input dimensions and selected materials. The room absorption is taken from the selected receiver. It is based on eqn. 1 from section 6.7.2.1 of BS8233 1999.
3.3.4 Traffic Noise to Internal

### Description

Contains a basic calculation from measured road traffic noise levels to internal Lp Rev levels. CRTN corrections are used to calculate the noise levels at the location of the facade, then a BS 8233 break-in calculation is used to calculate the resultant internal levels. As CRTN corrections are single figure, a shaper is used to convert the dB(A) level to octave bands for use with the break-in calc. Note: If the CRTN calcs contain a barrier, the typical traffic spectrum from BS 8233 may not
be suitable. Also, remember that the BS 8233 break-in calc starts with free-field levels.
3.3.5 Traffic Noise to Internal Quick

Description

Contains a basic calculation from measured road traffic noise levels to internal Lp Rev levels. CRTN corrections are used to calculate the noise levels at the location of the facade, then a BS 8233
break-in calculation is used to calculate the resultant internal levels. As CRTN corrections are single figure, a shaper is used to convert the dB(A) level to octave bands for use with the break-in calc. Note: If the CRTN calcs contain a barrier, the typical traffic spectrum from BS 8233 may not be suitable.
3.4 Break-Out

Enter topic text here.

3.4.1 EN 12354-4 Simple Break-Out

Description

Calculates Sound Pressure at receiver location based on the simplified model given in Annex E of EN 12354-4 to a receiver in line with the centre of the radiating surface.

3.5 Noise Transfer

Enter topic text here.
3.5.1 Rev to Rev

Description

Calculates the transfer of a reverberant sound pressure levels from one reverberant space to another. It implements the equation \(-R + 10\log(S) - 10\log(A)\).
### 3.5.2 Rev to Direct

**Description**

Calculates the transfer of reverberant sound pressure in the source room to the direct field of the receive room. An $L_w$ radiated from the separating element is calculated from the $L_{pRev}$ in the source room using equn. 2 of EN 12354-4 2000. Following this the $L_{pDirect}$ is calculated using the Rathe plane source distance loss based on the distance of the receiver from the separating element.
Room Acoustics
4 Room Acoustics

4.1 General

4.1.1 10 log S/A

Description
This container returns 10 log (S/A) based on the input facade area (S) and the selected receive room.

Inside the Container
4.1.2 A Calculator (V and T60)

Description

Calculates $A$ based on input Volume and Reverberation Time by rearranging Sabine's RT equation.

Inside the Container
Building Services
5 Building Services

5.1 General

5.1.1 Plant Item Surface Area Selector

Description
Will output the surface area of the selected side from a rectangular cuboid shaped item.

Inside the Container
5.2 Duct System Losses

5.2.1 Bend Loss

Description

Implements the five Bend Loss lookup tables included in the Acoustics Central Calculations Database adapted from CIBSE Guide B5. Check description before use. Bend Loss Lookup Tables must be loaded before use.

Inside the Container
5.2.2 Circ Lined Duct Losses

Description

Implements the 25mm and 50mm Lined Duct Loss lookup tables. Check description before use. 25mm and 50mm Lined Duct Losses Lookup Tables must be loaded before use.

Inside the Container
5.2.3 Circ Unlined Duct Losses

Description

Implements the Unlined Circ Duct Loss lookup table. Check description before use. Unlined Circ Duct Losses Lookup Table must be loaded before use.

Inside the Container
5.2.4 Rect Lined Duct Losses

Description

Implements the 25mm and 50mm Lined Rect Duct Loss lookup tables. Check description before use. 25mm and 50mm Lined Rect Duct Losses Lookup Tables must be loaded before use.

Inside the Container
5.2.5 Rect Unlined Duct Losses

Description

Implements the Unlined Rect Duct Loss lookup table. Check description before use. Unlined Rect Duct Losses Lookup Table must be loaded before use.

Inside the Container
5.2.6 Split Loss

Description

This correction takes account of the loss of sound power arising from a split in ductwork.

Inside the Container
5.2.7 Split Percentage RC

Description

Calculates the percentage at each of a rectangular and circular duct branches based on an area division

Inside the Container
5.2.8 Split Percentage RR

**Description**

Calculates the percentage at each of two rectangular duct branches based on an area division.

**Inside the Container**

[Diagram of the Split Percentage RR tool]
5.2.9 Two Branch Split - RC

Description

Calculates the noise levels and air volumes at each of a rectangular and circular duct branch. This is based purely on a division of sound power and air volume that is directly proportional to the cross-sectional area of the branches.

Inside the Container
5.2.10 Two Branch Split - RR

Description

Calculates the noise levels and air volumes at each of two rectangular duct branches. This is based purely on a division of sound power and air volume that is directly proportional to the cross-sectional area of the branches.

Inside the Container
5.3 End Reflection

5.3.1 End Reflection - Circ Flush

Description

Takes account of End Reflection of a circular duct terminating flush with the wall. Implements equation 6.2 from the 2002 CIBSE Guide B5.

Inside the Container
5.3.2 End Reflection - Circ Flush

Description

Takes account of End Reflection of a circular duct terminating flush with the wall. Implements equation 12 from the ASHRAE Handbook Chapter 48 - Noise and Vibration Control.

Inside the Container
5.3.3 End Reflection - Circ Free Space

Description

Takes account of End Reflection of a circular duct terminating in free space. Implements equation 12 from the ASHRAE Handbook Chapter 48 - Noise and Vibration Control.

Inside the Container
5.3.4 End Reflection - Rect Flush

Description

Takes account of End Reflection of a rectangular duct terminating flush with the wall. Implements equation 6.2 and 6.3 from the 2002 CIBSE Guide B5.

Inside the Container
5.3.5 End Reflection - Rect Flush

Description

Takes account of End Reflection of a rectangular duct terminating flush with the wall. Implements equation 12 from the ASHRAE Handbook Chapter 48 - Noise and Vibration Control.

Inside the Container
5.3.6 End Reflection - Rect Free Space

Description

Takes account of End Reflection of a rectangular duct terminating in free space. Implements equation 12 from the ASHRAE Handbook Chapter 48 - Noise and Vibration Control.

Inside the Container
5.4 Directivity

5.4.1 External Grille Directivity

Description

This correction determines directivity from a rectangular grille based on best-fit line equations generated using the grille directivity figures in the Flakt Woods Practical Guide to Noise Control figures 5.11 and 5.12. The values are reduced by 3dB to take account of Woods’ radiation loss of -11dB under hemi-spherical conditions (eqn. 5.4). The radiation loss effects will need to be included separately.

Inside the Container
5.5 Air Flow

5.5.1 Air Volume to Face Velocity

Description

Calculates the face velocity of the input air volume for the input cross-sectional area.

Inside the Container
5.6 Converters

5.6.1 Lp to Lw

Description
Converts Sound Pressure Levels to Sound Power Levels by assuming energy is distributed evenly across a conformal area extended to the specified distance around the object.

Inside the Container
5.6.2 Lw to LpRev (Src In Room)

**Description**

Calculates the reverberant component of a noise source located within the reverberant space by adding $K_{Rev}$ to the Sound Power Levels.

**Inside the Container**
5.6.3 Lw to Lp

Description

Converts Sound Power Levels to Sound Pressure Levels by assuming energy will be distributed evenly across a conformal area extended to the specified distance around the object.

Inside the Container
5.7 Calculation Segments

5.7.1 Grille Lw to LpDirect

Description

Takes account of corrections from Lw at grille to Lp at receiver. Determines directivity from an on-axis rectangular grille based on best-fit line equations generated using the grille directivity figures in the Flakt Woods Practical Guide to Noise Control figures 5.11. Radiation loss of -11dB is used as required with the DI, distance is calculated using 20log(d), and a 10log(n) correction is used for number of grilles.

Inside the Container
5.7.2 Grille Lw to LpRev

Description

Takes account of corrections from Lw at grille to Lp in the rooms reverberant field by adding Krev to the sound power. A 10 log (N) correction is also included to account for the number of grilles feeding into the reverberant field.

Inside the Container
5.8 Break-Out

5.8.1 Duct Break-Out

Description

Basic calculation of sound power radiated from a duct wall as a result of the noise break-out. Implements equn. 6.6 from CIBSE Guide B5. SRI’s used are those given in Table 7.5 of the guide, however these are not true break-out losses and as such should be used with caution. As described in the CIBSE Guide, the radiated sound power levels are given a maximum value 3dB lower than the in-duct sound power levels.

Inside the Container
5.8.2 Duct Break-Out

Description

Basic calculation of sound power radiated from a duct wall as a result of the noise break-out. Adapted from equn. 13 and the accompanying information from the ASHRAE Handbook Chapter 48.

Inside the Container
5.8.3 **Duct Breakout Lw to Lp Direct**

**Description**

Calculates the sound pressure at a distance from a duct as a result of a radiated sound power on the duct surface. Adapted from eqn. 23 given in the ASHRAE Handbook Chapter 48.

**Inside the Container**
### 5.9 Full Calcs

Enter topic text here.

#### 5.9.1 Fan Noise - Atmos Side

Contains a basic calculation of noise from a fan to an external receiver location. Includes duct loss, bend loss, end reflection, directivity, correction for off-axis, radiation, distance, screening and facade incidence. The building services lookup tables must be loaded before use.

<table>
<thead>
<tr>
<th>Calculation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noise Source</td>
<td>Contains a basic calculation of noise from a fan to an external receiver location. Includes duct loss, bend loss, end reflection, directivity, correction for off-axis, radiation, distance, screening and facade incidence. The building services lookup tables must be loaded before use.</td>
</tr>
</tbody>
</table>
## 5.9.2 Fan Noise - Room Side

### Description
Contains a basic calculation of noise from a fan to an internal receiver being served by the fan.
Contains general system losses along with the corrections required to calculate the direct and reverberant components in the receive rooms. The building services lookup tables must be loaded before use.

5.9.3 Fan Noise - Room Side Break Out

**Description**

Contains a basic calculation of noise from a fan to an internal receiver from noise breaking-out of a duct in the receive room. Contains general system losses along with the corrections required to calculate the direct and reverberant components in the receive room. The building services lookup tables must be loaded before use.
### 5.9.4 Fan Noise - Room Side Mult Receivers

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<th>125Hz</th>
<th>250Hz</th>
<th>500Hz</th>
<th>1kHz</th>
<th>2kHz</th>
<th>4kHz</th>
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</table>

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Description

Contains a basic calculation of noise from a fan to two internal receivers being served by the fan, in addition to a break out component to a different internal receiver. Contains general system losses along with the corrections required to calculate the direct and reverberant components in the receive rooms. The building services lookup tables must be loaded before use.

5.9.5 Cross Talk
Description

Contains a basic calculation of the resulting reduction in level difference across a separating element as a result of noise travelling through the ductwork serving the adjacent rooms. First the level difference arising from noise in the source room reverberant field travelling through the ductwork and being received in the receive room is calculated. Then the level difference arising from noise travelling through the partition is calculated. Finally, the two are added to determine the resultant level difference. This calculation only takes account of noise in the reverberant field in the source room, which is assumed to be diffuse - i.e. there is no direct component taken into account. Noise sources giving rise to a direct component (e.g. specific sources giving rise to a significant direct component at the entrance grille) would need special consideration. Similarly, there is no direct component through the partition, however the direct field radiated from the separating element is taken into account. This calculation has been developed from a review of available calcs from various sources, so ensure you are happy with the methodology before using.
Miscellaneous
6 Miscellaneous

6.1 Tools

6.1.1 Drawing Scaler

![Drawing Scaler](image)

**Description**

Used to scale from a drawing. Input the known reference distance, and the as reference distance as measured, and then the unknown measured distance.
6.1.2 Rect Surface Area Selector

Description

Used to scale from a drawing. Input the known reference distance, and the as reference distance as measured, and then the unknown measured distance.
General Acoustics
7 General Acoustics

7.1 Inputs

7.1.1 SF to OB

Description

Puts the input Single Figure value across all Octave Bands.
7.1.2 Wavelength

Description

Returns the wavelength of the various octave bands
7.2 Converters

7.2.1 TO to OB Arith Average

Description

This container converts third-octave band data to octave band data by arithmetically-averaging the data in the three third-octave bands that form the octave band. It is only valid across the range 1.6Hz to 20kHz.
7.2.2 TO to OB Logsubtract

Description

This container converts third-octave band data to octave band data by subtracting the logsum of the three third-octave bands that form the octave band from $10\log(3)$. It is only valid across the range 1.6Hz to 20kHz.
7.2.3 TO to OB Logsum

**Description**

This container converts third-octave band data to octave band data by log-summing the data in the three third-octave bands that form the octave band. It is only valid across the range 1.6 Hz to 20 kHz.
7.3 Corrections

7.3.1 Radiating Area

Description

Add 10 log (S) to the input noise levels to account for a radiating area.
7.3.2 Rev to Free-Field

Description

Takes account of the effect of noise in a reverberant space radiating to free-field by incorporating the selected diffusivity term \((C_d)\) as described in Annex B of EN 12354-4 2000.
7.4 Calculators

7.4.1 Octave Band Limits

Description

Calculates the lower and upper limits of an octave band based on the input centre frequency.
7.4.2 Room Mode Calculator

Description

This container will calculate the room modes for a rectangular room. Input the room dimensions, and integers for the mode required - e.g. 1,0,0 will give the axial room mode in the width dimension.
7.4.3 Third Octave Band Limits

**Description**

Calculates the lower and upper limits of a third-octave band based on the input centre frequency.