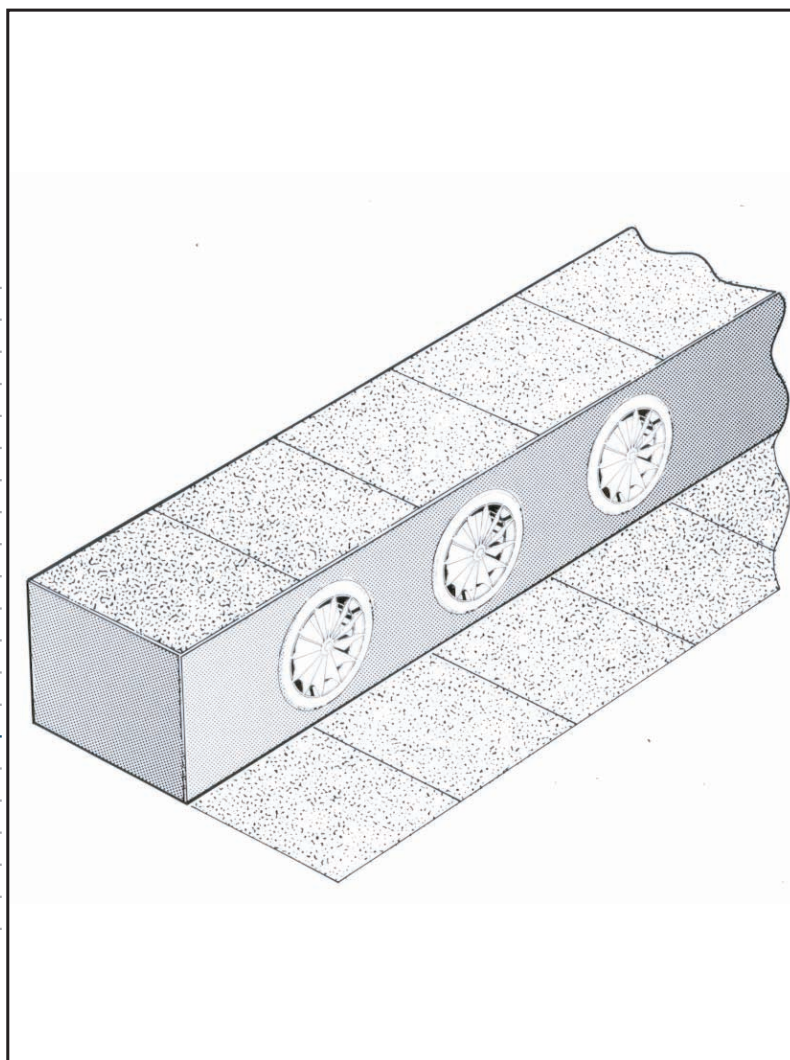


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Technical Selection



Step twist outlets DS....

Preliminary remarks

Step twist outlets are used for air supply in assembly rooms with banked seating, e.g. lecture halls, conference halls, cinemas, theatres, etc. The outlets are installed in the front of the steps.

In the floor zone step twist outlets generate turbulent mixing air flow, which has the advantage of rapid temperature equalization between supply air and indoor air. At about 0.5 m above the floor the air flows upward – similar to displacement ventilation – displacing the warm, stale indoor air to the return air collectors in the ceiling zone.

Construction design and placement

The outlet elements used are tried and tested outlets 1 from KRANTZ KOMPONENTEN:

- Twist outlets with circular exit, DN 63 and DN 100.
- Radial outlets with circular or square visible face DN 100.
- Adjustable floor outlets DN 150 set for displacement flow.

Step twist outlets are suitable for installation in wooden steps (or similar material) or concrete steps (Figure 1).

For installation in wooden steps a cylindrical sheet metal hood 2 is supplied to ensure even supply air distribution. On the supply side it is fitted with a perforated sheet metal disk which acts as a fixed damper 3.

For fastening in the wooden step the hood is fitted with two opposite clips 6 which are flexed against the inside of the step front when the sheet hood is inserted from the room. The sheet hood is then fastened with tacks or screws 7 in the circular step cutout 4. Then the outlet can be inserted from the room and screwed to the fixed damper 3 with a threaded bolt 8 and a rivet nut 9.

For outlet placement in concrete steps it is better to use a recess 10 instead of the sheet hood in the step front. A perforated metal sheet acting as a fixed damper 3 is fitted to the inside of the step at the client's expense or premounted when constructing the concrete casing pipe. A shell pipe with built-in fixed damper is also available on request.

The outlet in this case is fastened with a threaded bolt 8 and a rivet nut 9 in the centre of the fixed damper.

To avoid any damage to the outlets and the sheet hoods it is best to install them at the end of the construction phase.

While the outlet types DS-DD (twist outlet) and DS-RA (radial outlet) cover the front side of the step cutout or recess with their exit flanges 11, the DS-BA (floor outlet) covers it with the clamp ring with clip-on flange 13.

For smooth installation and function of the step twist outlets the minimum necessary clear step height is h_{min} (Figure 2). For lower steps the exit flange diameter for DS-DD and DS-BA can be minimized to fit a lower clear step height h^* .

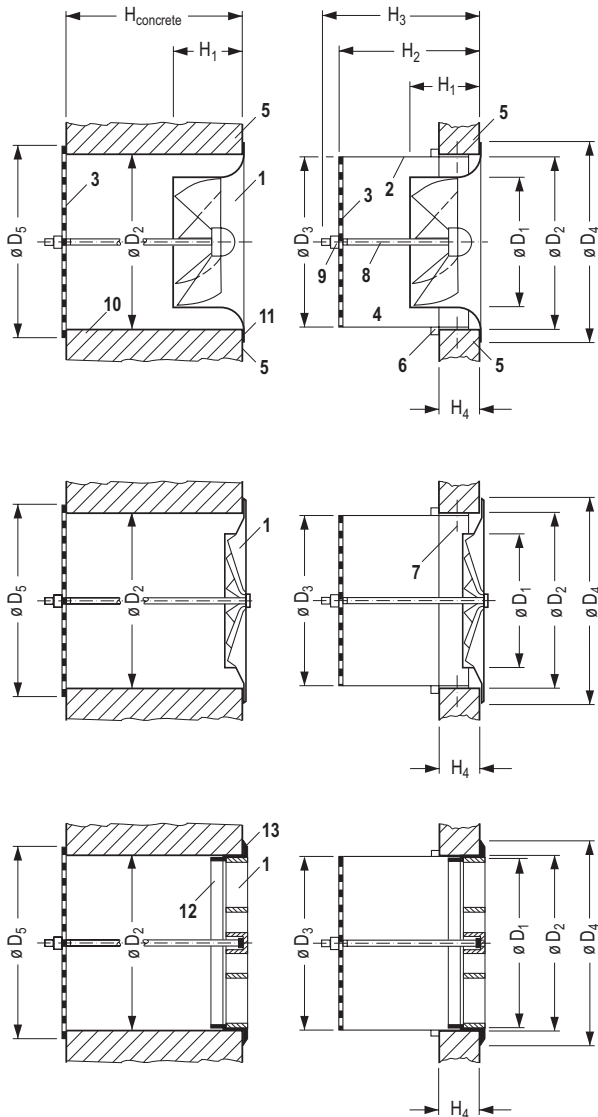
Selection and layout specifications

Step twist outlets					
Type		DS-DD	DS-RA	DS-BA	
Nominal diameter		DN 63	DN 100	DN 100	DN 150
max. volume flow rate in	l/s	3.5	10	10	10
	m ³ /h	12	35	35	35
Number per seat	units	3	1	1	1
Minimum outlet spacing in	mm	150	500	500	500
Maximum sound power level in	dB(A) ref. 10 ⁻¹² W	12	16	18	14
Maximum pressure loss in	Pa	22	20	22	20
Dimensions in mm:					
	D ₁	62	99	99	150
Bore Ø	D ₂	80	125	125	165
External Ø	D ₃	79	124	124	163
	D ₄	110	165	150	172
	D ₄ ^{* 2)}	85	130	—	—
	D ₅	140	185	185	220
	h_{min}	95	145	138	169
	h^* 2)	83	128	—	—
	H ₁	30	42	24	46
	H ₂	100	100	100	100
	H ₃	113	116	118	119
	H ₄ ³⁾	18 – 8 5	18 – 85	18 – 85	18 – 85
	H _{concrete}	≥ 100	≥ 100	≥ 100	≥ 100

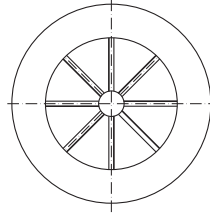
2) Minimum flange diameter Ø D₄^{*} for step height $h^* < h_{min}$

3) Possible thickness of wooden step front; specify exact dimensions when ordering

Installation in concrete step ¹⁾ Installation in wooden step

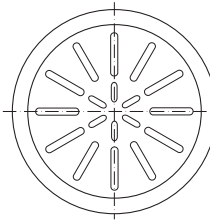
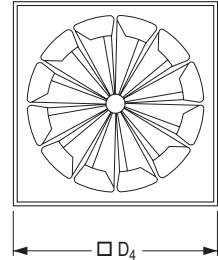
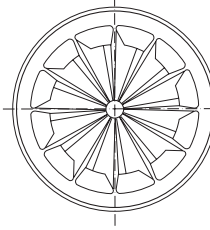


Outlet - frontal view



Twist outlet
Type: DS-DD-DN 63 or
DS-DD-DN 100

Radial outlet Type: DS-RA-DN 100
Circular visible face Square visible face



Floor outlet
Type: DS-BA-DN 150

Fig. 1: Installation in wooden and concrete steps

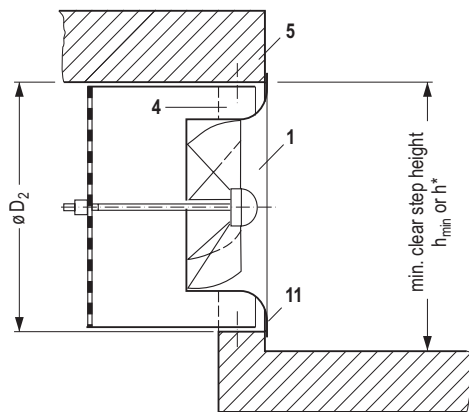


Fig. 2: Minimum clear step height, using example of Type DS-DD

Key	Material
1 Outlet – Twist outlet – Radial outlet – Floor outlet with clamp ring	Plastic Painted sheet metal Plastic
2 Sheet hood	Aluminium
3 Fixed damper	Galvanized sheet metal
4 Step cutout	Wood or similar material
5 Step front	—
6 Clip	Aluminium
7 Tack or screw 8 Threaded bolt ²⁾ 9 Rivet nut ²⁾	Galvanized sheet metal
10 Step recess	—
11 Exit flange	Plastic or sheet metal
12 Clamp ring 13 Clip-on flange	Plastic

1) Frontal fitting of fixed damper with claw fastener on request!
2) M 6 for types DS-DD and DS-RA; use M 8 for type DS-BA!

Mode of operation

The supply air flows from the floor plenum into the step twist outlets. The perforated metal sheet in the outlet intake generates a slightly higher pressure resulting in even air distribution.

The radial discharge flow is turbulent and twisted, which causes an intensive admixture of the supply air and ambient air on immediate discharge from the outlet in the floor zone. This results in smaller temperature stratification in the occupied zone than with pure displacement ventilation. For these reasons the minimum supply air temperature can amount to 18°C. In the floor zone the air temperatures are $\geq 21^\circ\text{C}$ and in the head zone of seated persons 22.5-23°C. The vertical temperature gradient in the occupied zone is $\leq 1.5 \text{ K/m}$ (Figure 3).

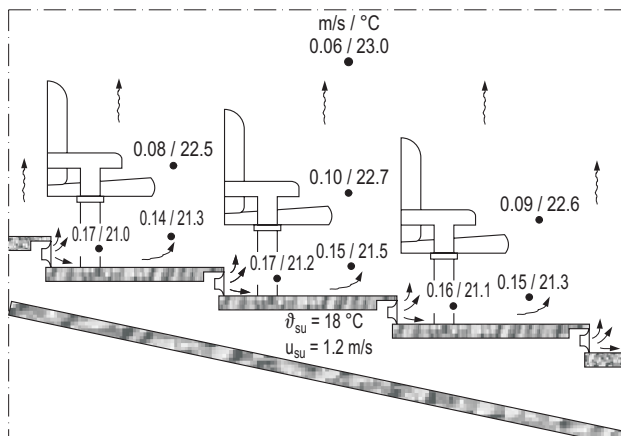


Fig. 3: Example of air velocities and temperatures. The supply air volume flow rate amounts to 10 l/s (35 m³/h) per seat; the temperature difference between supply air and indoor air is -5 K.

Due to the intensive induction of the indoor air in the floor zone, the jet velocity drops rapidly reaching a maximum of 0.15 m/s at audience level at a turbulence intensity of 40 - 45%.

At a height of 0.5 m above the floor the supply air disperses in the form of displacement ventilation, i.e. when it encounters people (heat sources) the fresh air ascends and displaces the warm, stale indoor air to the return air collectors at the ceiling. At $\geq 0.5 \text{ m}$ above the floor the indoor air velocities are $\leq 0.10 \text{ m/s}$.

The flow pattern formed (fresh air ascends when it encounters people and displaces pollutants and heat into the ceiling zone) raises the air quality in the occupied zone.

Due to the heat removal upwards the return air temperature exceeds the room temperature in the seating zone. That is why despite the relatively low temperature difference of 4 - 5 K between the indoor air in the head zone of the audience and the supply air, the heat loads of people and lighting can be effectively removed. Depending on room height and room heat load to be removed, the maximum temperature difference between supply air and return air can amount to as much as -12 K.



Fig. 4: Step twist outlet, spread of supply air jets

Sound power level and pressure loss

The sound power level of the step twist outlet is low. It meets the high acoustic requirements for theatres and similar assembly rooms.

Sound power level and pressure loss for all step twist outlets are shown in Figure 5.

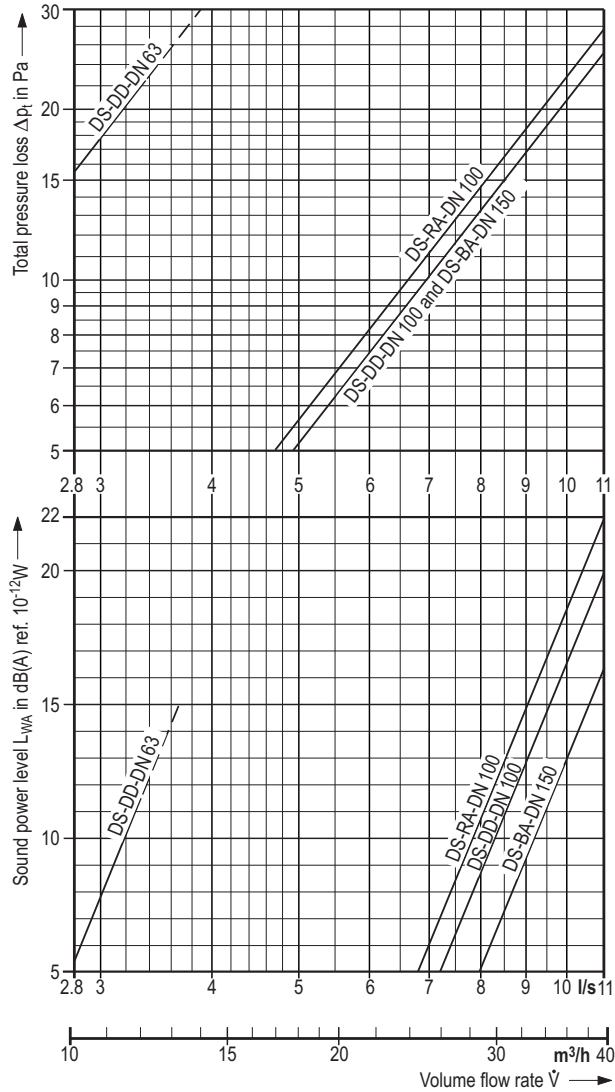


Fig. 5: Sound power level and pressure loss

Features

- Air distribution system for lecture halls, conference halls, theatres and other assembly rooms with banked fixed or removable seating
- Outlets built into step front
- Intensive admixture of supply air jets with indoor air in the floor zone resulting in low vertical temperature stratification in the occupied zone
- Supply air flow in the form of displacement upflow from the floor zone
- Draught-free air supply in the occupied zone
- Discharge element available in four designs
- Low sound power level
- Maximum air outlet volume flow rate 3.5 or 10 l/s (12 or 35 m^3/h), depending on type
- Temperature difference between supply air and indoor air up to -5 K and between supply air and return air up to -12 K , depending on room heat load and height
- Casing pipe available with built-in fixed damper for the recess in concrete steps
- Also usable in very low step fronts (minimum step height for type DS-DD-DN 63 = 84 mm)
- Air outlet can be installed from the room
- Low outlay option for comfortable climate
- Ideal when renovating theatres and other assembly rooms
- For front thickness of wooden steps from 18 to 85 mm and concrete steps from 100 mm

Type ¹⁾	Air outlet volume flow rate		Pres- sure loss Pa	Sound power level L_w in dB ref. 10^{-12}W ²⁾						
				dB(A)	Octave band centre frequency in Hz					
	l/s	m^3/h			125	250	500	1000	2000	4000
DS-BA-DN 150	8	30	14.5	6.5	—	—	—	—	—	—
	10	35	20	12	13	15	11	—	—	—
	11	40	28	18	18	21	17	14	10	—
DS-DD-DN 100	8	30	14.5	10.5	10	14	—	—	—	—
	10	35	20	15.5	15	19	13	10	—	—
	11	40	28	19.5	19	23	17	14	—	—
DS-RA-DN 100	8	30	16	12.5	11	15	10	—	—	—
	10	35	22	17.5	16	20	15	14	—	—
	11	40	30	21.5	20	24	19	18	12	—

1) Values for DS-DD-DN 63 on request

2) Values < 10 dB not shown

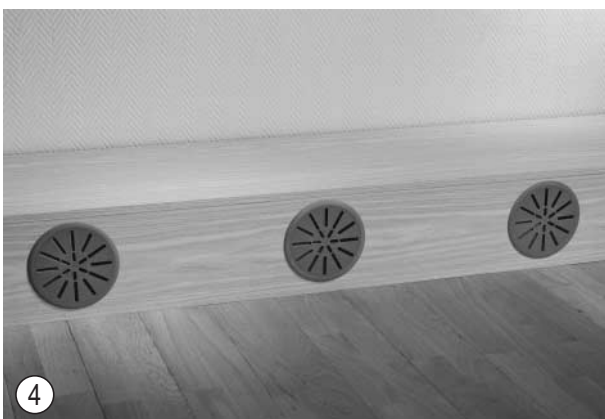
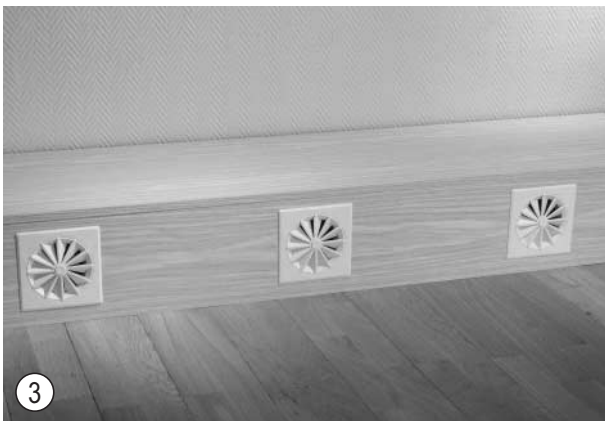
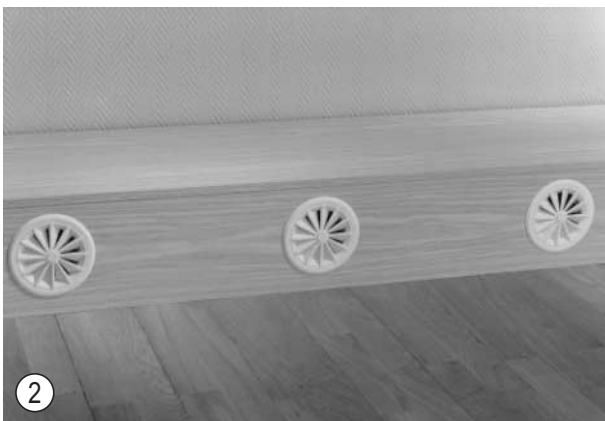
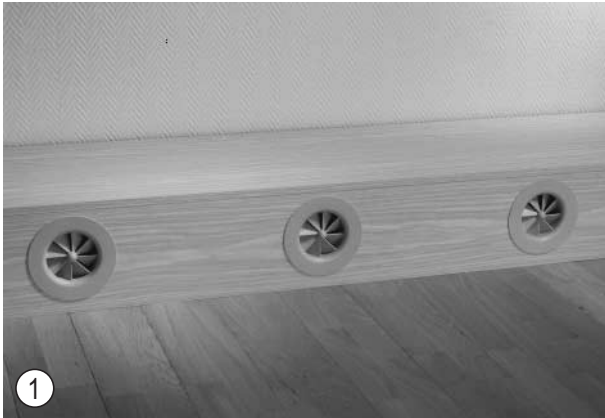


Fig. 6: Step twist outlets, photographs

- ① Type DS-DD-DN 100, twist outlet
- ② Type DS-RA-DN 100, radial outlet (with circular visible face)
- ③ Type DS-RA-DN 100, radial outlet (with square visible face)
- ④ Type DS-BA-DN 150, floor outlet
- ⑤ Type DS-DD-DN 63, twist outlet
- ⑥ Type DS-RA-DN 100 in a theatre

Type code

DS - ____ - DN ____

Step twist outlet
Kind / Function
Size

Kind / Function

DD = Twist outlet
RA = Radial outlet
BA = Floor outlet

Size

DN 63 and DN 100 for DS-DD
DN 100 for DS-RA
DN 150 for DS-BA

Please note,
type code is new,
see last page.

Tender text

..... units

Step twist outlet for installation in a step, for direct draught-free fresh air supply to the occupied zone with rapid temperature equalization between supply air and indoor air, made up of:

Circular air outlet to generate twisted supply air jets, designed as

- twist outlet.
- radial outlet, visible face circular square.
- floor outlet with clamp ring.

Sheet metal hood for air outlet installation in the step cutout of a **wooden step** (or similar material) made at client's expense, including built-in fixed damper for even air supply to all air outlets connected to a plenum.

Fixed damper for even air supply to all air outlets connected to a plenum; fixed damper installed on the supply side in front of the recess in the **concrete step** ¹⁾ made at the customer's expense.

Screw connection for fastening air outlet to step.

Technical data:

Volume flow rate: l/s (m³/h)
Size: DN
Thickness of step front H₄ ²⁾: mm
Perm. sound power level: dB(A) ref. 10⁻¹² W
Pressure loss: Pa

Material:

- twist outlet, plastic
- radial outlet, sheet metal
- floor outlet with clamp ring, plastic
- sheet metal hood, aluminium
- fixed damper, galvanized sheet metal

Colour of dyed plastic:

- twist outlet matching RAL 7038, agate grey
- floor outlet and clamp ring matching RAL 7037, dust grey

Colour as desired:

- twist outlet RAL
- radial outlet RAL
- floor outlet with clamp ring RAL

Make: KRANTZ KOMPONENTEN

Type: DS - ____ - DN ____

1) Casing pipe with built-in fixed damper made of galvanized sheet metal available on request

2) To specify for steps made of wood or similar material



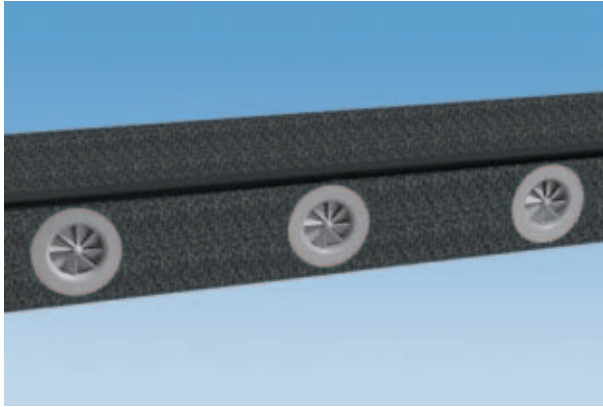
Caverion Deutschland GmbH

Krantz Komponenten

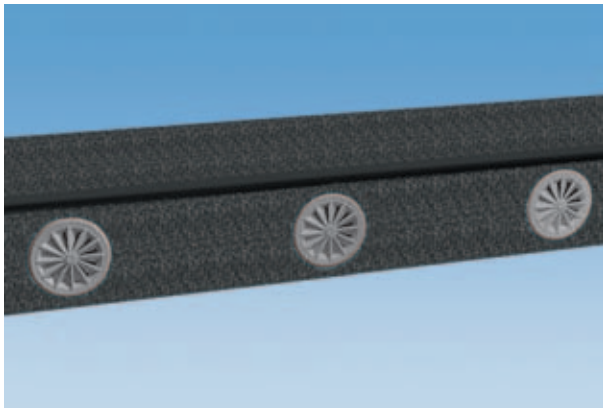
Uersfeld 24, 52072 Aachen, Germany

Phone: +49 241 441-1, Fax: +49 241 441-555

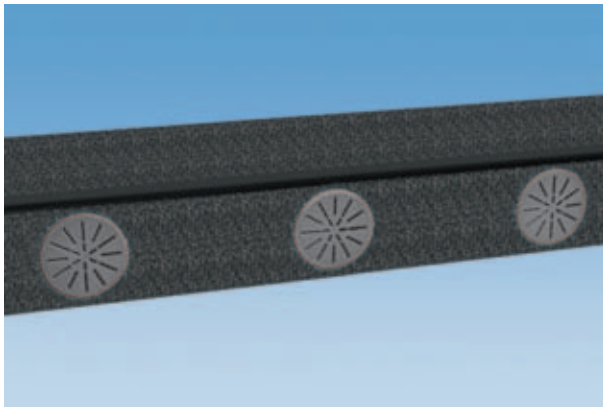
info@krantz.de, www.krantz.de



Step twist outlets, type DS-DD

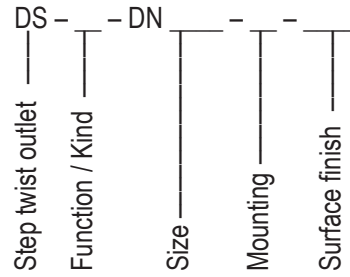


Step twist outlets, type DS-RA



Step twist outlets, type DS-BA

Type code



Function / Kind

- DD = Twist outlet
- RA = Radial outlet ¹⁾
- BA = Floor outlet

Size

	DS-DD	DS-RA	DS-BA
63 = DN 63	•		
100 = DN 100	•	•	
150 = DN 150			•

Mounting

- C = Installation in a concrete step
- W = Installation in a wooden step

Surface finish

- 0 = No coating
- = Face painted to RAL

Subject to technical alteration.

¹⁾ Square face available on request