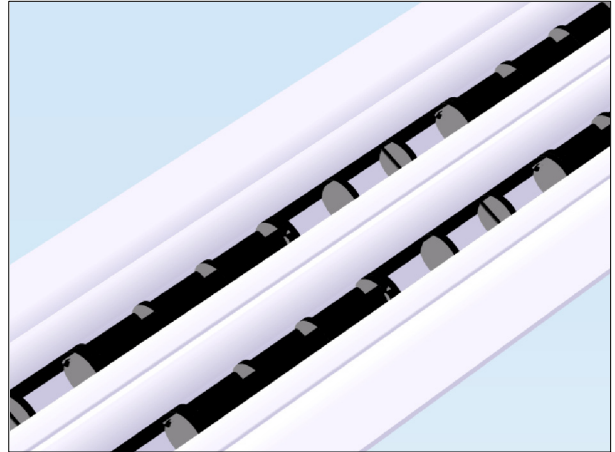


Technical Documentation
**Linear diffusers
series LDB**



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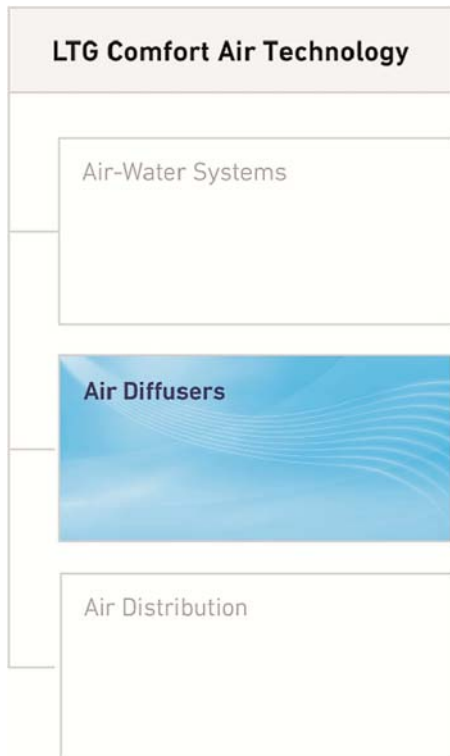
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Linear diffusers series LDB



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Notes

Dimensions stated in this brochure are in mm.

Dimensions stated in this brochure are subject to General Tolerances according to DIN ISO 2768-vL.

Length tolerance : $\leq 1.5 \text{ m} \pm 1.5 \text{ mm}$
 $\geq 1.5 \text{ m} \pm 2.0 \text{ mm}$

For the outlet grille see the special tolerances specified in the drawing.

Straightness and twist tolerances for extruded aluminum profiles according to DIN EN 12020-2.

For punched profiles - LDB 12 and LDB 15 - twice the straightness and torsion tolerances acc. to DIN EN 12020-2.

The surface finishes meet standard indoor use requirements, i.e. room climate requirements according to DIN EN ISO 7730. Other finishes meeting special use requirements are available on request.

You will find the actual tender documentations at the end of this document. They are available in word format at your local dealership or at www.LTG-AG.de.

Please note!

The profiles for our linear diffusers are exclusively designed for use as decoration elements to cover the gap between the ceiling and the diffuser. They are not suitable for use as supporting profiles or fasteners!

Linear diffusers series LDB - the decisive elements for the efficiency of air conditioning and ventilation systems

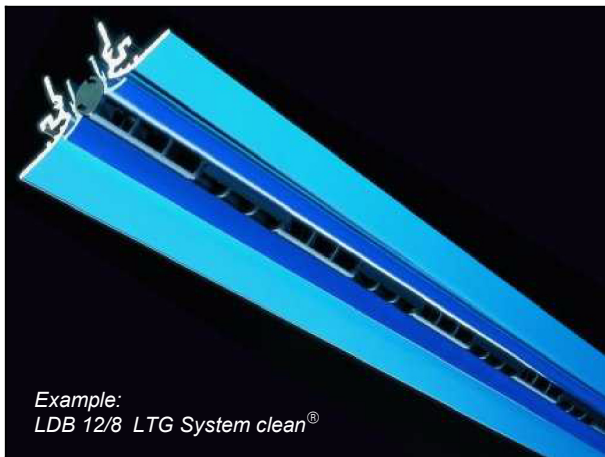
Diffusers are designed to ensure a uniform distribution of the conditioned air within the room.

Their proper functioning is, therefore, essential for the well-being and health of people working in air conditioned spaces.

LTG diffusers of the LDB series meet any vital requirements:

- draft free conditions
- adaptation to individual requirements even after installation without reducing the efficiency
- uniform distribution of the conditioned air within the room

View of unit



Fields of Application

LTG diffusers type LDB are suitable for all kinds of applications, e.g. rooms with:

- high comfort requirements such as offices
- increased heat loads and fresh air requirements such as labs or conference rooms
- special requirements regarding acoustics such as broadcasting studios
- constant temperature requirements such as production halls.

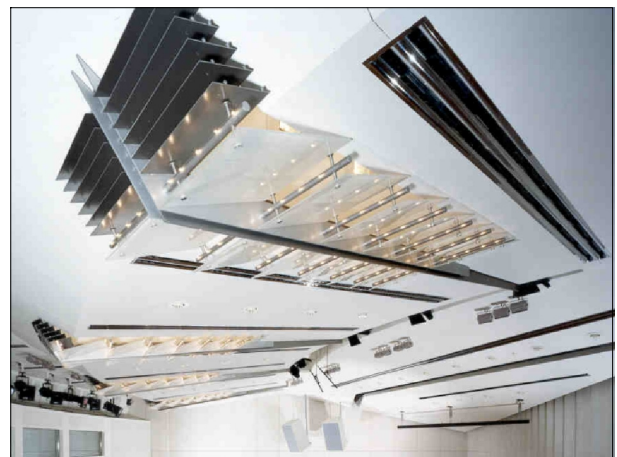
LTG diffusers type LDB are perfect for both supply air with a constant or varying volume flow rate and return air with the same nozzle adjustment.

Installation, positioning

LTG diffusers type LDB may be installed in ceilings, walls or window parapets depending on the looks desired, the existing air conditioning system and the intended use. Also available are diffusers for special requests.

- flexibility regarding the interior design, by ensuring both the use for an inconspicuous installation and as an eye-catching decoration element.

Based on user feedback and its experience in plant construction, LTG designs and tests products in its state-of-the-art R&D center under real-life conditions to ensure that through individual consideration of the varying fields of application, the best solution is found whenever a diffuser is being designed.



Example: LTG Linear diffuser type LDB 50 installed in the Liedersalle, Stuttgart

Linear diffusers series LDB

Product overview

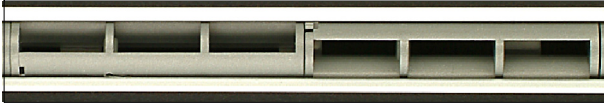
| Type | | LDB 12 | LDB 20/8 | LDB 50 | LDB 12/8 LTG System clean® |
|--|---------|--|---|---|---|
| Air diffusion | | Slot nozzles, individually adjustable, even after installation | | | |
| Special features | | For an inconspicuous installation in shaded joints and suspended ceilings | For high comfort | For high ceilings and large volume flow rates | For high comfort. With an additional slot in the diffuser border profile to reduce contamination around the diffuser. |
| Profile width | [mm] | 15 resp. 28 | 31 ... 240 | 100, 200, 300 | 31 ... 240 |
| Cylinder Ø | [mm] | 12 | 20 | 50 | 12 |
| Recommended air flow rate | [m³/hm] | 65 | 1 slot: 110 2 slots: 190 3 slots: 250 4 slots: 300 | 1 slot: 310 2 slots: 430 3 slots: 510 | 1 slot: 70 2 slots: 130 3 slots: 190 4 slots: 250 |
| at L _{WA} | [dB(A)] | 35 | 30 | 38 | 30 |
| Number of slot rows | | 1 | 1 ... 4 | 1 ... 3 | 1... 3 |
| Recommended installation height | [m] | from 2.4 | from 2.6 | from 3.5 | from 2.4 |
| Length | [mm] | up to 1500 | up to 2000 | up to 2100 | up to 2000 |
| Version | | Profile surface: untreated aluminum, anodized, painted similar to RAL. The painted profiles are suitable for standard use (refer to page 3). For application in wet areas, such as swimming pools, the anodized profiles have proven successful. Diffuser nozzles: black, white or aluminum grey, on request in other colors similar to RAL. The diffusers can alternatively be ordered without air distribution box. | | | |
| Accessories | | For integration in the ceiling, a variety of border and additional profiles is available. | | | |

| Type | | LDB 15 LTG System clean® | LDB 16/M/1 | LDB 32/M/1 |
|--|---------|---|--|------------|
| Air diffusion | | Plug in elements, adjustable even after installation | Fixed air outlet geometry | |
| Special features | | With an additional slot in the diffuser border profile to reduce contamination around the diffuser. | Entirely of metal, thus non-flammable. | |
| Profile width | [mm] | 15 resp. 25 | 16 | 32 |
| Recommended air flow rate | [m³/hm] | up to 60 | 75 | 90 |
| at L _{WA} | [dB(A)] | 25 | 35 | 35 |
| Number of slot rows | | 1 | 1 | 1 |
| Recommended installation height | | from 2.4 | from 2.5 | from 2.5 |
| Length | [mm] | up to 2000 | up to 1500 | up to 1500 |
| Version | | Profile surface: untreated aluminum, anodized, painted similar to RAL. The painted profiles are suitable for standard use (refer to page 3). For application in wet areas, such as swimming pools, the anodized profiles have proven successful. | Entirely of metal, galvanized steel, black coated with integrated air outlet geometry. | |

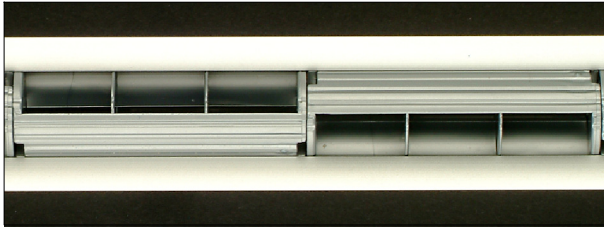
Linear diffusers series LDB

Unit views

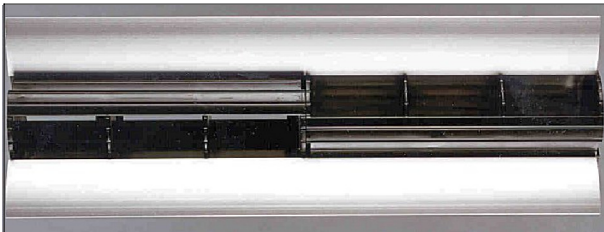
Type LDB 12



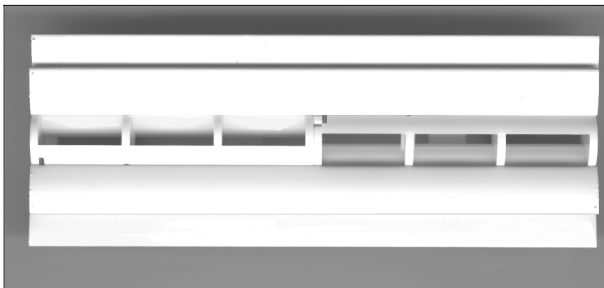
Type LDB 20/8



Type LDB 50



Type LDB 12/8 LTG System clean®



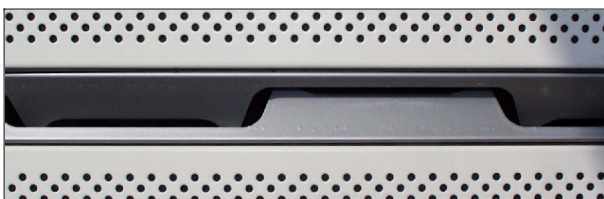
Type LDB 15 LTG System clean®



Type LDB 16/M/1



Type LDB 32/M/1



Linear diffusers series LDB

Advantages

- Wide range of individual designs.
- Nozzle arrangement and micro-jet pattern provide a high-induction air flow, ensuring a rapid reduction of supply air speed and temperature differences.
- High flexibility of nozzle adjustment allows the air flow pattern to be adapted to changed room conditions even after installation.
- Compact air plenum box fits even the tightest space in intermediate ceilings.
- Factory-set diffuser nozzles ensure an easy, fast and cost-saving installation.

Function

The LTG diffuser type LDB is an adjustable linear diffuser allowing treated air to be distributed precisely within the room, thus ensuring both highest thermal and acoustic comfort.

The diffuser consists of slot nozzles with an optimized interior and profile contour, mounted in aerodynamically harmonized aluminum frames. Each of the nozzles can be adjusted individually, thus permitting a large number of different flow patterns, varying from a flat ceiling flow to a broad fan jet with a maximum of 36 micro-jets per meter diffuser length (except LDB 15, LDB 16/M/1 and LDB 32/M/1).

These features ensure low air speeds and a rapid reduction of temperature differences within the room, some of the basic requirements for agreeable conditions in the occupied space.

The highly inductive effect produces a stable flow pattern and permits supply air temperatures up to 12 K lower than the ambient temperature.

Linear diffusers series LDB

Series LDB LTG System clean®

Advantages

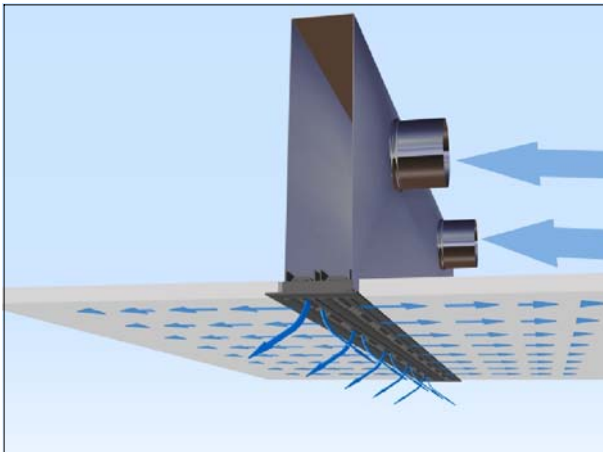
- Reduced renovation and maintenance costs thanks to an additional air curtain close to the ceiling preventing airborne particles from depositing.
- Any options of the linear diffuser type LDB are equally suitable for an integration into ceilings.
- Special ceilings are protected from contamination.
- Improved induction, stabilized flow pattern and low speed of the supply air in the occupied space.
- Optimized air-side resistance, i.e. in general no need for additional devices.

Function

The LTG diffuser type LDB LTG System clean® was designed to protect ceilings from airborne dust particles.

The clean supply air is split into large number of individual jets. Additionally, part of the supply air is diffused directly along the ceiling through a slot in the diffuser border profile. With this air curtain, dust particles from tobacco smoke to textile abrasions are prevented from depositing on the ceiling which considerably reduces the need for frequent re-painting or renovation.

In the occupied zone, the supply air jets - diagonally directed from the ceiling - are further stabilized while reducing turbulences, ensuring a totally "diffuse" air flow pattern.



Function of LTG System clean®

Series LDB entirely made of metal

Advantages

- Diffuser entirely made of metal, thus non-flammable.
- Optimized air outlet geometry ensuring a high induction ratio and a rapid reduction of supply air speed and temperature differences.
- Compact air plenum box for inconspicuous installation in shaded joints and suspended ceilings.
- Fixed air outlet geometry for a perfect operation without the need for an adjusting device.

Function

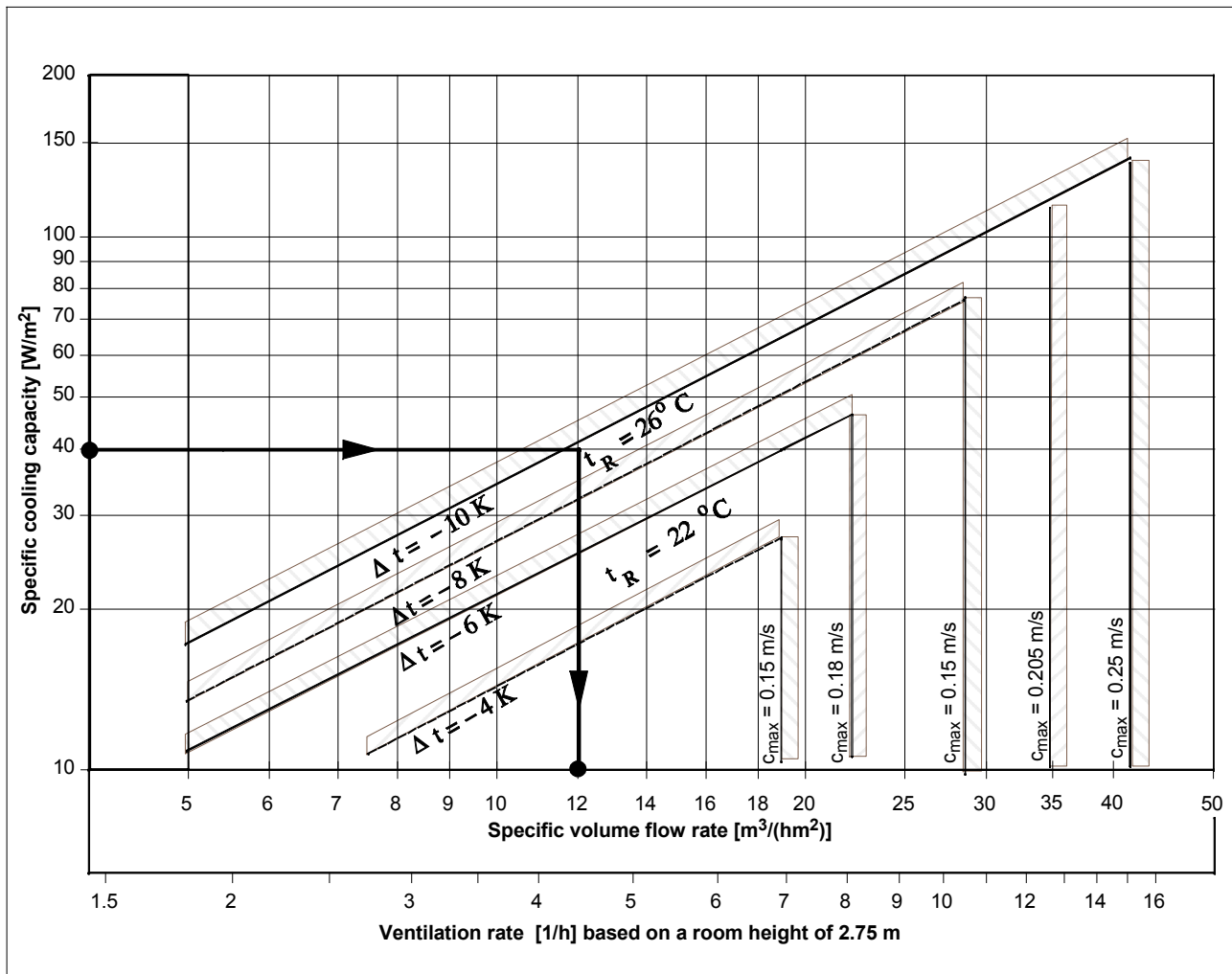
The linear diffusers type LDB 16/M/1 and LDB 32/M/1 were engineered specifically for an inconspicuous installation in shaded joints and suspended ceilings.

The diffuser is entirely made of metal and thus non-flammable (fire protection class A1).

The outlet geometry, optimized in LTG's labs, provides a high induction ratio, ensures a rapid reduction of supply air speed and temperature differences, and thus ensures a perfect operation of the diffuser without the need for any adjusting device.

Linear diffusers series LDB

Diagram for “air only” systems



According to DIN 1946, air-only ventilation systems with a specific room temperature (e.g. 22 °C or 26 °C, see diagram) are limited to a maximum room air speed, i.e. 0.15 (0.20) m/s for 22 °C and 0.18 (0.25) m/s for 26 °C.

These limit values are generally valid and independent of the diffuser type.

Use of the diagram

Based on the known value, i.e. the specific cooling load, the specific volume flow rate can be calculated by choosing the corresponding temperature and volume flow rate of the supply air depending on the desired room temperature of 22 or 26 °C respectively.

DIN limits should, however, be observed to avoid draft and other sources of discomfort.

If the ventilation rate is too high, additional means to reduce the cooling load should be considered already during planning (e.g. sun screens etc.).

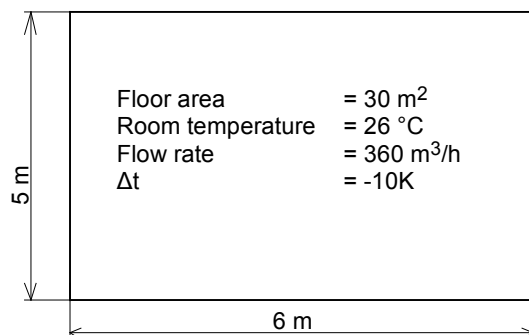
Example:

An office area of 30 m² (room length 6 m, room width 5 m) requires ventilation and cooling.

The desired room temperature is 26 °C.

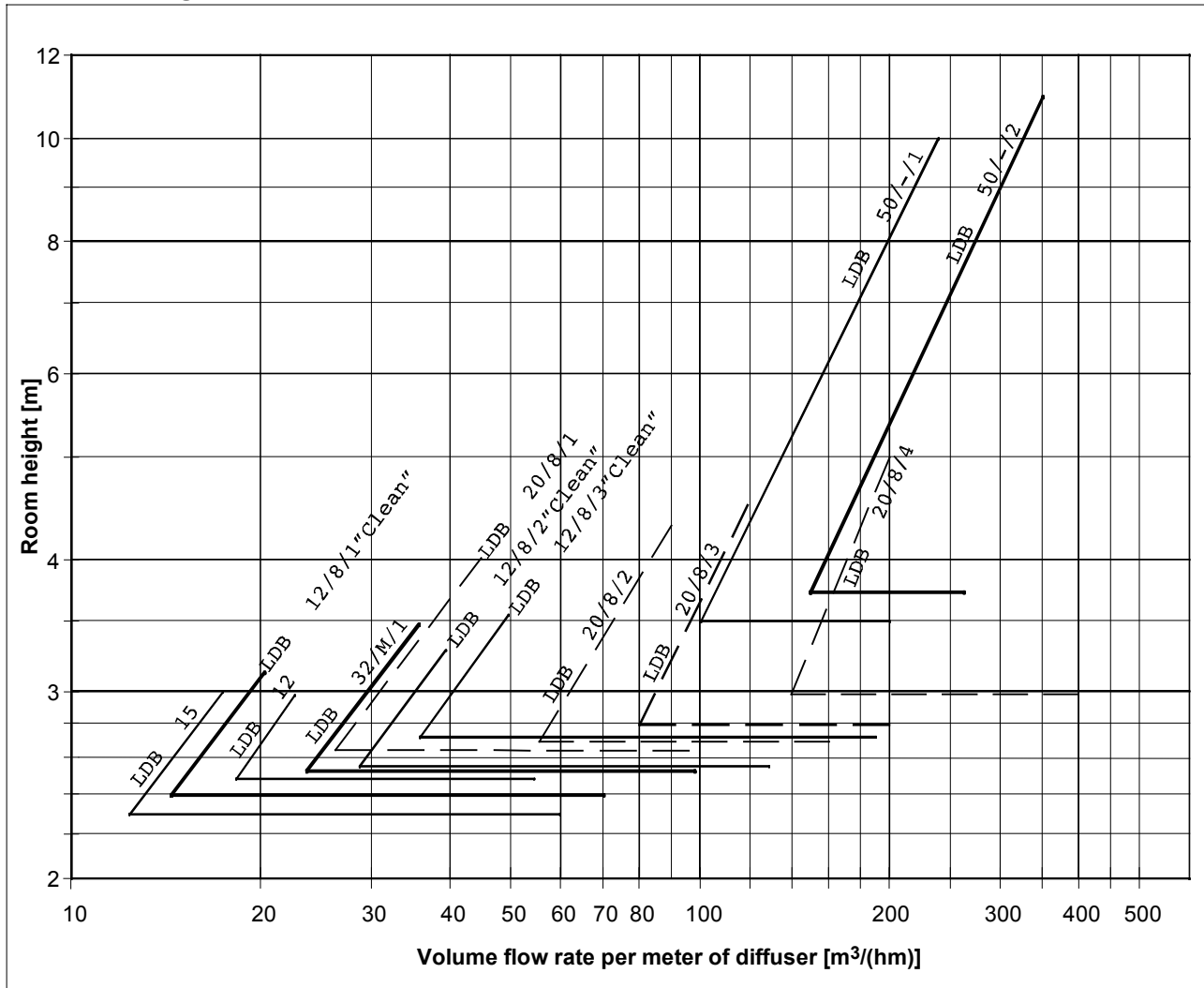
With a specific cooling capacity of 40 W/m² and $\Delta t = -10$ K, the specific volume flow rate is 12 m³/(h·m²).

The supply air required is 360 m³/h.



Linear diffusers series LDB

Selection diagram



With the volume flow rate known and the installation height taken into consideration, a quick decision can be made regarding the appropriate number of slot rows and the diffuser type.

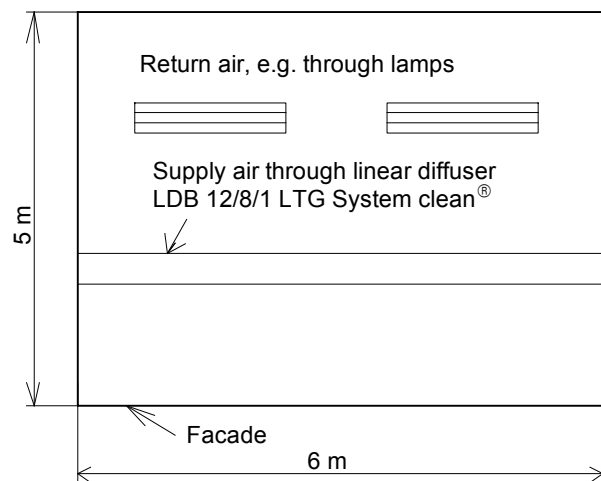
Since there usually is a choice of products, the diffuser type that suits the application best may be selected.

Example:

Based on the example opposite, a volume flow rate of $60 \text{ m}^3/(\text{hm})$ is obtained. With a room height of 2.75 m , LDB 12/8/1 LTG System clean[®] would be perfect, but LDB 20/8/1 might be installed just as well.

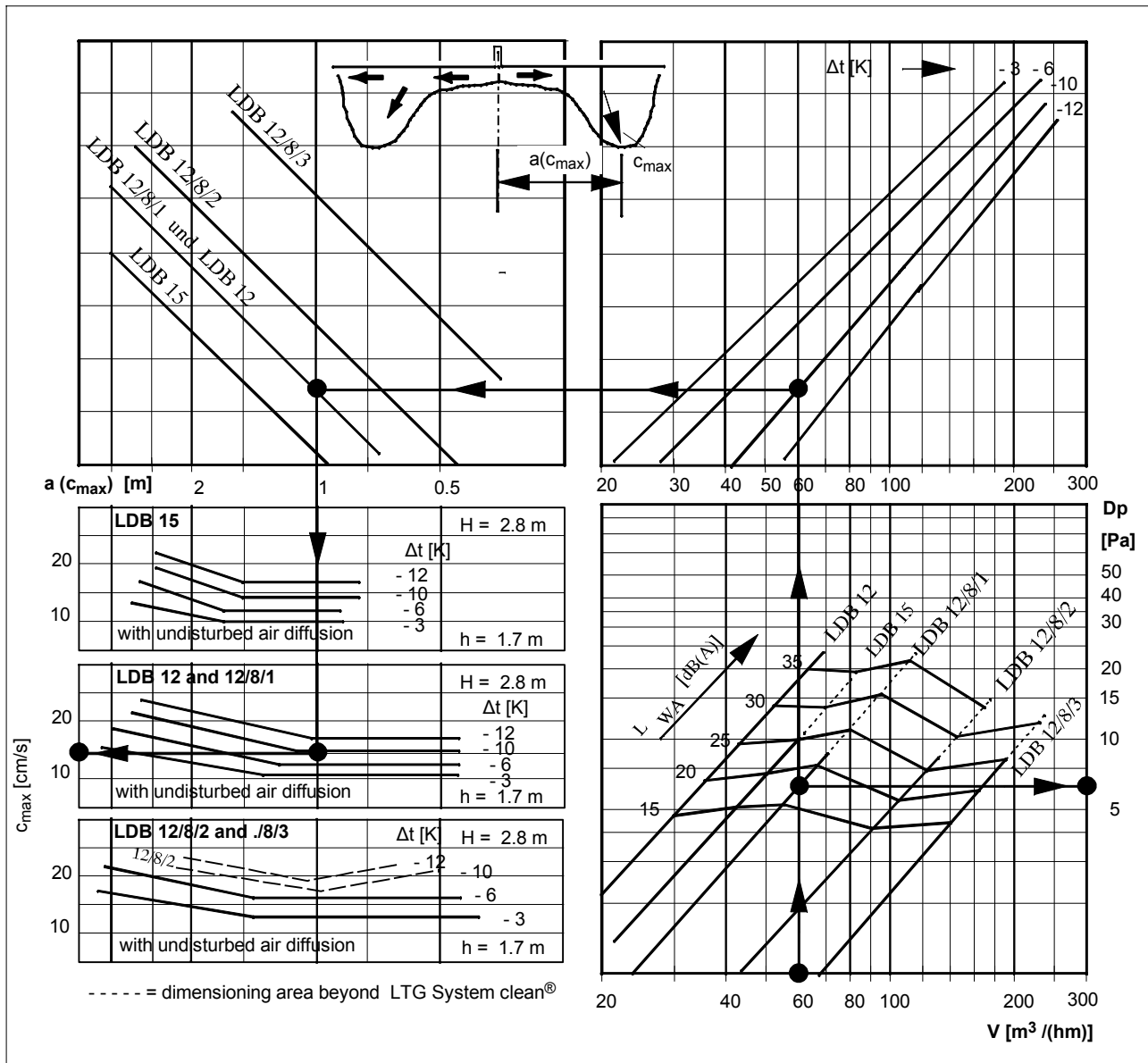
→ Diffuser Type LDB 12/8/1 LTG System clean[®] with a volume flow rate of $60 \text{ m}^3/(\text{hm})$ was selected.

Example:



Linear diffusers series LDB Selection LDB 12, LDB 12/8 ... clean[®], LDB 15 ... clean[®]

Selection diagram



Legend

| | | |
|----------------------|---|------------------------|
| V | = volume flow rate | [m ³ /(hm)] |
| t _{zu} | = supply air temperature | [°C] |
| t _{RA} | = room air temperature | [°C] |
| Δt | = temperature difference between t _{zu} and t _{RA} | [K] |
| Δp | = pressure drop | [Pa] |
| L _{WA} | = sound power level | [dB(A)] |
| a(c _{max}) | = extension of jet at which the maximum speed of the ambient air was measured | [m] |
| c _{max} | = maximum speed of ambient air with uniformly distributed thermal loads | [cm/s] |
| H | = room height | [m] |
| h | = height of measuring point | [m] |

Note: The recommended min. distance between two parallel diffusers should, in case of high temperature differences Δt, not be less than the value of a (c_{max}).

The diagrams are based on measuring results with the standard nozzle adjustment and a room height of 2.8 m.

Example for diagram above

Volume flow rate per meter of diffuser:
V = 60 m³/(hm)

Resulting data for type LDB 12/8/1:

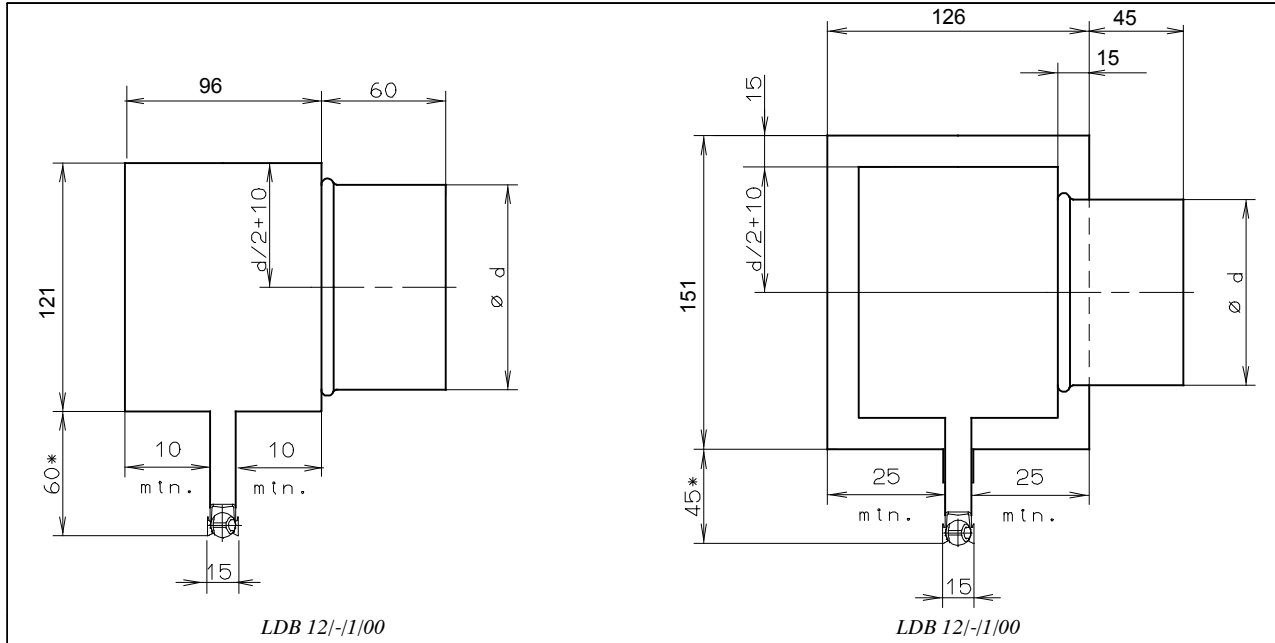
| | |
|----------------------|------------|
| Δp | = 7 Pa |
| L _{WA} | = 17 dB(A) |
| Δt | = -10 K |
| a(c _{max}) | ≈ 1 m |
| c _{max} | ≤ 5 cm/s |

Linear diffusers series LDB

Type LDB 12 - dimensions and accessories border profiles

Air distribution box for LDB 12 without insulation

Air distribution box for LDB12 with insulation (double skin box)

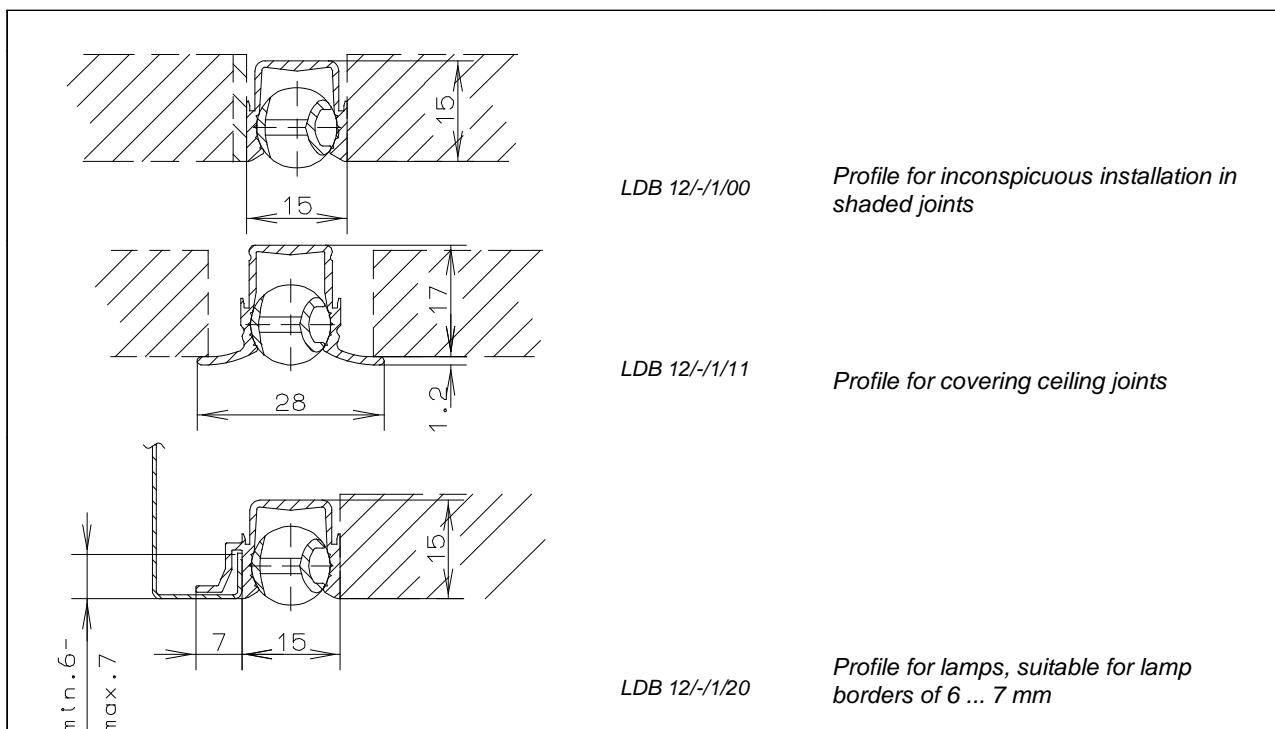


The values given refer to standard versions. Reduced box sizes and spigot diameters are available on request, depending on volume flow rate and acoustic requirements. *) Neck lengths 45 to 80 mm

Spigot dimensions for LDB 12

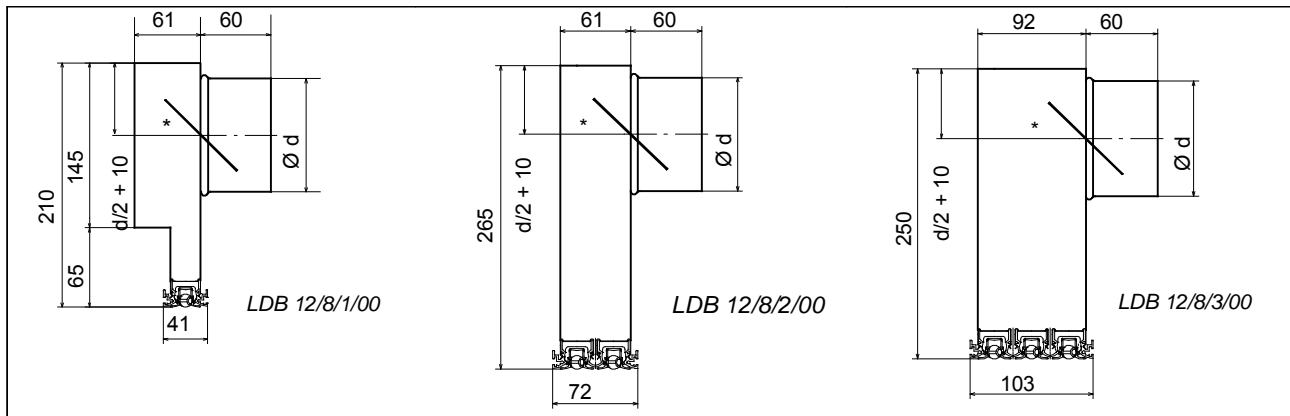
| Diffuser length | L _{nom} [mm]* | 500 | 750 | 1000 | 1250 | 1500 |
|-----------------|------------------------|--------|--------|--------|--------|--------|
| LDB 12 | Ø d [mm] | 1 x 99 | 1 x 99 | 1 x 99 | 2 x 99 | 2 x 99 |

Border profiles for LDB 12 (length max. 1250 mm)

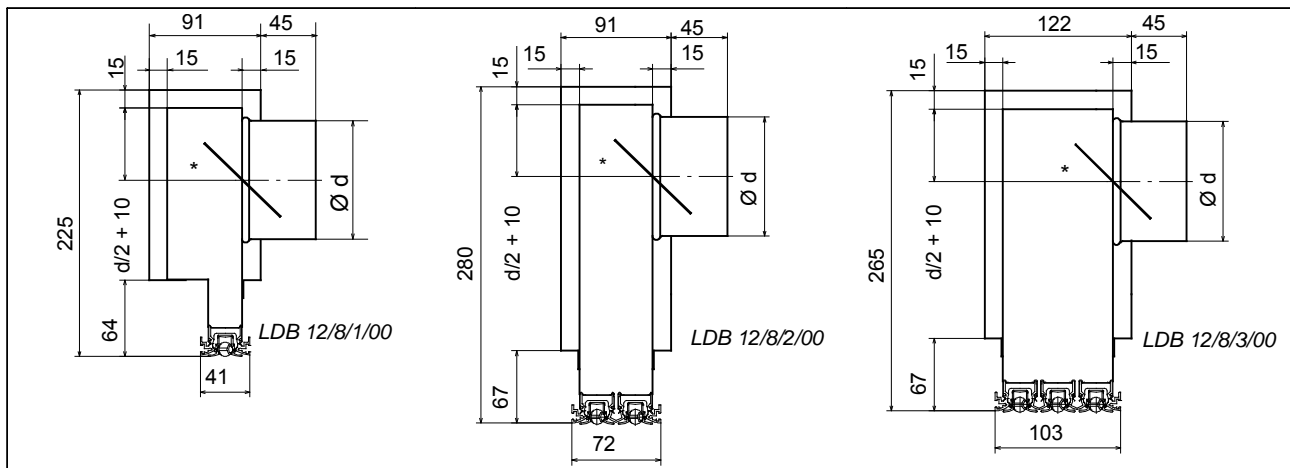


Linear diffusers series LDB Type LDB 12/8 LTG System clean[®] - dimensions

Air distribution boxes for LDB 12/8 LTG System clean[®]



Air distribution boxes for LDB 12/8 LTG System clean[®] with insulation (double skin box)



* Execution: integrated throttle damper DLU at spigot diameters 99 ... 139

The values given refer to standard versions.

Reduced box sizes and spigot diameters are available on request, depending on volume flow rate and acoustic requirements.

Spigot dimensions for LDB 12/8 LTG System clean[®]

| Diffuser length L_{nom} [mm] | 500 | 750 | 1000 | 1250 | 1500 | 1750 | 2000 |
|--------------------------------|-----|-----|------|------|------|------|------|
|--------------------------------|-----|-----|------|------|------|------|------|

The given values L_{WA} refer only to the execution without throttle damper resp. with throttle damper open.

LDB 12/8/1, example: 70 m³/hm

| L_{WA} in dB(A) out of diagram p. 10 (ref. to L_{nom}) | 19 | 21 | 22 | 23 | 24 | 24 | 25 |
|---|-------------------------------------|----------|----------|----------|----------|----------|----------|
| $\varnothing = 79$ mm | no. of spigots / | | | | | | |
| | [correction to diagram in (dB)] | 1 / [-2] | 1 / [+3] | 2 / [-2] | 2 / [0] | 2 / [+3] | 2 / [+6] |
| $\varnothing = 99$ mm | | 1 / [-4] | 1 / [0] | 1 / [+5] | 2 / [-2] | 2 / [0] | 2 / [+3] |
| $\varnothing = 124$ mm | standard version highlighted | 1 / [-5] | 1 / [-3] | 1 / [+1] | 1 / [+4] | 1 / [+7] | 2 / [0] |
| | | | | | | | 2 / [+1] |

LDB 12/8/2, example: 130 m³/hm

| L_{WA} in dB(A) out of diagram p. 10 (ref. to L_{nom}) | 24 | 26 | 27 | 28 | 29 | 29 | 30 |
|---|-------------------------------------|----------|----------|----------|----------|----------|----------|
| $\varnothing = 79$ mm | no. of spigots / | | | | | | |
| | [correction to diagram in (dB)] | 1 / [+1] | 2 / [-3] | 2 / [-1] | 2 / [+2] | 3 / [-2] | 3 / [0] |
| $\varnothing = 99$ mm | | 1 / [-2] | 1 / [+2] | 2 / [-2] | 2 / [-1] | 2 / [0] | 2 / [+3] |
| $\varnothing = 124$ mm | standard version highlighted | 1 / [-3] | 1 / [-2] | 1 / [0] | 2 / [-3] | 2 / [-3] | 2 / [-1] |
| $\varnothing = 139$ mm | | 1 / [-3] | 1 / [-3] | 1 / [-1] | 1 / [+2] | 2 / [-3] | 2 / [-2] |

LDB 12/8/3, example: 190 m³/hm

| L_{WA} in dB(A) out of diagram p. 10 (ref. to L_{nom}) | 22 | 24 | 25 | 26 | 27 | 27 | 28 |
|---|-------------------------------------|----------|----------|----------|----------|----------|----------|
| $\varnothing = 99$ mm | no. of spigots / | | | | | | |
| | [correction to diagram in (dB)] | 1 / [+4] | 2 / [0] | 2 / [+4] | 3 / [+2] | 3 / [+4] | 4 / [+3] |
| $\varnothing = 124$ mm | | 1 / [0] | 1 / [+5] | 2 / [0] | 2 / [+2] | 2 / [+5] | 3 / [+2] |
| $\varnothing = 139$ mm | standard version highlighted | 1 / [-1] | 1 / [+2] | 1 / [+6] | 2 / [0] | 2 / [+2] | 2 / [+4] |
| $\varnothing = 159$ mm | | 1 / [-1] | 1 / [0] | 1 / [+1] | 1 / [+3] | 2 / [0] | 2 / [+1] |

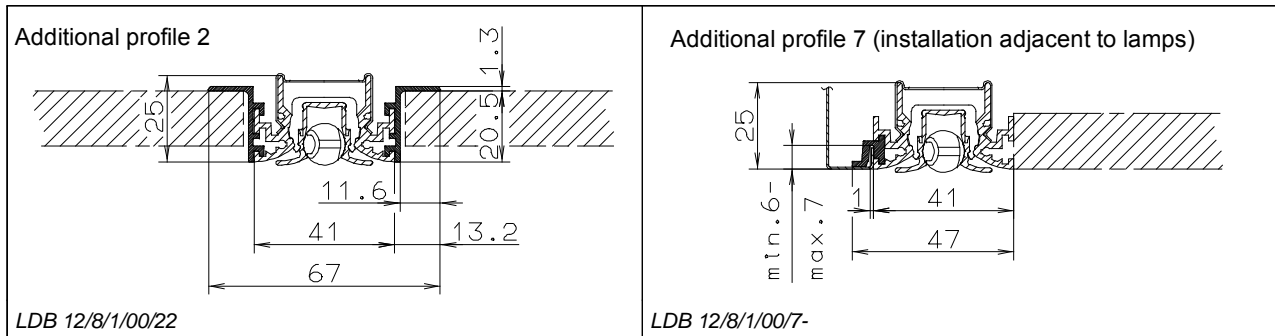
Example: $L_{WA} = L_{WA}$ (out of diagram in page 9) + [correction value],

LDB 12/8/3, length 1500 mm, 2 x \varnothing 139, $L_{WA} = 27$ dB(A) + 2 dB = 29 dB(A)

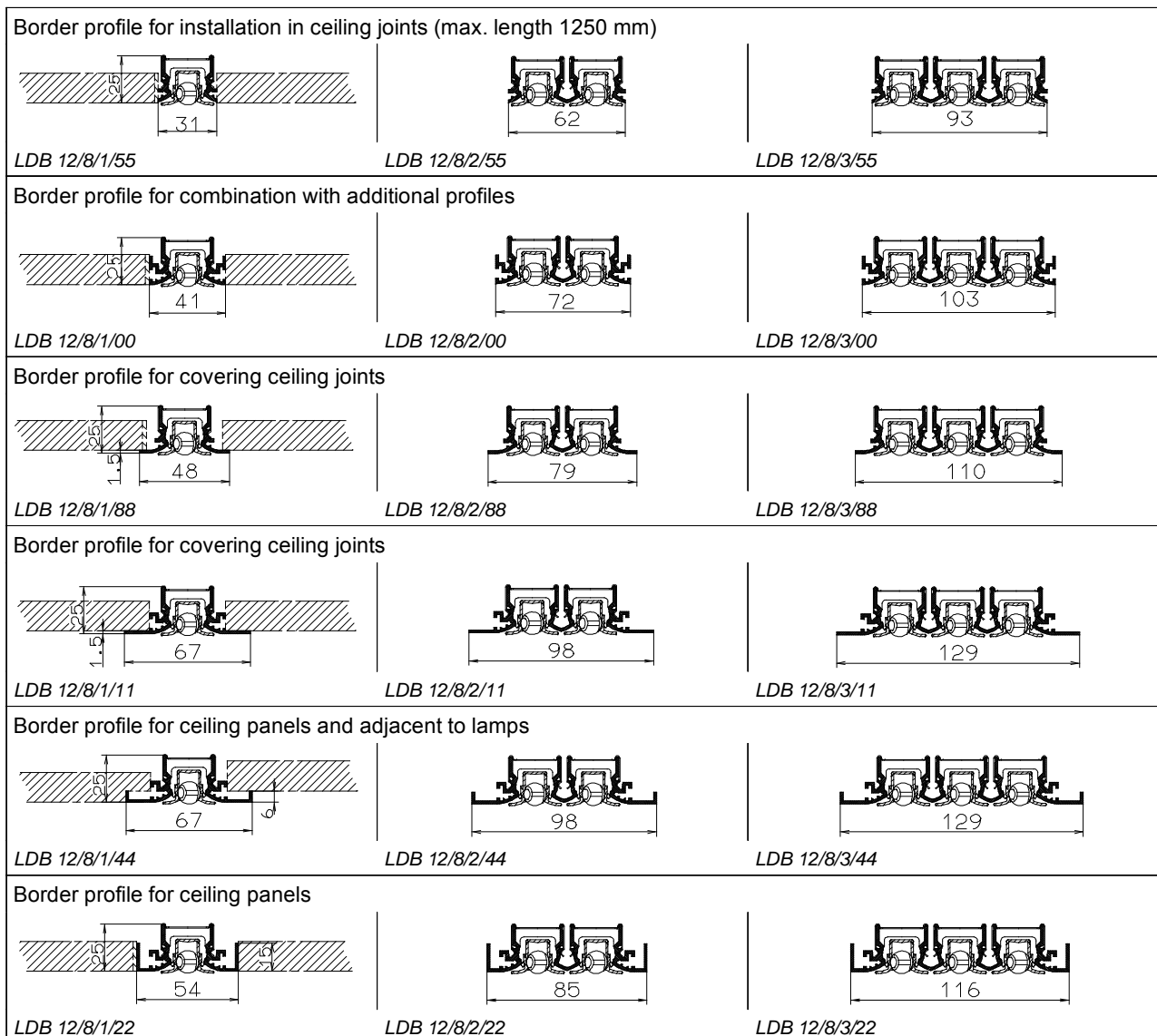
Linear diffusers series LDB Type LDB 12/8 LTG System clean[®] - accessories

Various border and additional profiles are available for LTG linear diffusers series LDB and LDB LTG System clean[®] ensuring a perfect integration in and adaptation to all kinds of ceiling systems. Thus, both an inconspicuous installation of the diffuser and its use as an interior design element are possible. Profiles may also be used in combination with each other.

Additional profiles for LDB 12/8 LTG System clean[®]



Border profiles for LDB 12/8 LTG System clean[®]



Linear diffusers series LDB

Type LDB 12/8 LTG system clean[®] - with sound absorber

Insertion loss / end reflection factor

The cross-talk sound transmission via air ducts between adjacent rooms is a sound flanking path which might reduce the sound insulation of partition walls or suspended ceilings.

DIN 4109 or customer agreements set minimum sound insulation requirements for partition walls in terms of a weighted sound reduction index R'_w .

Sound insulation indices may be calculated in terms of a sound pressure level difference with known ceiling surface S and the equivalent absorption surface A of the receiving room:

$$\Delta L = R_L - 10 \lg (S/A)$$

When assessing the sound pressure level difference in the air duct between the source and receiving room, calculation must be in the frequency bands (compare VDI 2081, Pages 1, 2, and LTG selection program). Therefore, for cross-talk sound absorbers manufacturers' frequency-dependent insertion loss indices will have to be used. For air diffusers, the insertion loss/end reflection of the air diffusers according to DIN EN ISO 7235 is decisive.

The following decision must be made:

1. no cross-talk sound absorber required
2. sound absorber integrated in the air diffuser required
3. additional packaged attenuator of length x required

Through loss data of the air diffusers are determined as follows:

$$D_t = D_i + D_{td}$$

D_i air diffuser insertion loss index

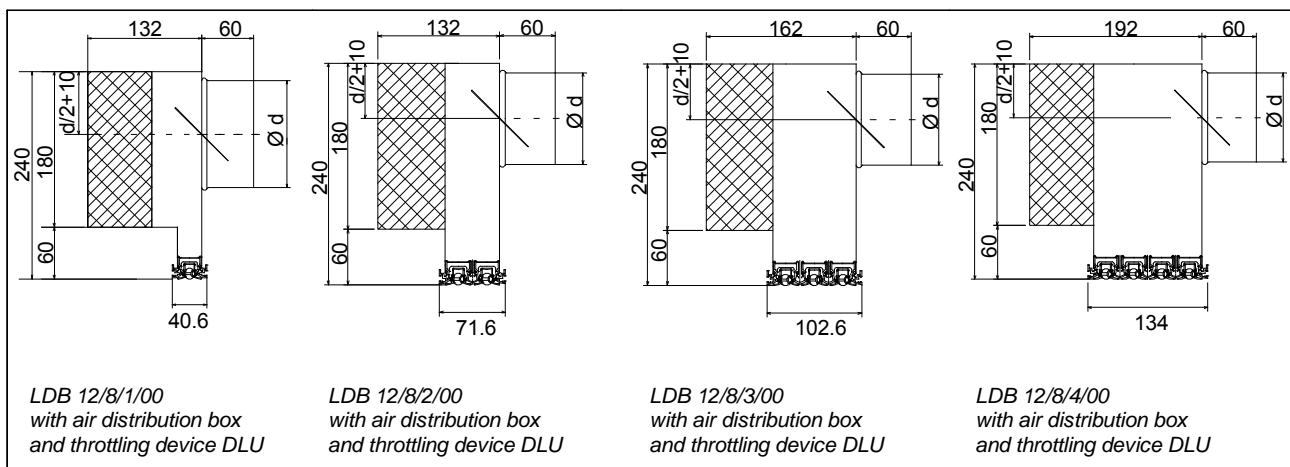
D_{td} theoretical end reflection at the open end of a straight, solid duct (duct end reflection) from equation B3 in DIN EN ISO 7235

Insertion loss /end reflection factor D_t

| Octave [Hz] | D_t <u>without</u> sound trap [dB] | | | |
|-------------|--------------------------------------|------------|------------|------------|
| | LDB 12/8/1 | LDB 12/8/2 | LDB 12/8/3 | LDB 12/8/4 |
| 63 | 25 | 22 | 19 | 21 |
| 125 | 16 | 17 | 14 | 15 |
| 250 | 8 | 6 | 7 | 5 |
| 500 | 12 | 8 | 8 | 8 |
| 1000 | 12 | 7 | 9 | 7 |
| 2000 | 9 | 5 | 5 | 4 |
| 4000 | 6 | 5 | 6 | 5 |
| 8000 | 6 | 5 | 4 | 4 |

| Octave [Hz] | D_t <u>with</u> sound trap [dB] | | | |
|-------------|-----------------------------------|------------|------------|------------|
| | LDB 12/8/1 | LDB 12/8/2 | LDB 12/8/3 | LDB 12/8/4 |
| 63 | 25 | 22 | 19 | 21 |
| 125 | 16 | 17 | 14 | 15 |
| 250 | 18 | 12 | 11 | 9 |
| 500 | 22 | 18 | 16 | 15 |
| 1000 | 24 | 19 | 15 | 13 |
| 2000 | 19 | 15 | 12 | 10 |
| 4000 | 20 | 13 | 13 | 11 |
| 8000 | 18 | 11 | 11 | 9 |

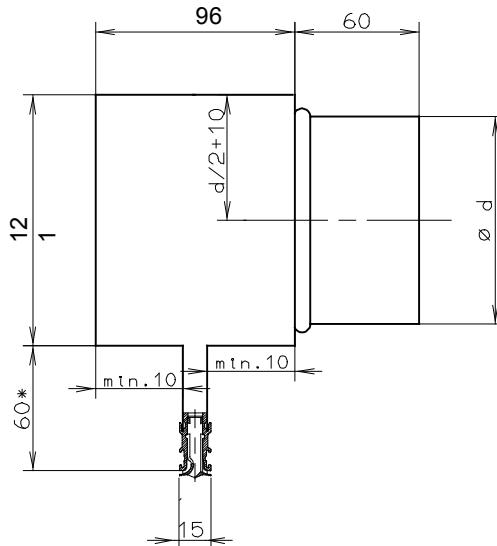
Dimensions air distribution box LDB 12/8 with sound absorber (melamine resin foam)



Linear diffusers series LDB Type LDB 15 LTG System clean® – dimensions, border profiles

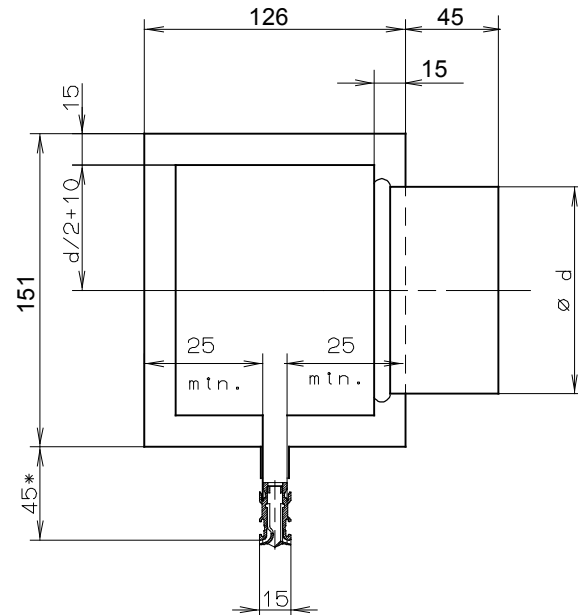
Air distribution boxes for LDB 15 LTG System clean®

Without insulation



LDB 15/0/1/00

With insulation (double skin box)

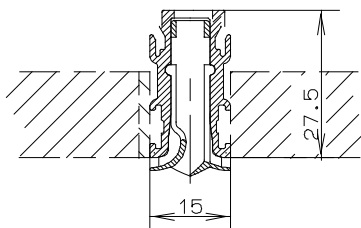


LDB 15/0/1/00

The values given refer to standard versions. Reduced box sizes and spigot diameters are available on request, depending on volume flow rate and acoustic requirements. *) Neck lengths 45 ... 80 mm

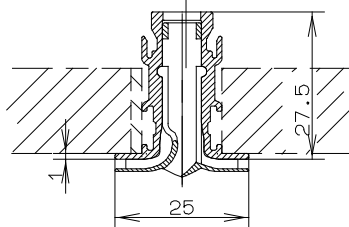
| Spigot dimensions LDB 15 ... clean® | Length of diffuser | L _{Nom} [mm]* | 500 | 750 | 1000 | 1250 | 1500 | 1750 | 2000 |
|--|--------------------|------------------------|------|------|------|------|------|------|------|
| | LDB 15 | Ø d [mm] | 1x99 | 1x99 | 1x99 | 2x99 | 2x99 | 2x99 | 2x99 |

Border profiles for LDB 15 LTG System clean®



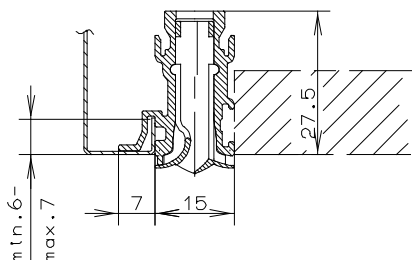
LDB 15/0/1/00

Profile for inconspicuous installation in shaded joints



LDB 15/1/1/11

Profile for covering ceiling joints

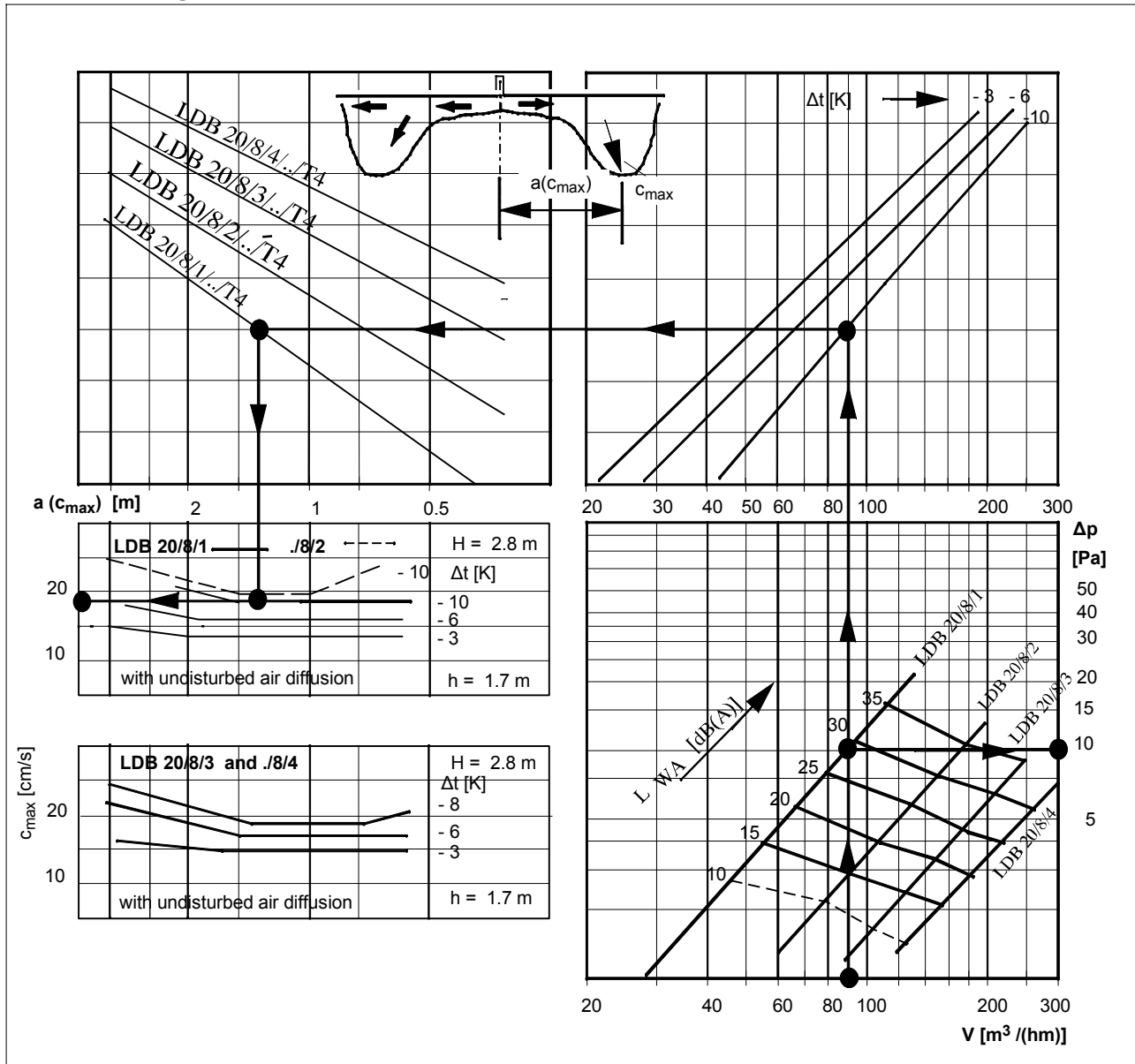


LDB 15/0/1/20

Profile for lamps, suitable for lamp borders of 6 ... 7 mm

Linear diffusers series LDB Type LDB 20/8 - Selection

Selection diagram



Legend

| | | |
|----------------------|---|------------------------|
| V | = volume flow rate | [m ³ /(hm)] |
| t _{zu} | = supply air temperature | [°C] |
| t _{RA} | = room air temperature | [°C] |
| Δt | = temperature difference between t _{zu} and t _{RA} | [K] |
| Δp | = pressure drop | [Pa] |
| L _{WA} | = sound power level | [dB(A)] |
| a(c _{max}) | = extension of jet at which the maximum speed of the ambient air was measured | [m] |
| c _{max} | = maximum speed of ambient air with uniformly distributed thermal loads | [cm/s] |
| h | = height of measuring point | [m] |
| H | = room height | [m] |

Note: The recommended min. distance between two parallel diffusers should, in case of high temperature differences Δt, not be less than the value of a(c_{max}).

The diagrams are based on measuring results with the standard nozzle adjustment and a room height of 2.8 m.

Example for diagram above

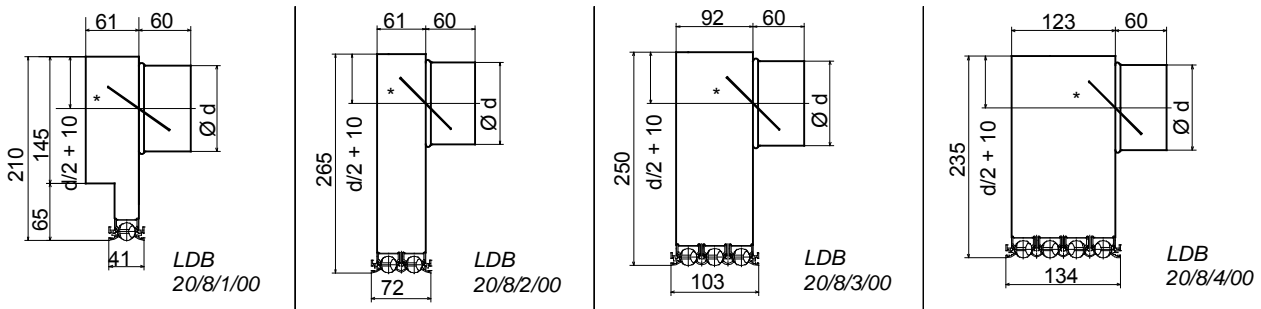
Volume flow rate per meter of diffuser:
V = 90 m³/(hm)

Resulting data for type LDB 20/8/1:

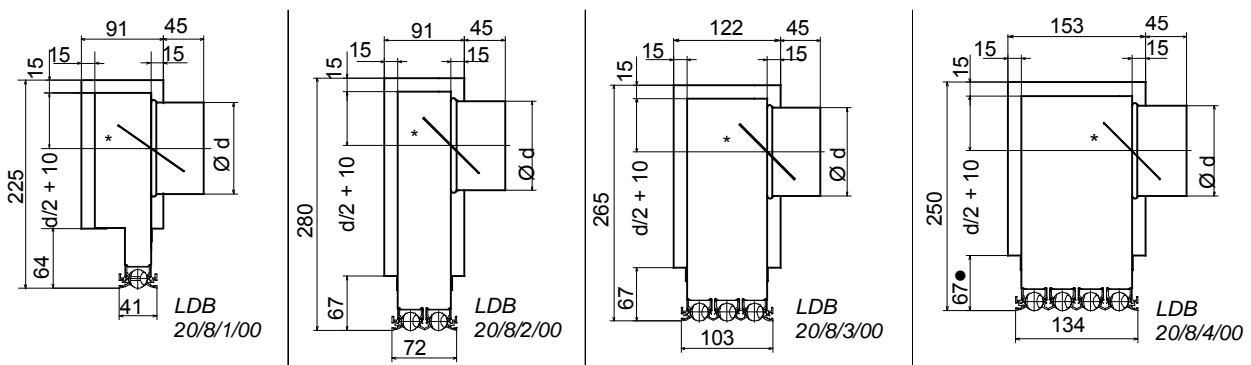
| | |
|----------------------|------------|
| Δp | = 10 Pa |
| L _{WA} | = 28 dB(A) |
| Δt | = -10 K |
| a(c _{max}) | ≈ 1.4 m |
| c _{max} | ≤ 18 cm/s |

Linear diffusers series LDB Type LDB20/8 - dimensions

Air distribution boxes for LDB 20/8



Air distribution boxes for LDB 20/8 with insulation (double skin box)



* Execution: integrated throttle damper DLU at spigot diameters 99 ... 139

The values given refer to standard versions.

Reduced box sizes and spigot diameters are available on request, depending on volume flow rate and acoustic requirements.

- For the double skin box LDB 20/8/4 and a spigot diameter of 160, it is 52 mm instead of 67 mm

Spigot dimensions for LDB 20/8

| Diffuser length L_{nom} [mm] | 500 | 750 | 1000 | 1250 | 1500 | 1750 | 2000 | |
|--|--|----------|----------|----------|----------|----------|----------|----------|
| The given values L_{WA} refer only to the execution without throttle damper resp. with throttle damper open. | | | | | | | | |
| LDB 20/8/1, example: 90 m³/hm | | | | | | | | |
| L_{WA} in dB(A) out of diag. p. 15 (ref. to L_{nom}) | 26 | 28 | 29 | 30 | 31 | 31 | 32 | |
| $\varnothing = 79$ mm | no. of spigots / [correction to diagram in (dB)] | 1 / [+1] | 2 / [0] | 2 / [+1] | 2 / [+2] | 3 / [0] | 3 / [+2] | 4 / [+1] |
| $\varnothing = 99$ mm | | 1 / [0] | 1 / [+2] | 2 / [0] | 2 / [+1] | 2 / [+1] | 2 / [+1] | 3 / [+1] |
| $\varnothing = 124$ mm | standard version highlighted | 1 / [0] | 1 / [0] | 1 / [+2] | 2 / [0] | 2 / [0] | 2 / [+2] | 2 / [+2] |
| LDB 20/8/2, example: 150 m³/hm | | | | | | | | |
| L_{WA} in dB(A) out of diag. p. 15 (ref. to L_{nom}) | 27 | 29 | 30 | 31 | 32 | 32 | 33 | |
| $\varnothing = 79$ mm | no. of spigots / [correction to diagram in (dB)] | 1 / [+1] | 2 / [-2] | 2 / [0] | 3 / [-2] | 3 / [-1] | 3 / [+1] | 4 / [-1] |
| $\varnothing = 99$ mm | | 1 / [-1] | 2 / [-3] | 2 / [-2] | 2 / [-1] | 3 / [-2] | 3 / [-1] | 3 / [-1] |
| $\varnothing = 124$ mm | | 1 / [-2] | 1 / [-2] | 1 / [+1] | 2 / [-2] | 2 / [-2] | 2 / [-1] | 2 / [0] |
| $\varnothing = 139$ mm | standard version highlighted | 1 / [-2] | 1 / [-2] | 1 / [0] | 2 / [-2] | 2 / [-2] | 2 / [-1] | 2 / [-1] |
| LDB 20/8/3, example: 210 m³/hm | | | | | | | | |
| L_{WA} in dB(A) out of diag. p. 15 (ref. to L_{nom}) | 27 | 29 | 30 | 31 | 32 | 32 | 33 | |
| $\varnothing = 99$ mm | no. of spigots / [correction to diagram in (dB)] | 1 / [+1] | 2 / [-4] | 2 / [+1] | 3 / [-2] | 3 / [+1] | 4 / [-1] | 4 / [+1] |
| $\varnothing = 124$ mm | | 1 / [-5] | 1 / [+2] | 2 / [-5] | 2 / [-2] | 2 / [+2] | 3 / [-2] | 3 / [0] |
| $\varnothing = 139$ mm | | 1 / [-6] | 1 / [-2] | 1 / [+3] | 2 / [-4] | 2 / [-2] | 2 / [+1] | 3 / [-4] |
| $\varnothing = 159$ mm | standard version highlighted | 1 / [-7] | 1 / [-6] | 1 / [-3] | 1 / [0] | 2 / [-6] | 2 / [-4] | 2 / [-3] |
| LDB 20/8/4, example: 260 m³/hm | | | | | | | | |
| L_{WA} in dB(A) out of diag. p. 15 (ref. to L_{nom}) | 27 | 29 | 30 | 31 | 32 | 32 | 33 | |
| $\varnothing = 124$ mm | no. of spigots / [correction to diagram in (dB)] | 1 / [+1] | 2 / [-1] | 2 / [+1] | 3 / [0] | 3 / [+1] | 4 / [0] | 4 / [+1] |
| $\varnothing = 139$ mm | | 1 / [0] | 1 / [+3] | 2 / [0] | 2 / [+1] | 3 / [-1] | 3 / [+1] | 4 / [0] |
| $\varnothing = 159$ mm | standard version highlighted | 1 / [-1] | 1 / [0] | 1 / [+2] | 2 / [-1] | 2 / [0] | 2 / [+1] | 3 / [-1] |

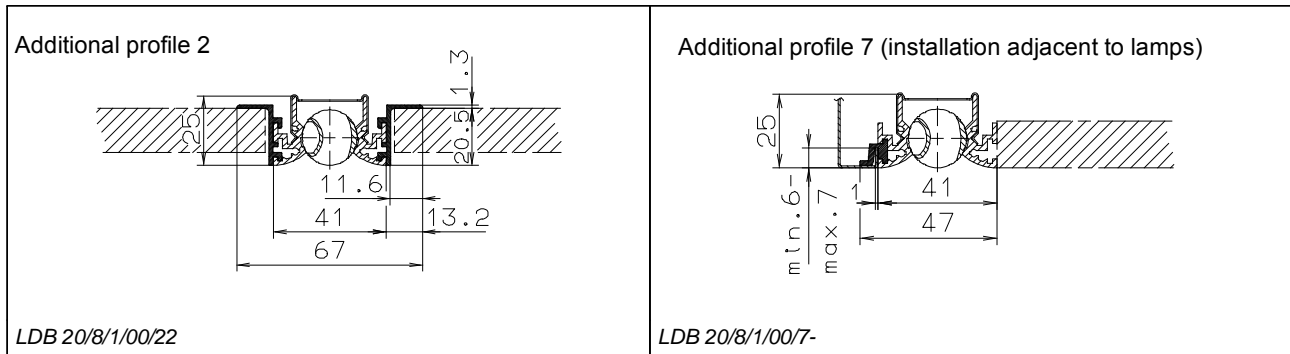
Example: $L_{WA} = L_{WA}$ (out of diagram in page 15) + [correction value],

LDB 20/8/2, length = 1000 mm, 2 x \varnothing 99, $L_{WA} = 30$ dB(A) - 2 dB = 28 dB(A)

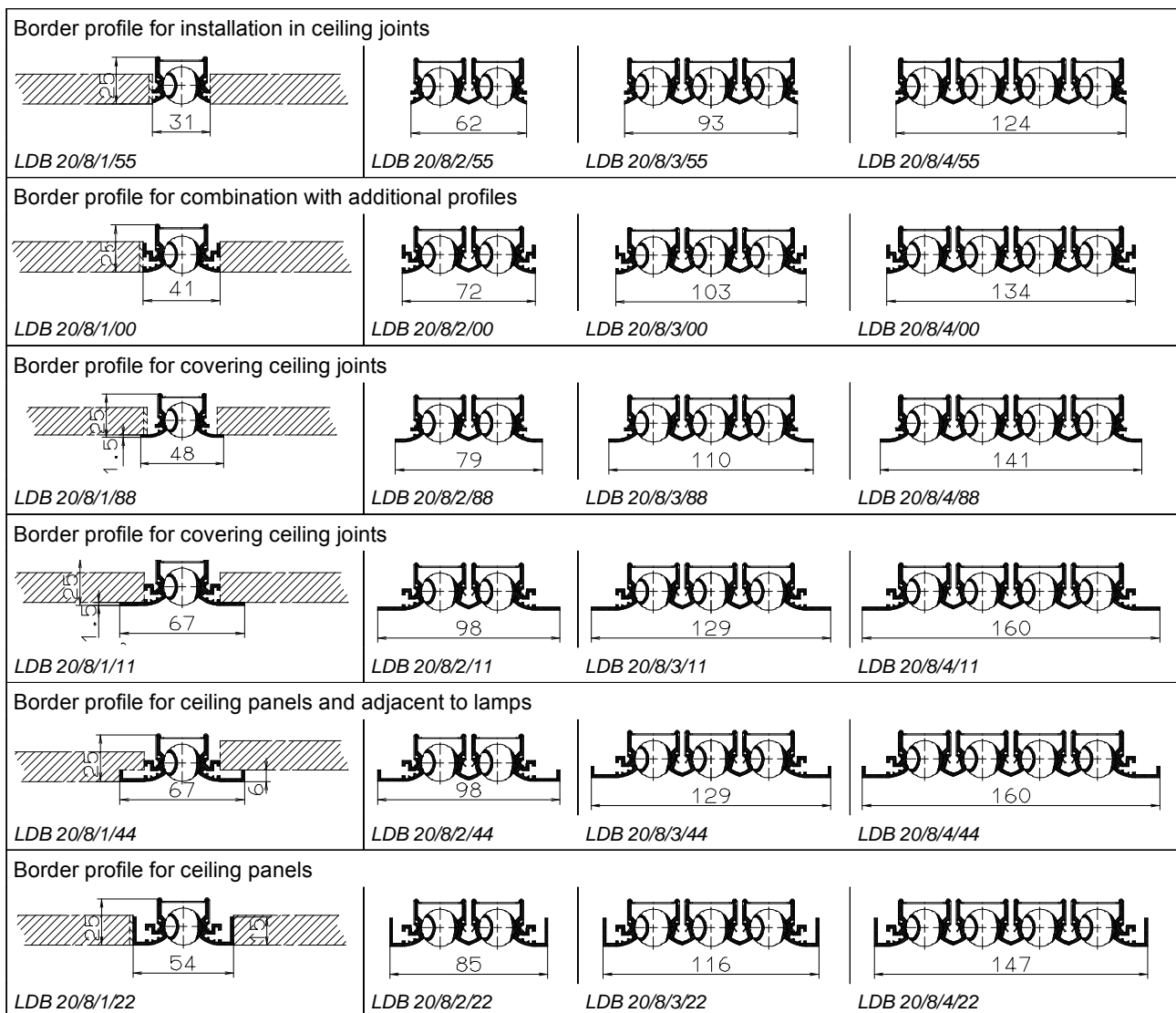
Linear diffusers series LDB Type LDB 20/8 - additional profiles, border profiles

Various border and additional profiles are available for LTG linear diffusers type LDB and LDB LTG System clean[®] ensuring a perfect integration in and adaptation to all kinds of ceiling systems. Thus, both an inconspicuous installation of the diffuser and its use as an interior design element are possible. Profiles may also be used in combination with each other.

Additional profiles for LDB 20/8



Border profiles for LDB 20/8



Linear diffusers series LDB

Type LDB 20/8 - with sound absorber

Insertion loss / end reflection factor

The cross-talk sound transmission via air ducts between adjacent rooms is a sound flanking path which might reduce the sound insulation of partition walls or suspended ceilings.

DIN 4109 or customer agreements set minimum sound insulation requirements for partition walls in terms of a weighted sound reduction index R'_w .

Sound insulation indices may be calculated in terms of a sound pressure level difference with known ceiling surface S and the equivalent absorption surface A of the receiving room:

$$\Delta L = R_L - 10 \lg (S/A)$$

When assessing the sound pressure level difference in the air duct between the source and receiving room, calculation must be in the frequency bands (compare VDI 2081, pages 1, 2, and LTG selection program). Therefore, for cross-talk sound absorbers manufacturers' frequency-dependent insertion loss indices will have to be used. For air diffusers, the insertion loss/end reflection of the air diffusers according to DIN EN ISO 7235 is decisive.

The following decision must be made:

1. no cross-talk sound absorber required
2. sound absorber integrated in the air diffuser required
3. additional packaged attenuator of length x required

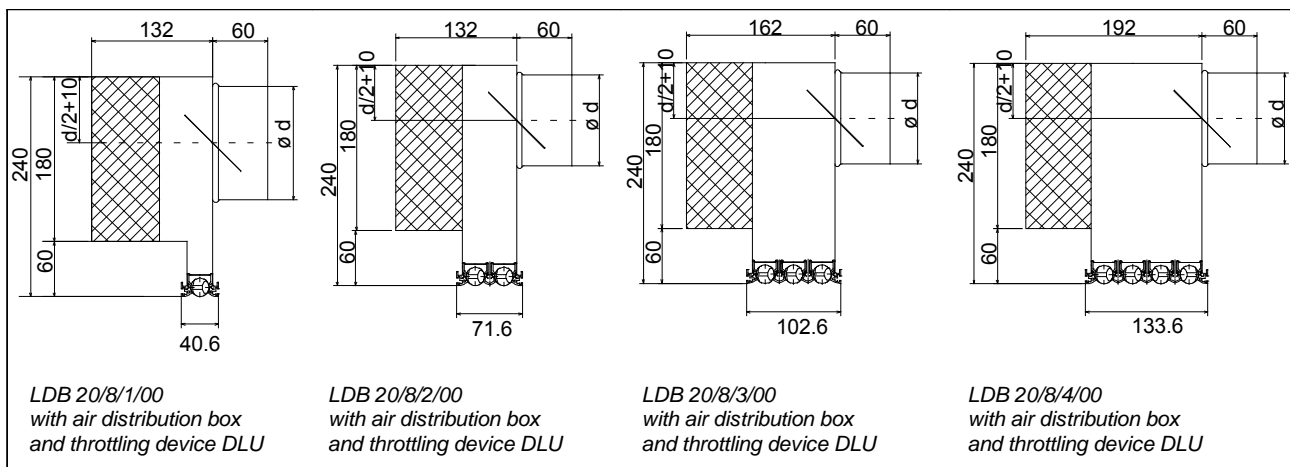
Through loss data of the air diffusers are determined as follows:

$$D_t = D_i + D_{td}$$

D_i air diffuser insertion loss index

D_{td} theoretical end reflection at the open end of a straight, solid duct (duct end reflection) from equation B3 in DIN EN ISO 7235

Dimensions air distribution box LDB 20/8 with sound absorber (melamine resin foam)



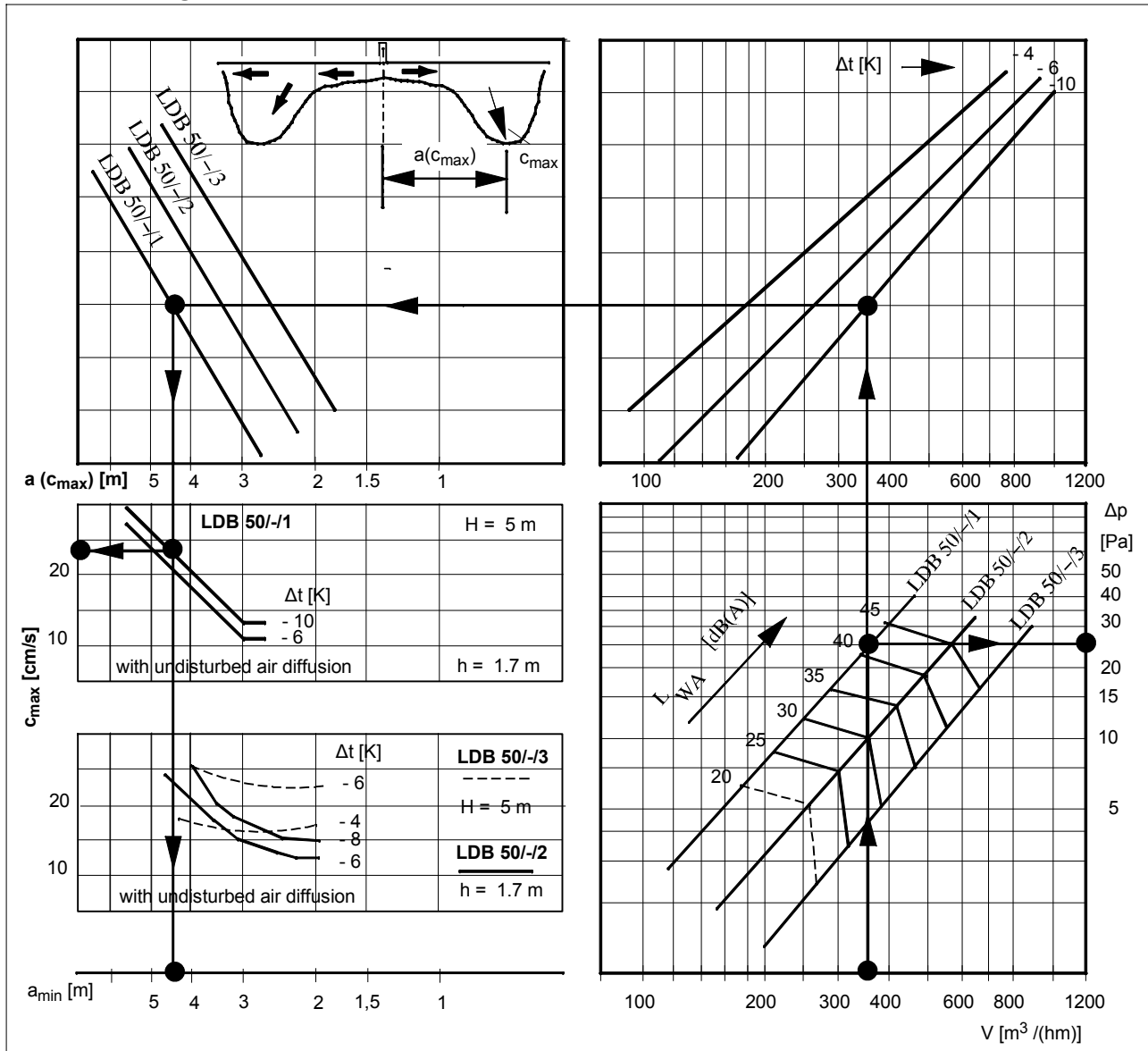
Insertion loss / end reflection factor D_t

| Octave [Hz] | D_t without sound trap [dB] | | | |
|-------------|-------------------------------|------------|------------|------------|
| | LDB 20/8/1 | LDB 20/8/2 | LDB 20/8/3 | LDB 20/8/4 |
| 63 | 25 | 22 | 19 | 21 |
| 125 | 16 | 17 | 14 | 15 |
| 250 | 8 | 6 | 7 | 5 |
| 500 | 12 | 8 | 8 | 8 |
| 1000 | 12 | 7 | 9 | 7 |
| 2000 | 9 | 5 | 5 | 4 |
| 4000 | 6 | 5 | 6 | 5 |
| 8000 | 6 | 5 | 4 | 4 |

| Octave [Hz] | D_t with sound trap [dB] | | | |
|-------------|----------------------------|------------|------------|------------|
| | LDB 20/8/1 | LDB 20/8/2 | LDB 20/8/3 | LDB 20/8/4 |
| 63 | 25 | 22 | 19 | 21 |
| 125 | 16 | 17 | 14 | 15 |
| 250 | 18 | 12 | 11 | 9 |
| 500 | 22 | 18 | 16 | 15 |
| 1000 | 24 | 19 | 15 | 13 |
| 2000 | 19 | 15 | 12 | 10 |
| 4000 | 20 | 13 | 13 | 11 |
| 8000 | 18 | 11 | 11 | 9 |

Linear diffusers series LDB Type LDB 50 - Selection

Selection diagram



Legend

| | | | |
|----------------------|---|---|------------------------|
| V | = | volume flow rate | [m ³ /(hm)] |
| t _{zu} | = | supply air temperature | [°C] |
| t _{RA} | = | room air temperature | [°C] |
| Δt | = | temperature difference between t _{zu} and t _{RA} | [K] |
| Δp | = | pressure drop | [Pa] |
| L _{WA} | = | sound power level | [dB(A)] |
| a(C _{max}) | = | extension of jet at which the maximum speed of the ambient air was measured | [m] |
| C _{max} | = | maximum speed of ambient air with uniformly distributed thermal loads | [cm/s] |
| H | = | room height | [m] |
| h | = | height of measuring point | [m] |

Note: The recommended min. distance between two parallel diffusers should, in case of high temperature differences Δt, not be less than the value of a (C_{max}).

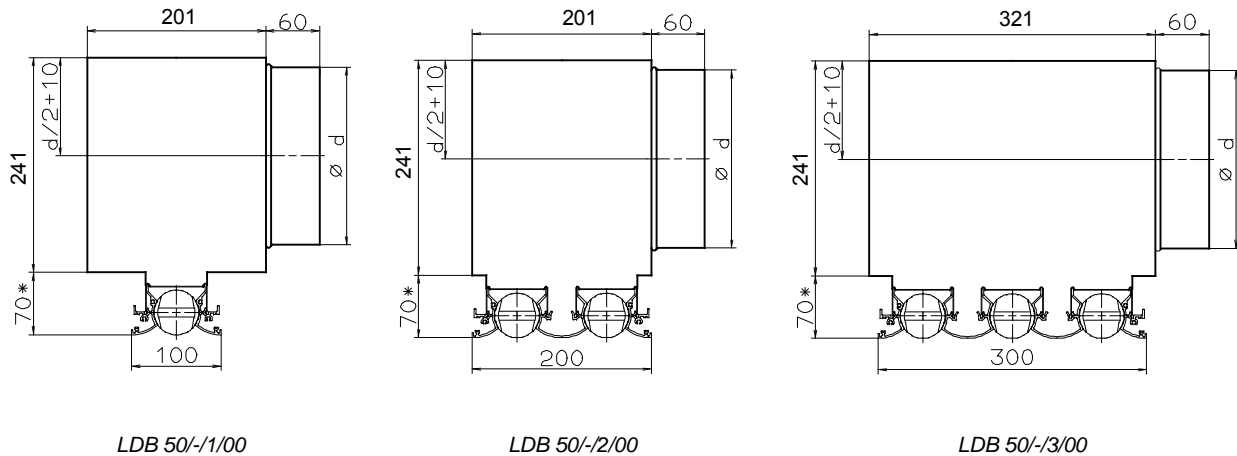
The diagrams are based on measuring results with the standard nozzle adjustment, a room height of 5 m and a uniform load distribution. For an optimized air flow, an adaptation may be required according to project.

Example for diagram above

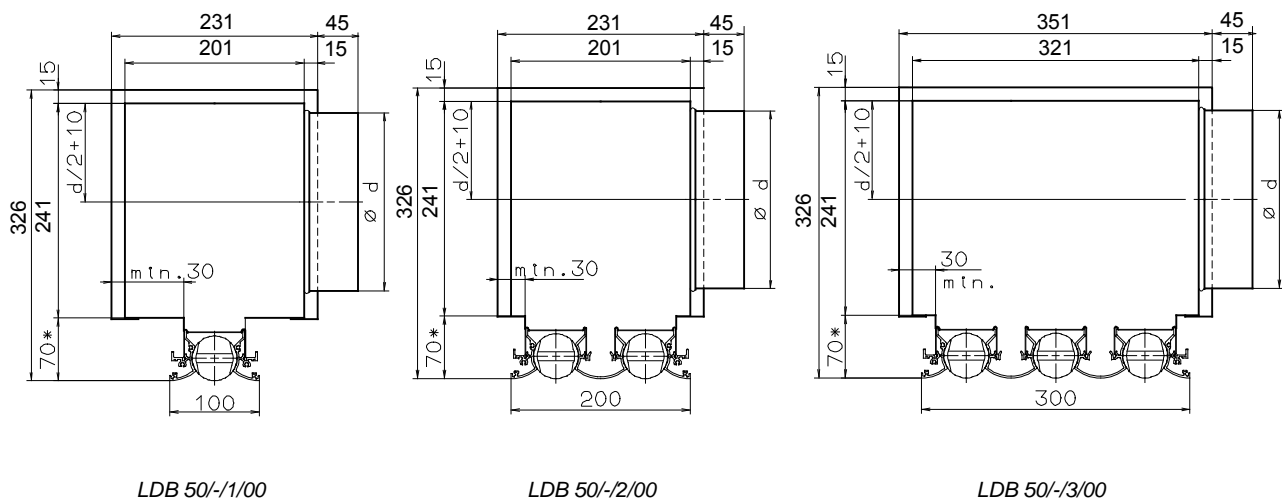
Volume flow rate per meter of diffuser:
 $V = 360 \text{ m}^3/(\text{hm})$
 Resulting data for type LDB 50/-1:
 $\Delta p = 26 \text{ Pa}$
 $L_{WA} = 41 \text{ dB(A)}$
 $\Delta t = -10 \text{ K}$
 $a(C_{max}) \approx 4.4 \text{ m}$
 $C_{max} \leq 24 \text{ cm/s}$

Linear diffusers series LDB Type LDB 50 - dimensions and additional profiles

Dimensions of air distribution boxes for LDB 50 without insulation



Dimensions of air distribution boxes for LDB 50 with insulation (double skin box)



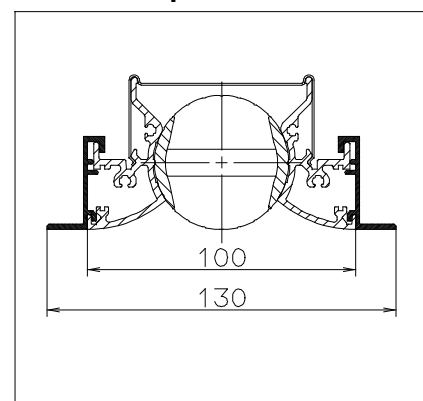
The values given refer to standard versions. Reduced box sizes and spigot diameters are available on request, depending on volume flow rate and acoustic requirements. *) Neck length 70 ... 170 mm

Spigot dimensions for LDB 50

| Diffuser length | L_{nom} [mm]* | 300 | 600 | 900 | 1200 | 1500 | 1800 | 2100 |
|----------------------------|--------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| LDB 50/-1 (1 slot row) | Ø d | 1x 199 | 1x 199 | 2x 199 | 2x 199 | 3x 199 | 3x 199 | 3x 199 |
| LDB 50/-2 (2 slot rows) | Ø d | 1x 199 | 1x 199 | 2x 199 | 2x 199 | 3x 199 | 3x 199 | 4x 199 |
| LDB 50/-3 (3 slot rows) | Ø d | 1x 199 | 1x 199 | 2x 199 | 2x 199 | 3x 199 | 3x 199 | 4x 199 |

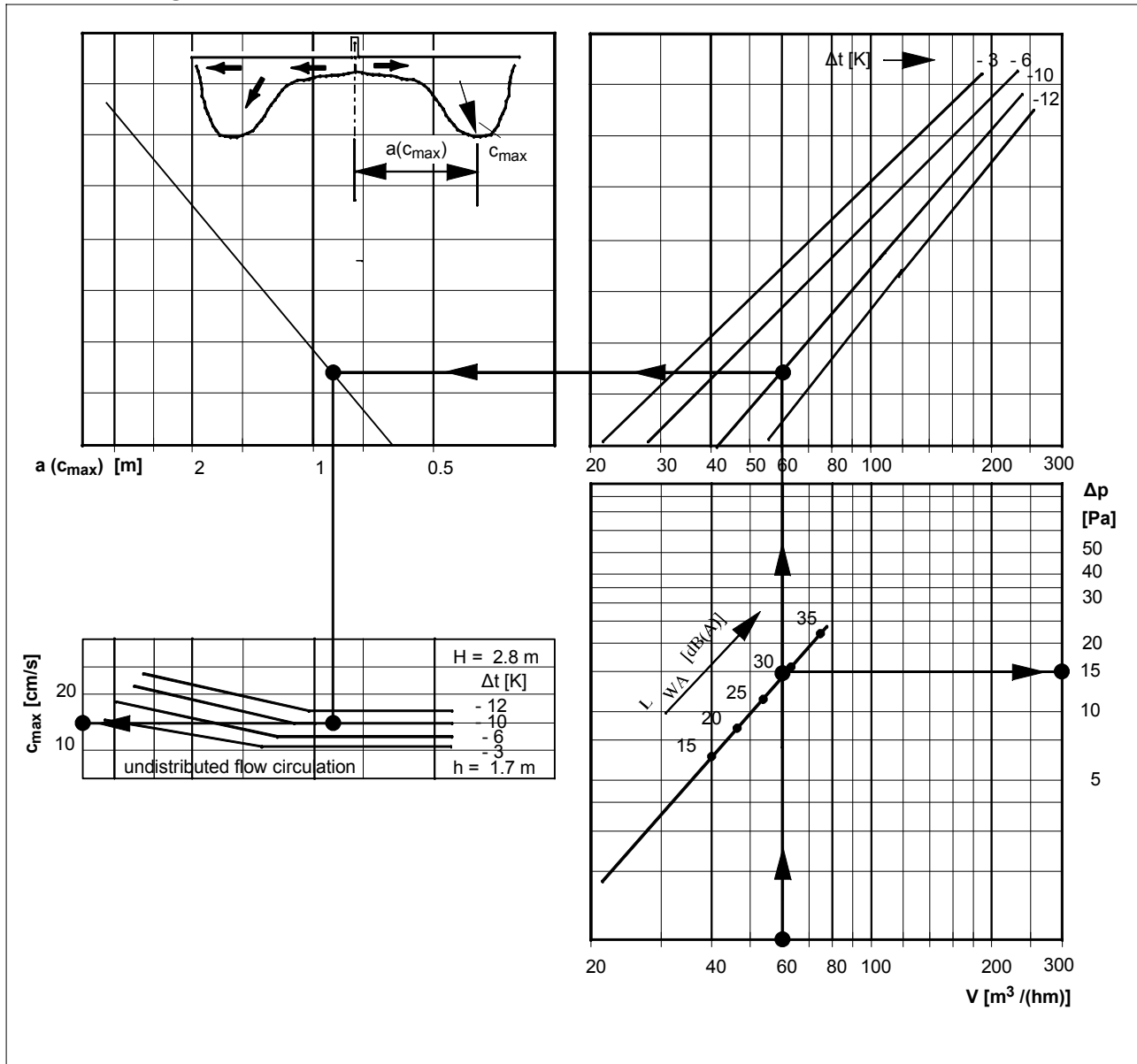
*) We recommend to choose large spigot and duct diameters to obtain the lowest possible duct speed as this will result in lower pressure losses and less noise caused by the flow. Due to an improved air distribution, the system can do without some of the additional units usually required such as throttle valves.

Additional profile for LDB 50



Linear diffusers series LDB Type LDB 16/M/1 - Selection

Selection diagram



Legend

| | | |
|--------------|---|------------------------|
| V | = volume flow rate | [m ³ /(hm)] |
| t_{zu} | = supply air temperature | [°C] |
| t_{RA} | = room air temperature | [°C] |
| Δt | = temperature difference between t_{zu} and t_{RA} | [K] |
| Δp | = pressure drop | [Pa] |
| L_{WA} | = sound power level | [dB(A)] |
| $a(C_{max})$ | = extension of jet at which the maximum speed of the ambient air was measured | [m] |
| C_{max} | = maximum speed of ambient air with uniformly distributed thermal loads | [cm/s] |
| H | = room height | [m] |
| h | = height of measuring point | [m] |

Note: The recommended min. distance between two parallel diffusers should, in case of high temperature differences Δt , not be less than the value of $a(C_{max})$.

The diagrams are based on measuring results with a room height of 2.8 m.

Example for diagram above

Volume flow rate per meter of diffuser:

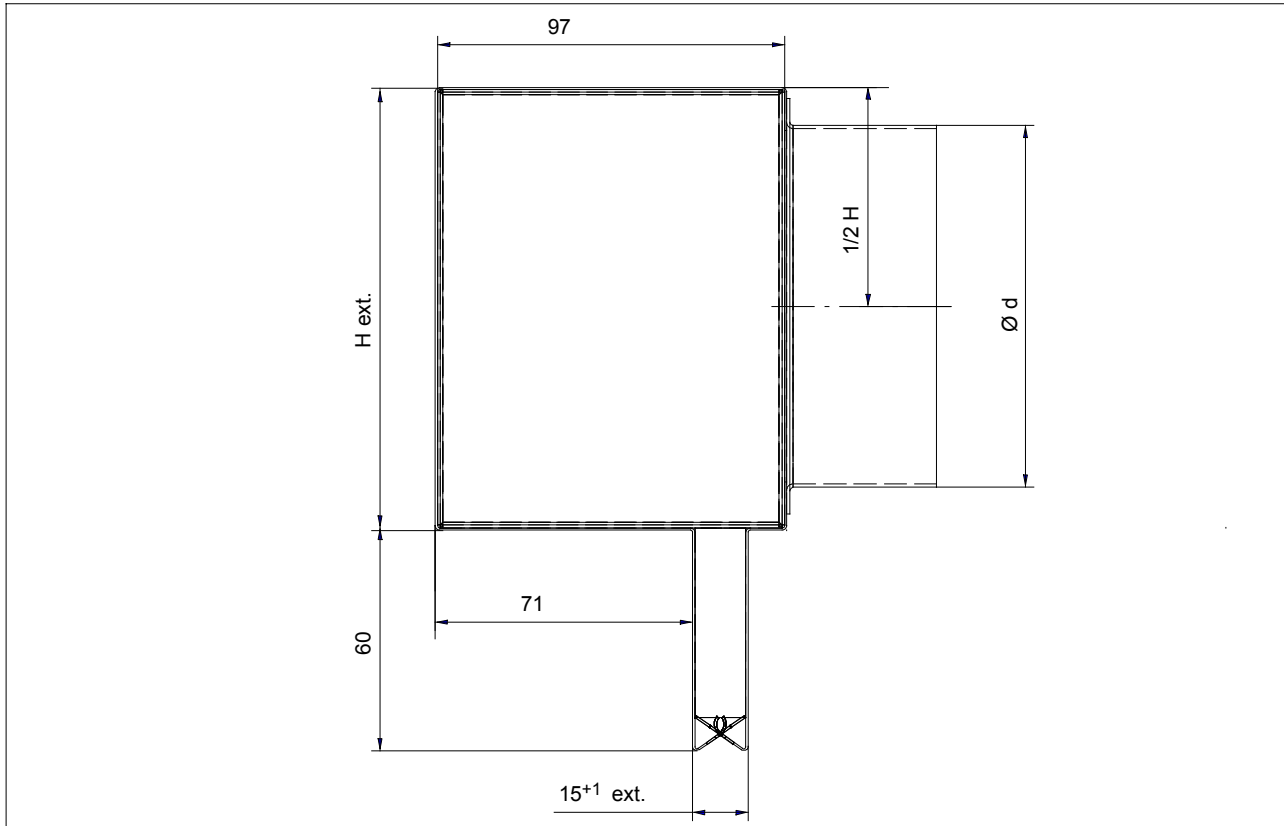
$$V = 60 \text{ m}^3/(\text{hm})$$

Resulting data:

| | | |
|--------------|---|----------|
| Δp | = | 15 Pa |
| L_{WA} | = | 28 dB(A) |
| Δt | = | -10 K |
| $a(C_{max})$ | ≈ | 0.8 m |
| C_{max} | ≤ | 15 cm/s |

Linear diffusers series LDB Type LDB 16/M/1 - dimensions

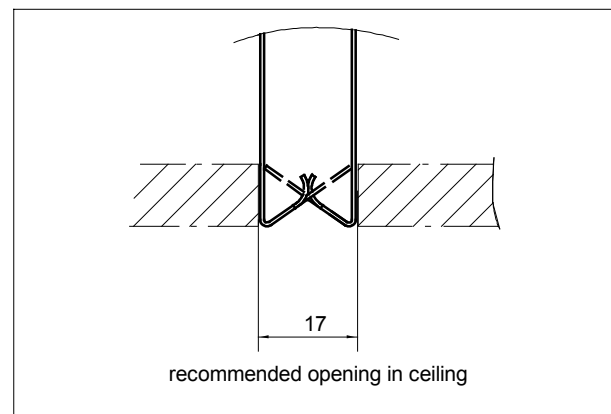
Dimensions of air distribution box for LDB 16/M/1 without insulation



Spigot dimensions for LDB 16/M/1

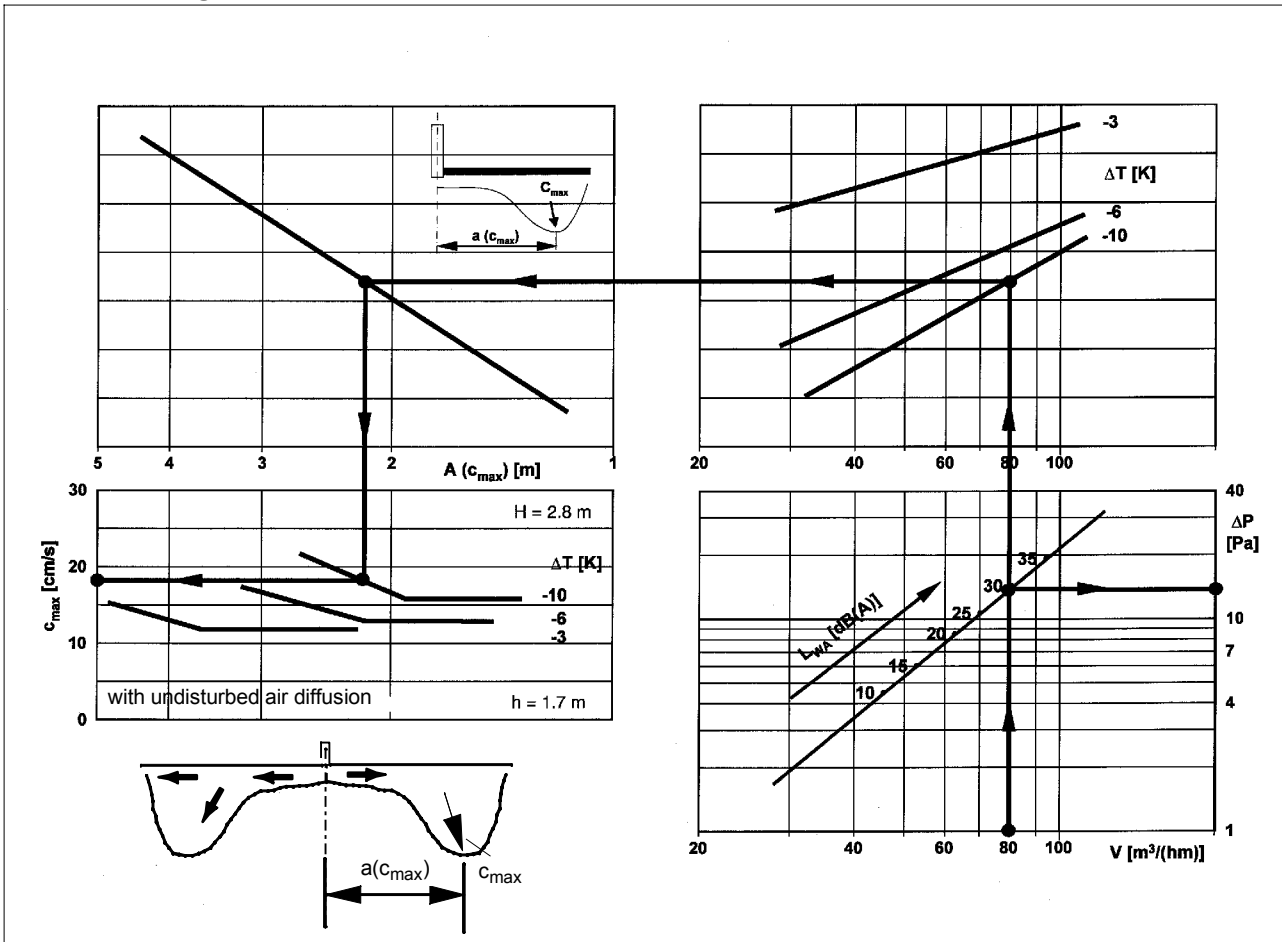
| Diffuser length | L _{nom} | [mm] | 1000 | 1250 | 1500 |
|-------------------|------------------|------|--------|--------|---------|
| Spigot-diameter | Ø d | [mm] | 1 x 99 | 1 x 99 | 1 x 124 |
| Height of the box | H | [mm] | 122 | 122 | 142 |

Profiles for installation in shaded joints



Linear diffusers series LDB Type LDB 32/M/1 - Selection

Selection diagram



Legend

| | | | |
|----------------------|---|---|------------------------|
| V | = | volume flow rate | [m ³ /(hm)] |
| t _{zu} | = | supply air temperature | [°C] |
| t _{RA} | = | room air temperature | [°C] |
| Δt | = | temperature difference between t _{zu} and t _{RA} | [K] |
| Δp | = | pressure drop | [Pa] |
| L _{WA} | = | sound power level | [dB(A)] |
| a(c _{max}) | = | extension of jet at which the maximum speed of the ambient air was measured | [m] |
| H | = | thermal loads | [cm/s] |
| H | = | room height | [m] |
| h | = | height of measuring point | [m] |

Note: The recommended min. distance between two parallel diffusers should, in case of high temperature differences Δt, not be less than the value of a(c_{max}).

The diagrams are based on measuring results with the standard nozzle adjustment and a room height of 2.8 m and a measuring height of 1.7 m.

Example for diagram above

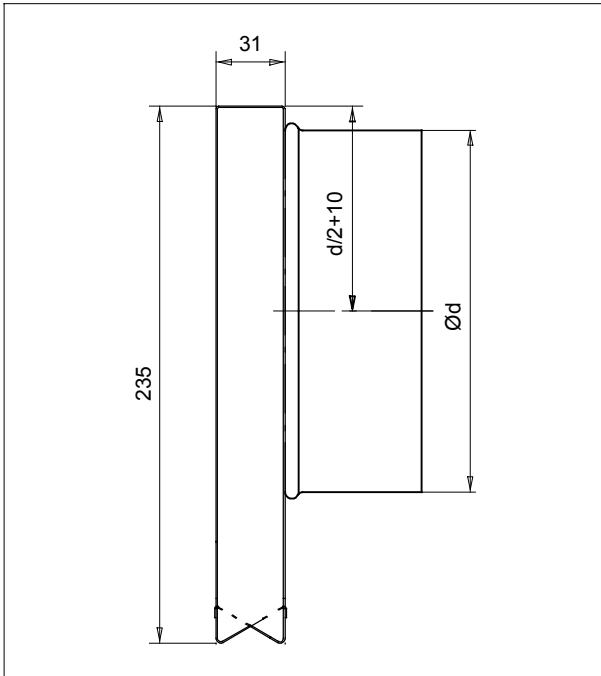
Volume flow rate per meter of diffuser:
V = 80 m³/(hm)

Resulting data for type LDB 32/M/1:

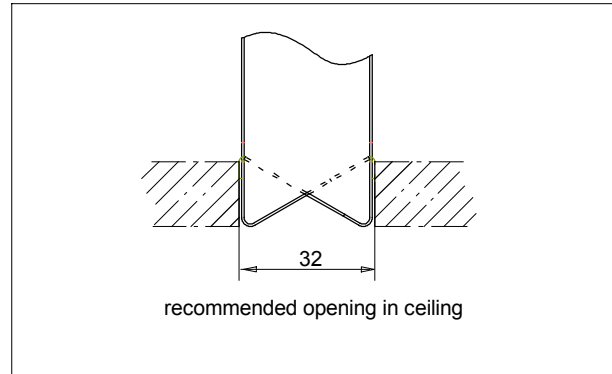
Δp = 13 Pa
L_{WA} = 30 dB(A)
Δt = -10 K
a(c_{max}) ≈ 2.1 m
c_{max} ≤ 18 cm/s

Linear diffusers series LDB Type LDB32/M/1 - dimensions

Dimensions of air distribution box for LDB 32/M/1 without insulation



Profiles for installation in shaded joints



Spigot dimensions for LDB 32/M/1

| Diffuser length | L_{nom} | [mm] | 1000 | 1250 | 1500 |
|-----------------|-----------------|------|---------|---------|---------|
| Spigot diameter | $\varnothing d$ | [mm] | 1 x 139 | 1 x 159 | 1 x 159 |

Linear diffusers series LDB

Distance between parallel linear diffusers and to walls

An unfavorable arrangement of linear diffusers in parallel lines or close to walls may result in air flow speeds higher than those given in the technical specifications.

In order to avoid this problem:

- ensure that the distance between parallel linear diffusers is sufficiently large to exclude any interaction,
- ensure that air jets are mixed above the occupied zone (e.g. at a height of 1.8 m).

Based on these requirements, the two areas marked in Figure 1 are obtained indicating the recommended distance b between parallel linear diffusers.

For an installation parallel to walls, at least half the distance ($b/2$) is required.

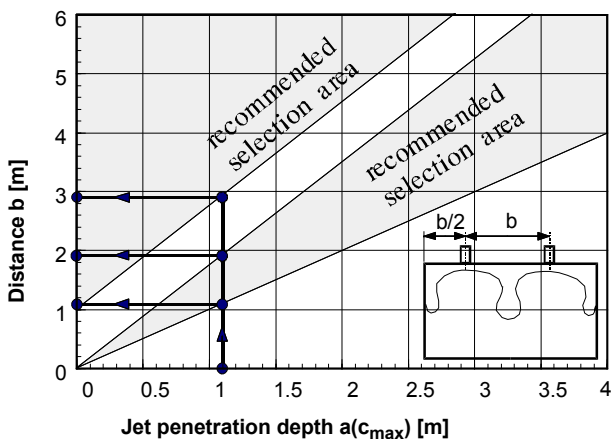


Figure 1: Distance between parallel diffusers with a symmetric air flow pattern

Example

From the selection diagram: $a(c_{max}) = 1.1$ m

Recommended distance betw. parallel diffusers: $1.1 \text{ m} < b < 1.9 \text{ m}$ or $b > 2.9 \text{ m}$

recommended distance to the wall: $b/2 > 0.55 \text{ m}$

All linear diffusers also allow an asymmetric splitting of the air volume in a 1/3 to 2/3 ratio.

The recommended distances $b_{1/3}$ and $b_{2/3}$ between parallel diffusers are illustrated in Figure 2. For the jet penetration depth $a(c_{max})$ refer to the selection diagrams for a *symmetric distribution*.

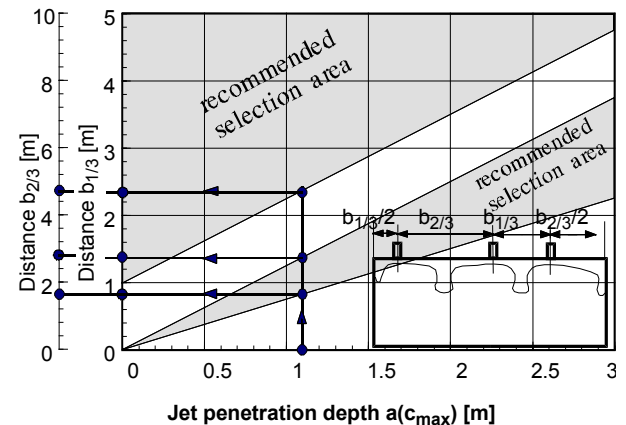


Figure 2: Distance between parallel diffusers with an asymmetric air flow pattern (1/3 to 2/3).

Example

From the selection diagram: $a(c_{max}) = 1.1$ m

Recommended distance between parallel diffusers:

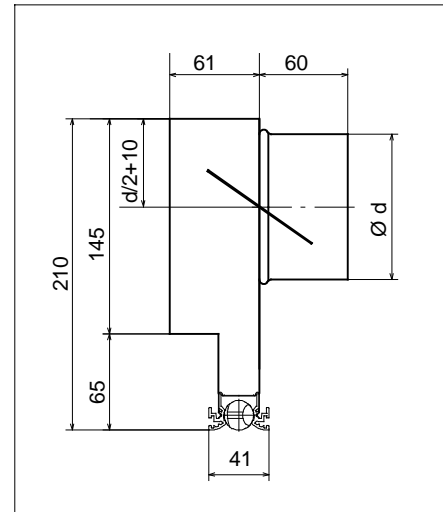
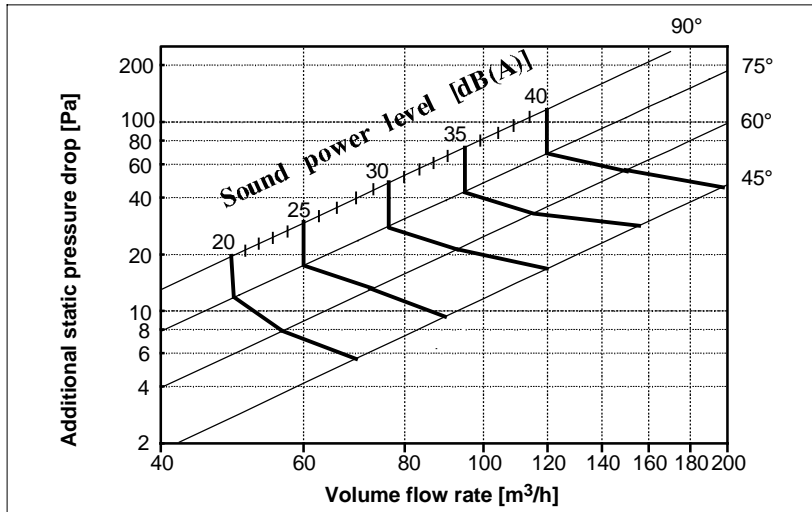
- 1/3-share: $0.8 \text{ m} < b_{1/3} < 1.4 \text{ m}$ or $b_{1/3} > 2.4 \text{ m}$
 2/3-share: $1.6 \text{ m} < b_{2/3} < 2.8 \text{ m}$ or $b_{2/3} > 4.8 \text{ m}$

Recommended distance

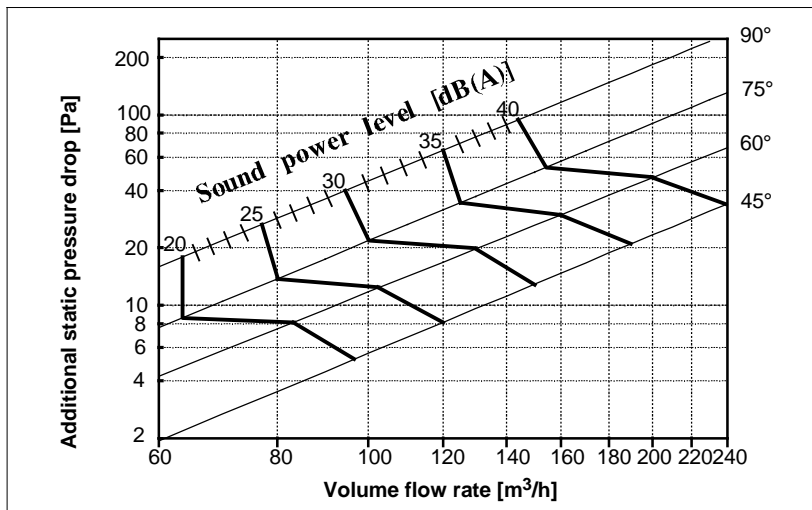
- to the wall:
 1/3-share: $b_{1/3}/2 > 0.4 \text{ m}$
 2/3-share: $b_{2/3}/2 > 0.8 \text{ m}$

Linear diffusers series LDB Accessories - throttling device type DLU

Pressure drop and acoustic level DLU Ø 99

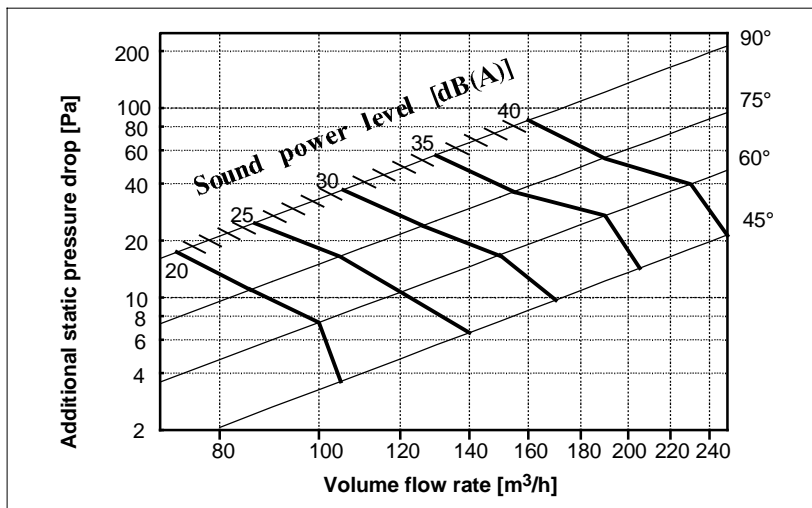


Pressure drop and acoustic level DLU Ø 124



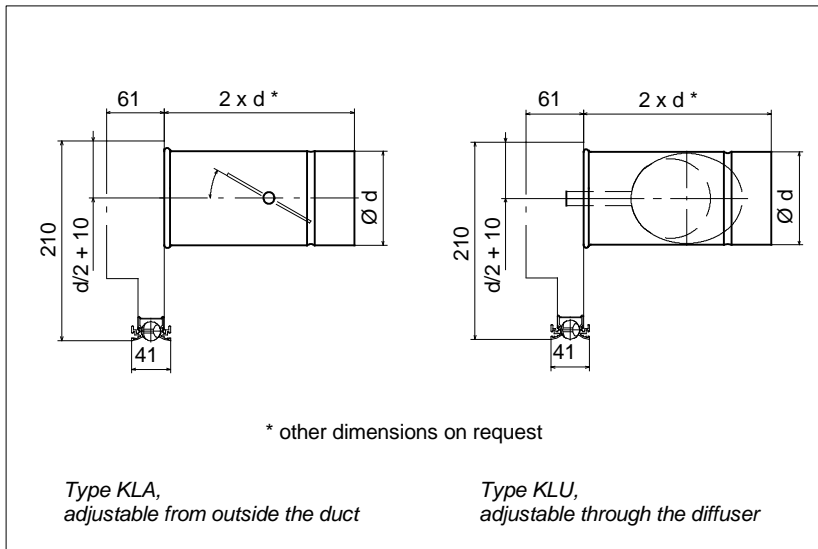
The throttle damper type DLU consists of a damper blade out of galvanizes steel sheet, integrated in the air distribution box. It is adjustable through the diffuser.

Pressure drop and acoustic level DLU Ø 139



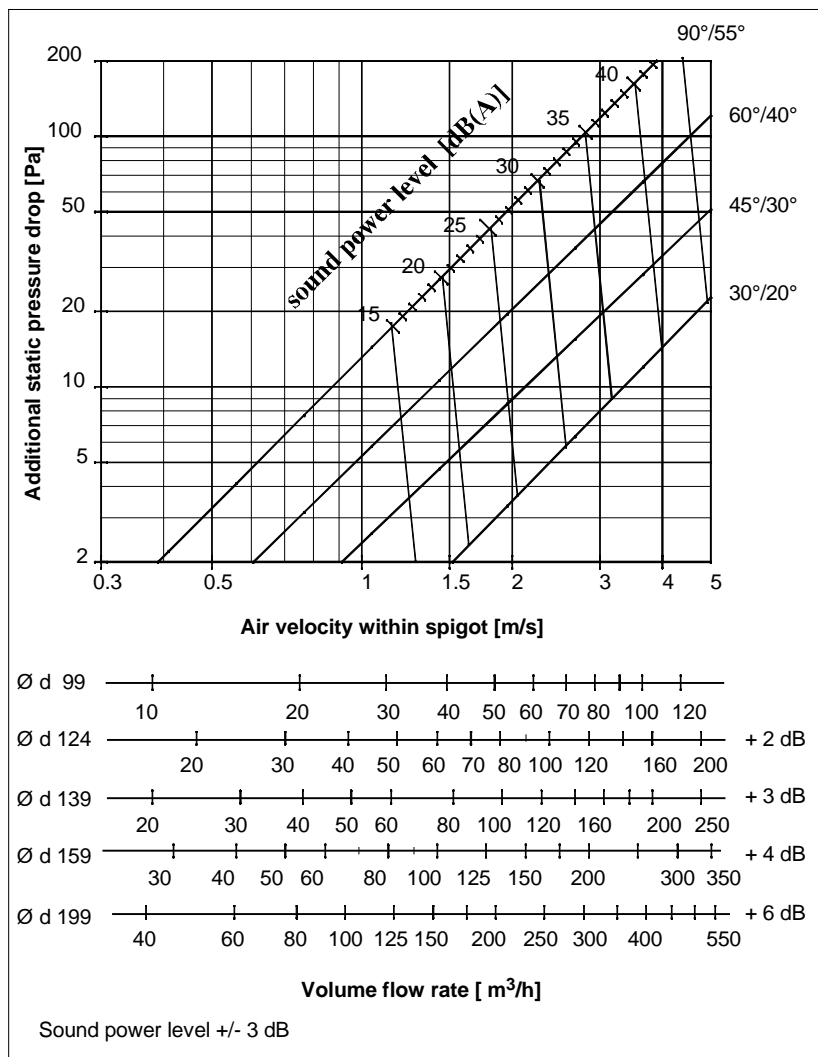
For an acoustic dimensioning, the sound sources must be summed logarithmically when using throttling devices in combination with linear diffusers.

Linear diffusers series LDB Accessories - throttling devices type KLA and KLU



The throttling damper type KLA and KLU are manually adjustable devices for connection to the air distribution box. The damper blades are made of perforated plate available with various free areas to suit throttling requirements. Type KLA is adjustable from outside the duct on the pivot spindle. Type KLU is adjustable through the diffuser.

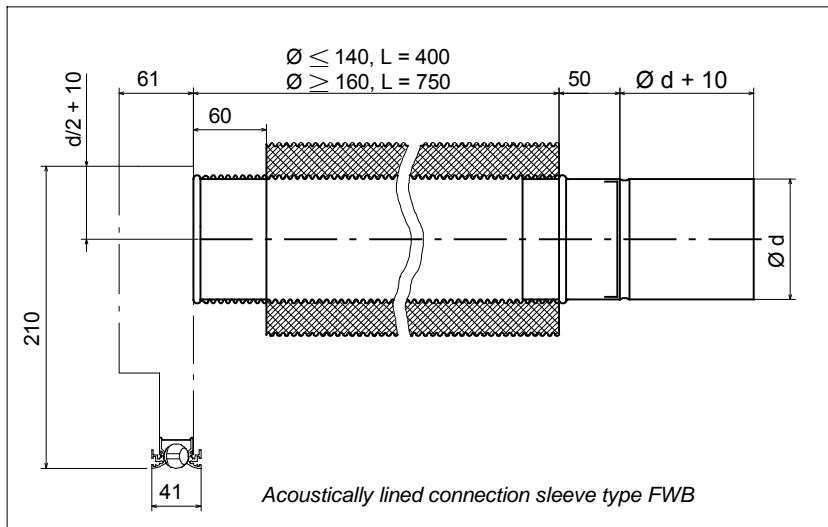
Pressure drop and acoustic level KLA, KLU



For an acoustic dimensioning, the sound sources must be summed logarithmically when using throttling devices in combination with linear diffusers.

Linear diffusers series LDB Accessories - throttling devices type FWA and FWB

Fixed resistance plate with installation sleeve



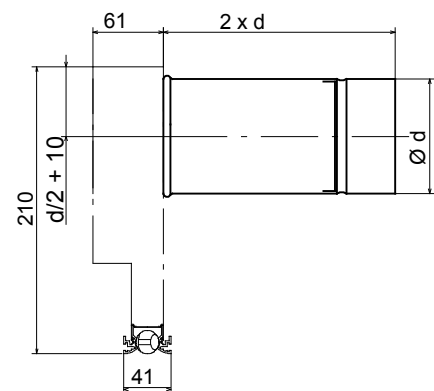
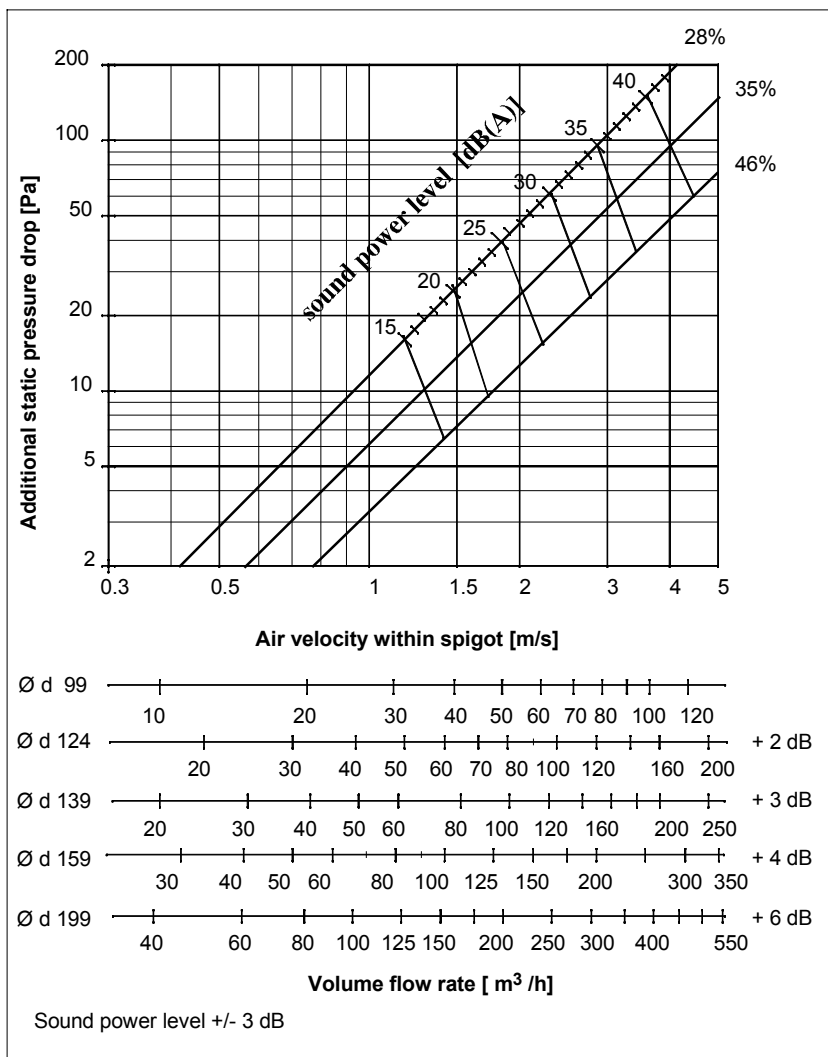
Type FWA

A galvanized perforated plate within an installation duct sleeve which replaces the standard spigot of the air distribution box.

Type FWB

An acoustically lined connection to reduce duct-borne noise and „crosstalk“. Diffuser selection can be made more critically.

Pressure drop and acoustic level FWA



Fixed resistance plate type FWA

For an acoustic dimensioning, the sound sources must be summed up logarithmically when using throttling devices in combination with linear diffusers.

Linear diffusers series LDB Accessories for installation of lamps

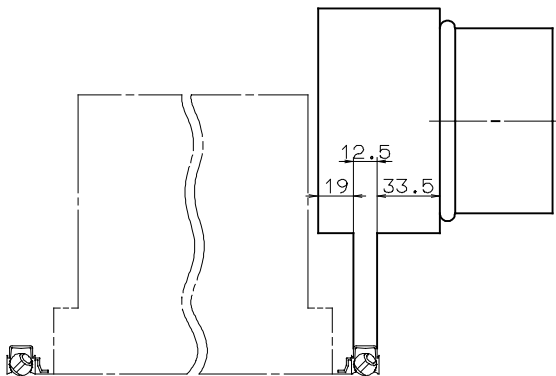
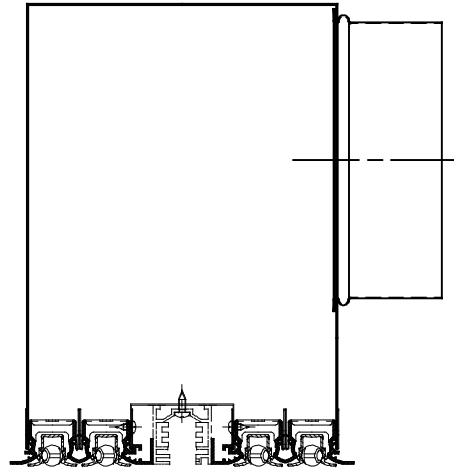
LTG has developed special border profiles for the application of linear diffusers in combination with lamps. A wide variety of lamp brands and styles can be used with the linear diffusers. The installation of the diffuser is performed by screw connections. In order to make the installation

even easier, the components are standard, which means that no drilling or adjusting of the linear diffusers will be required to fit the lamps.

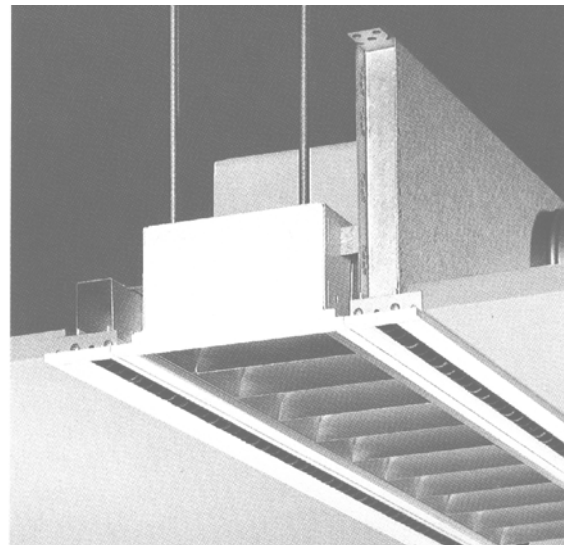
Alternatively, the lamps may be integrated in the air distribution box by using a lamp rail.



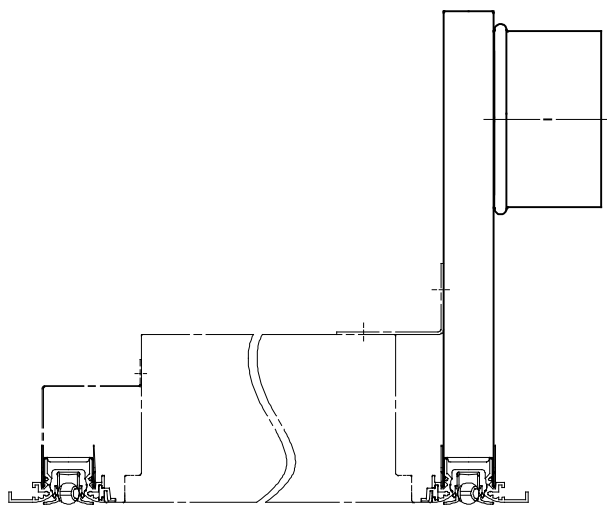
LTG linear diffusers type LDB 12/8/2/12 with a lamp rail integrated in the air distribution box.



Example for lamp installation using LDB 12/-/1/20

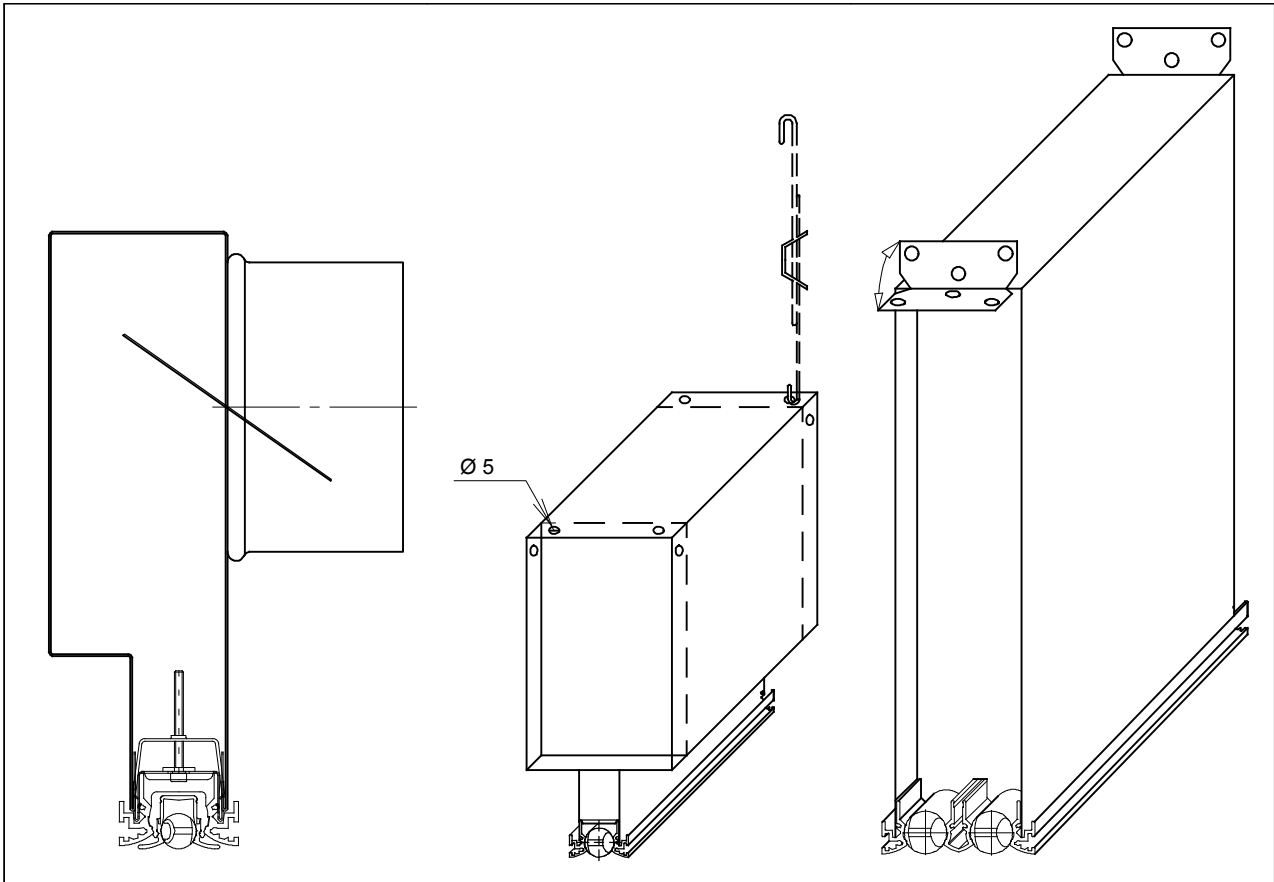


*Example for lamp installation, suitable for the following LTG linear diffuser types:
 LDB 12/-/1/20
 LDB 15/0/1/20
 LDB 12/8/1/40/07
 LDB 20/8/1/40/07*



Example for lamp installation using LDB 12/8/1/20

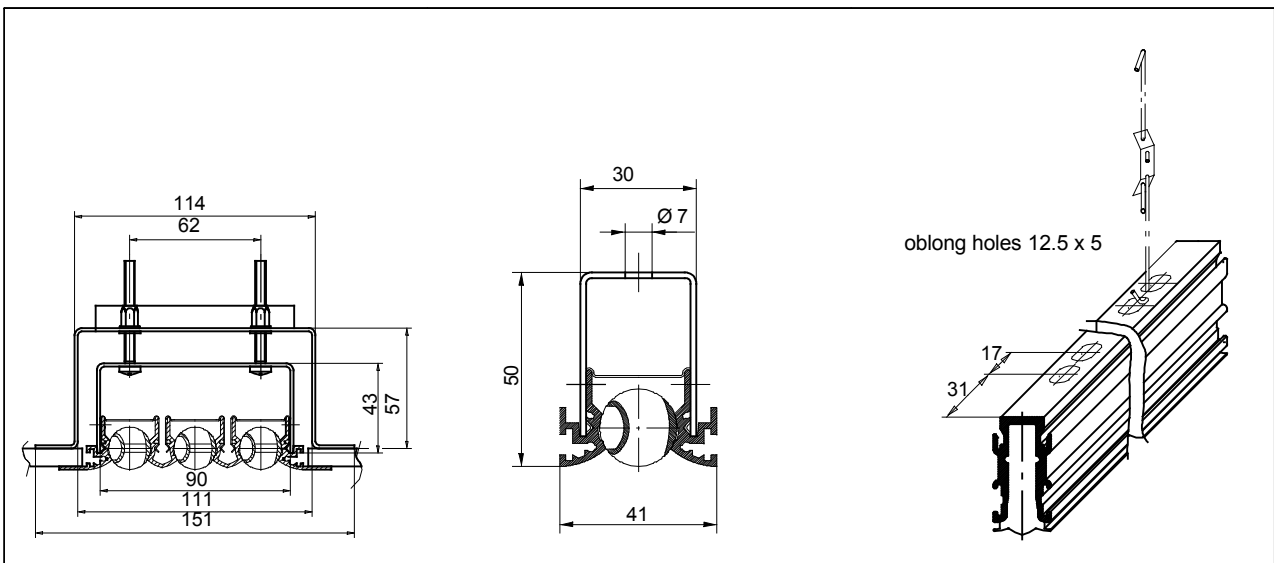
Linear diffusers series LDB Accessories for suspension



Example for installation of type LDB 12/8/1/00 with air distribution box and **subsequently "second fix" installed** slotted rail

Example for installation of type LDB 20/8/1/00 with air distribution box and **continuously adjustable spring hanger** (adjusting range about 3/4 of the length of the hooked wire)

Example for installation of type LDB 20/8/2/00 with air distribution box without insulation. The **four suspension eyes** are included in the delivery of the narrow box.



Example for installation of type LDB 20/8/3/11 with **fixing brackets** for blind attachment

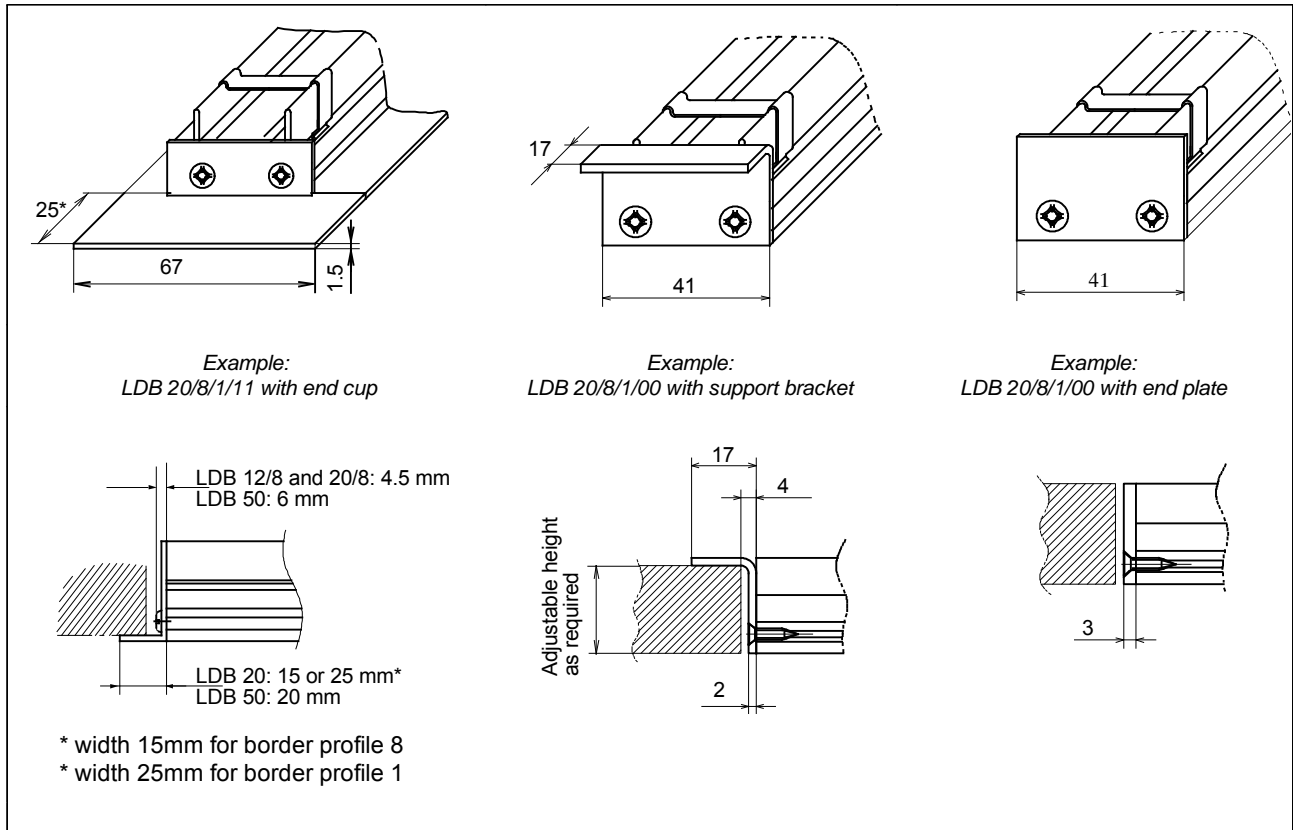
Example for installation of type LDB 20/8/1/00 with **suspension bracket** for blind attachment

Example for installation of **blind profiles** type LDB 15

Linear diffusers series LDB Accessories for installation

Installation of end caps

By using end caps, a closed frame of linear diffusers is obtained.

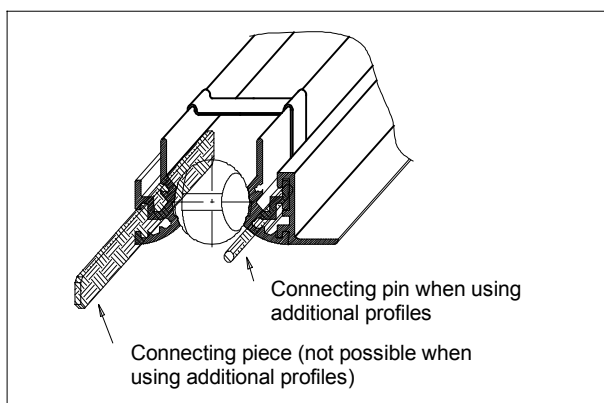


Connecting piece

A flush mounting of the diffusers is achieved by using connecting pieces inserted in the guiding grooves of the profiles.

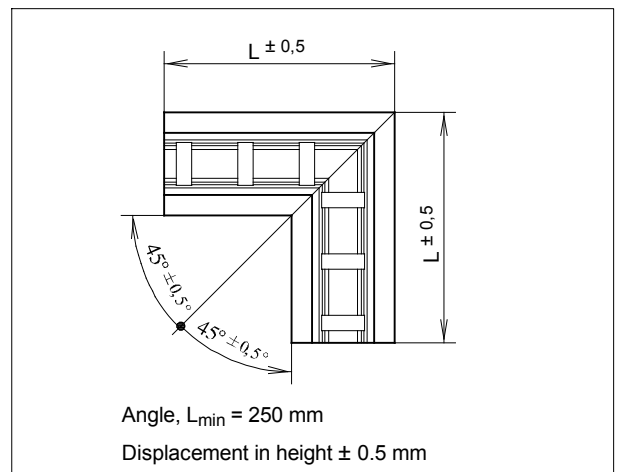
Several linear diffusers may thus be connected to form a continuous line.

For linear diffusers with additional profiles, a flush mounting is achieved by using additional overlap profiles or connecting pins.



Angle

Angles offer a perfect solution for the continuous installation of linear diffusers.



Linear diffusers series LDB

Nomenclature

LDB 20/8 / 1 / 00 / - - / E6-EV1 / 2000 / N4 / S / 1 / S / O / L / - -
 (1) (2) (3) (4) (5) (6) (7) (8) (9) (10) (11) (12) (13) (14)

- (1) **Diffuser type** LDB 12/-; LDB 12/8 LTG System clean®; LDB 15; LDB 16/M/1; LDB 20/8; LDB 32/M/1; LDB 50/-
- (2) **Number of slots** 1..4 LDB 12, 15, 16/M/1 and 32/M/1 have only 1 slot row
- (3) **Border profile** 0..8 left - right (except LDB 16/M/1, LDB 32/M/1, LDB 50)
- (4) **Additional profile** -, 1..7 left - right (except LDB 12, LDB 15, LDB 16/M/1, LDB 32/M/1)
- (5) **Surface**
E6 = anodized, unbrushed
LG = painted, gloss
LM = painted, matt
R = unfinished
X = special finish
B = coated (for LDB 16/M/1, LDB 32/M/1)
- (6) **Colour**
RAL-shade = painted (LDB 16/M/1 and LDB 32/M/1 black, RAL 9011)
anodized = anodizing shade
- (7) **Slot length** [mm]
- (8) **Flow pattern**
N1...N9 (LDB 15 only N4 resp. N8)
T1...T9 (LDB 16/M/1 and 32/M/1 only T4)
- (9) **Nozzle colour**
S = black
W = white
G = aluminium grey
- (10) **End caps** (not for LDB 16/M/1 and LDB 32/M/1)
 - = without
 1 = both sides
 2 = left
 3 = right
- (11) **Box type**
 - = without
S = narrow
L = longitudinal double box
W = angle
 (-, L + W not for LDB 16/M/1 and LDB 32/M/1)
- (12) **Cylinder type** (not for LDB 16/M/1 and LDB 32/M/1)
O = open
B = blind
- (13) **Suspension**
O = without (not for LDB 16/M/1 and LDB 32/M/1)
B = suspension brackets (not for LDB 16/M/1 and LDB 32/M/1)
L = fixing bracket
- (14) **Size A** (concerning suspension, not for LDB 16/M/1 and LDB 32/M/1)
 [mm]

Specification and schedule of prices

Linear diffuser type LDB 12

September 2012 / page 1 of 2

| Quantity | Description of services | Unit price in € | Total price in € |
|----------|---|--------------------|---------------------|
| | <p>Adjustable linear diffuser LDB 12 for constant or variable flow rates.</p> <p>May be adjusted to ranges of 100 ...20% of the nominal volume flow rate without the need for any additional mechanical devices. Flow pattern from flat ceiling jet to broad jet comprising of 18 individual micro-jets per meter, thus either providing or avoiding the Coanda effect. Direction of diffusion adjustable by 180°, factory-set. Setting may be reproduced at any time. Subsequent adjustment possible even after installation, adjustment with close-to-zero opening possible. Long cylinders with high induction ratio, optimized contour, rapid reduction of expelled air speed and temperature difference. Diffuser suitable for variable flow rates of 10 ... 80 m³/h</p> <p><u>Diffuser comprising of:</u></p> <ul style="list-style-type: none"> - <u>Extruded aluminum profiles</u> - <u>Cylindrical slot nozzles</u>, plastic, Ø 12 mm, with rectifier fins and air flow-optimized interior contour for a virtually turbulence-free and noiseless air guidance - <u>Air distribution box</u> of galvanized sheet steel with suspension eyes and connecting socket for easy insertion (standard). W = 96 mm, H = 121 mm, d = 100 mm, neck height = 60 mm Total height = 181 mm <p>Design Length = _____ mm (maximum length in one piece: 1500 mm) 1-slot-version LDB 12/-/1</p> <p>Aluminum rails</p> <ul style="list-style-type: none"> o painted similar to RAL _____ o natural anodized <p>Cylinders</p> <ul style="list-style-type: none"> o black (standard) o white o aluminum grey (RAL 9007) <p>Diffuser profile</p> <ul style="list-style-type: none"> o border profile no. 0 for installation in shaded joints LDB 12/-/1/00 o border profile no. 1 for installation in ceiling joints LDB 12/-/1/11 o border profile no. 2 for lamp installation LDB 12/-/1/20 <p>Manufacturer: LTG Aktiengesellschaft Series: Linear diffusers Model: LDB 12</p> | | |

Specification and schedule of prices

Linear diffuser type LDB 12

September 2012 / page 2 of 2

| Quantity | Description of services | Unit price in € | Total price in € |
|----------|--|--------------------|---------------------|
| | <p>Special versions, accessories (on request, additional charge)</p> <ul style="list-style-type: none"> o Without air distribution box <ul style="list-style-type: none"> o as blind diffuser o air-ducting o with 2 suspension brackets o Color of aluminum rails anodized other than natural o Plug connector for line assembly o With special air distribution box <p style="margin-left: 20px;">Special dimensions of the air distribution box</p> <p style="margin-left: 20px;">W = _____ mm, H = _____ mm, d = _____ mm</p> <p style="margin-left: 20px;">Neck height = _____ mm (40 ... max. 170 mm, standard: 60 mm)</p> <ul style="list-style-type: none"> o Insulation through double skin box o Fixed resistor with sleeve type FWA for insertion on site o Fixed resistor, acoustically indifferent, type FWB for insertion on site o Adjustable throttling device type KLA for insertion on site o Adjustable throttling device type KLU for insertion on site, adjustable from below o Lamp installation <p style="margin-left: 20px;">Brand _____</p> <p style="margin-left: 20px;">Type _____</p> | | |

Specification and schedule of prices

Linear diffuser type LDB 12/8 LTG System clean[®]

September 2012 / page 1 of 2

| Quantity | Description of services | Unit price in € | Total price in € |
|----------|---|--------------------|---------------------|
| | <p>Adjustable linear diffuser LDB 12/8 LTG System clean[®] for constant or variable flow rates.</p> <p>May be adjusted to ranges of 100 ... 20 % of the nominal volume flow rate without the need for any additional mechanical devices.</p> <p>Flow pattern from flat ceiling jet to broad jet comprising of 18 individual micro-jets per meter and slot row, thus either providing or avoiding the Coanda effect.</p> <p>Direction of diffusion adjustable by 180°, factory-set. Setting may be reproduced at any time.</p> <p>Subsequent adjustment possible even after installation, adjustment with close-to-zero opening possible.</p> <p>Long cylinders with high induction ratio, optimized contour, rapid reduction of expelled air speed and temperature difference.</p> <p>Production of an additional air curtain close to ceiling and diffuser to virtually keep airborne dust particles from depositing on the ceiling.</p> <p><u>Diffuser comprising of:</u></p> <ul style="list-style-type: none"> - <u>Extruded aluminum profiles</u> - <u>Cylindrical slot nozzles</u>, plastic, Ø 12 mm, with rectifier fins and air flow-optimized interior contour for a virtually turbulence-free and noiseless air guidance - <u>Air distribution box</u> of galvanized sheet steel with suspension eyes and connecting socket for easy insertion (standard). - Integrated <u>throttling damper</u> type DLU at socket diameters 99 ... 139 <p>Design Length = _____ mm (maximum length in one piece: 2000 mm)</p> <ul style="list-style-type: none"> o 1-slot-version LDB 12/8/1/... o 2-slot version LDB 12/8/2/... o 3-slot-version LDB 12/8/3/... <p>Aluminum rails</p> <ul style="list-style-type: none"> o painted similar to RAL _____ o natural anodized <p>Cylinders</p> <ul style="list-style-type: none"> o black (standard): o white o aluminum grey (RAL 9007) <p>Diffuser profile</p> <ul style="list-style-type: none"> o Border profile no. 00 o Border profile no. 11 o Border profile no. 22 o Border profile no. 44 o Border profile no. 55 o Border profile no. 88 <p>Manufacturer: LTG Aktiengesellschaft Series: Linear diffusers Model: LDB 12/8 LTG System clean[®]</p> | | |

Specification and schedule of prices

Linear diffuser type LDB 12/8 LTG System clean[®]

September 2012 / page 2 of 2

| Quantity | Description of services | Unit price in € | Total price in € |
|----------|--|--------------------|---------------------|
| | <p>Special versions, accessories (on request, additional charge)</p> <ul style="list-style-type: none"> o Air distribution box with integrated sound trap for improved cross-talk attenuation (melamin resin foam) o Without air distribution box <ul style="list-style-type: none"> o as blind diffuser o air-ducting o with 2 suspension brackets o Color of aluminum rails anodized other than natural <p>Diffuser profile</p> <ul style="list-style-type: none"> o Additional profile no. 2 o Additional profile no. 7 (for lamp installation) o End cover for front 15 mm <ul style="list-style-type: none"> o detached o mounted o End cover for front 25 mm <ul style="list-style-type: none"> o detached o mounted o Plug connector for line assembly o Special air distribution box <p>Special dimensions of the air distribution box</p> <p>W = _____ mm, H = _____ mm, d = _____ mm</p> <p>Neck height = _____ mm (40 ... max. 170 mm)</p> <ul style="list-style-type: none"> o Insulation through double skin box o Fixed resistor with sleeve type FWA for insertion on site o Fixed resistor, acoustically indifferent, type FWB for insertion on site o Adjustable throttling device type KLA for insertion on site o Adjustable throttling device type KLU for insertion on site, adjustable from below o Lamp installation <p>Brand _____</p> <p>Type _____</p> | | |

Specification and schedule of prices

Linear diffuser type LDB 15 LTG System clean®

September 2012 / page 1 of 2

| Quantity | Description of services | Unit price in € | Total price in € |
|----------|---|--------------------|---------------------|
| | <p>Adjustable linear diffuser LDB 15 LTG System clean® for constant or variable flow rates.</p> <p>May be adjusted to ranges of 100 ... 20 % of the nominal volume flow rate without the need for any additional mechanical devices. Flow pattern comprising of 19 individual microjets per meter. Direction of diffusion adjustable, factory-set, subsequent adjustment possible even after installation, detachable diffuser elements. High induction ratio, optimized diffuser contour, rapid reduction of expelled air speed and temperature difference.</p> <p>Production of an additional air curtain close to ceiling and diffuser to virtually keep airborne dust particles from depositing on the ceiling.</p> <p><u>Diffuser comprising of:</u></p> <ul style="list-style-type: none"> - <u>Extruded aluminum profiles, natural anodized</u> - <u>Cylindrical slot nozzles</u>, plastic, with rectifier fins and air flow-optimized interior contour for a virtually turbulence-free and noiseless air guidance - <u>Air distribution box</u> of galvanized sheet steel with suspension eyes and connecting socket for easy insertion (standard). <p>Design Length = _____ mm (maximum length in one piece: 2000 mm) 1-slot-version LDB 15/-/1</p> <p>Cylinders</p> <ul style="list-style-type: none"> o black (standard) o white o aluminum grey (RAL 9007) <p>Diffuser profile</p> <ul style="list-style-type: none"> o Border profile no. 00 LDB 15/0/1/00 Diffuser width 15 mm, for installation in shaded joints o Border profile no. 11 LDB 15/0/1/11 Diffuser width 25 mm, for installation in ceiling joints o Border profile no. 20 LDB 15/0/1/20 for lamp installation <p>Manufacturer: LTG Aktiengesellschaft Series: Linear diffusers Model: LDB 15 LTG System clean®</p> | | |

Specification and schedule of prices

Linear diffuser type LDB 15 LTG System clean[®]

September 2012 / page 2 of 2

| Quantity | Description of services | Unit price in € | Total price in € |
|----------|--|--------------------|---------------------|
| | <p>Special versions, accessories (on request, additional charge)</p> <ul style="list-style-type: none"> o Without air distribution box <ul style="list-style-type: none"> o as blind diffuser o air-ducting o with 2 suspension brackets o Plug connector for line assembly o Special air distribution box <p>Special dimensions of the air distribution box</p> <p>W = _____ mm, H = _____ mm, d = _____ mm</p> <p>Neck height = _____ mm (40 ... max. 170 mm)</p> <ul style="list-style-type: none"> o Insulation through double skin box o Fixed resistor with sleeve type FWA for insertion on site o Fixed resistor, acoustically indifferent, type FWB for insertion on site o Adjustable throttling device type KLA for insertion on site o Adjustable throttling device type KLU for insertion on site, adjustable from below o Lamp installation <p>Brand _____</p> <p>Type _____</p> | | |

Specification and schedule of prices

Linear diffuser type LDB 20/8

September 2012 / page 1 of 2

| Quantity | Description of services | Unit price in € | Total price in € |
|----------|---|--------------------|---------------------|
| | <p>Adjustable linear diffuser LDB 20/8 for constant or variable flow rates.</p> <p>May be adjusted to ranges of 100 ... 20 % of the nominal volume flow rate without the need for any additional mechanical devices. Flow pattern from flat ceiling jet to broad jet comprising of 17 individual micro-jets per meter and slot row, thus either providing or avoiding the Coanda effect. Direction of diffusion adjustable by 180°, factory-set, setting may be reproduced at any time. Subsequent adjustment possible even after installation, adjustment with close-to-zero opening possible. Long cylinders with high induction ratio, optimized contour, rapid reduction of expelled air speed and temperature difference.</p> <p><u>Diffuser comprising of:</u></p> <ul style="list-style-type: none"> - <u>Extruded aluminum profiles</u> - <u>Cylindrical slot nozzles</u>, plastic, Ø 20 mm, with rectifier fins and air flow-optimized interior contour for a virtually turbulence-free and noiseless air guidance - <u>Air distribution box</u> of galvanized sheet steel with suspension eyes and connecting socket for easy insertion (standard). - Integrated <u>throttling damper</u> type DLU at socket diameters 99 ... 139 <p>Design Length = _____ mm (maximum length in one piece: 2000 mm)</p> <ul style="list-style-type: none"> o 1-slot-version LDB 20/8/1/... o 2-slot-version LDB 20/8/2/... o 3-slot-version LDB 20/8/3/... o 4-slot-version LDB 20/8/4/... <p>Aluminum rails</p> <ul style="list-style-type: none"> o painted similar to RAL _____ o natural anodized <p>Cylinders</p> <ul style="list-style-type: none"> o black (standard) o white o aluminum grey (RAL 9007) <p>Diffuser profile</p> <ul style="list-style-type: none"> o border profile no. 00 o border profile no. 11 o border profile no. 22 o border profile no. 44 o border profile no. 55 o border profile no. 88 <p>Manufacturer: LTG Aktiengesellschaft Series: Linear diffusers Model: LDB 20/8</p> | | |

Specification and schedule of prices

Linear diffuser type LDB 20/8

September 2012 / page 2 of 2

| Quantity | Description of services | Unit price in € | Total price in € |
|----------|---|--------------------|---------------------|
| | <p>Special versions, accessories (on request, additional charge)</p> <ul style="list-style-type: none"> o Air distribution box with integrated sound trap for improved cross-talk attenuation (melamine resin foam) o Without air distribution box <ul style="list-style-type: none"> o as blind diffuser o air-ducting o with 2 suspension brackets o Color of aluminum rails anodized other than natural <p>Diffuser profile</p> <ul style="list-style-type: none"> o Additional profile no. 2 o Additional profile no. 7 (for lamp installation) o End cover for front 15 mm <ul style="list-style-type: none"> o detached o mounted o End cover for front 25 mm <ul style="list-style-type: none"> o detached o mounted o Plug connector for line assembly o Special air distribution box <p>Special dimensions of the air distribution box</p> <p>W = _____ mm, H = _____ mm, d = _____ mm</p> <p>Neck height = _____ mm (40 ... max. 170 mm)</p> <ul style="list-style-type: none"> o Insulation through double skin box o Fixed resistor with sleeve type FWA for insertion on site o Fixed resistor, acoustically indifferent, type FWB for insertion on site o Adjustable throttling device type KLA for insertion on site o Adjustable throttling device type KLU for insertion on site, adjustable from below o Lamp installation <p>Brand _____</p> <p>Type _____</p> | | |

Specification and schedule of prices

Linear diffuser type LDB 50

September 2012 / page 1 of 2

| Quantity | Description of services | Unit price in € | Total price in € |
|----------|---|--------------------|---------------------|
| | <p>Adjustable linear diffuser LDB 50 for constant or variable flow rates.</p> <p>May be adjusted to ranges of 100 ... 20 % of the nominal volume flow rate without the need for any additional mechanical devices. Flow pattern from flat ceiling jet to broad jet comprising of 7 individual micro-jets per meter and slot row, thus either providing or avoiding the Coanda effect. Direction of diffusion adjustable by 180°, factory-set, setting may be reproduced at any time. Subsequent adjustment possible even after installation, adjustment with close-to-zero opening possible. Long cylinders with high induction ratio, optimized contour, rapid reduction of expelled air speed and temperature difference.</p> <p><u>Diffuser comprising of:</u></p> <ul style="list-style-type: none"> - <u>Extruded aluminum profiles</u> - <u>Cylindrical slot nozzles</u>, plastic, Ø 50 mm - <u>Air distribution box</u> of galvanized sheet steel with suspension eyes and connecting socket for easy insertion (standard). - <u>Diffuser rail</u> offering the possibility to realize various attachments to the ceiling using additional profiles <p>Design Length = _____ mm (maximum length in one piece: 2100 mm)</p> <ul style="list-style-type: none"> o 1-slot-version LDB 50/-/1/... o 2-slot-version LDB 50/-/2/... o 3-slot-version LDB 50/-/3/... <p>Aluminum rails</p> <ul style="list-style-type: none"> o painted similar to RAL _____ o natural anodized <p>Cylinders</p> <ul style="list-style-type: none"> o black (standard) o white o aluminum grey (RAL 9007) <p>Diffuser profile</p> <ul style="list-style-type: none"> o Border profile no. 00 o Additional profile no. 11 <p>Manufacturer: LTG Aktiengesellschaft Series: Linear diffusers Model: LDB 50</p> | | |

Specification and schedule of prices

Linear diffuser type LDB 50

September 2012 / page 2 of 2

| Quantity | Description of services | Unit price in € | Total price in € |
|----------|--|--------------------|---------------------|
| | <p>Special versions, accessories (on request, additional charge)</p> <ul style="list-style-type: none"> o Without air distribution box <ul style="list-style-type: none"> o as blind diffuser o air-ducting o with 2 suspension brackets o Color of Aluminum rails anodized other than natural <p>Diffuser profile</p> <ul style="list-style-type: none"> o End cover for front 20 mm <ul style="list-style-type: none"> o detached o mounted o additional profile no. 1 for installation in ceiling joints o Plug connector for line assembly <p>Special air distribution box</p> <p>Special dimensions of the air distribution box</p> <p>W = _____ mm, H = _____ mm, d = _____ mm</p> <p>Neck height = _____ mm (70 ... max. 170 mm, standard: 70 mm)</p> <ul style="list-style-type: none"> o Insulation through double skin box o Fixed resistor with sleeve type FWA for insertion on site o Fixed resistor, acoustically indifferent, type FWB for insertion on site o Adjustable throttling device type KLA for insertion on site o Adjustable throttling device type KLU for insertion on site, adjustable from below | | |

Specification and schedule of prices

Linear diffuser type LDB 16/M/1

September 2012 / page 1 of 1

| Quantity | Description of services | Unit price in € | Total price in € |
|----------|--|--------------------|---------------------|
| | <p>All-metal linear diffuser (building materials class A1) for constant or variable flow rates.</p> <p>May be adjusted to ranges of 100 ... 20 % of the nominal volume flow rate without the need for any additional mechanical devices. Flow pattern comprising of 9 individual microjets per meter. Optimized outlet geometry for high induction ratio and rapid reduction of expelled air speed and temperature difference.</p> <p><u>Diffuser comprising of:</u></p> <ul style="list-style-type: none"> - <u>Air distribution box</u> of galvanized sheet steel black coating, with integrated outlet contour, connecting spigot for easy insertion and 2 suspension eyes. <p>Design Length = _____ mm (maximum length in one piece: 1500 mm) 1-slot-version LDB 16/M/1</p> <p>Manufacturer: LTG Aktiengesellschaft Series: Linear diffusers Model: LDB 16/M/1</p> <p>Special versions, accessories (on request, additional charge)</p> <ul style="list-style-type: none"> o Plug connector for line assembly o Fixed resistor with sleeve type FWA for insertion on site o Fixed resistor, acoustically indifferent, type FWB for insertion on site o Adjustable throttling device type KLA for insertion on site o Adjustable throttling device type KLU for insertion on site, adjustable from below | | |

Specification and schedule of prices

Linear diffuser type LDB 32/M/1

September 2012 / page 1 of 1

| Quantity | Description of services | Unit price in € | Total price in € |
|----------|--|--------------------|---------------------|
| | <p>All-metal linear diffuser (building materials class A1) for constant or variable flow rates.</p> <p>May be adjusted to ranges of 100 ... 20 % of the nominal volume flow rate without the need for any additional mechanical devices. Flow pattern comprising of 9 individual microjets per meter Optimized outlet geometry for high induction ratio and rapid reduction of expelled air speed and temperature difference.</p> <p><u>Diffuser comprising of:</u></p> <ul style="list-style-type: none"> - <u>Narrow air distribution box</u> of galvanized sheet steel, black coating, with integrated outlet contour, connecting spigot for easy insertion and 2 suspension eyes. <p>Design Length = _____ mm (maximum length in one piece: 1500 mm) 1-slot-version LDB 32/M/1</p> <p>Manufacturer: LTG Aktiengesellschaft Series: Linear diffusers Model: LDB 326/M/1</p> <p>Special versions, accessories (on request, additional charge)</p> <ul style="list-style-type: none"> o Plug connector for line assembly o Fixed resistor with sleeve Type FWA for insertion on site o Fixed resistor, acoustically indifferent, type FWB for insertion on site o Adjustable throttling device type KLA for insertion on site o Adjustable throttling device type KLU for insertion on site, adjustable from below | | |

Locations and Representatives

Germany

Office East 2

Sales area: **postcode 01 - 09, 98 - 99**
Johannes-Ebert-Straße 20 · D-09128 Chemnitz
Herr Schenfeld ☎ +49 371 77118-01, Fax -02
E-mail: Schenfeld@LTG-AG.de

Office East 1

Sales area: **postcode 10 - 25, 39**
Eisenhutweg 51a · D-12487 Berlin
Herr Linke ☎ +49 30 632287-74, Fax -75
E-mail: Linke@LTG-AG.de

Office North

Sales area: **postcode 20 - 31, 38**
An den Auewiesen 24 · D-31515 Wunstorf
Herr Krocker ☎ +49 5031 5150234, Fax 9623334
E-Mail: Krocker@LTG-AG.de

Office West

Sales area: **postcode 32 - 33, 40 - 53, 58 - 59**
Baststraße 30 · D-46119 Oberhausen/Rheinl.
Herr Perenz ☎ +49 208 30431-55, Fax -56
E-mail: Perenz@LTG-AG.de

Central Office 2

Sales area: **postcode 34 - 37, 56 - 57, 61 - 62, 65**
Sperberweg 16 · D-35745 Herborn
Herr Hartmann ☎ +49 2772 570-725, Fax -727
E-mail: M.Hartmann@LTG-AG.de

Central Office 1

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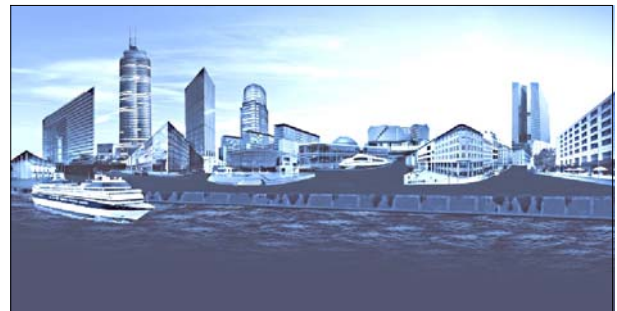
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The Program for Comfort Air Technology

Key components

Air diffusers for ceilings, walls and floors: LTG System clean[®], linear diffusers, displacement air diffusers, swirl diffusers Coandavent[®] · LTG chilled beam cool wave[®] · Induction units Klimavent[®] · Induction unit Coandatrol[®] · Fan coil units Raumluf · Ceiling fan coil units Ventotel[®] · Decentralized facade ventilation units Univent[®] · Airflow control units · labair[®] system: components for lab ventilation



LTG Engineering Services

Technical services for investors, architects, engineers and plant builders during design, construction and operation of buildings. Reliable and precise data relating to the ventilation of air conditioning system are given already before realization of the project, determined by measurements, calculations, building simulations and experiments.

The Program for Process Air Technology

Key components

Axial, radial and tangential fans · Fahrtwind Simulators · LTG Filtration Technology: fans, suction nozzles, dampers, filters, separators, compactors · LTG Humidification Technology: air humidifiers, product humidifiers

LTG Engineering Services

Technical services during development and operation of assembly groups, machines and plants · Analysis, simulation, optimization · Customized solutions · Mobile filtration lab/ filter engineering on site