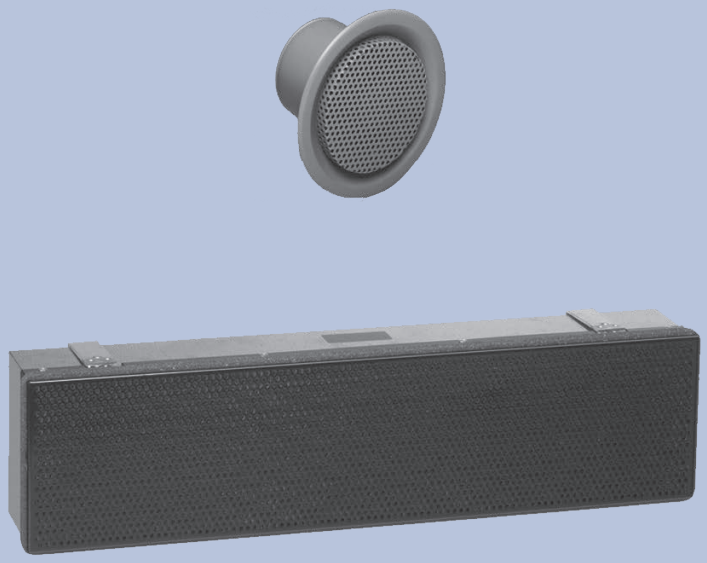


Krantz

Step displacement outlets Q-S....

Air distribution systems

DS 4054 E 07.2019

Step displacement outlets

Construction design

Preliminary remarks

Step displacement outlets are used to supply air in assembly rooms with seating arranged on stepped floors, such as lecture halls, congress halls, theatres, etc. They operate according to the principle of displacement ventilation and are designed for installation in the step front, directly behind the seats.

ß provides 2 types:
a) Linear step displacement outlet, frequently installed as a continuous band, standard height H = 120 mm
b) Circular step displacement outlet, sizes DN 80 and DN 100

The air is supplied to the outlets from the pressurized plenum located under the steps.
Patent rights registered.

Construction design

Linear step displacement outlet
The linear step displacement outlet is made up of a cassette with a perforated intake **1a** (at the back) or **1b** (at the bottom), a built-in jet straightener **2** and a finely perforated frontal plate **3** for air discharge.

The outlet cassette is available with or without frame. In the frame option **11** the cassette is inserted till it abuts the step front and is fastened at the frame. There are two ways of fastening: with wood screws **11a** or with claw fasteners **12**. To ensure airtightness, the rear of the frame is fitted with sealing strip **6**.

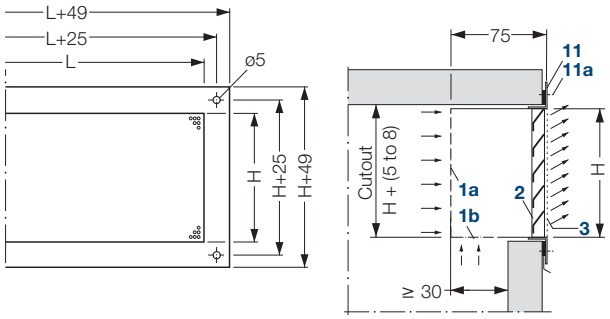
In the frameless type, the cassette is inserted into the step front with about 5 – 10 mm backspace and fixed to prefitted fixing brackets **5** by push-in connections **4**. To ensure airtightness, this cassette is fitted with skirting sealing strip **6**.

Cassettes with frames are used for higher steps.

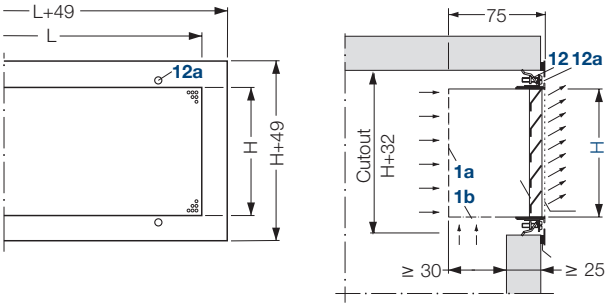
Cassettes without frames are most suitable for lower steps. They are also useful for installation in curved steps. These cassettes can also be placed in polygonal rows.

Note:
When ordering please indicate:
air supply from the back or the bottom.

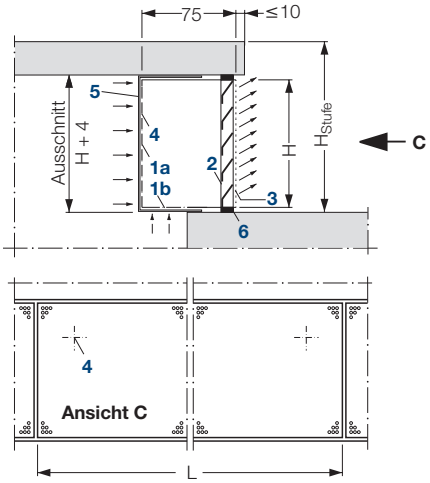
Linear step displacement outlet



– **with frame and screws 11a**



– **with frame and claw fasteners 12**



– **without frame, with push-in connections 4 at fixing brackets 5**

Fig. 1: Linear step outlets – installation options for various types

Key for all pages

1a Perforated intake, at the back
1b Perforated intake, at the bottom
2 Jet straightener
3 Perforated frontal plate
4 Push-in connection
5 Fixing bracket
6 Skirting sealing strip
7 Circular housing
9 Fixed throttle
10 Exit flange
11 Frame
11a Screw
12 Claw fastener
12a Claw fastener screw, concealed

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Step displacement outlets

Construction design

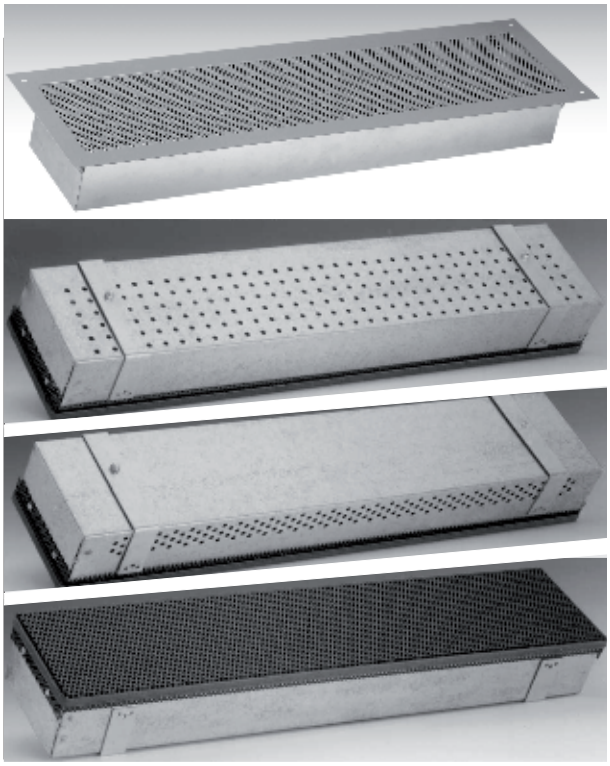


Fig. 2: **Linear step displacement outlet**
top: **with frame for screw fastening**
under it: **without frame, with fixing brackets**
from top: **– Air intake at the back**
– Air intake at the bottom
– Frontal plate for air discharge

Circular step displacement outlet

The main components of the diffuser are the circular housing **7**, the fixed throttle **9** and the exit flange **10** with finely perforated frontal plate **3**. The outlet will be fastened through the perforated front plate to the step by means of two claw fasteners **12** or optionally with two fast drywall screws **12a**. To ensure airtightness, the rear of the exit flange is fitted with sealing strip **6**.

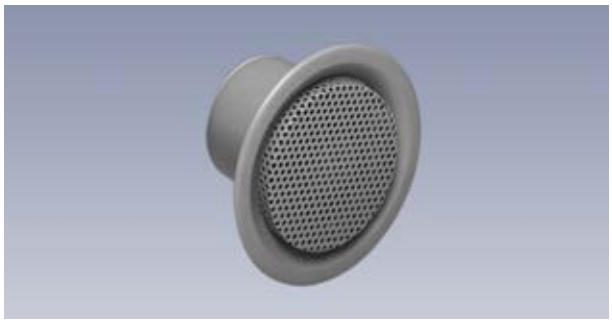
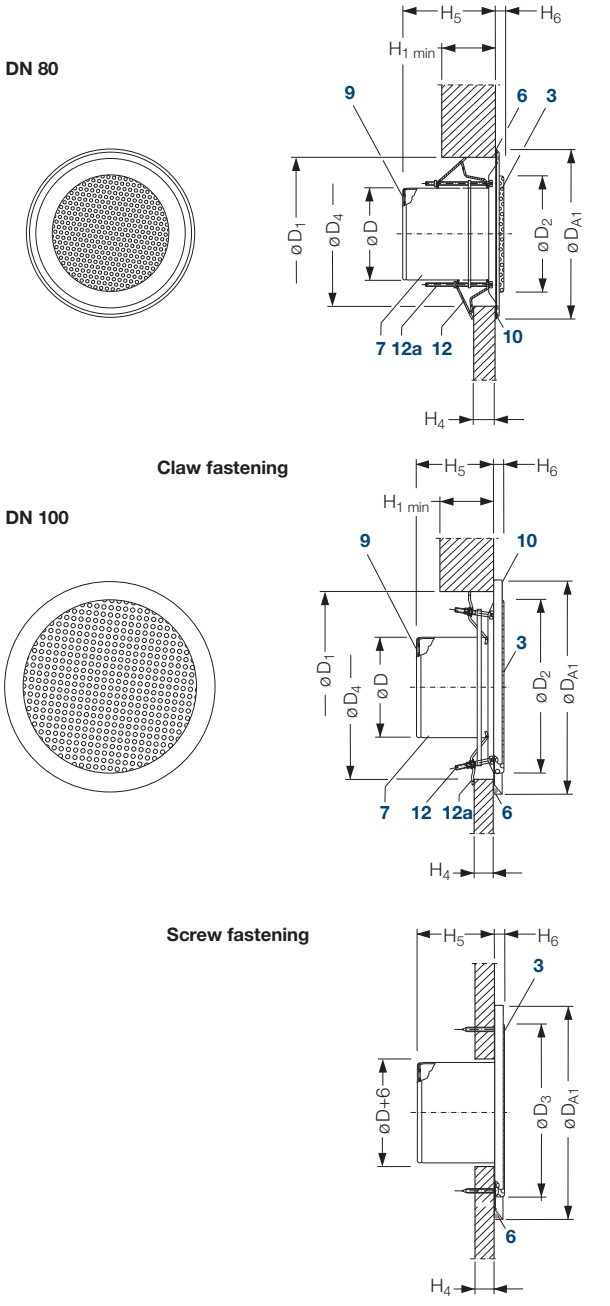


Fig. 3: **Circular step displacement outlet**



ø DN	ø D mm	ø D_1 mm	ø D_2 mm	ø D_3 mm	ø D_4 mm
80	$79^{\pm0.5}$	$132^{\pm1}$	100	-	$127^{\pm1}$
100	$99^{\pm0.5}$	$182^{\pm1}$	160	146	$177^{\pm1}$

ø DN	ø D_{A1} mm	$H_{1\ min}$ mm	H_4 mm	H_5 mm	H_6 mm
80	146	28	20	80	7
100	195	50	12	71	16

Note:
For claw fastener fitting in step front, the following applies:
– $H_{1\ min}$ for $øD_1$
– H_4 for $øD_4$

Fig. 4: **Circular step displacement outlet**

Step displacement outlets

Mode of operation

Mode of operation

The supply air flows from the pressurized plenum of the raised floor into the diffuser. The perforated intake or the fixed throttle (depending on the outlet type) generates an even air flow.

The perforated frontal plate generates a low-turbulence discharge flow with low momentum and even penetration depth.

With the linear step displacement outlet, the built-in jet straightener raises the air flow from the floor, thus counteracting any jet constriction and acceleration effects. The air velocities in the foot zone are low.

With the circular step displacement outlet, the supply air is spread out radially; this considerably reduces the indoor air velocities.

Due to buoyancy forces, the supply air then ascends to the breathing space of the seated person.

The air velocities around the feet of the seated persons may reach up to 0.17 m/s, but usually remain under 0.16 m/s. At heights > 0.3 m above the floor, the air velocities are < 0.10 m/s. The turbulence intensity is about 20%.

The circular step displacement outlet is available in DN 80 and DN 100. Size DN 80 ($\dot{V}_{max}$ = 10 l/s [35 m³/h]) suffices for supplying one person with fresh air. DN 100 ($\dot{V}_{max}$ = 16.5 l/s [60 m³/h]) can supply up to 2 persons.

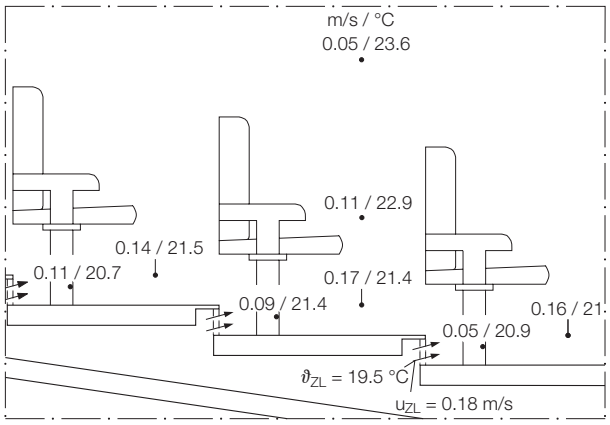
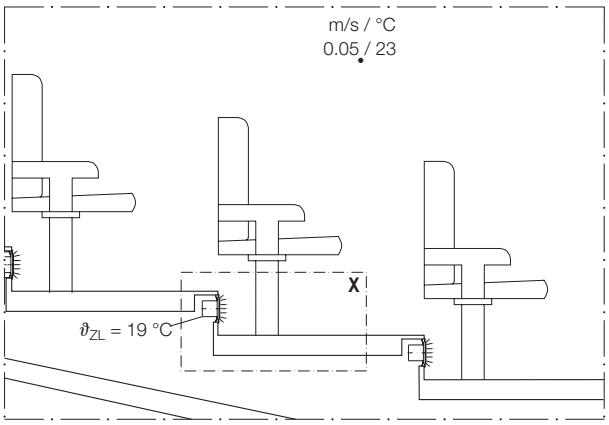


Fig. 5: Linear step displacement outlet
Example of air velocities and temperatures in the leg zone, supply air volume flow rate 21 l/(s·m) [75 m³/(h·m)] or 12.5 l/s [45 m³/h] per person; temperature difference $\Delta\vartheta_{ZL-RL}$= – 4 K.

The minimum spacing between two outlets of size
– DN 80 is 500 mm
– DN 100 is 1,100 mm.

The air temperature in the leg zone is 1 – 2 K above the supply air temperature. To comply with the occupied zone's temperature specified by EN ISO 7730, the supply air temperature should be ≥ 19°C.

Buoyancy forces give rise to a vertical temperature gradient of up to 2 K/m, depending on thermal load and room height. This results in the return air temperature under the ceiling being higher than the room temperature in the breathing space of the seated person. With small temperature differences between supply air and indoor air ($\Delta\vartheta_{ZL-RL} \leq -4$ K, see Figures 5 and 6), the heat loads of the occupants and lights can be removed effectively.



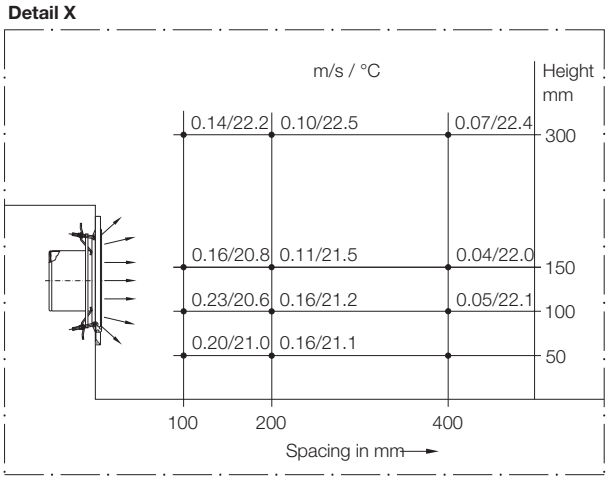


Fig. 6: Circular step displacement outlet DN 80
Example of air velocities and temperatures in the leg zone, supply air volume flow rate 10 l/s [35 m³/h] per outlet, outlet spacing 0.65 m; temperature difference $\Delta\vartheta_{ZL-RL}$ = –4 K.

Step displacement outlets

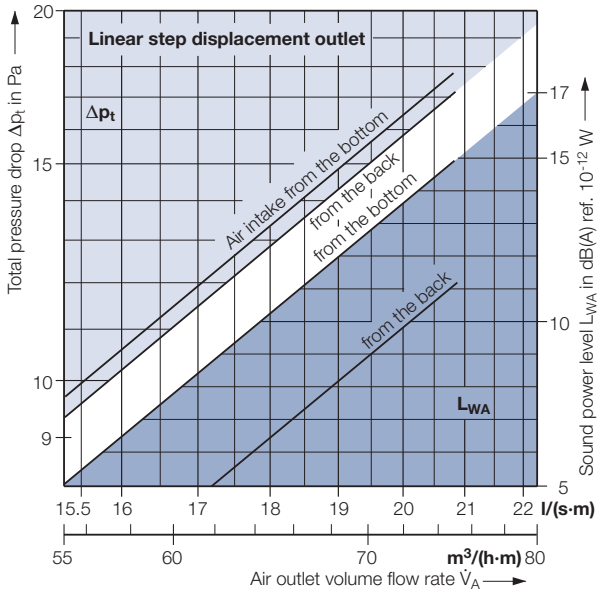
Layout specifications

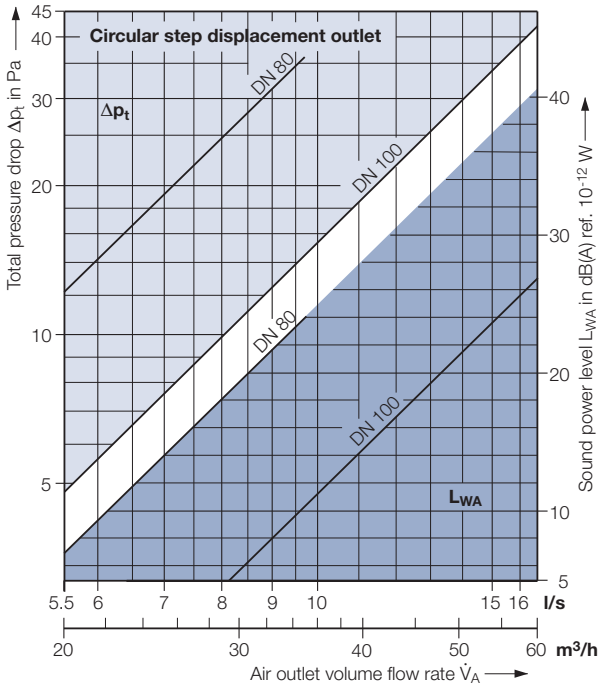
Fig. 7: **Jet pattern made visible with smoke tracer**
top: **Linear step displacement outlet**
bottom: Circular step displacement outlet

Technical data

	Linear step displacement outlet	Circular step displacement outlet	
		DN 80	DN 100
Max. supply air volume flow rate	21 l/(s·m)	10 l/s	16.5 l/s
	75 m³/(h·m)	35 m³/h	60 m³/h
Discharge velocity	≤ 0.18 m/s	largely radial discharge	
Supply air temperature	≥ 19°C	≥ 19°C	
Temperature difference supply air–indoor air [1] supply air–return air	≤ – 4 K ≤ –12 K	≤ – 4 K ≤ –12 K	
Height or largest visible diameter	120 mm [2]	ø 146 mm	ø 212 mm
Depth	75 mm	80 mm	
Length	preferably 1,200 mm for 2 seats	—	

Sound power level and pressure drop





Step displacement outlet		Diffuser volume flow rate V̇A				Total pressure loss Δpt	Sound power level LW in dB ref. 10-12 W: LWA	Octave band centre frequency in Hz						
		l/s	m³/h	l/(s·m)	m³/(h·m)	Pa	dB(A)	125	250	500	1 K	2 K	4 K	8 K
Linear	H = 120 mm, L = 1200 mm Intake from **the back**	20	72	17	60	11	4	11	7	< 7	< 7	< 7	< 7	< 7
		25	90	21	75	17	11	18	11	7	9	< 7	< 7	< 7
	H = 120 mm, L = 1200 mm Intake from **the bottom**	20	72	17	60	12	8	15	8	< 7	< 7	< 7	< 7	< 7
		25	90	21	75	18	15	22	15	12	11	< 7	< 7	< 7
Circular	**DN 80**	7	25	—	—	19	14	18	11	10	8	< 7	< 7	< 7
		10	35			36	24	26	18	19	22	13	< 7	< 7
	DN 100	11	40	—	—	18	14	16	10	11	7	< 7	< 7	< 7
		16.5	60			42	27	24	21	24	24	18	11	< 7

[1] At head level of seated person
[2] Other heights, possibly including inactive surfaces, on request

Step displacement outlets

Installation specifications

Linear step displacement outlet

Type with frame and screws: Fig. 8a
Type with frame and claw fasteners: Fig. 8b
The diffuser is inserted in the correct position (see 'Top' label) into the step cutout till it abuts the step front. It is then aligned vertically and horizontally. The frame with rear sealing strip is pressed against the step front and screwed up (Fig. 8a) or locked by turning the lock screws of the claw fasteners (Fig. 8b).

Type without frame: Fig. 8c
Two fixing brackets per outlet are to be fastened by the client inside the step cutout, using tacks or screws. While each fixing bracket is fitted with a fastening bolt, the back wall of the diffuser has 2 openings provided with springs. When inserting the outlet and pressing it against the fixing brackets, the fastening bolts catch into the springs; the outlet is fixed.

The fixing brackets and a template for their correct positioning are supplied together with the outlets.

Please take care that:
– the fixing brackets are put in place with the fastening bolts in their upper halves,
– the diffuser is inserted in the correct position (see 'Top' label).

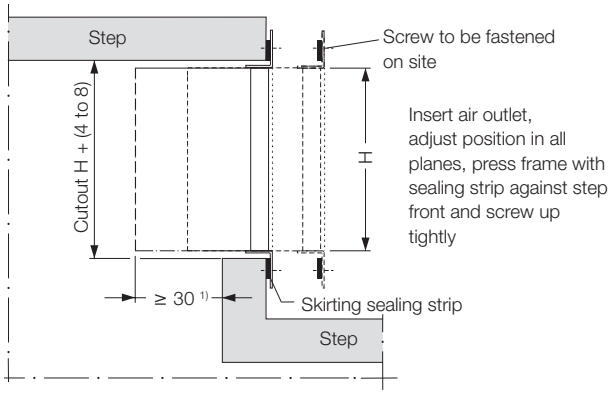


Fig. 8a: Type with frame and screws

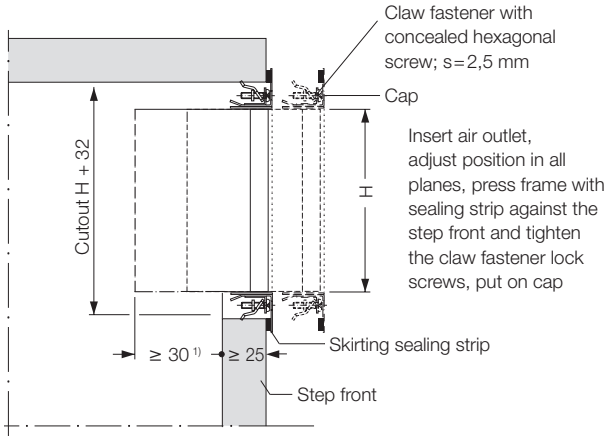


Fig. 8b: Type with frame and claw fasteners

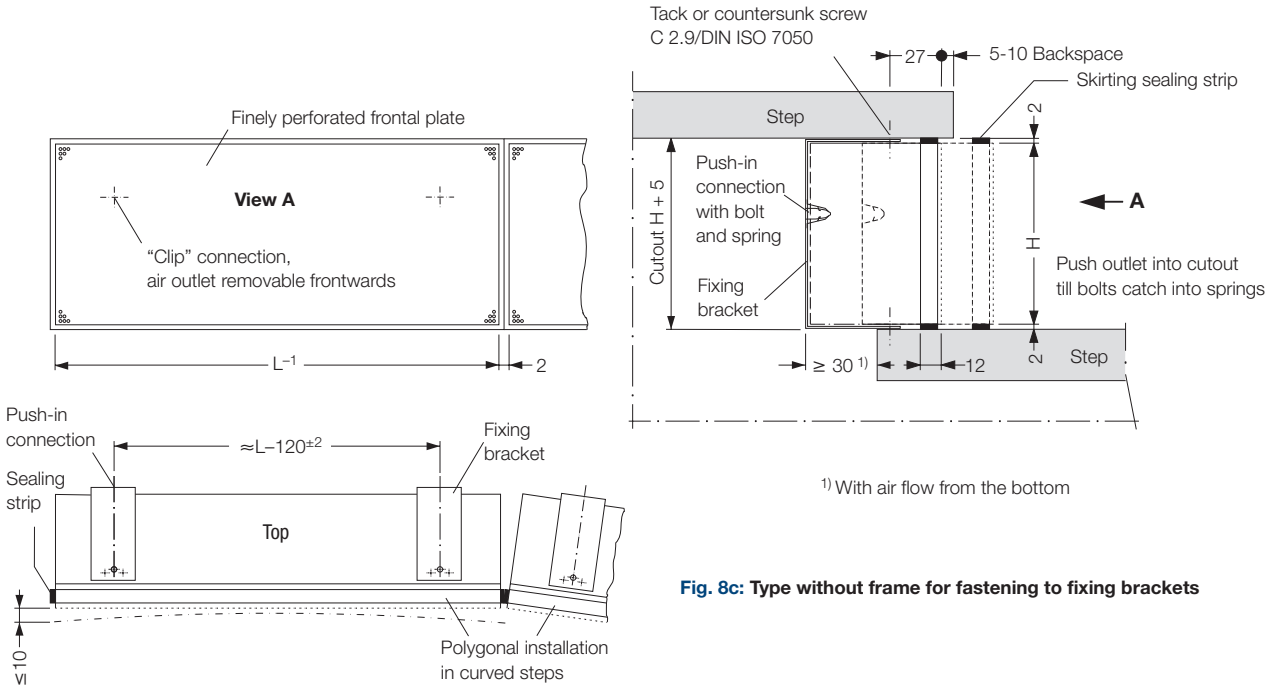


Fig. 8c: Type without frame for fastening to fixing brackets

Fig. 8: Mounting sketch for linear step displacement outlet with and without frame

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Step displacement outlets

Installation specifications and features

Circular step displacement outlet

Insert the outlet into the circular cutout and align it horizontally for fastening. Tighten the screws through the perforated front evenly while pressing on the outlet.

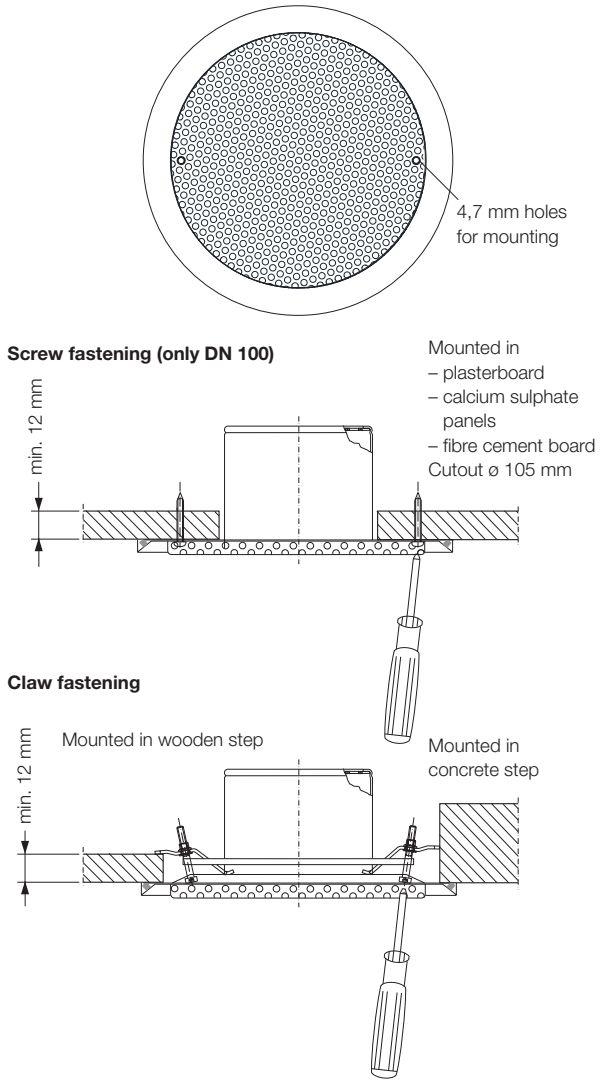

Fig. 9: Mounting sketch for circular step displacement outlet, showing DN 80 (Similar mounting for DN 100)

Fig. 10: Linear step displacement outlet in the Kansai University, Osaka

Features

- Air distribution system for lecture halls, congress halls, theatres and other assembly rooms with or without fixed seating
- Installation in wooden or concrete steps
- Low-turbulence jet dispersion close to floor according to the principle of displacement ventilation
- Avoidance of jet constriction and acceleration effects thanks to built-in jet straightener in the linear step displacement outlet
- Ideal jet spread with great reduction of indoor air velocity with the circular displacement outlet
- Draught-free fresh air supply to the occupied zone
- Available in linear shape, height = 120 mm, or circular shape, size DN 80 and size DN 100
- Air supply from pressurized plenum under the floor
- Air intake from the back. With the linear step displacement outlet, air intake also possible from the bottom
- Very low sound power level
- Volume flow rate up to 21 l/(s•m) [75 m^3/(h•m)] for linear step displacement outlet and up to 16.5 l/s [60 m^3/h] for circular step displacement outlet
- Temperature differences between:
  supply air and indoor air up to – 4 K,
  supply air and return air up to – 12 K,
  depending on thermal load and room height
- Linear step displacement outlet available with or without frame; circular step displacement outlet fitted with exit flange
- Depending on type, fastening to step with fixing brackets, screws, or claw fasteners

Fig. 11: Circular step displacement outlet, University of Leipzig

Step displacement outlets

Type code and tender text

Type code – Linear step displacement outlet

Q-SL – ____ – ____ – __ – __ – ____

Linear step displacement outlet
Height
Length
Fastening
Option
Surface finish

Height [2]
120 = 120 mm

Length
500 = 500 mm
1000 = 1000 mm
1200 = 1200 mm

Fastening
B = with bracket
K = with claw fastener
S = with screws

Option
H = Air intake from the rear
U = Air intake from the bottom

Surface finish
.... = Face painted to RAL ....

– Circular step displacement outlet

Q-SR – DN ____ – ____

Circular step displacement outlet
Size
Surface finish

Size
80 = DN 80
100 = DN 100

Fastening
K = with claw fastener
S = with screws (only DN 100)

Surface finish
.... = Face painted to RAL ....

Tender text – Linear step displacement outlet

.... units,
Linear step displacement outlet Q–SL, for installation in a step cutout or bore, designed for low-turbulence, draught-free fresh air supply to the occupied zone,

consisting of:
- finely perforated frontal plate to generate low-turbulence discharge flow according to the principle of displacement ventilation,
- perforated intake or fixed throttle for even air supply, especially when several outlets are connected to the floor plenum,
- Air intake from pressurized plenum, intake at the back or the bottom of the outlet, jet straightener to raise jet on discharge side, optionally with frame and screws or claw fasteners [1], or without frame, with fixing brackets for push-in connection,
- skirting seal for ensuring airtightness.
- optional template for fastening type B (with fixing brackets)

Material
- Step displacement outlet made of galvanized sheet metal,visible part painted to RAL ....
- Jet straightener made of polycarbonate PC GF 10, dark grey

Make: Krantz
Type: Q-SL – ____ – ____ – __ – __ – ____

–Circular step displacement outlet

.... units,
Circular step displacement outlet Q–SR for installation in a step cutout or bore, designed for low-turbulence, draught-free fresh air supply to the occupied zone,

consisting of:
- finely perforated frontal plate to generate low-turbulence discharge flow according to the principle of displacement ventilation,
- perforated intake or fixed throttle for even air supply, especially when several outlets are connected to the floor plenum, air intake from pressurized plenum,
- skirting seal at the back of the exit flange to ensure airtightness,
- concealed hexagon socket screws at claw fasteners.

Material
Step displacement outlet made of galvanized sheet metal, visible part painted to RAL ....

Make: Krantz
Type: Q-SR – DN ____ – ____

Subject to technical alterations.

[1] Colourless cap; RAL colour on request
[2] Other heights on request

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