KOMPONENTEN ®

Applied system solutions

Linear whirl outlet WL....

Linear whirl outlet

Preliminary remarks

The linear whirl outlet generates turbulent mixing ventilation. It can be installed on or in a wall or ceiling. Applications are rooms with high thermal comfort and acoustic requirements (e.g. offices, restaurants and assembly rooms) as well as lobbies and entrance halls and also workshops and production facilities in trade and industry.

Construction design

The major component of the whirl outlet is the discharge element **1** made of galvanized sheet metal. It has several supply air discharge chambers **2**. Connection to the supply air system can be made either via a connection box **4** with spigot **5** or by direct installation in the bottom of a supply air duct **6** (mainly for use in trade and industry). The connection box is optionally available with acoustic lining. As standard the connection spigot is placed on the air discharge side; it is optionally available with volume flow damper (adjustable from room). On customer's request the connection spigot can also be placed on the opposite side or on top of the outlet.

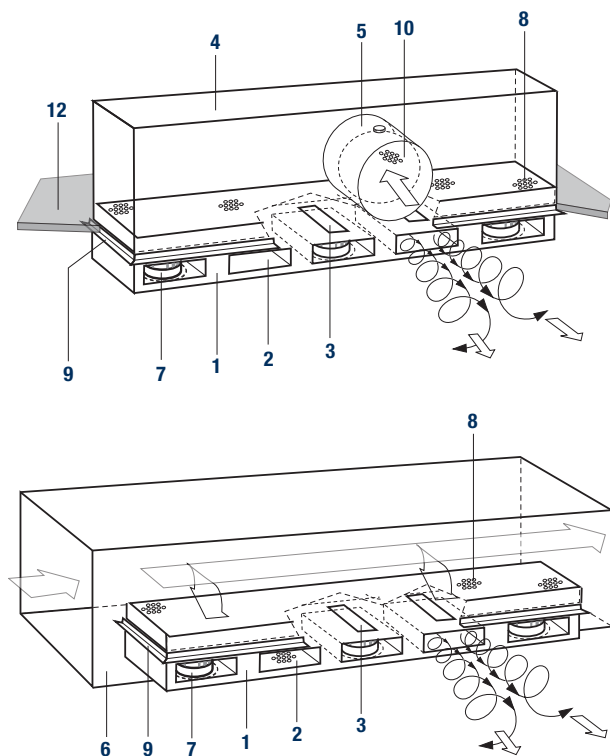The linear whirl outlet is available in three sizes.

Figure 1: **Linear whirl outlet**
top: with connection box
bottom: built onto a supply air duct

On request, the bottom of the discharge element can be additionally fitted with twist outlets **7** with sharp-edged exits. This enables to discharge part of the supply air vertically downwards.

Mode of operation

The dimensions of the discharge chambers **2** and inlet openings **3** are matched to generate two air jets whirling against each other on discharge. Jet stability and induction effect are high. Tangential air patterns with high penetration depth are formed.

Sizes WL-1 and WL-2 can be installed directly under the room ceiling. With size WL-3, the discharge chambers must be placed at least 1 m from the ceiling.

The discharge chambers are designed for air jet discharge at an upward incline of about 15°. At larger distances from the ceiling, this increases the jet stability and prevents a downflow to the occupied zone in cooling mode.
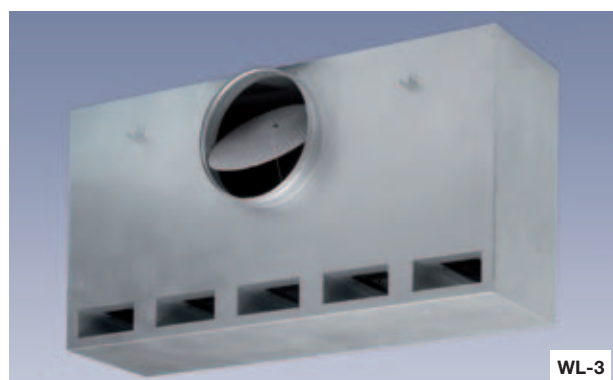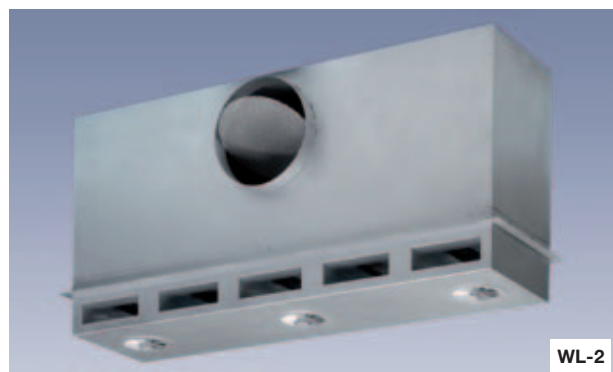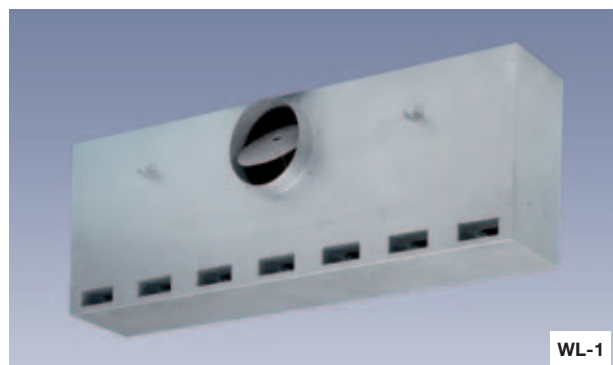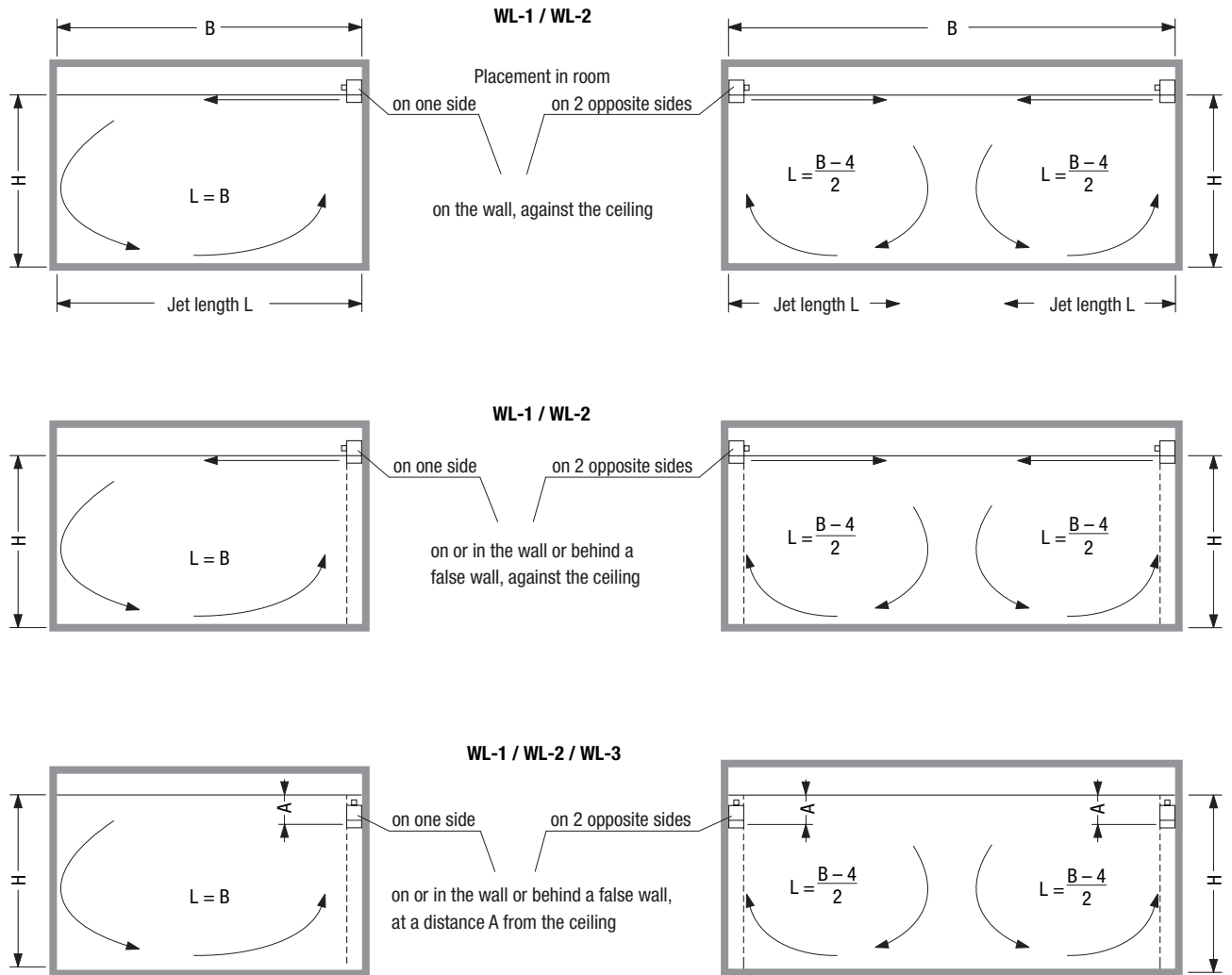

WL-1

WL-2

WL-3

Figure 2: Linear whirl outlet with connection box and connection spigot;
WL-2 additionally fitted with 3 twist outlets (in bottom of discharge element)

Linear whirl outlet

Placement – Jet length and technical data

WL-1 / WL-2

B

H

$L = B$

Jet length L

Placement in room

on one side   on 2 opposite sides

on the wall, against the ceiling

B

$L = \dfrac{B-4}{2}$ $L = \dfrac{B-4}{2}$

H

Jet length L   Jet length L

WL-1 / WL-2

H

$L = B$

on one side   on 2 opposite sides

on or in the wall or behind a
false wall, against the ceiling

$L = \dfrac{B-4}{2}$ $L = \dfrac{B-4}{2}$

H

WL-1 / WL-2 / WL-3

A

H

$L = B$

on one side   on 2 opposite sides

on or in the wall or behind a false wall,
at a distance A from the ceiling

A   A

$L = \dfrac{B-4}{2}$ $L = \dfrac{B-4}{2}$

H

Key

1 Discharge element
2 Discharge chamber
3 Inlet opening
4 Connection box
5 Connection spigot [2)]
6 Supply air duct

7 Twist outlet (on request)
8 Perforated plate
9 Support bracket (optional)
10 Volume flow damper (optional)
10a Damper adjusting device
11 Fastening bracket
12 False ceiling

Technical data

Size		WL-1		WL-2		WL-3	
Air volume flow rate		l/s	m³/h	l/s	m³/h	l/s	m³/h
$\dot{V}_{A\,min}$		28 [1)]	100 [1)]	28 [1)]	100 [1)]	110	400
$\dot{V}_{A\,max}$		100	350	140	500	305	1 100
Discharge height							
H_{min}	m	2.6		2.6		4	
H_{max}	m	4		5		6	
Jet length							
L_{min}	m	4		4		8	
L_{max}	m	9		11		16	
Minimum distance A							
to ceiling	m	0		0		1	
Max. temperature difference supply air to indoor air $\Delta\vartheta_{ZL-RL}$							
−8 K when cooling							
+5 K when heating if at least 30% of the return air is extracted at floor level							
+8 K when heating if over 50% of the return air is extracted at floor level							

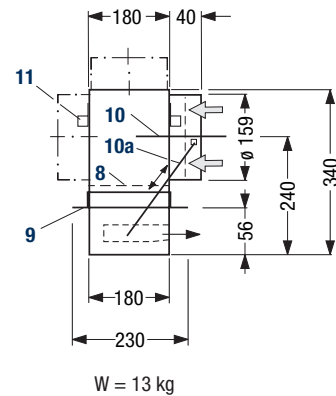[1)] At distances from the ceiling < 0.5 m, $\dot{V}_{min}$ = 14 l/s [50 m³/h]
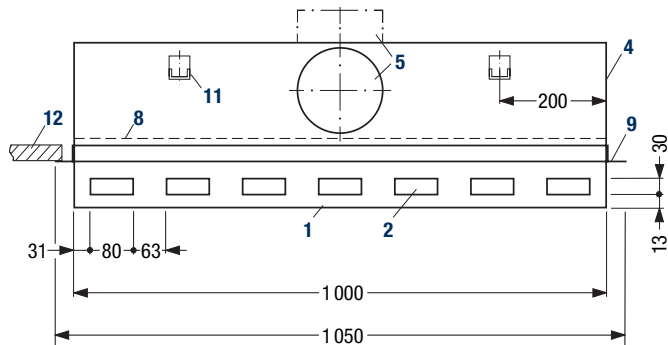
[2)] As standard the connection spigot is placed on the air discharge side.
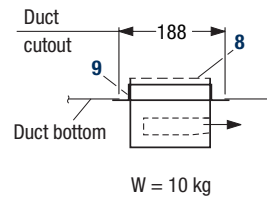Other placement options are available on request.

Linear whirl outlet

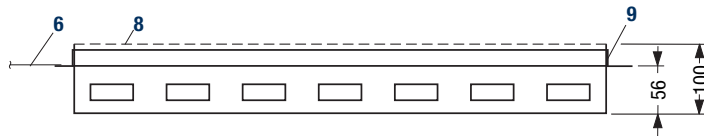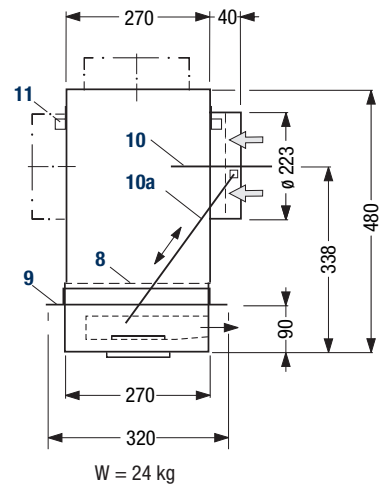## Sizes WL-1 and WL-2 – Dimensions

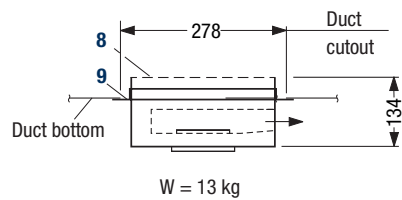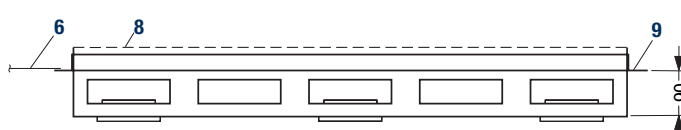**WL-1 with connection box**

W = 13 kg

WL-1 for duct connection

W = 10 kg

WL-1: Length of duct cutout: with single placement L = 1 008 mm; in rows L = (n · 1 000) + 8 mm

WL-2 with connection box

W = 24 kg
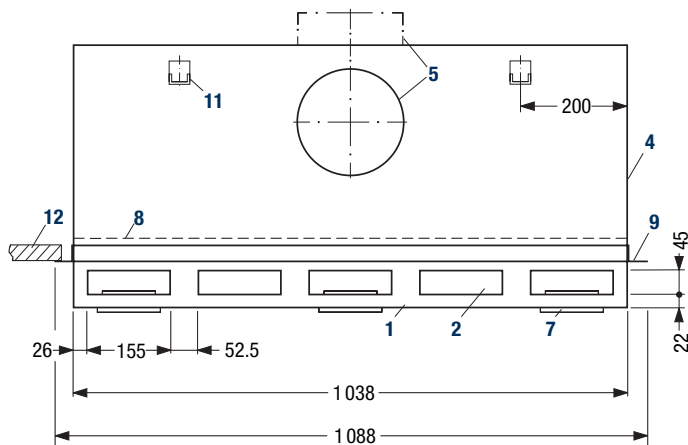
WL-2 for duct connection

W = 13 kg

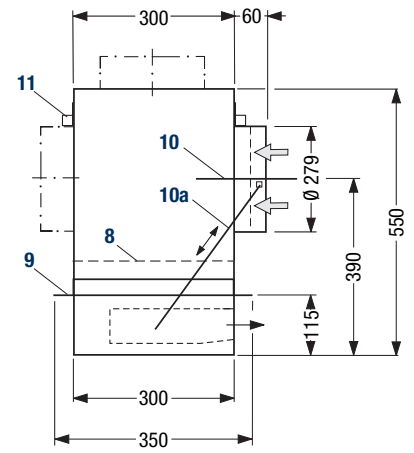**WL-2:** Length of duct cutout: with single placement L = 1 046 mm; in rows L = (n · 1 038) + 8 mm

Linear whirl outlet

Size WL-3 – Dimensions

WL-3 with connection box
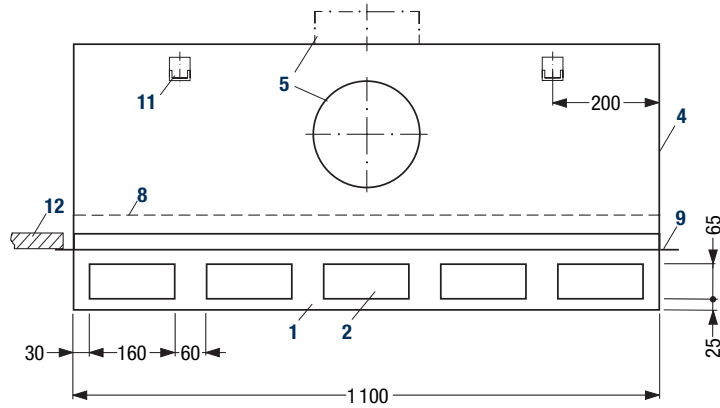
W = 26 kg

WL-3 for duct connection
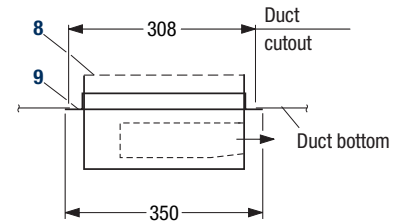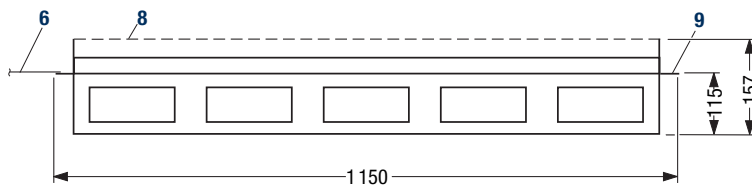
W = 17 kg

WL-3: Length of duct cutout: with single placement L = 1 108 mm; in rows L = (n · 1 100) + 8 mm

Key

1 Discharge element	**7** Twist outlet (on request)
2 Discharge chamber	**8** Perforated plate
3 Inlet opening	**9** Support bracket (optional)
4 Connection box	**10** Volume flow damper (optional)
5 Connection spigot [1]	**10a** Damper adjusting device
6 Supply air duct	**11** Fastening bracket
	12 False ceiling

[1] As standard the connection spigot is placed on the air discharge side.

Other placement options are available on request.

Figure 3: Linear whirl outlet in a restaurant

Linear whirl outlet

Layout

Comfort criteria [1]

The outlet layout must comply with the maximum allowable indoor air velocities in the occupied zone in cooling mode. The indoor air velocity depends on the cooling load that is to be removed from the room. The maximum specific cooling capacity $\dot{q}$ depends on the discharge height and the maximum allowable indoor air velocity u (Graph 1). First, the maximum specific volume flow rate $\dot{V}_{Sp\ max}$ is determined in relation to the indoor air velocity u, the discharge height H and the maximum temperature difference supply air to return air $\Delta\vartheta_{max}$ using Graph 1.
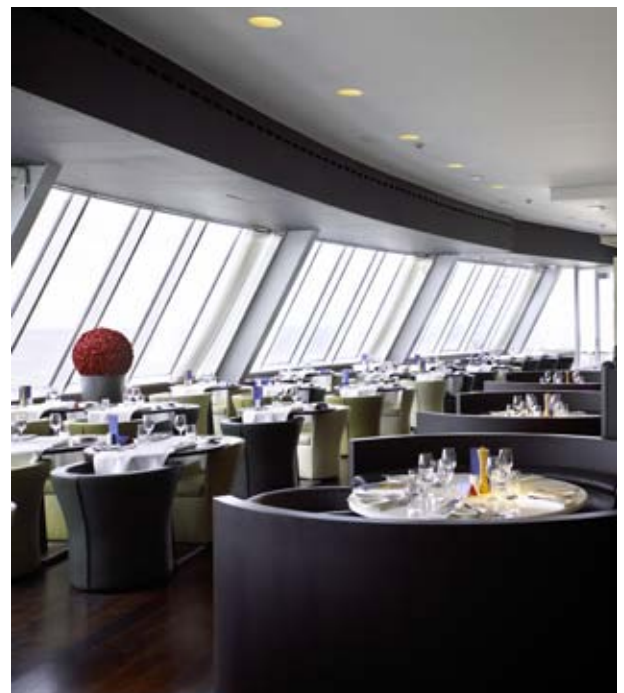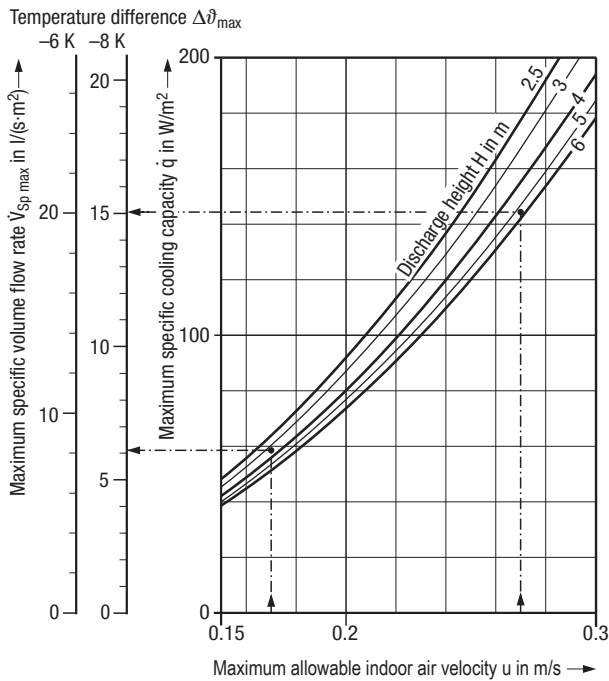

Graph 1: Max. specific volume flow rate

To comply with the maximum allowable indoor air velocities, the volume flow rate supplied to the room $\dot{V}_{Sp\ tats}$ may not exceed the maximum specific volume flow rate $\dot{V}_{Sp\ max}$. On the basis of the maximum specific volume flow rate $\dot{V}_{Sp\ max}$ and the jet length L, the coverage width E and the minimum air outlet spacing A_{min} can be determined using the following equations:

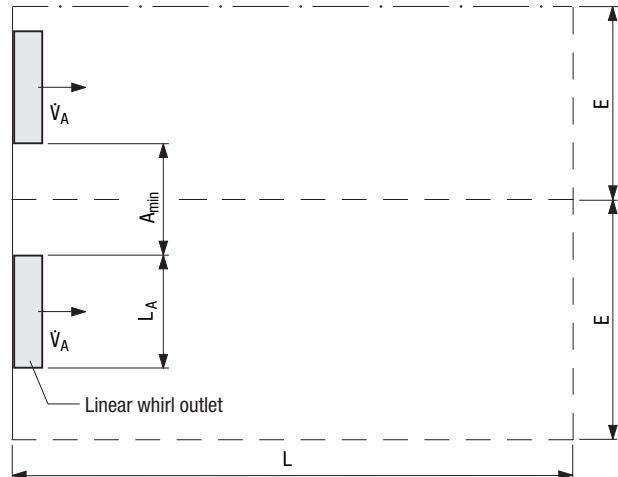$$E = \frac{\dot{V}_A}{\dot{V}_{Sp\ max} \cdot L} \qquad\qquad A_{min} = E - L_A$$

Figure 4: Coverage width E, jet length L and minimum spacing A_{min}

Key for layout:

E	= coverage width in m
L	= jet length in m (see page 3)
L_A	= air outlet length in m
$\dot{V}_A$	= supply air volume flow rate per air outlet in l/s
$\dot{V}_{A\ max}$	= max. volume flow rate per air outlet in l/s depending on discharge height
$\dot{V}_{Sp\ max}$	= max. specific volume flow rate per m² of floor area in l/(s·m²)
$\dot{V}_{Sp\ tats}$	= actual specific volume flow rate per m² of floor area in l/(s·m²)
$\dot{V}_{A\ Str}$	= max. volume flow rate per air outlet in l/s depending on maximum possible jet length
$\Delta\vartheta_{max}$	= max. temperature difference supply air to return air in K
$\dot{q}$	= max. specific cooling capacity in W/m²
H	= discharge height in m
A_{min}	= minimum spacing required between two air outlets in m
u	= max. allowable indoor air velocity in m/s
L_{WA}	= sound power level in dB(A) ref. 10^{-12} W
Δp_t	= total pressure drop in Pa

Size	Air outlet volume flow rate $\dot{V}_A$		Sound power level L_W in dB ref. 10^{-12} W								
			L_{WA}	Octave band centre frequency in Hz							
	l/s	m³/h	dB(A)	63	125	250	500	1 K	2 K	4 K	8 K
WL-1	70	250	36	45	46	38	34	29	25	16	10
	85	300	40	49	50	42	38	33	29	20	14
	100	350	44	53	54	46	42	37	33	24	18
	70	250	34	44	45	35	32	27	21	16	13
	85	300	38	48	49	39	36	31	25	20	17
	100	350	42	53	53	43	40	35	29	24	21
WL-2	85	300	26	29	30	28	24	20	15	12	—
	110	400	33	36	37	35	31	27	22	19	14
	140	500	38	41	42	40	36	32	27	24	19
	85	300	24	31	32	25	20	16	14	11	—
	110	400	31	38	39	32	27	23	21	18	14
	140	500	36	43	44	37	32	28	26	23	19
WL-3	140	500	26	30	31	24	23	22	15	—	—
	220	800	38	42	43	36	35	34	27	13	—
	305	1 100	46	50	51	44	43	42	35	21	17
	140	500	24	30	31	28	22	17	11	—	—
	220	800	36	42	43	40	34	29	23	11	—
	305	1 100	44	50	51	48	42	37	31	19	—

☐ Connection box without acoustic lining   ▨ Connection box with acoustic lining

[1] See our brochure ref. TB 69 'Layout specifications for thermal comfort'

Linear whirl outlet with connection box

Layout examples

L = B = 8 m

Discharge height H = 3.4 m

Room width B = 8 m

L   *L*

$$L = \frac{30 - 4}{2} = 13 \text{ m}$$

Discharge height H = 5.5 m
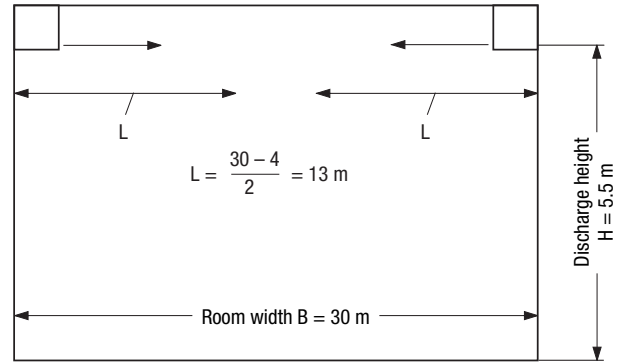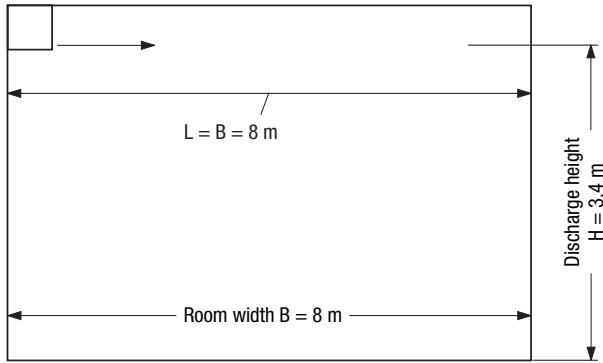
Room width B = 30 m

Example 1: Open-plan office

Size WL-1

1	Supply air volume flow rate $\dot{V}$	=	830 l/s
2	Discharge height H	=	3.4 m
3	Room width B	=	8 m
4	Floor area A	=	200 m^2
5	Allowable sound power level L_{WA}	=	45 dB(A)
6	Air outlet length L_A	=	1 m
7	Comfort criteria (see page 6)		

Specification: max. allowable indoor air velocity u   =   0.17 m/s

from Graph 1 follows at $\Delta\vartheta_{max} = -8$ K $\Rightarrow \dot{q} = 58$ W/m^2

⇒ max. specific volume flow rate   =   6.1 l/(s·m^2)

8 L = B   =   8 m

From nomogram 1:

9	$\dot{V}_{A\,max}$	=	92 l/s
10	Jet length L	=	8 m
11	$\dot{V}_{A\,Str}$	=	83 l/s
12	$\dot{V}_A$ selected	=	83 l/s
13	Z	≈	10 units (**1 : 12** ≙ 830 l/s : 83 l/s)
14	L_{WA}	=	40 dB(A) ref. 10^{-12} W
15	Δp_t	=	40 Pa

According to Figure 4:

16 E $= \dfrac{83 \text{ l/s}}{6.1 \text{ l/(s·m}^2) \cdot 8 \text{ m}}$ = 1.7 m

17 A_{min} =   1.7 − 1.0   = 0.7 m

Example 2: Workshop for assembly of small equipment

Size WL-3 placed on two opposite walls

1	Supply air volume flow rate $\dot{V}$	=	8 300 l/s
2	Discharge height H	=	5.5 m
3	Room width B	=	30 m
4	Floor area A	=	840 m^2
5	Allowable sound power level L_{WA}	=	65 dB(A)
6	Air outlet length L_A	=	1.1 m
7	Comfort criteria (see page 6)		

Specification: max. allowable indoor air velocity u   =   0.27 m/s

from Graph 1 follows at $\Delta\vartheta_{max} = -8$ K $\Rightarrow \dot{q} = 144$ W/m^2

⇒ max. specific volume flow rate   =   15 l/(s·m^2)

8 L $= \dfrac{B - 4}{2}$ =   13 m

From nomogram 2:

9	$\dot{V}_{A\,max}$	=	289 l/s
10	Jet length L	=	13 m
11	$\dot{V}_{A\,Str}$	=	225 l/s
12	$\dot{V}_A$ selected	=	220 l/s
13	Z	=	19 units per side (**1·½:12** ≙ 8 300 l/s · 0.5 : 220 l/s)
14	L_{WA}	=	38 dB(A) ref. 10^{-12} W
15	Δp_t	≈	37 Pa

According to Figure 4:

16 E $= \dfrac{220 \text{ l/s}}{15 \text{ l/(s·m}^2) \cdot 13 \text{ m}}$ = 1.13 m

17 A_{min} =   1.13 − 1.1   = 0.03 m

Linear whirl outlet with connection box

Layout graphs and insertion loss
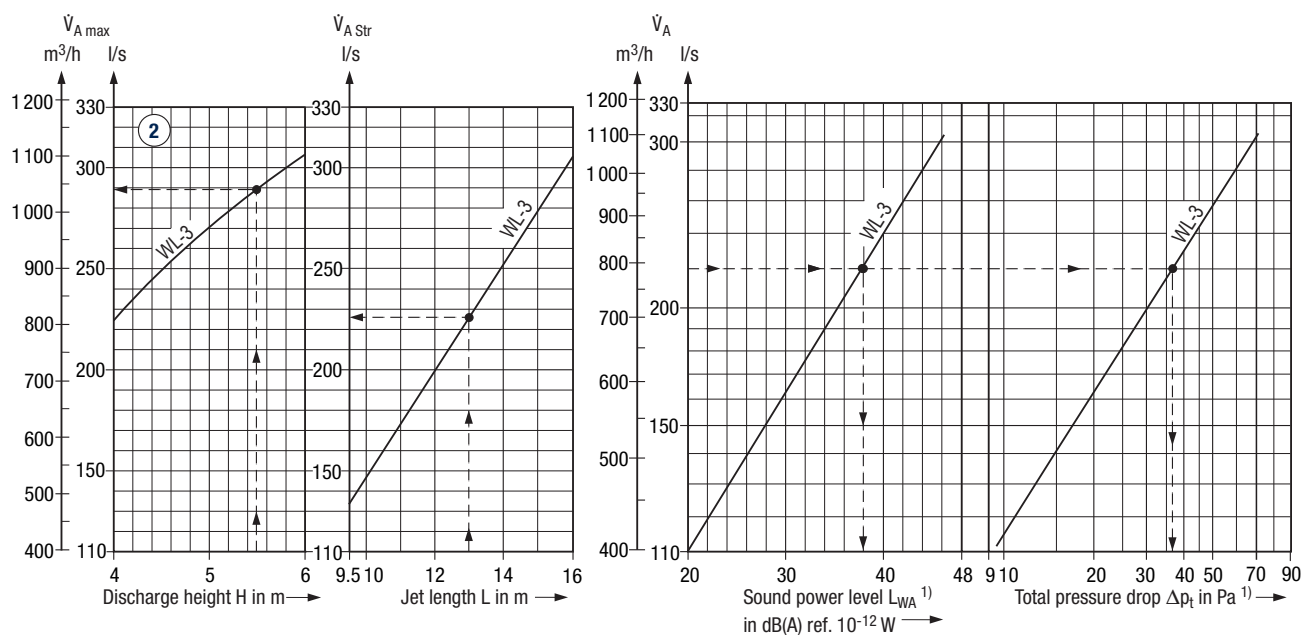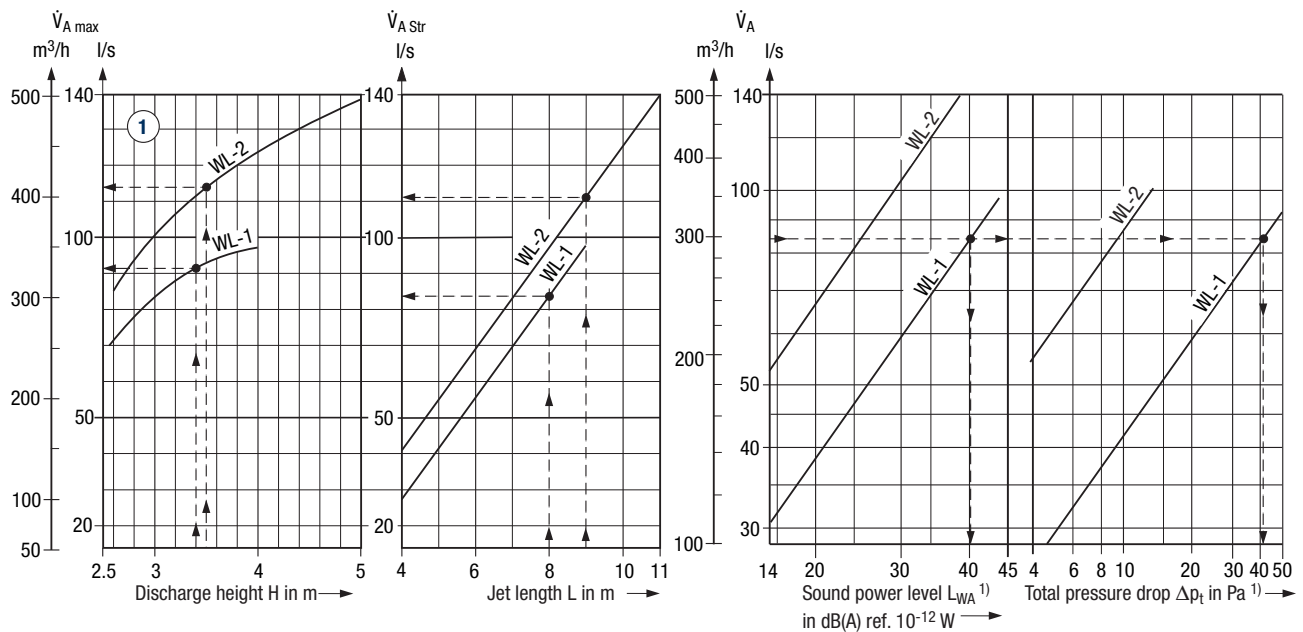
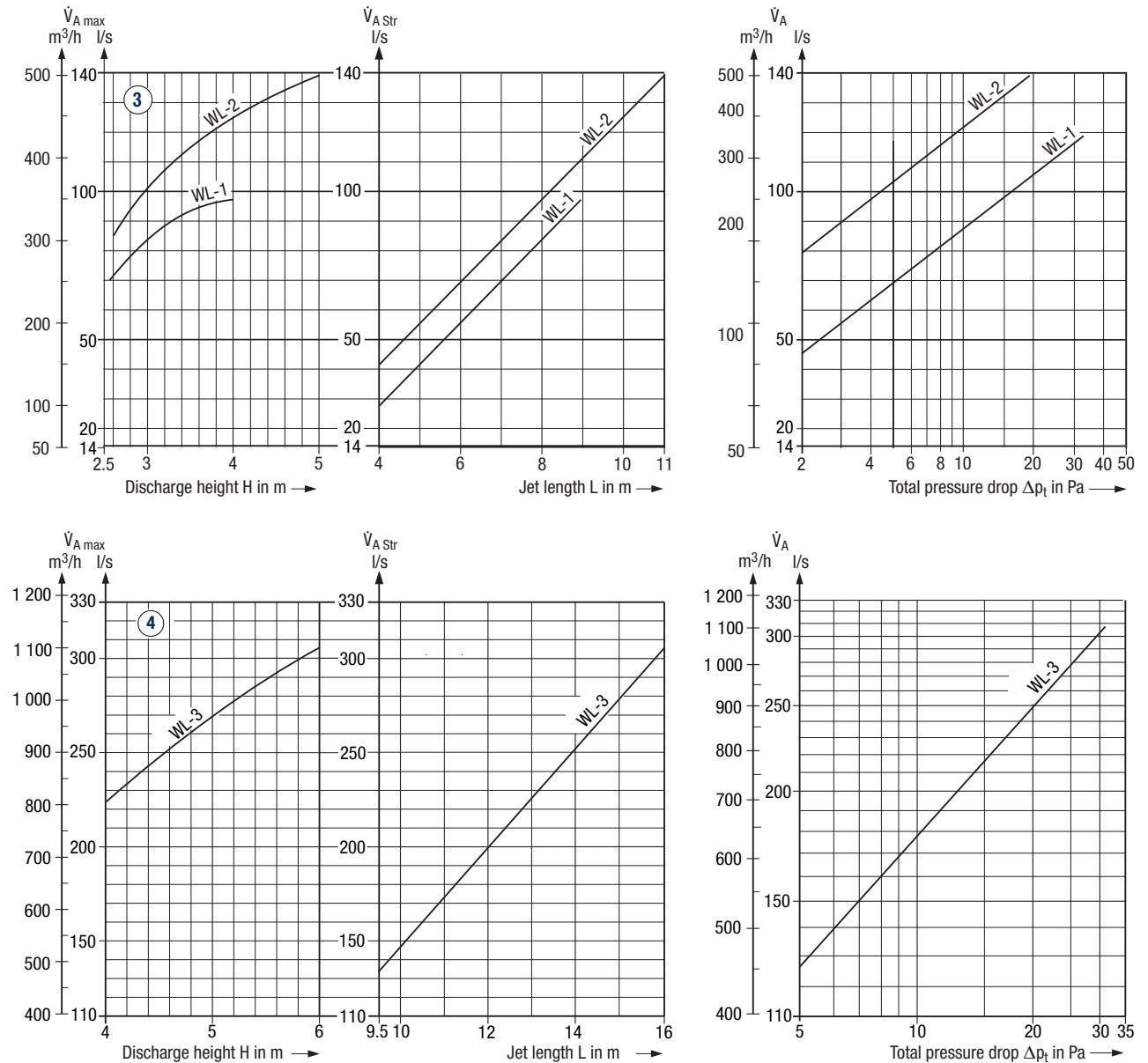| Size	Insertion loss in dB									Insertion loss in dB							
	Connection box **without** acoustic lining									Connection box **with** acoustic lining							
	Octave band centre frequency in Hz									Octave band centre frequency in Hz							
	63	125	250	500	1 K	2 K	4 K	8 K		63	125	250	500	1 K	2 K	4 K	8 K
WL-1	1	1	4	10	14	12	10	12		1	1	6	12	18	18	21	14
WL-2	1	1	7	8	12	13	10	12		1	2	11	10	16	20	22	24
WL-3	1	1	4	10	10	9	9	10		1	1	7	13	18	19	23	25

[1] Applies to connection box without acoustic lining; with acoustic lining the sound power level is about 2 dB(A) lower. The pressure drop is the same for both types.

Linear whirl outlet for duct connection

Layout graphs

Graph 3 (top row)

- Left axis: $\dot{V}_{A\,max}$ in m³/h and l/s vs. Discharge height H in m — curves WL-1, WL-2
- Middle: $\dot{V}_{A\,Str}$ in l/s vs. Jet length L in m — curves WL-1, WL-2
- Right: $\dot{V}_A$ in m³/h and l/s vs. Total pressure drop Δp_t in Pa — curves WL-1, WL-2

Graph 4 (bottom row)

- Left axis: $\dot{V}_{A\,max}$ in m³/h and l/s vs. Discharge height H in m — curve WL-3
- Middle: $\dot{V}_{A\,Str}$ in l/s vs. Jet length L in m — curve WL-3
- Right: $\dot{V}_A$ in m³/h and l/s vs. Total pressure drop Δp_t in Pa — curve WL-3

Note:

With direct duct connection, the sound power level depends on the air velocity in the duct, the duct shape and run, and components inside the duct, if any. Values for specific requirements are available on request.

Figure 5: Linear whirl outlet at Kursaal, Ostend (B)
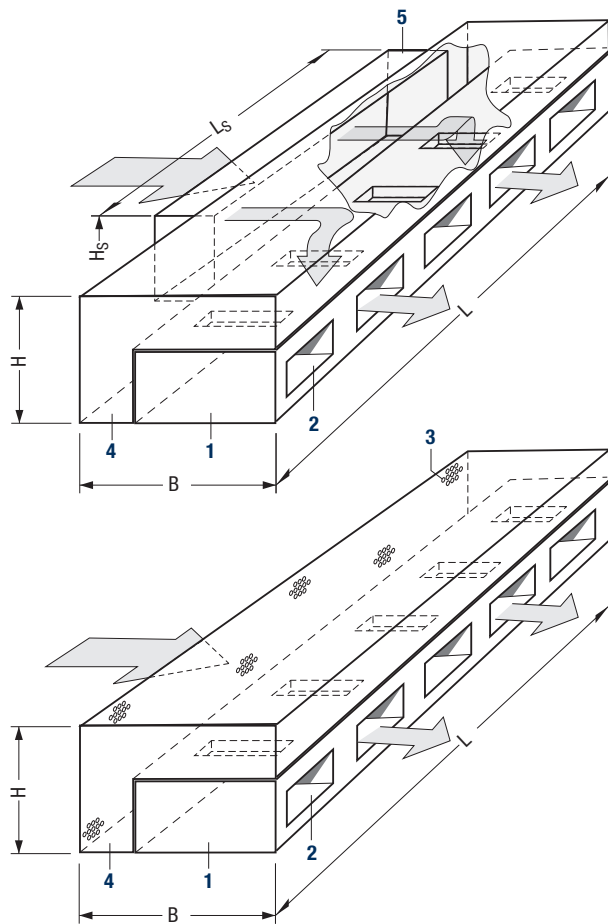
Linear whirl outlet
Slim design and features

Linear whirl outlet for low ceiling plenums

The slim linear whirl outlet is available for rooms or room areas with very low ceiling plenums. Figure 6 shows this design for installation under a gallery, for example. It is available either with a connection spigot **5** for duct connection or with a rear perforated metal screen **3** for connection to a pressurized plenum. Jet pattern and sound power level are not altered by the low-height connection box; the values mentioned on page 8 apply.

Key

1 Discharge element

2 Discharge chamber

3 Perforated metal screen (for connection to pressurized plenum)

4 Connection box

5 Connection spigot (optional)

Features

- For turbulent mixing ventilation
- Installation on or in walls or ceilings
- Available in three sizes
- Maximum volume flow rate
  Size WL-1: 100 l/s [350 m³/h]
  Size WL-2: 140 l/s [500 m³/h]
  Size WL-3: 305 l/s [1 100 m³/h]
- The maximum volume flow rate can be raised by about 15% by installing three twist outlets (on request) in the bottom of the discharge element
- Penetration depth of supply air jets up to 16 m
- Discharge height from 2.6 to 6 m
- Maximum temperature difference supply air to indoor air –8 K when cooling and +5 to +8 K when heating, depending on placement of return air openings
- Low sound power level and low pressure drop
- With connection box or for direct duct connection
- Slim linear whirl outlet also available
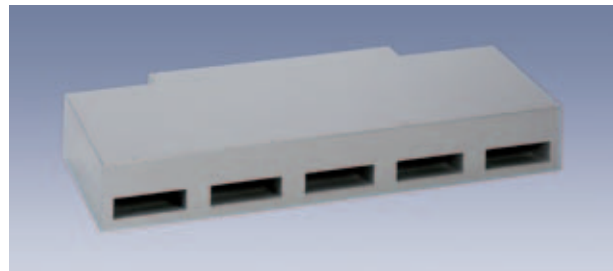- Unobtrusive integration into room architecture also possible
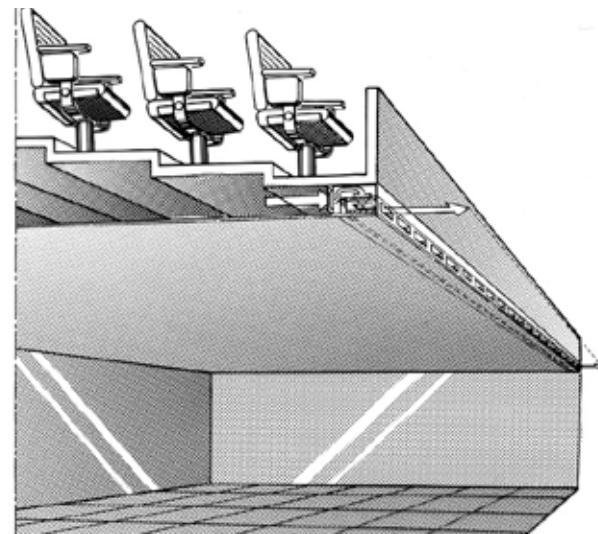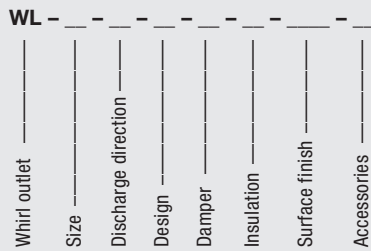

Figure 7: Slim linear whirl outlet

Size	Height H mm	Width B mm	Length L mm	H_S mm	L_S mm	Weight kg
WL-1	100	250	1 000	68	598	12.0
WL-2	140	340	1 038	98	598	16.5
WL-3	260	370	1 100	198	598	23.5

Figure 6: Dimensions of slim linear whirl outlet

Figure 8: Slim linear whirl outlets installed in a row in the ceiling area under a gallery and connected to a pressurized plenum

Linear whirl outlet

Type code

WL – __ – __ – __ – __ – __ – __ – ____ – __

Whirl outlet	
Size	
Discharge direction	
Design	
Damper	
Insulation	
Surface finish	
Accessories	

Size

1 = size 1
2 = size 2
3 = size 3

Discharge direction

E = one-way discharge
N = one-way discharge (low height)

Design

R = connection to rectangular duct
K = connection box [1]
A = connection spigot (low height)
D = connection to pressurized plenum (low height)

Damper (only with design K and A)

0 = no volume flow damper
R = with volume flow damper adjustable from room

Insulation (only with design K)

0 = without acoustic lining
I = with acoustic lining

Surface finish

... = face painted to RAL ….

Accessories

0 = none
A = support bracket

Tender text
– WL-1, WL-2, WL-3

.... units

Linear whirl outlet to generate high-induction air jets for turbulent mixing ventilation,

consisting of:

– a rectangular discharge element with several discharge chambers for one-way air discharge, designed for connection to a rectangular duct, with perforated plate for uniform air flow; placement either singly or consecutively in rows; on request the bottom of the discharge element can be additionally fitted with 3 twist outlets;
– an optional connection box which is optionally available with acoustic lining and volume flow damper adjustable from room

Material:

– Discharge element and support bracket made of galvanized sheet metal, desired colour RAL ….
– Connection box and perforated plate made of galvanized sheet metal
– Twist outlets made of polystyrene on request

Make: KRANTZ KOMPONENTEN
Type: WL – __ – __ – __ – __ – __ – ____ – __

– Slim linear whirl outlet

.... units

Slim linear whirl outlet to generate high-induction air jets for turbulent mixing ventilation,

consisting of:

– a rectangular discharge element with several discharge chambers for one-way air discharge,
– a low-height connection box fitted either with rear connection spigot (length … mm x height … mm), optionally available with volume flow damper adjustable from room, or with a rear perforated metal screen for outlet connection to a pressurized plenum

Material:

Discharge element and connection box made of galvanized sheet metal

Make: KRANTZ KOMPONENTEN
Type: WL – __ – __ – __ – __ – __ – ____ – __

Subject to technical alterations.

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[1] As standard the connection spigot is placed on the air discharge side. Other placement options are available on request.