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ISO 13261-1

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Sound power rating of air-conditioning and air-source heat pump equipment —

Part 1:
Non-ducted outdoor equipment

Détermination du niveau de puissance acoustique des climatiseurs et pompes à chaleur sur l'air —

Partie 1: Appareils extérieurs non raccordés

Reference number
ISO 13261-1:1998(E)

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 13261-1 was prepared by Technical Committee ISO/TC 86, *Refrigeration*, Subcommittee SC 6, *Factory-made air-conditioning and heat pump units*.

Annex A forms an integral part of this part of ISO 13261. Annex B is for information only.

Sound power rating of air-conditioning and air-source heat pump equipment —

Part 1:
Non-ducted outdoor equipment

1 Scope

This part of ISO 13261 specifies methods for the determination of sound power ratings of air-conditioning and air-source heat pump equipment to be used outdoors.

It is applicable to the sound power rating of the outdoor sections of factory-made residential, commercial and industrial air-conditioning and air-source heat pump equipment which are electrically driven with mechanical compression and which are intended to be installed outdoors. This part of ISO 13261 includes both non-ducted equipment and equipment with ducts that terminate indoors. It includes both an octave-band sound power level rating and a single-number A-weighted overall sound power level rating.

This part of ISO 13261 does not apply to equipment which has ducted outdoor sections, or to chillers, products with variable speed compressors, or industrial process equipment.

NOTE — The terms "air-conditioner" and "equipment" are used to mean "air-conditioners and air-source heat pumps" in this part of ISO 13261.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 13261. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 13261 are encouraged to investigate the possibility of applying the most recent editions of the standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 3742:1988, *Acoustics — Determination of sound power levels of noise sources — Precision methods for discrete-frequency and narrow-band sources in reverberation rooms.*

ISO 3743-1:1994, *Acoustics — Determination of sound power levels of noise sources — Engineering methods for small, movable sources in reverberant fields.— Part 1: Comparison method for hard-walled test rooms.*

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

ISO 3744:1994, *Acoustics — Determination of sound power levels of noise sources using sound pressure — Engineering method in an essentially free field over a reflecting plane.*

ISO 3745:1977, *Acoustics — Determination of sound power levels of noise sources — Precision methods for anechoic and semi-anechoic rooms.*

ISO 4871:1996, *Acoustics — Declaration and verification of noise emission values of machinery and equipment*.

ISO 5151:1994, *Non-ducted air-conditioners and heat pumps — Testing and rating for performance.*

ISO 9614-1:1993, *Acoustics — Determination of sound power levels of noise sources using sound intensity — Part 1: Measurement at discrete points.*

ISO 9614-2:1996, *Acoustics — Determination of sound power levels of noise sources using sound intensity — Part 2: Measurement by scanning.*

ISO 12001:1996, *Acoustics — Noise emitted by machinery and equipment — Rules for the drafting and presentation of a noise test code.*

ISO 13253:1995, *Ducted air-conditioners and air-to-air heat pumps — Testing and rating for performance*.

3 Definitions

For the purposes of this part of ISO 13261, the following definitions apply.

3.1
air-conditioner
one or more factory-made assemblies which normally include an evaporator or cooling coil, a compressor and condenser combination, and may also include a heating function; where such equipment is provided in more than one assembly, the separated assemblies shall be designed to be used together

NOTE — The requirements for sound ratings specified in this part of ISO 13261 are based on the use of matched assemblies.

3.2
air-source heat pump
one or more factory-made assemblies which normally include an indoor conditioning coil, a compressor and outdoor coil (including means to provide a heating function), and may optionally include a cooling function; when such equipment is provided in more than one assembly, the separated assemblies shall be designed to be used together

NOTE — The requirements for sound ratings specified in this part of ISO 13261 are based on the use of matched assemblies.

3.3
sound power level, L_W
ten times the logarithm to the base 10 of the ratio of the sound power radiated by the sound source under test to a reference sound power, expressed in decibels (dB)

NOTE — The reference sound power used in this part of ISO 13261 is 1 pW (picowatt).

3.4
sound pressure level, L_p
ten times the logarithm to the base 10 of the ratio of a given sound pressure squared to a reference sound pressure squared, expressed in decibels (dB)

NOTE — The reference sound pressure used in this part of ISO 13261 is 20 µPa (micropascals).

3.5
octave band
band of sound covering a range of frequencies such that the highest is twice the lowest

NOTE — The octave bands used in this part of ISO 13261 are those shown in table 1.

3.6
one-third-octave band
band of sound covering a range of frequencies such that the highest is the cube root of two (approximately 1,26) times the lowest

NOTE — The one-third-octave bands used in this part of ISO 13261 are those shown in table 1.

3.7
hertz (Hz)
unit of frequency in cycles per second

3.8
published rating
statement of the assigned values of those performance characteristics, under stated rating conditions, by which air-conditioning equipment may be chosen to fit its application

NOTE — These values apply to all equipment of identical size and type (model) and nominal capacity produced by the same manufacturer for the specific temperature conditions for which the equipment is rated for cooling and/or heating capacities.

3.8.1
standard rating
rating based on tests performed at standard rating conditions

3.8.2
application rating
rating based on tests performed at other than standard rating conditions

Table 1 — Standard frequency bands

Values in hertz

Octave band			One-third-octave band		
Lower frequency limit	**Centre* frequency**	**Upper frequency limit**	**Lower frequency limit**	**Centre* frequency**	**Upper frequency limit**
44	63**	90	44 56 71	50** 63** 80**	56 71 90
90	125	180	90 112 140	100 125 160	112 140 180
180	250	355	180 224 280	200 250 315	224 280 355
355	500	710	355 450 560	400 500 630	450 560 710
710	1 000	1 400	710 900 1 120	800 1 000 1 250	900 1 120 1 400
1 400	2 000	2 800	1 400 1 800 2 240	1 600 2 000 2 500	1 800 2 240 2 800
2 800	4 000	5 600	2 800 3 550 4 500	3 150 4 000 5 000	3 550 4 500 5 600
5 600	8 000	11 200	5 600 7 100 9 000	6 300 8 000 10 000	7 100 9 000 11 200

* The centre frequency is the geometric mean of the frequency limits.
** These bands are considered to be optional.
NOTE — The frequencies in this table have been rounded off slightly for ordinary use.

4 Requirements for conducting sound tests

4.1 Testing requirements for equipment

4.1.1 Sound tests shall be conducted in accordance with the test methods (Grade 1 or Grade 2 as identified in ISO 12001) specified in ISO 3742:1988, ISO 3743-1, ISO 3743-2, ISO 3744, ISO 3745, ISO 9614-1 and ISO 9614-2. (See table 2.)

Table 2 — Sound power ratings — Methods and information

International Standard	Octave-band sound power level data			Overall A-weighted sound power level data	
	63 Hz Optional data	125 Hz to 4 kHz Rating data	8 kHz Rating data	Normal procedure	Special procedure
ISO 3742:1988	See 4.3	·	·	·	
ISO 3743-1*	See 4.3	·	·	·	
ISO 3743-2*	See 4.3	·	·	·	
ISO 3744	See 4.3	·	·	·	
ISO 3745	See 4.3	·	·	·	
ISO 9614-1	See 4.3	·	See 4.2		See 5.4.1.2
ISO 9614-2	See 4.3	·	See 4.2		See 5.4.1.2
* ISO 3743-1 and ISO 3743-2 are only to be used for testing small, portable equipment.					

4.1.2 High air speeds and adverse air streams causing turbulence may affect the sound measured by a microphone. These effects will tend to result in an overestimation of the sound power of the product. Thus, it is recommended that the air speed at the microphone should not exceed 2 m/s. The error due to air streams may be checked by repeating the measurement at a larger distance from the product. If the resulting sound power levels at both measurement distances are within ±1,0 dB, the air-stream effects are negligible.

4.2 Data to be taken

4.2.1 Sound power levels shall be determined in decibels (ref. 1 pW) for the one-third-octave bands from 100 Hz to 10 000 Hz, or the full-octave bands from 125 Hz to 8 000 Hz, as listed in table 1. Sound power levels shall be determined in accordance with the specific International Standard on acoustics, listed in clause 2, which was used to conduct the test.

4.2.2 If testing is conducted in accordance with ISO 9614, data are to be reported only for frequencies up to and including 6 300 Hz. Data above 6 300 Hz can only be provided for information purposes when using ISO 9614 because the uncertainties are not defined above 6 300 Hz. In addition, special con-sideration must be given to the determination of the overall A-weighted sound power level rating (see 5.4) using the procedures established in annex A.

NOTE — If additional information on sound power levels at 50 Hz, 63 Hz and 80 Hz one-third-octave bands or the 63 Hz octave band is to be optionally provided, it is recommended that the standard rating temperature conditions and the measurement methods in the applicable standards be respected.

4.3 Special testing considerations for the optional 63 Hz octave band

4.3.1 When extending the testing procedures in ISO 3742, ISO 3743-1, ISO 3743-2 and annex A below 100 Hz, the standard deviation shall not exceed 5 dB.

4.3.2 When testing in accordance with ISO 3744, the acoustical environment shall have an acoustical environmental correction K_2 of less than or equal to 2 dB.

4.3.3 When testing in accordance with ISO 3745, the acoustical environment shall have an acoustical environmental correction K_2 of less than or equal to 0,5 dB.

4.3.4 When testing in accordance with ISO 9614, a larger microphone spacer will allow measurements at lower frequencies but the field indicators of this part of ISO 13261 shall be satisfied.

4.4 Use of windscreen

The use of a foam windscreen on the microphone is required in these tests. The effect of the windscreen on the microphone response shall not be more than ±1 dB for frequencies of 50 Hz to 4 000 Hz or ±1,5 dB for frequencies of 4 000 Hz to 10 000 Hz. Sound measurements shall not be made with air velocities over the microphone exceeding 2 m/s.

4.5 Equipment mounting

4.5.1 All equipment shall be mounted according to the manufacturer's installation instructions. If any deviations from these instructions are necessary, they shall be made in a manner that will not affect the acoustic performance of the equipment, and such mounting deviations shall be reported.

4.5.2 In the case of wall-mounted equipment, the mounting wall should be of heavy masonry or equivalent construction (normal incidence absorption coefficient of less than 0,06 over the frequency range of interest), or an auxiliary mounting platform shall be provided to minimize wall vibration effects. Where a single packaged air-conditioner can be installed partly outdoors and partly indoors (such as a window air-conditioner), it shall be mounted in accordance with the manufacturer's installation instructions into a partition which is impervious to sound and shall include any wall sleeves, mounting frames or mounting brackets normally supplied with the equipment.

5 Sound rating procedures

5.1 General

This part of ISO 13261 uses both an octave-band sound power level (L_W) and a single-number A-weighted overall sound power level (L_{WA}) rating system. Either one-third-octave band sound power levels or octave-band sound power levels may be used to obtain these ratings. Sound ratings shall be determined in accordance with the operating conditions established in the performance rating standards for the equipment.

NOTE — To provide additional information as shown in annex B, the one-third-octave band sound power levels are adjusted to reflect the subjective response to any discrete frequency components. The discrete frequency adjusted data are then converted into a single-number, tone-adjusted A-weighted overall sound power level sound quality indicator (L_{WAT}).

5.2 Determination of equipment sound power levels

Equipment sound power levels for each octave band or one-third-octave band shown in table 1 shall be determined in accordance with clause 4. The sound power levels shall be expressed in decibels (ref. 1 pW) for each octave band or one-third-octave band.

5.3 Determination of the octave band sound power level rating, L_W

The octave band sound power level rating for the specified conditions shall be determined directly from the measured octave band levels (see 4.2) or can be calculated from the one-third-octave band sound power levels using equation (1).

$$L_{W(i)} = 10 \log_{10}\left[\sum_{n=1}^{N} 10^{L_{W(n)}/10}\right] \text{dB} \qquad \ldots (1)$$

where

$L_{W(i)}$ is the octave band sound power level rating, in decibels, for the specific i^{th} octave band from 125 Hz to 8 000 Hz; this may also optionally include the 63 Hz octave band when one-third-octave band test data are available;

$L_{W(n)}$ is the one-third-octave band sound power level corresponding to the n^{th} band;

N is the total number of one-third-octave bands in the i^{th} octave band (N = 3).

5.4 Determination of the A-weighted overall sound power level rating, L_{WA}

The single-number, A-weighted overall sound power level rating is obtained by logarithmically summing either the converted A-weighted one-third-octave band sound power data or the converted A-weighted octave band sound power data.

5.4.1 Conversion of one-third- or full-octave band sound power levels to A-weighted sound power band levels

The A-weighted sound power band levels shall be obtained by adding the appropriate conversion values given in table 3.

5.4.1.1 When testing is conducted in accordance with ISO 3742, ISO 3743-1, ISO 3743-2, ISO 3744 or ISO 3745, the equipment sound power levels obtained as specified in 5.2 shall be converted to A-weighted sound power levels by adding the appropriate conversion values given in table 3. The overall A-weighted sound power level rating shall then be calculated as specified in 5.4.2.

5.4.1.2 When testing is conducted in accordance with ISO 9614, the special procedure described in annex A shall be employed to determine if an overall A-weighted sound power level rating can be considered to be valid.

Table 3 — A-Weighted conversions

Band centre frequency Hz	**One-third-octave band conversions** dB	**Octave band conversions** dB
50	– 30,2	
63	– 26,2	– 26,2
80	– 22,5	
100	– 19,1	
125	– 16,1	– 16,1
160	– 13,4	
200	– 10,9	
250	– 8,6	– 8,6
315	– 6,6	
400	– 4,8	
500	– 3,2	– 3,2
630	– 1,9	
800	– 0,8	
1 000	0	0
1 250	+ 0,6	
1 600	+ 1,0	
2 000	+ 1,2	+ 1,2
2 500	+ 1,3	
3 150	+ 1,2	
4 000	+ 1,0	+ 1,0
5 000	+ 0,5	
6 300	– 0,1	
8 000	– 1,1	– 1,1
10 000	– 2,5	

5.4.2 Calculation of the A-weighted overall sound power level rating, L_{WA}

The A-weighted overall sound power level rating for the specified conditions shall be determined from the A-weighted full- or one-third-octave band sound power levels obtained in 5.4.1 by using equation (2).

$$L_{WA(i)} = 10 \log_{10}\left[\sum_{n=1}^{N} 10^{L_{WA(n)}/10}\right] \text{dB} \quad \ldots (2)$$

where

L_{WA} is the A-weighted overall sound power level rating, in decibels;

$L_{WA(n)}$ is the A-weighted one-third-octave or the octave band level in the n^{th} band;

N is the total number of A-weighted one-third-octave bands or octave bands

where

N = 21 for 100 Hz to 10 000 Hz for standard one-third-octave bands, or

N = 24 for 50 Hz to 10 000 Hz to include low frequency one-third-octave bands, or

N = 7 for 125 Hz to 8 000 Hz for standard octave bands, or

N = 8 for 63 Hz to 8 000 Hz to include low frequency octave bands.

5.5 Standard rating conditions

Standard sound ratings shall be determined at the rating conditions specified in 5.5.1 through 5.5.4.

5.5.1 Electrical characteristics

Tests shall be performed at the rated voltage, phase and frequency specified on the equipment nameplate, and measured at the equipment's supply connection. For equipment with dual nameplate voltage ratings, standard sound tests shall be performed at both voltages. The higher of the two ratings obtained shall be the standard sound rating, or both ratings shall be used and suitably identified. For equipment with dual nameplate frequencies, standard sound tests shall be performed at both frequencies. The higher of the two ratings shall be the standard sound ratings or both ratings shall be used and suitably identified.

5.5.2 Air flow

The air flow on both the indoor-side and the outdoor-side shall be the same as that required to produce the rated cooling and heating capacities under the International Standard used for rating the specific type of equipment being tested.

5.5.3 Operation of equipment

All components required to conduct the standard thermal rating test shall be operated while data are being taken.

5.5.3.1 Cooling operations

The test conditions for conducting the acoustical rating tests during cooling operations shall be those used to rate the cooling capacities (T_1 and/or T_2 and/or T_3) of those units. These are specified in ISO 5151 and in ISO 13253.

5.5.3.2 Heating operations

The test conditions for conducting acoustical rating tests during heating operations for free-delivery air-source heat pumps shall be those used to rate the heating capacities (high and/or low but not the extra low temperature conditions) of those units. These are specified in ISO 5151, in ISO 13253, or in the International Standard for the specific type of equipment being tested.

5.5.4 Indoor side operating conditions

The indoor side shall be maintained as specified in 5.5.4.1 or 5.5.4.2.

5.5.4.1 Single package units

Tests shall be conducted at the air flow specified for the standard rating tests for cooling in ISO 13253 or in ISO 5151.

5.5.4.2 Split-system units

The indoor refrigeration load shall be maintained at the values required to duplicate those encountered in the standard rating tests specified in ISO 13253 or in ISO 5151.

5.5.5 Test condition tolerances

5.5.5.1 The allowable temperature tolerances for the sound rating tests are ±1,0 °C for water temperatures and ±3,0 °C for air temperatures.

5.5.5.2 When indoor-side refrigeration loads are simulated by a method not requiring air, the following tolerances apply:

suction gas temperature at compressor: ±3,0 °C;

evaporator pressure: ±14 kPa.

6 Published ratings

6.1 General

6.1.1 Published ratings shall consist of two parts:

a) the octave band sound power level (L_W) for each of the bands from 125 Hz to 8 000 Hz, except when using ISO 9614 (see 4.2.2), and

b) the A-weighted overall sound power level rating (L_{WA}).

6.1.2 The ISO acoustical rating standard, the test method and the Grade No. of the test method used to determine the sound power level rating, and this part of ISO 13261 shall be clearly identified with the published sound power ratings.

6.1.3 All published sound power ratings shall be expressed in decibels rounded to the nearest decibel. The published sound power rating of any equipment tested in accordance with this part of ISO 13261 shall conform to the requirements established in 4.2 of ISO 4871:1996 concerning the uncertainty of measurement with respect to the precision of the measurement method.

NOTE — Published information may include the tone-adjusted A-weighted sound power level sound quality indicator (L_{WAT}) derived from the values obtained at the cooling and heating capacity rating conditions for air-source heat pumps and air-conditioners.

6.2 Standard ratings

Standard ratings shall be obtained at all cooling and heating capacity rating conditions for air-source heat pumps and air-conditioners, and shall be individually stated for each condition. (See 5.5.)

6.3 Application ratings

Wherever application ratings are published, they shall be accompanied by the standard sound power ratings, clearly designated as such. Published application ratings shall include a clear statement of the thermal conditions at which the ratings apply.

Annex A
(normative)

Special rating procedure using ISO 9614

A.1 Scope

This special rating procedure is established to determine if ISO 9614 can be used to obtain a valid overall A-weighted sound power level rating which is equivalent to a rating obtained using other International Standards specified in clause 2. This special rating procedure is required because the uncertainties are not defined for frequencies above 6 300 Hz when using ISO 9614.

A.2 Procedure

A.2.1 Calculate the overall A-weighted sound power level using unrounded one-third-octave band data from 100 Hz to 6 300 Hz.

A.2.2 Calculate the overall A-weighted sound power level using unrounded octave band data from 100 Hz to 10 000 Hz (see 5.4).

A.2.3 Compare the two overall A-weighted sound power level values calculated in A.2.1 and A.2.2.

A.2.3.1 If the difference is 1 dB or less, the 100 Hz to 10 000 Hz calculated A-weighted value can be considered to be valid. This value shall be rounded to the nearest decibel and used as the rating.

A.2.3.2 If the difference between the two overall A-weighted sound power level values is greater than 1 dB, a valid overall A-weighted sound power rating cannot be stated.

Annex B
(informative)

Determination of the single-number, tone-adjusted A-weighted overall sound power level sound quality indicator (L_{WAT})

NOTE — The single-number, tone-adjusted A-weighted overall sound power level sound quality indicator has been developed as a means to account for the undesirable effect of audible tones within a sound spectrum.

B.1 Adjustment of one-third-octave band sound power level data to A-weighted one-third octave band sound power level data

Refer to 5.4.1.

B.2 Adjustment of A-weighted one-third-octave band sound power level data for discrete frequencies response.

B.2.1 Whenever the sound power level of any one-third-octave band determined as in 5.2 exceeds the average of the two adjacent bands by 2 dB or more, the level of that band shall be arithmetically adjusted in accordance with table B.1. In making these adjustments, the projections shall be rounded off to the next higher 0,5 dB.

Table B.1 — Adjustments for discrete frequency response

One-third-octave band Hz			Projection of band level over average of adjacent band levels dB						
Lower frequency limit	Centre frequency*	Upper frequency limit	2,0	2,5	3,0 to 3,5	4,0 to 4,5	5,0 to 5,5	6,0 to 8,0	Over 8,0
44	50	56	†	†	†	†	†	†	†
56	63	71	†	†	†	†	†	†	†
71	80	90	†	†	†	†	†	†	†
90	100	112	†	†	†	†	†	†	†
112	125	140	– 0,5	– 0,5	– 0,5	– 0,5	– 0,5	– 1,0	– 1,0
140	160	180	0	0	0	0	0	0	0
180	200	224	+ 0,5	+ 0,5	+ 0,5	+ 0,5	+ 1,0	+ 1,0	+ 1,0
224	250	280	1,0	1,0	1,0	1,5	1,5	1,5	2,0
280	315	355	1,0	1,5	1,5	2,0	2,0	2,5	2,5
355	400	450	1,5	2,0	2,0	2,5	2,5	3,0	3,0
450	500	560	2,0	2,0	2,5	2,5	3,0	3,0	3,5
560	630	710	2,0	2,5	2,5	3,0	3,5	3,5	4,0
710	800	900	2,5	2,5	3,0	3,5	3,5	4,0	4,5
900	1 000	1 120	2,5	3,0	3,0	3,5	4,0	4,5	4,5
1 120	1 250	1 400	2,5	3,0	3,5	4,0	4,0	4,5	5,0
1 400	1 600	1 800	3,0	3,0	3,5	4,0	4,5	5,0	5,0
1 800	2 000	2 240	3,0	3,5	4,0	4,5	4,5	5,0	5,5
2 240	2 500	2 800	3,0	3,5	4,0	4,5	5,0	5,0	5,5
2 800	3 150	3 550	3,0	3,5	4,0	4,5	5,0	5,5	5,5
3 550	4 000	4 500	3,0	3,5	4,0	4,5	5,0	5,5	6,0
4 500	5 000	5 600	3,0	3,5	4,0	4,5	5,0	5,5	6,0
5 600	6 300	7 100	3,0	3,5	4,0	4,5	5,0	5,5	6,0
7 100	8 000	9 000	3,0	3,5	4,0	4,5	5,0	5,5	6,0
9 000	10 000	11 200	†	†	†	†	†	†	†

* The centre frequency is the geometric mean of the frequency limits.
† Discrete frequency adjustments not applicable.

NOTE — All of the upper and lower frequencies in the above table have been rounded off slightly for ordinary use.

B.2.2 The adjustments shown in table B.1 may also be made using the following equation for frequencies of 100 Hz and above.

$$L' = L - P + 10 \log_{10} \{\text{antilog}_{10} [\log_{10} (\text{antilog}_{10} [P/10] - 1) + B] + 1\} \text{ dB}$$

where

L' is the corrected one-third-octave band level, in decibels;

L is the original one-third-octave band level, in decibels;

P is the original one-third-octave band projection, in decibels;

$$B = 76{,}2794 - 75{,}7439\,Y + 29{,}9803\,Y^2 - 6{,}13769\,Y^3 + 0{,}691827\,Y^4 - 0{,}0408822\,Y^5 + 0{,}000991561\,Y^6$$

$$Y = \log_e F$$

F is the one-third-octave band centre frequency, in hertz.

In the above equation, L' shall be rounded to the nearest 0,5 dB.

B.3 Calculation of the single-number, tone-adjusted A-weighted overall sound power level sound quality indicator, L_{WAT}

The single-number, tone-adjusted A-weighted overall sound power level sound quality indicator for the specified conditions shall be determined from the one-third-octave band sound power levels that were adjusted in accordance with B.1 and B.2 These tone-adjusted one-third-octave band sound power levels shall be converted to a single-number, tone-adjusted A-weighted overall sound power level sound quality indicator by using the equation below and rounding off to the nearest decibel:

$$L_{WAT} = 10 \log_{10} \left[\sum_{n=1}^{N} 10^{L_{WAT(n)}/10} \right] \text{dB}$$

where

L_{WAT} is the single-number, tone-adjusted, A-weighted overall sound power level sound quality indicator in decibels;

$L_{WAT(n)}$ is the tone-adjusted A-weighted one-third octave sound power level in the n^{th} band;

N is the total number of tone-adjusted A-weighted one-third-octave bands

where

N = 21 for 100 Hz to 10 000 Hz, or

N = 24 for 50 Hz to 10 000 Hz.

ICS 17.140.20;23.120;27.080

Descriptors: cooling, heating, air conditioning equipment, outdoor equipment, air conditioners, room air conditioners, heat pumps, noise (sound), engine noise, tests, acoustic tests, determination, sound power, ratings, acoustic measurements.

Price based on 11 pages