# Performance of the ducted silencers
# FVS 200-1000
# FVS 200-600
# FVS 200-300

| | |
|---|---|
| **Requested by** | **Flexovent OÜ**<br>Mart Petermann<br>Kadaka tee 70a<br>12618, Tallinn<br>ESTONIA<br>mart.petermann@flexovent.ee |
| **Order ref.** | Mart Petermann, 20.12.2021, EF4APT210087-03 |
| **Contact person** | **Eurofins Expert Services Oy**<br>Pekka Kettunen<br>Tekniikantie 4B<br>02150 Espoo<br>tel. +358 40 159 6471<br>PekkaKettunen@eurofins.fi |
| **Assignment** | Determination of the performance of the ducted silencer FVS 200-1000/600/300 |
| **Sample details** | The customer delivered the silencer, the specifications of which are in appendix 1.<br><br>Samples were received 5.1.2022.<br>Measurements were carried out 2.2.2022. |
| **Methods** | Total pressure loss measurements, flow noise measurements and insertion loss measurements were carried out according to ISO 7235:2003 /1/. Description of the test facility is presented in appendix 2.<br><br>Air flow rates were measured according to ISO 5167-1:2003 and ISO 5167-2:2003 /2/ using orifice plates with corner tappings.<br><br>FINAS Finnish Accreditation Service has accredited our laboratory (T001) to perform measurements according to standards ISO 7235:2003, ISO 5167-1:2003 and ISO 5167-2:2003. Other measurements mentioned in this test report do not belong to the field of accreditation. |

**Results**

Measurement results are presented in appendix 3-5. Measurement results are valid only for the tested samples.

Instruments used in measurements are presented in appendix 6.

**References**

/1/ ISO 7235:2003. Acoustics - Laboratory measurement procedures for ducted silencers and air-terminal units - Insertion loss, flow noise and total pressure loss.

/2/ ISO 5167-1:2003. Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full. Part 1: General principles and requirements.

ISO 5167-2:2003. Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full. Part 2: Orifice plates.

**Espoo, 3.2.2022**

*Pekka Kettunen*
*Expert*

*Mika Hurme*
*Expert*

Appendices 6

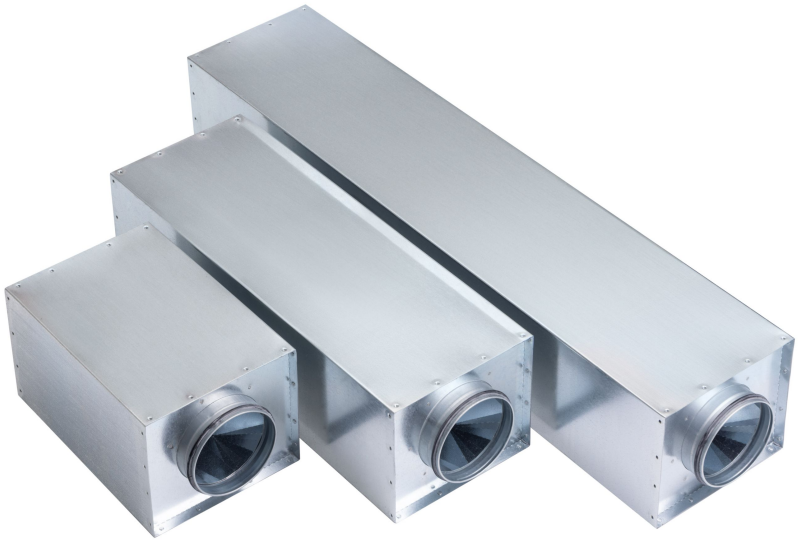
Distribution Customer, electronically approved

Ducted silencer: FVS 200-1000/600/300

**Description of the sample**

ISO 7235:2003

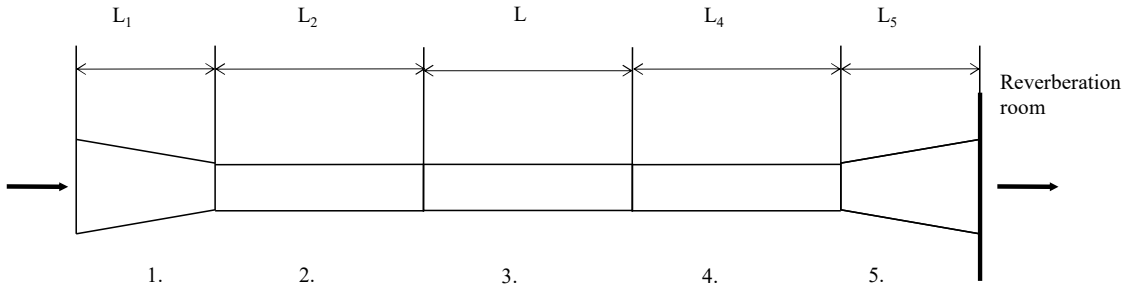
| Symbols and units | FVS 200-1000 | FVS 200-600 | FVS 200-300 | Substitution duct |
|---|---|---|---|---|
| Type | Ducted silencer | | | Spiral duct |
| Diameter of the inlet and outlet sections Ød, mm | 200 | | | 200 |
| Width a, mm | 300 | | | - |
| Height b, mm | 255 | | | - |
| Length L, mm | 1000 | 600 | 300 | 1000 / 600 / 300 |
| Mass, kg | 10.63 | 7.15 | 4.38 | - |
| Thickness of steel duct material, mm | 0.7 | | | 0.7 |
| Direction of flow determined | no | | | no |
| Direction of insertion loss | no | | | no |



Ducted silencer: FVS 200-1000/600/300

**Test facility**

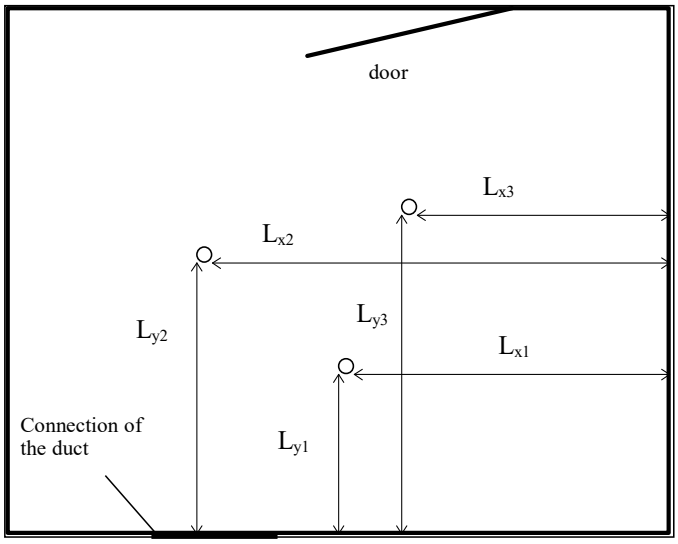
ISO 7235:2003




| Components: | Symbols and units | Length |
|---|---|---|
| 1. Transition Ø1600 / Ø200 | $L_1$, mm | 5420 |
| 2. Duct Ø200 | $L_2$, mm | 2000 |
| 3. Silencer | L, mm | 300 / 600 / 1000 |
| 4. Duct Ø200 | $L_4$, mm | 3000 / 2500 / 2500 |
| 5. Transition Ø200 / Ø1250 | $L_5$, mm | 4100 |
| Total lenght of measurement duct | | 14820 / 14620 / 15020 |

Volume of the reverberation room is 298 m³.

Microphone location in the reverberation room




| Symbol | Unit | Distance |
|---|---|---|
| $L_{x1}$ | m | 2.0 |
| $L_{y1}$ | m | 3.6 |
| $h_1$ | m | 2.7 |
| $L_{x2}$ | m | 3.7 |
| $L_{y2}$ | m | 2.1 |
| $h_2$ | m | 2.6 |
| $L_{x3}$ | m | 4.0 |
| $L_{y3}$ | m | 4.1 |
| $h_3$ | m | 3.9 |

Symbols and units

| | |
|---|---|
| $L_x$ | Distance from wall, m |
| $L_y$ | Distance from wall, m |
| h | Distance from floor, m |

Ducted silencer: FVS 200-1000/600/300

**Test facility**

ISO 7235:2003

Volume of the reverberation room: 298 m³

Reverberation time T of the reverberation room and the transmission coefficient t of the measurement duct transmission element Ø 200.

| Symbol | Unit | T |
|---|---|---|
| $T_{50}$ | s | 5.15 |
| $T_{63}$ | s | 5.51 |
| $T_{80}$ | s | 3.82 |
| $T_{100}$ | s | 3.85 |
| $T_{125}$ | s | 6.28 |
| $T_{160}$ | s | 5.19 |
| $T_{200}$ | s | 5.72 |
| $T_{250}$ | s | 5.25 |
| $T_{315}$ | s | 5.71 |
| $T_{400}$ | s | 4.21 |
| $T_{500}$ | s | 5.17 |
| $T_{630}$ | s | 4.43 |
| $T_{800}$ | s | 5.44 |
| $T_{1000}$ | s | 5.68 |
| $T_{1250}$ | s | 4.94 |
| $T_{1600}$ | s | 4.14 |
| $T_{2000}$ | s | 3.91 |
| $T_{2500}$ | s | 3.11 |
| $T_{3150}$ | s | 2.39 |
| $T_{4000}$ | s | 2.06 |
| $T_{5000}$ | s | 1.62 |
| $T_{6300}$ | s | 1.30 |
| $T_{8000}$ | s | 1.03 |
| $T_{10000}$ | s | 0.69 |

| Symbol | Unit | τ |
|---|---|---|
| $\tau_{50}$ | - | 0.890 |
| $\tau_{63}$ | - | 0.949 |
| $\tau_{80}$ | - | 0.971 |
| $\tau_{100}$ | - | 0.987 |
| $\tau_{125}$ | - | 0.997 |
| $\tau_{160}$ | - | 0.997 |
| $\tau_{200}$ | - | 0.997 |
| $\tau_{250}$ | - | 0.997 |
| $\tau_{315}$ | - | 0.997 |
| $\tau_{400}$ | - | 0.997 |
| $\tau_{500}$ | - | 0.997 |
| $\tau_{630}$ | - | 0.997 |
| $\tau_{800}$ | - | 0.997 |
| $\tau_{1000}$ | - | 0.997 |
| $\tau_{1250}$ | - | 1.000 |
| $\tau_{1600}$ | - | 1.000 |
| $\tau_{2000}$ | - | 1.000 |
| $\tau_{2500}$ | - | 1.000 |
| $\tau_{3150}$ | - | 1.000 |
| $\tau_{4000}$ | - | 1.000 |
| $\tau_{5000}$ | - | 1.000 |
| $\tau_{6300}$ | - | 1.000 |
| $\tau_{8000}$ | - | 1.000 |
| $\tau_{10000}$ | - | 1.000 |

Transmission coefficient τ has not been measured at frequencies below 50 Hz.

Symbols and units

$T_{50...10000}$ Reverberation time, s

$\tau_{50...10000}$ Transmission coefficient, -

$_{50...10000}$ Centre frequency of one-third octave band, Hz

Ducted silencer: FVS 200-1000/600/300

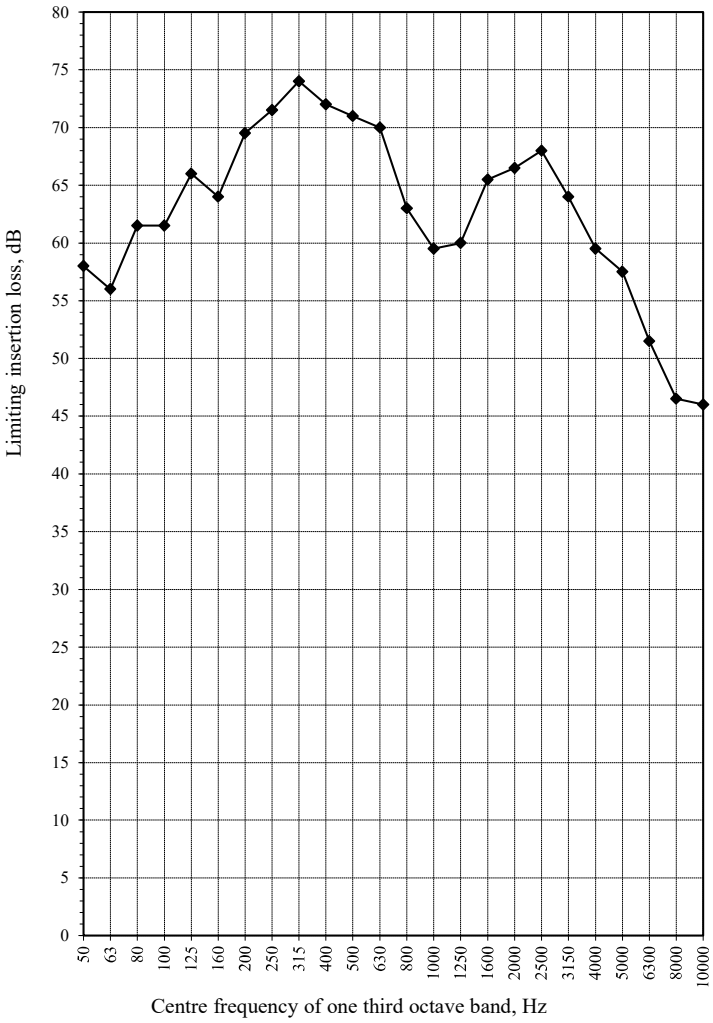
**Limiting insertion loss of the test facility**

ISO 7235:2003

Diameter of the inlet and outlet sections: 200 mm

Length: 15020 mm

| Symbol | Unit | D |
|---|---|---|
| $D_{1/3oct50}$ | dB | 58.0 |
| $D_{1/3oct63}$ | dB | 56.0 |
| $D_{1/3oct80}$ | dB | 61.5 |
| $D_{1/3oct100}$ | dB | 61.5 |
| $D_{1/3oct125}$ | dB | 66.0 |
| $D_{1/3oct160}$ | dB | 64.0 |
| $D_{1/3oct200}$ | dB | 69.5 |
| $D_{1/3oct250}$ | dB | 71.5 |
| $D_{1/3oct315}$ | dB | 74.0 |
| $D_{1/3oct400}$ | dB | 72.0 |
| $D_{1/3oct500}$ | dB | 71.0 |
| $D_{1/3oct630}$ | dB | 70.0 |
| $D_{1/3oct800}$ | dB | 63.0 |
| $D_{1/3oct1000}$ | dB | 59.5 |
| $D_{1/3oct1250}$ | dB | 60.0 |
| $D_{1/3oct1600}$ | dB | 65.5 |
| $D_{1/3oct2000}$ | dB | 66.5 |
| $D_{1/30ct2500}$ | dB | 68.0 |
| $D_{1/3oct3150}$ | dB | 64.0 |
| $D_{1/3oct4000}$ | dB | 59.5 |
| $D_{1/3oct5000}$ | dB | 57.5 |
| $D_{1/3oct6300}$ | dB | 51.5 |
| $D_{1/3oct8000}$ | dB | 46.5 |
| $D_{1/3oct10000}$ | dB | 46.0 |




Symbols and units

| | |
|---|---|
| $D_{1/3oct50...10000}$ | Insertion loss in one-third octave bands, dB |
| 50...10000 | Centre frequency of one third octave band, Hz |

Ducted silencer: FVS 200-1000/600/300

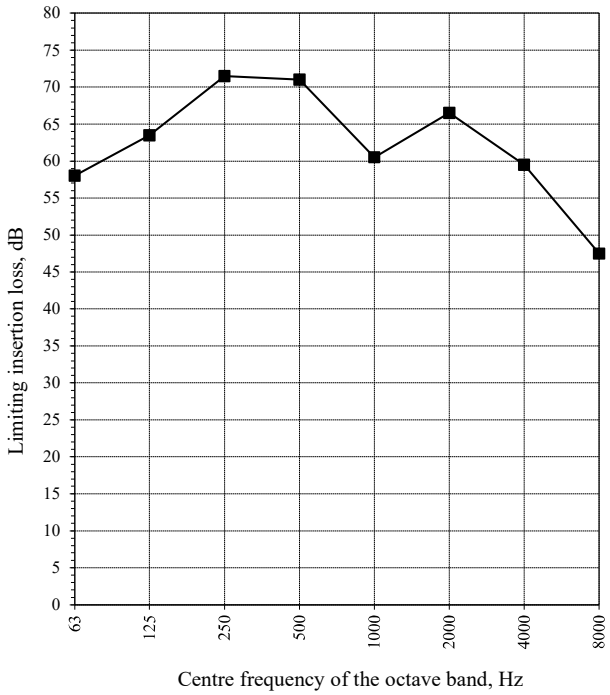
**Limiting insertion loss of the test facility**

ISO 7235:2003

Diameter of the inlet and outlet sections: 200 mm

Length: 15020 mm

| Symbol | Unit | D |
|---|---|---|
| $D_{oct63}$ | dB | 58 |
| $D_{oct125}$ | dB | 64 |
| $D_{oct250}$ | dB | 72 |
| $D_{oct500}$ | dB | 71 |
| $D_{oct1000}$ | dB | 61 |
| $D_{oct2000}$ | dB | 67 |
| $D_{oct4000}$ | dB | 60 |
| $D_{oct8000}$ | dB | 48 |




Symbols and units

$D_{oct63...8000}$ Insertion loss in octave bands, dB

$_{63...8000}$ Centre frequency of octave band, Hz

Ducted silencer: FVS 200-1000

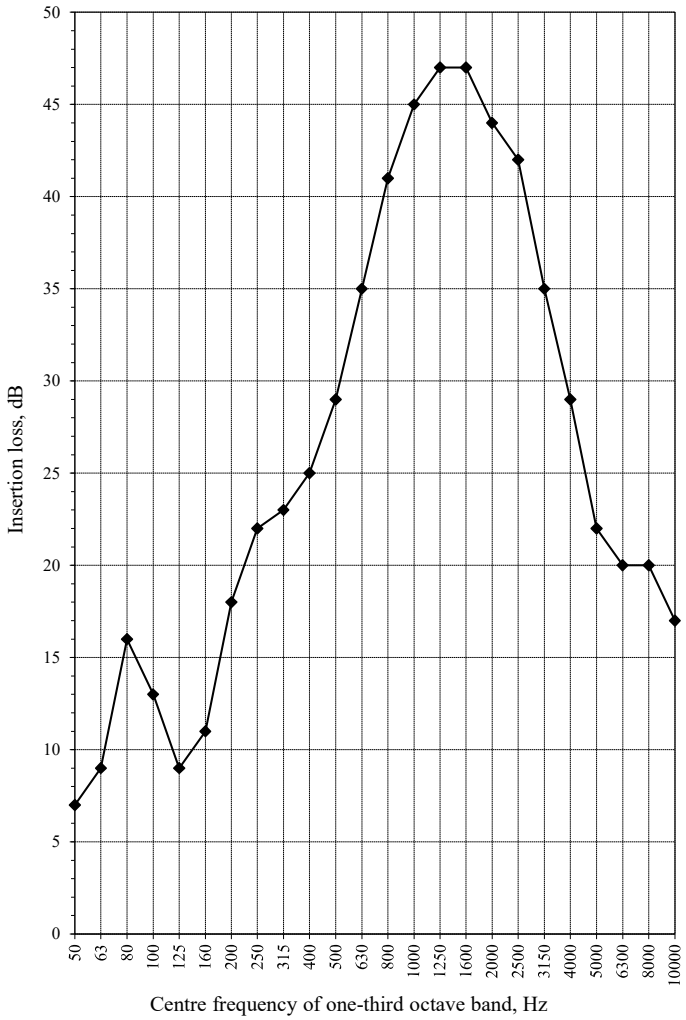
**Insertion loss in one-third octave bands**

ISO 7235:2003

Diameter of the inlet and outlet sections: 200 mm

Length: 1000 mm

| Symbol | Unit | Di |
|---|---|---|
| $D_{1/3oct50}$ | dB | 7 |
| $D_{1/3oct63}$ | dB | 9 |
| $D_{1/3oct80}$ | dB | 16 |
| $D_{1/3oct100}$ | dB | 13 |
| $D_{1/3oct125}$ | dB | 9 |
| $D_{1/3oct160}$ | dB | 11 |
| $D_{1/3oct200}$ | dB | 18 |
| $D_{1/3oct250}$ | dB | 22 |
| $D_{1/3oct315}$ | dB | 23 |
| $D_{1/3oct400}$ | dB | 25 |
| $D_{1/3oct500}$ | dB | 29 |
| $D_{1/3oct630}$ | dB | 35 |
| $D_{1/3oct800}$ | dB | 41 |
| $D_{1/3oct1000}$ | dB | 45 |
| $D_{1/3oct1250}$ | dB | 47 |
| $D_{1/3oct1600}$ | dB | 47 |
| $D_{1/3oct2000}$ | dB | 44 |
| $D_{1/3oct2500}$ | dB | 42 |
| $D_{1/3oct3150}$ | dB | 35 |
| $D_{1/3oct4000}$ | dB | 29 |
| $D_{1/3oct5000}$ | dB | 22 |
| $D_{1/3oct6300}$ | dB | 20 |
| $D_{1/3oct8000}$ | dB | 20 |
| $D_{1/3oct10000}$ | dB | 17 |




Symbols and units

| | |
|---|---|
| Di | Insertion loss, dB |
| $D_{1/3oct50...10000}$ | Insertion loss in one-third octave bands, dB |
| $_{50...10000}$ | Centre frequency of one-third octave band, Hz |

Ducted silencer: FVS 200-1000

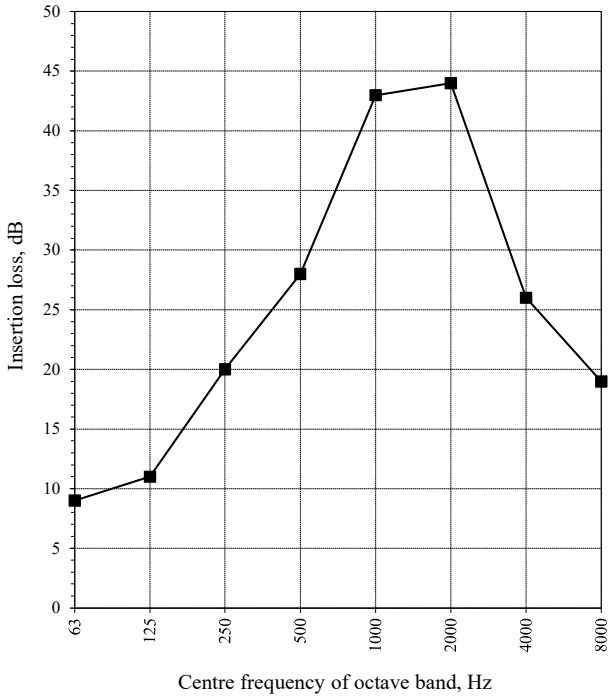
**Insertion loss in octave bands**

ISO 7235:2003

Diameter of the inlet and outlet sections: 200 mm

Length: 1000 mm

| Symbol | Unit | Di |
|---|---|---|
| $D_{oct63}$ | dB | 9 |
| $D_{oct125}$ | dB | 11 |
| $D_{oct250}$ | dB | 20 |
| $D_{oct500}$ | dB | 28 |
| $D_{oct1000}$ | dB | 43 |
| $D_{oct2000}$ | dB | 44 |
| $D_{oct4000}$ | dB | 26 |
| $D_{oct8000}$ | dB | 19 |




Symbols and units

| | |
|---|---|
| Di | Insertion loss, dB |
| $D_{oct63...8000}$ | Insertion loss in octave bands, dB |
| $_{63...8000}$ | Centre frequency of octave band, Hz |

Ducted silencer: FVS 200-1000

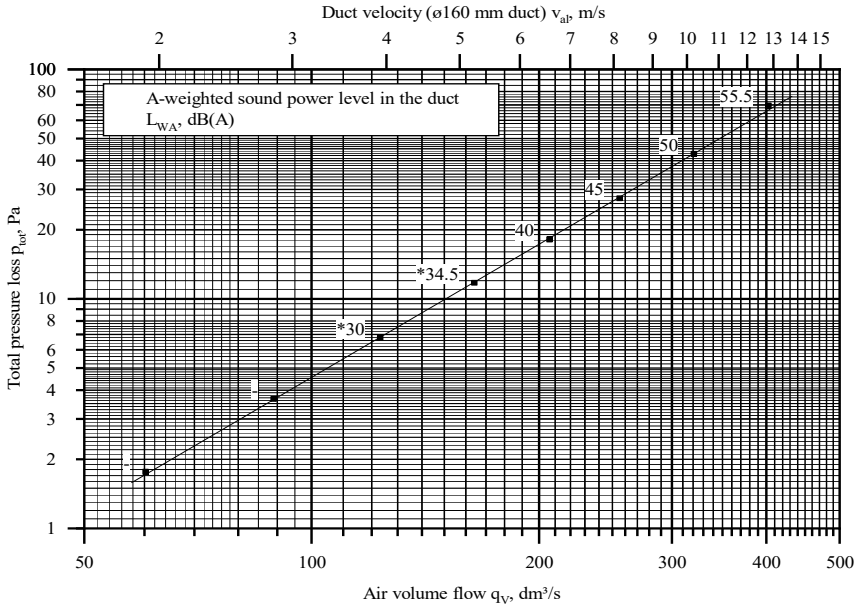
**Pressure loss and flow noise in octave bands**

ISO 7235:2003

Diameter of the inlet and outlet sections: 200 mm

Length: 300 mm

Air density 1,20 kg/m³




| Symbol | Unit | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| $q_V$ | dm³/s | 60.3 | 89.0 | 123 | 164 | 207 | 256 | 321 | 403 |
| $v_{a1}$ | m/s | 1.9 | 2.8 | 3.9 | 5.2 | 6.6 | 8.1 | 10.2 | 12.8 |
| $p_{tot}$ | Pa | 1.8 | 3.7 | 6.7 | 11.7 | 18.1 | 27.4 | 42.6 | 69.3 |
| $\zeta_{tot}$ | - | 0.80 | 0.76 | 0.73 | 0.71 | 0.70 | 0.69 | 0.68 | 0.70 |
| $L_{W63}$ | dB | * | * | 39.9 | 40.7 | 46.1 | 50.3 | 53.8 | 57.5 |
| $L_{W125}$ | dB | * | * | 35.8 | 37.9 | 43.4 | 46.4 | 51.1 | 55.8 |
| $L_{W250}$ | dB | * | * | 29.9 | 35.0 | 39.2 | 42.8 | 46.8 | 51.5 |
| $L_{W500}$ | dB | * | * | 25.8 | 32.8 | 37.7 | 41.8 | 45.9 | 49.8 |
| $L_{W1000}$ | dB | * | * | *19.3 | 28.8 | 35.1 | 40.4 | 45.4 | 50.2 |
| $L_{W2000}$ | dB | * | * | *14.8 | *22.5 | 30.7 | 37.4 | 43.6 | 49.3 |
| $L_{W4000}$ | dB | * | * | *19.9 | *20.3 | *23.5 | *30.3 | 38.2 | 44.9 |
| $L_{W8000}$ | dB | * | * | *26.1 | *26.1 | *26.1 | *26.5 | *29.2 | *35.5 |
| $L_W$ | dB | * | * | 41.9 | 43.9 | 49.1 | 53.1 | 57.1 | 61.5 |
| $L_{WA}$ | dB(A) | * | * | *29.8 | *34.6 | 39.9 | 44.9 | 50.1 | 55.3 |

*) The background noise requirements of standard ISO 3741:2010 have not been met.

Data represent upper bounds to the sound power level of the noise source under test.

Symbols and units

| | |
|---|---|
| $q_V$ | Air volume flow rate, dm³/s |
| $v_{a1}$ | Duct velocity (ø200 mm duct), m/s |
| $p_{tot}$ | Total pressure loss, Pa |
| $\zeta_{tot}$ | Total pressure loss coefficient, - |
| $L_{W63...8000}$ | Sound power level in the duct in octave bands, dB |
| $_{63...8000}$ | Centre frequencies of the octave bands, Hz |
| $L_W$ | Sound power level in the duct, dB |
| $L_{WA}$ | A-weighted sound power level in the duct, dB(A) |

Ducted silencer: FVS 200-600

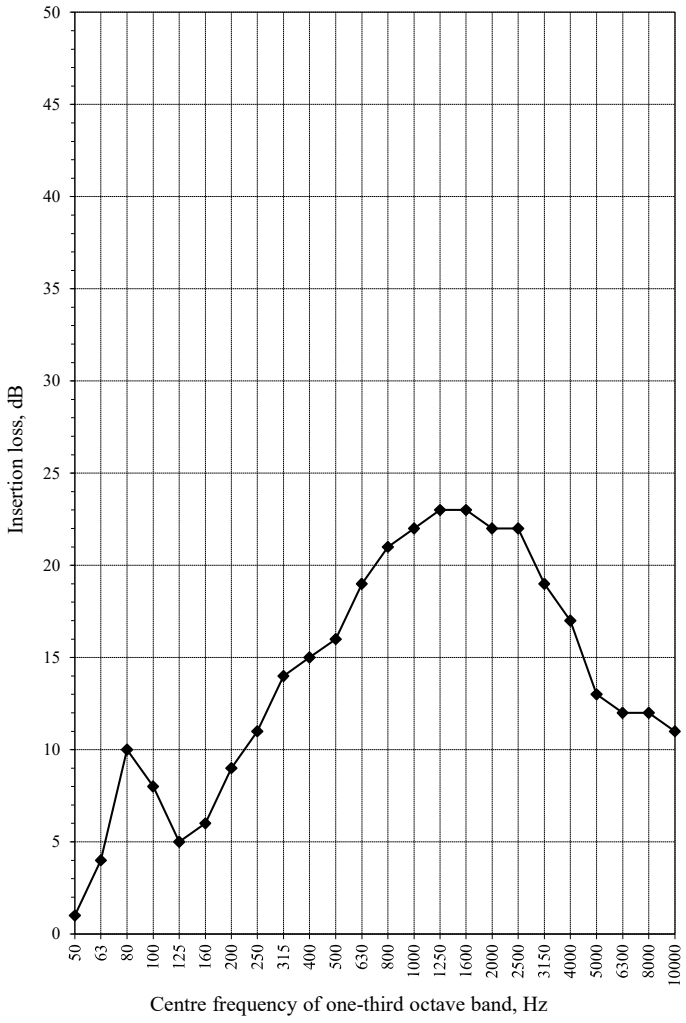
**Insertion loss in one-third octave bands**

ISO 7235:2003

Diameter of the inlet and outlet sections: 200 mm

Length: 600 mm

| Symbol | Unit | Di |
|---|---|---|
| $D_{1/3oct50}$ | dB | 1 |
| $D_{1/3oct63}$ | dB | 4 |
| $D_{1/3oct80}$ | dB | 10 |
| $D_{1/3oct100}$ | dB | 8 |
| $D_{1/3oct125}$ | dB | 5 |
| $D_{1/3oct160}$ | dB | 6 |
| $D_{1/3oct200}$ | dB | 9 |
| $D_{1/3oct250}$ | dB | 11 |
| $D_{1/3oct315}$ | dB | 14 |
| $D_{1/3oct400}$ | dB | 15 |
| $D_{1/3oct500}$ | dB | 16 |
| $D_{1/3oct630}$ | dB | 19 |
| $D_{1/3oct800}$ | dB | 21 |
| $D_{1/3oct1000}$ | dB | 22 |
| $D_{1/3oct1250}$ | dB | 23 |
| $D_{1/3oct1600}$ | dB | 23 |
| $D_{1/3oct2000}$ | dB | 22 |
| $D_{1/3oct2500}$ | dB | 22 |
| $D_{1/3oct3150}$ | dB | 19 |
| $D_{1/3oct4000}$ | dB | 17 |
| $D_{1/3oct5000}$ | dB | 13 |
| $D_{1/3oct6300}$ | dB | 12 |
| $D_{1/3oct8000}$ | dB | 12 |
| $D_{1/3oct10000}$ | dB | 11 |




Symbols and units

| | |
|---|---|
| Di | Insertion loss, dB |
| $D_{1/3oct50...10000}$ | Insertion loss in one-third octave bands, dB |
| $_{50...10000}$ | Centre frequency of one-third octave band, Hz |

Ducted silencer: FVS 200-600

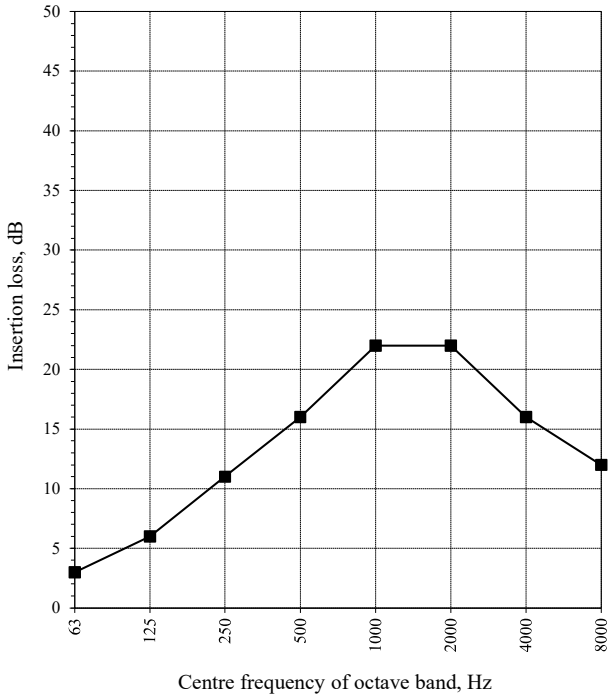
**Insertion loss in octave bands**

ISO 7235:2003

Diameter of the inlet and outlet sections: 200 mm

Length: 600 mm

| Symbol | Unit | Di |
|---|---|---|
| $D_{oct63}$ | dB | 3 |
| $D_{oct125}$ | dB | 6 |
| $D_{oct250}$ | dB | 11 |
| $D_{oct500}$ | dB | 16 |
| $D_{oct1000}$ | dB | 22 |
| $D_{oct2000}$ | dB | 22 |
| $D_{oct4000}$ | dB | 16 |
| $D_{oct8000}$ | dB | 12 |




Symbols and units

| | |
|---|---|
| Di | Insertion loss, dB |
| $D_{oct63...8000}$ | Insertion loss in octave bands, dB |
| $_{63...8000}$ | Centre frequency of octave band, Hz |

Ducted silencer: FVS 200-600

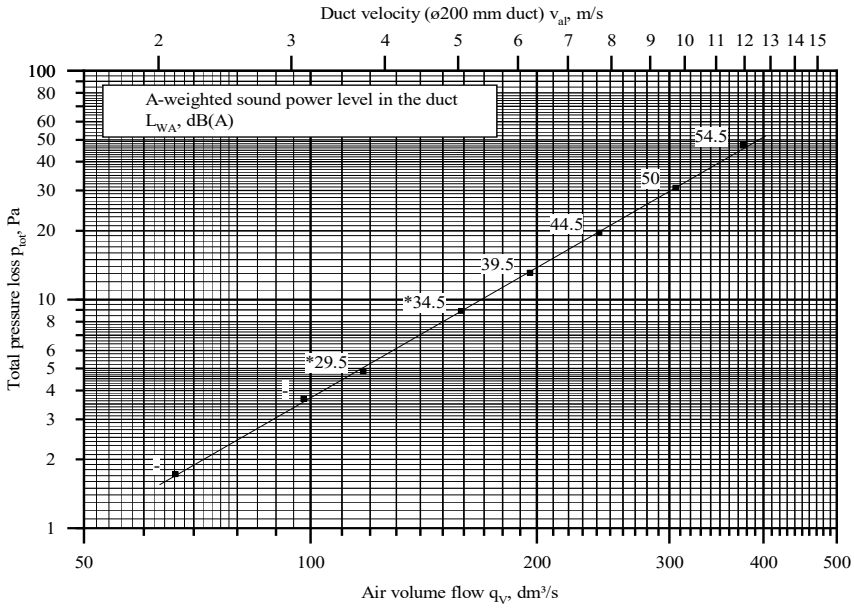
**Pressure loss and flow noise in octave bands**

ISO 7235:2003

Diameter of the inlet and outlet sections: 200 mm

Length: 600 mm

Air density 1,20 kg/m³




| Symbol | Unit | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| $q_V$ | dm³/s | 66.2 | 98.0 | 118 | 159 | 196 | 242 | 306 | 376 |
| $v_{a1}$ | m/s | 2.1 | 3.1 | 3.7 | 5.0 | 6.2 | 7.7 | 9.7 | 12.0 |
| $p_{tot}$ | Pa | 1.7 | 3.7 | 4.8 | 8.9 | 13.1 | 19.6 | 30.7 | 47.2 |
| $\zeta_{tot}$ | - | 0.65 | 0.63 | 0.58 | 0.58 | 0.56 | 0.55 | 0.54 | 0.55 |
| $L_{W63}$ | dB | * | * | *35.7 | 41.8 | 44.6 | 49.9 | 54.3 | 58.3 |
| $L_{W125}$ | dB | * | * | 33.2 | 39.0 | 42.2 | 46.4 | 51.1 | 55.7 |
| $L_{W250}$ | dB | * | * | 29.9 | 35.3 | 38.9 | 42.4 | 46.4 | 50.4 |
| $L_{W500}$ | dB | * | * | 25.7 | 33.1 | 37.7 | 41.9 | 46.0 | 49.2 |
| $L_{W1000}$ | dB | * | * | *18.4 | 28.3 | 34.3 | 39.5 | 44.9 | 49.1 |
| $L_{W2000}$ | dB | * | * | *14.2 | *21.8 | 29.7 | 36.5 | 43.1 | 48.3 |
| $L_{W4000}$ | dB | * | * | *19.8 | *20.3 | *22.4 | *28.8 | 37.2 | 43.7 |
| $L_{W8000}$ | dB | * | * | *26.1 | *26.1 | *26.1 | *26.4 | *28.2 | *33.5 |
| $L_W$ | dB | * | * | *38.9 | 44.8 | 48.0 | 52.7 | 57.3 | 61.5 |
| $L_{WA}$ | dB(A) | * | * | *29.3 | *34.6 | 39.5 | 44.4 | 49.8 | 54.3 |

*) The background noise requirements of standard ISO 3741:2010 have not been met.

Data represent upper bounds to the sound power level of the noise source under test.

Symbols and units

| | |
|---|---|
| $q_V$ | Air volume flow rate, dm³/s |
| $v_{a1}$ | Duct velocity (ø200 mm duct), m/s |
| $p_{tot}$ | Total pressure loss, Pa |
| $\zeta_{tot}$ | Total pressure loss coefficient, - |
| $L_{W63...8000}$ | Sound power level in the duct in octave bands, dB |
| $_{63...8000}$ | Centre frequencies of the octave bands, Hz |
| $L_W$ | Sound power level in the duct, dB |
| $L_{WA}$ | A-weighted sound power level in the duct, dB(A) |

Ducted silencer: FVS 200-300

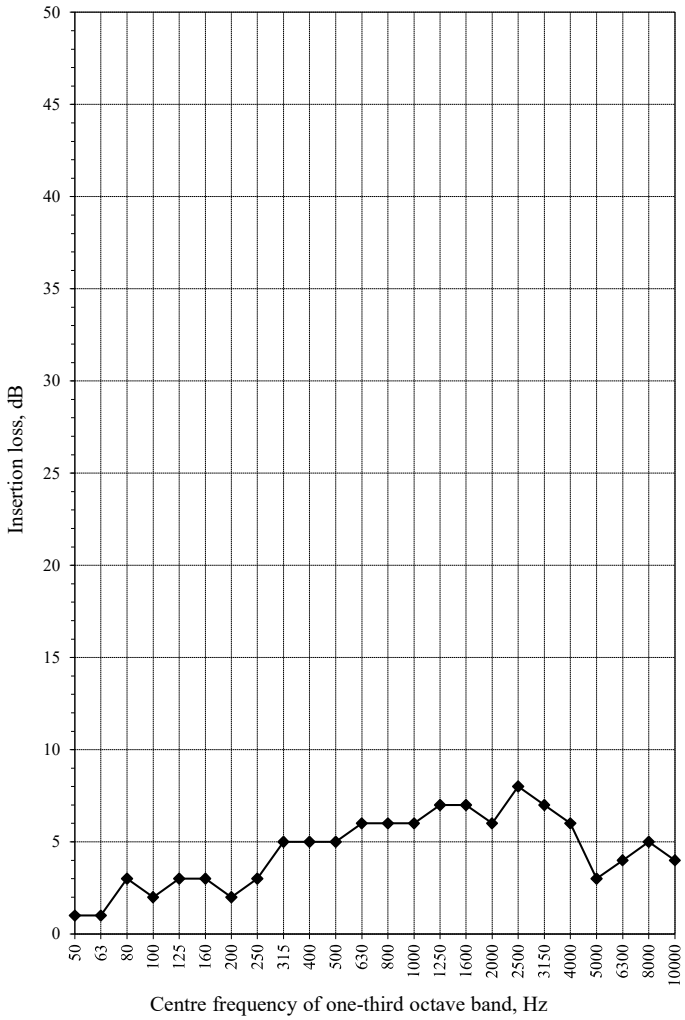
**Insertion loss in one-third octave bands**

ISO 7235:2003

Diameter of the inlet and outlet sections: 200 mm

Length: 300 mm

| Symbol | Unit | Di |
|---|---|---|
| $D_{1/3oct50}$ | dB | 1 |
| $D_{1/3oct63}$ | dB | 1 |
| $D_{1/3oct80}$ | dB | 3 |
| $D_{1/3oct100}$ | dB | 2 |
| $D_{1/3oct125}$ | dB | 3 |
| $D_{1/3oct160}$ | dB | 3 |
| $D_{1/3oct200}$ | dB | 2 |
| $D_{1/3oct250}$ | dB | 3 |
| $D_{1/3oct315}$ | dB | 5 |
| $D_{1/3oct400}$ | dB | 5 |
| $D_{1/3oct500}$ | dB | 5 |
| $D_{1/3oct630}$ | dB | 6 |
| $D_{1/3oct800}$ | dB | 6 |
| $D_{1/3oct1000}$ | dB | 6 |
| $D_{1/3oct1250}$ | dB | 7 |
| $D_{1/3oct1600}$ | dB | 7 |
| $D_{1/3oct2000}$ | dB | 6 |
| $D_{1/3oct2500}$ | dB | 8 |
| $D_{1/3oct3150}$ | dB | 7 |
| $D_{1/3oct4000}$ | dB | 6 |
| $D_{1/3oct5000}$ | dB | 3 |
| $D_{1/3oct6300}$ | dB | 4 |
| $D_{1/3oct8000}$ | dB | 5 |
| $D_{1/3oct10000}$ | dB | 4 |




Symbols and units

| | |
|---|---|
| Di | Insertion loss, dB |
| $D_{1/3oct50...10000}$ | Insertion loss in one-third octave bands, dB |
| $_{50...10000}$ | Centre frequency of one-third octave band, Hz |

Ducted silencer: FVS 200-300

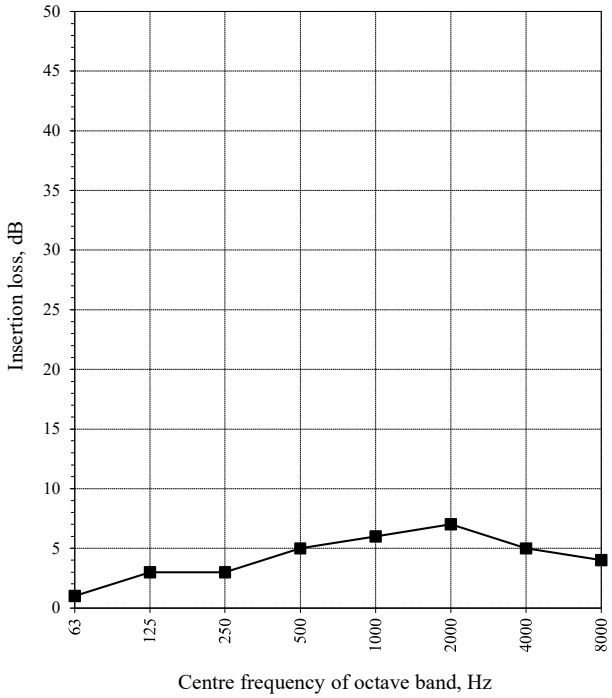
**Insertion loss in octave bands**

ISO 7235:2003

Diameter of the inlet and outlet sections: 200 mm

Length: 300 mm

| Symbol | Unit | Di |
|---|---|---|
| $D_{oct63}$ | dB | 1 |
| $D_{oct125}$ | dB | 3 |
| $D_{oct250}$ | dB | 3 |
| $D_{oct500}$ | dB | 5 |
| $D_{oct1000}$ | dB | 6 |
| $D_{oct2000}$ | dB | 7 |
| $D_{oct4000}$ | dB | 5 |
| $D_{oct8000}$ | dB | 4 |




Symbols and units

| | |
|---|---|
| Di | Insertion loss, dB |
| $D_{oct63...8000}$ | Insertion loss in octave bands, dB |
| $_{63...8000}$ | Centre frequency of octave band, Hz |

Ducted silencer: FVS 200-300

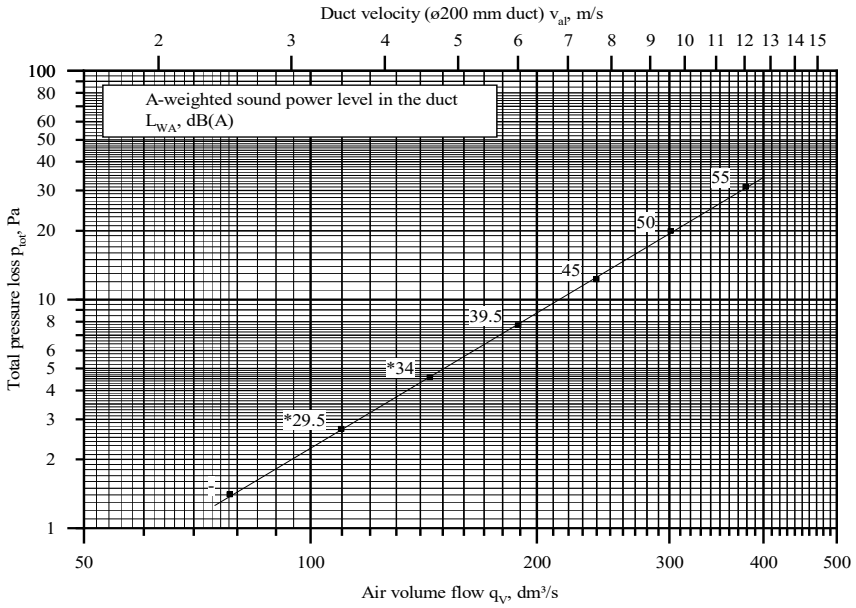
**Pressure loss and flow noise in octave bands**

ISO 7235:2003

Diameter of the inlet and outlet sections: 200 mm

Length: 300 mm

Air density 1,20 kg/m³




| Symbol | Unit | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| $q_V$ | dm³/s | 78.1 | 110 | 144 | 189 | 240 | 301 | 379 |
| $v_{a1}$ | m/s | 2.5 | 3.5 | 4.6 | 6.0 | 7.6 | 9.6 | 12.0 |
| $p_{tot}$ | Pa | 1.4 | 2.7 | 4.6 | 7.7 | 12.3 | 20.0 | 31.1 |
| $\zeta_{tot}$ | - | 0.38 | 0.37 | 0.36 | 0.36 | 0.35 | 0.36 | 0.36 |
| $L_{W63}$ | dB | * | *35.8 | 39.9 | 45.4 | 49.8 | 53.7 | 58.1 |
| $L_{W125}$ | dB | * | 34.5 | 38.5 | 43.3 | 47.4 | 52.0 | 56.7 |
| $L_{W250}$ | dB | * | 31.0 | 34.9 | 39.2 | 43.1 | 47.2 | 51.6 |
| $L_{W500}$ | dB | * | 26.9 | 33.0 | 37.8 | 42.1 | 46.1 | 49.6 |
| $L_{W1000}$ | dB | * | *16.2 | 26.9 | 34.6 | 39.9 | 45.0 | 49.6 |
| $L_{W2000}$ | dB | * | *13.7 | *19 | 29.3 | 37.3 | 43.6 | 49.1 |
| $L_{W4000}$ | dB | * | *19.8 | *20 | *22.1 | *29.2 | 37.7 | 44.8 |
| $L_{W8000}$ | dB | * | *26 | *26 | *26 | *26.3 | *28.1 | *33.7 |
| $L_W$ | dB | * | *39.5 | 43.6 | 48.7 | 53.1 | 57.4 | 61.9 |
| $L_{WA}$ | dB(A) | * | *29.6 | *34 | 39.6 | 44.9 | 50.1 | 55.0 |

*) The background noise requirements of standard ISO 3741:2010 have not been met.

Data represent upper bounds to the sound power level of the noise source under test.

Symbols and units

| | |
|---|---|
| $q_V$ | Air volume flow rate, dm³/s |
| $v_{a1}$ | Duct velocity (ø200 mm duct), m/s |
| $p_{tot}$ | Total pressure loss, Pa |
| $\zeta_{tot}$ | Total pressure loss coefficient, - |
| $L_{W63...8000}$ | Sound power level in the duct in octave bands, dB |
| $_{63...8000}$ | Centre frequencies of the octave bands, Hz |
| $L_W$ | Sound power level in the duct, dB |
| $L_{WA}$ | A-weighted sound power level in the duct, dB(A) |

**Instruments used:**

| Instrument | Type code | Serial number | Calibrated |
|---|---|---|---|
| Micromanometer | Furness FC012 | 9802124 | 07/2021 |
| Micromanometer | Furness FC012 | 110057 | 07/2021 |
| Micromanometer | Furness FC012 | 9802125 | 07/2021 |
| Barometer | Vaisala PTB220BAC2A1 | W4230002 | 07/2021 |
| Hygrometer | Rotronic HTT | 8501156 | 11/2021 |
| Temperature logger | Agilent 34970A | MY44071581 | 07/2021 |
| Pistonphone | B&K 4228 | 3063558 | 01/2021 |
| Microphone | B&K 4943 | 2415046 | before measurements |
| Microphone preamplifier | B&K 2660 | 15040598 | |
| Real-time analyser | Norsonic RT 830-2 | 11504 | 07/2020 |
| Rotating microphone stand | B&K 3923 | 1678218 | |
| Reverberation room | 298 m³ | | |