Air Conditioning System Indivent®

Primary air flow diagram labels:

- return air
- primary air
- joint
- cold water
- 4000 - 7500
- > 2500
- ① ② ③ ④

① **Mixed air flow** →
Reduction of velocity/tempe - rature differences due to high induction mixing with ambient air

② **Displacement air flow** →
Supply air mixed with ambient air, moves towards the facade

③ Thermal effect and displaced room air transport airborne pollution and thermal loads to high level.

④ Return flow path to the exhaust location and for mixing with supply air
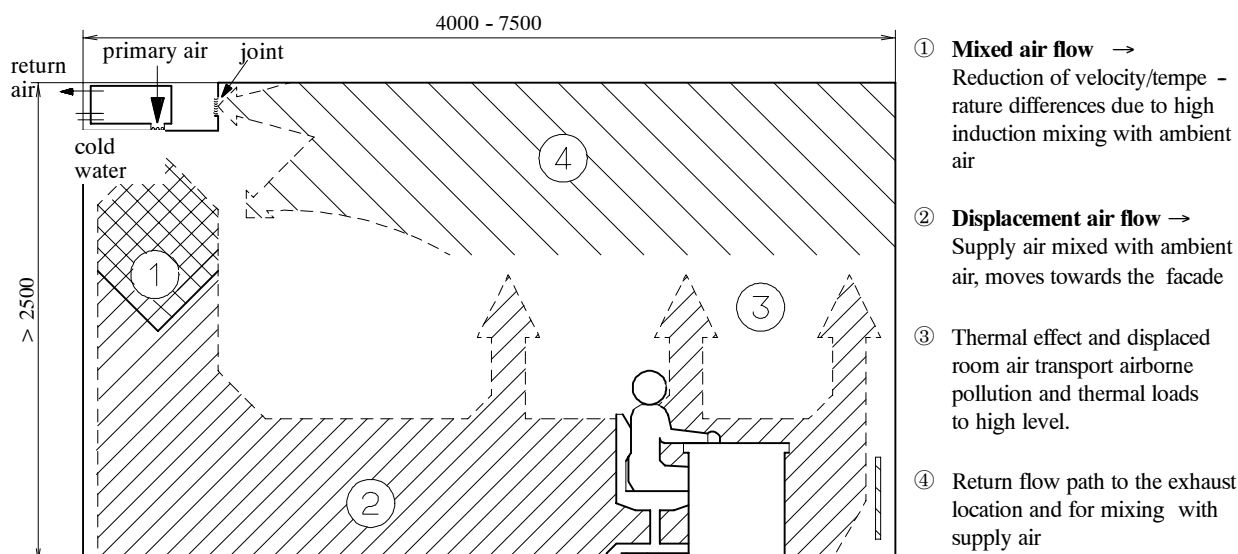
Scheme of Indivent® system flow pattern

Requirements

Modern air conditioning systems are required to remove heat loads and airborne substances from the occupied space in a safe and effective manner, without producing any draft. The air conditioning system's construction, however, must leave room for flexibility with view to the appearance and use of the room. Furthermore, the system must be cost effective within a wide performance range.

Solution

The LTG system Indivent® meets these requirements. It offers high thermal comfort by combining the advantages of both a mixed and a displacement air flow.

Advantages

• **Comfort**

- High cooling capacities and uniform temperatures in the entire occupied space.

- High thermal comfort due to low air speeds and low turbulence.

- High Air Quality – Heat and airborne pollution are exhausted at high level.

• **Economy**

- The Indivent system requires only one compact, room saving air duct system since the heat loads are being removed via a compact chilled water system.

• **Flexibility**

- Interior design of ceiling, lighting and window elements is permitted.

- Workplaces in the room may be arranged according to requirement, without any restrictions.

Function

The LDB Linear Diffuser with integrated cooling is installed in the ceiling over the core wall while heating is provided through radiators located under the window. With this configuration, identical flow patterns during summer and winter are achieved. Further enhancements allow for over-window locations.

Recirculated air is drawn in from the room and across a cooling coil. The mixture of fresh air and recirculated air is blown into the room through a linear diffuser. In the local mixed air zone ① the temperature/velocity differences between the ambient air and the supply air are reduced.

Close to the floor, the cooled air jet ② directs itself at low speed and with little turbulence across the occupied space towards the window. The air speed is virtually independent of the cooling load. The temperature difference between the head and the foot level is less than 1K.

Air heated by room loads rises to high level ③.

Above the occupied space a cushion of warm room air with an increased pollution concentration is formed and removed from the room. In this way the formation of temperature layers ensures cost effective system operation ④.

Range of products

The core element of the Indivent system is the LDB Linear Diffuser with integrated cooling, the Indivent unit. The following types are available:

Type LVC

Fan coil unit for recirculated air operation, water-side valve control, on request with separate fresh air connection. Available in four sizes.
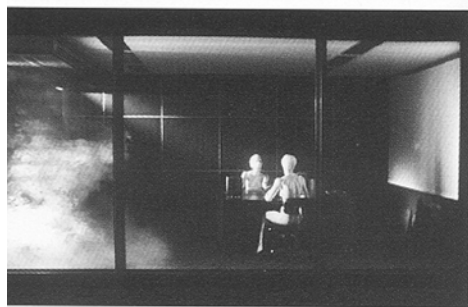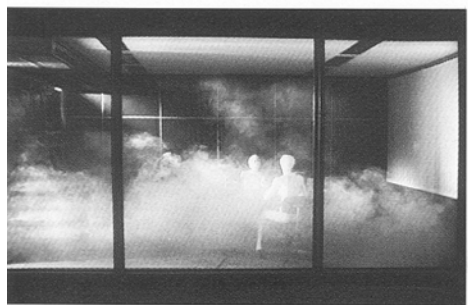
Installation

Units are usually installed over the 'core' wall, in a ceiling bulkhead or in a suspended ceiling. Indivent units require connection to the air conditioning system's primary air supply and the chilled water system.

*Air Conditioning System Indivent®
Type LVC*

Local mixed air zone

Deflection of the air flow near the floor

Air heated by occupants or equipment rises to high level

Proposed installation

The **best installation position for the linear diffusers** depends on:

- use of the room

- type of room

- ceiling design

- return air path inside the false ceiling.

Flexibility of diffuser design and adjustment, ensures a perfect solution from both flow technology and aesthetic aspects, for example:

Ideal location for the induction unit/ fan coil unit with return air is within an **open grid ceiling**.
Equally successful are **closed false ceilings or ceiling bulkheads** that are separated through walls extending to the room soffit. Shadow joints in the ceiling boxes or in the marginal gap serve as return air openings.

The average speed in these openings should not exceed 0.6 to 0.9 m/s (jet contraction not considered).

For installation of LTG Linear Diffusers in the area close to the corridor, the following is recommended:

- If there are no ceiling bulkheads separating the supply air from the return air, a distance of about 1 m must be kept between the return air opening and the air outlet.

- Install the linear diffuser in parallel to the corridor wall. Optimum distance: 0.6 to 1 m.

- When using full height cupboards , a minimum distance of 0.2 m between the air outlet and the cupboard front must be provided.

- Cabinets directly underneath linear diffusers will have no impact on the indoor air flow if a clearance of about 0.4 m to the ceiling is allowed.

Installation example for the Air Conditioning System Indivent®

Air Conditioning System Indivent® Ceiling Fan Coil Unit Type LVC-2

The air conditioning system Indivent type LVC has been designed for two-pipe systems with water-side control valves.

Function

LTG type LVC units incorporate a built-in cross-flow fan which draws in air from the ceiling void and cools it within a heat exchanger. The heat exchanger is fitted with an intake filter.

The cross-flow fans are low-noise and maintenance-free. The speed control is performed through a pole-changing internal rotor motor with five speeds, wired to a factory-mounted terminal box (for terminal connection refer to page 45).

The fan coil units are essentially recirculation type air units but a connection for fresh air is available on request. With that option, the fresh air is supplied through a separate, one-row supply air slot.

Design

LDB linear diffuser

Cylinders:	polystyrene black, mat
	polystyrene white, mat
Rails:	aluminum natural anodised
	painted (similar to RAL)
	or high-gloss chromium-plated
Air distribution box:	galvanized steel

Integrated cooling

Housing:	galvanized steel
Heat exchanger:	copper pipe with
	pressed-on aluminum fins
Filter:	Class EU2

Attention: The water inlet temperature must stay above dew-point ($\geqq$ 16°C) since the unit is not designed for operation with condensate formation.

Advantages

- **Several sizes**
  four sizes for capacity range

- **Low-noise operation**
  efficient cross-flow fan

- **Cost effective**
  low-energy fan operation

- **Easy control**
  single or group control

- **Flexibility**
  on request, the unit is also available with connection for fresh air

- **Adaptability**
  adjustable outlet for optimising room air flow

- **Design**
  the slot profiles are available in a variety of versions and colours.

- **Space saving**
  compact construction suits low ceiling voids.

- **Maintenance-friendly**
  easy-to-replace filter and a maintenance-free motor.

Air Conditioning System Indivent® Ceiling Fan Coil Unit Type LVC−R with detachable Air Distribution Box and Diffuser Rail

Type LVC-R offers the possibility to instal and remove the air distribution box and the diffuser rail independently of the unit, even subsequently. This is particularly advantageous, e.g. for inspection purposes. With the air distribution box and diffuser rail removed, the unit is perfectly accessible through the thus created opening. Additional openings for maintenance checks are, therefore, not required.

Advantages

- **Additional inspection openings are not required**
  - cost saving
  - more flexibility with view to ceiling design
  - uniform look of the ceiling design
- **No contamination of the diffuser rail during construction and renovation**
  thanks to the possibility to detach it or instal it subsequently

270

272
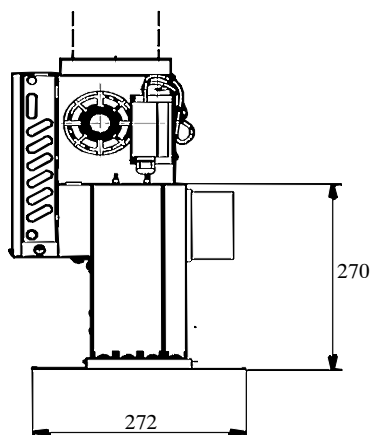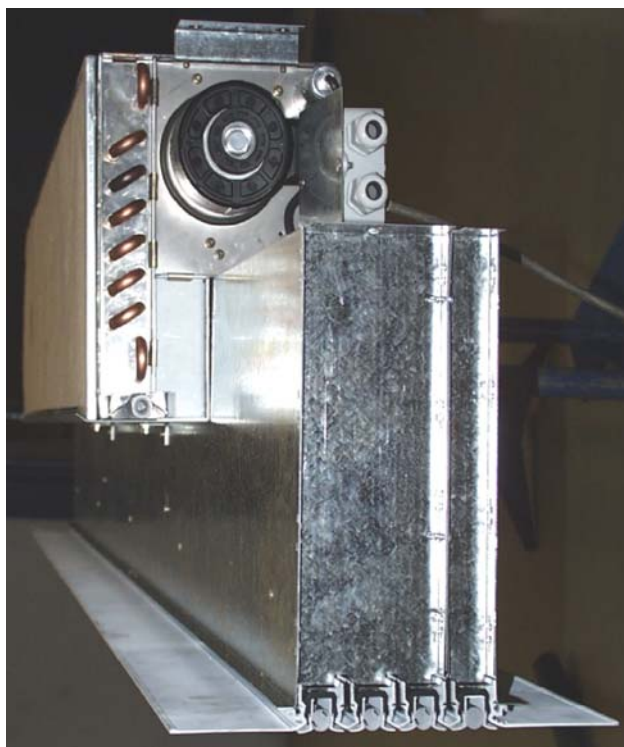
Specification

Fan-coil unit for two-pipe system with one heat exchanger to cool the room air.

Central water-side control.

Ceiling installation.

Diffuser rail and air distribution box easily detachable through metric screw connections.

LDB diffuser rail LDB 12/8/4 or LDB 20/8/4 with enlarged profile for subsequent installation using specific fastening brackets (Second-fix)

Installation order

- Connect box to the base unit using 6 screws.
- Suspend safety loop in LDB.
- Press on LDB rail.
- Fasten screw M4 with cross tip through LDB until the screw resistance has been overcome
- Bracket positions in the LDB box and tightens.
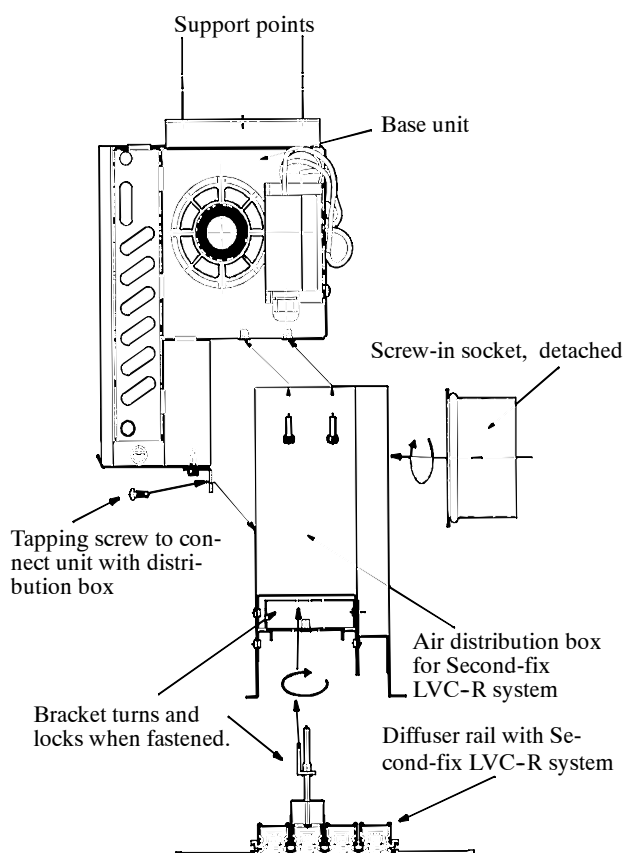
Support points

Base unit

Screw-in socket, detached

Tapping screw to connect unit with distribution box

Air distribution box for Second-fix LVC-R system

Bracket turns and locks when fastened.

Diffuser rail with Second-fix LVC-R system

Air Conditioning System Indivent® Ceiling Fan Coil Unit Type LVC-2 with Linear Diffuser LDB 20/8/4 or LDB 12/8/4
Specification, Dimensions, Technical Data

Specification

Fan coil unit with one heat exchanger for heating or cooling the ambient air.
Central water-side control.

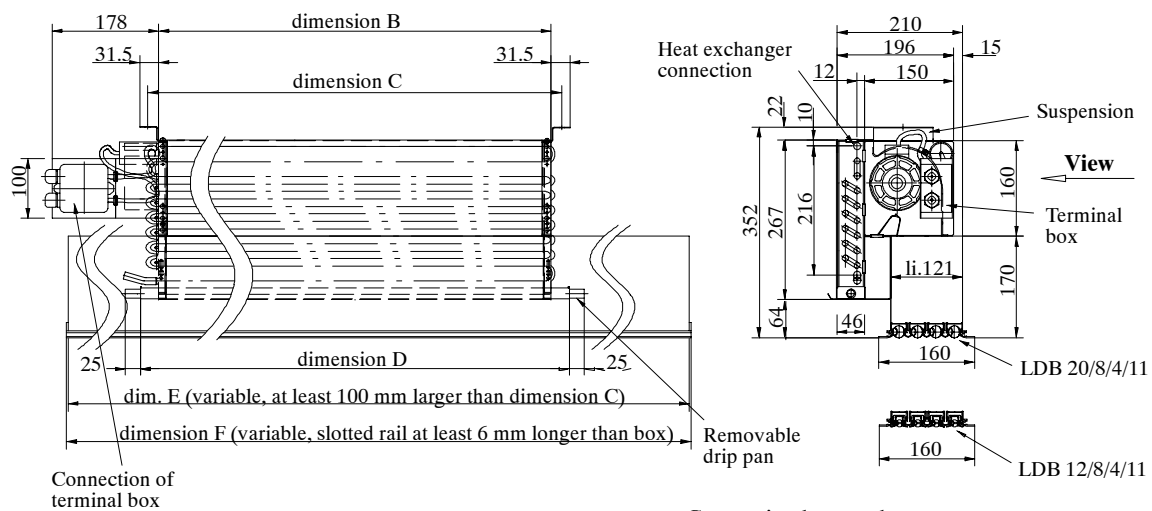Vertical or horizontal installation (in the ceiling).
Water connection on the right or left with 1/2" internal thread and venting.

Dimensions

Size	B [mm]	C [mm]	D [mm]	Weight [kg] with slot length [mm]
630	627	663	885	26 / 1250
800	857	893	1085	31 / 1500
1000	1057	1093	1335	37 / 1750
1250	1257	1293	1535	44 / 2000

View always on outlet
- cross-flow fan motor always on the left
- side water connection LHS or RHS
(picture shows LHS)

Connection heat exchanger:

shown 12 mm Cu-tube,
other dimensions with connection 1/2" internal thread.

Please note:
Position and size of the inspection openings must meet constructional requirements

Ceiling fan coil unit type LVC with LDB 20/8/4/11 (LDB 12/8/4/11)

Technical specifications
Electrical current and power consumption for units with and without filter

Size	Imax [mA]	Electrical power consumption P_el (± 20 %) [W] Speed				
		I	II	III	IV	V
630 and 800	90	17 W	18 W	19 W	20 W	22 W
1000 and 1250	130	16 W	18 W	20 W	22 W	24 W

for more technical data, refer to the next page

Speed control wiring diagram

Air Conditioning System Indivent® Ceiling Fan Coil Unit Type LVC-2 with Linear Diffuser LDB 20/8/4 - Technical Data

Size 630

Speed	Box length 1000 mm						Box length 1500 mm					
	without filter			with filter			without filter			with filter		
	V [m³/h]	L_{wA} [dB(A)]	$Q_{k\,oF}/\Delta t$ [W/K]	V [m³/h]	L_{wA} [dB(A)]	$Q_{kmF}/\Delta t$ [W/K]	V [m³/h]	L_{wA} [dB(A)]	$Q_{k\,oF}/\Delta t$ [W/K]	V [m³/h]	L_{wA} [dB(A)]	$Q_{kmF}/\Delta t$ [W/K]
I	190	36	48	170	37	43	200	35	45	180	36	42
II	230	43	54	210	42	47	240	39	54	210	41	48
III	270	50	60	240	47	55	280	45	61	250	49	55
IV	310	50	67	280	50	63	320	48	66	290	52	63
V	350	50	70	310	54	68	360	50	69	320	54	66

$w_{ok} / \Delta p_w = 200$ [kg/h] / 20 [kPa]

Size 800

Speed	Box length 1000 mm						Box length 1500 mm					
	without filter			with filter			without filter			with filter		
	V [m³/h]	L_{wA} [dB(A)]	$Q_{k\,oF}/\Delta t$ [W/K]	V [m³/h]	L_{wA} [dB(A)]	$Q_{kmF}/\Delta t$ [W/K]	V [m³/h]	L_{wA} [dB(A)]	$Q_{k\,oF}/\Delta t$ [W/K]	V [m³/h]	L_{wA} [dB(A)]	$Q_{kmF}/\Delta t$ [W/K]
I	180	34	50	170	37	45	190	34	54	180	35	50
II	220	41	58	200	41	54	240	39	62	210	40	57
III	260	48	66	240	45	63	290	44	70	260	45	66
IV	310	49	73	290	49	71	330	46	78	300	49	75
V	350	50	80	330	51	77	380	49	83	340	51	80

$w_{ok} / \Delta p_w = 200$ [kg/h] / 22 [kPa]

Size 1000

Speed	Box length 1500 mm						Box length 2000 mm					
	without filter			with filter			without filter			with filter		
	V [m³/h]	L_{wA} [dB(A)]	$Q_{k\,oF}/\Delta t$ [W/K]	V [m³/h]	L_{wA} [dB(A)]	$Q_{kmF}/\Delta t$ [W/K]	V [m³/h]	L_{wA} [dB(A)]	$Q_{k\,oF}/\Delta t$ [W/K]	V [m³/h]	L_{wA} [dB(A)]	$Q_{kmF}/\Delta t$ [W/K]
I	190	26	50	180	29	44	180	26	48	180	29	46
II	280	35	70	260	39	64	280	35	70	270	39	65
III	370	43	84	330	46	78	390	42	84	360	46	80
IV	450	48	97	400	51	90	490	47	98	440	51	91
V	580	55	112	510	57	108	670	56	113	610	58	106

$w_{ok} / \Delta p_w = 200$ [kg/h] / 23 [kPa]

Size 1250

Speed	Box length 1500 mm						Box length 2000 mm					
	without filter			with filter			without filter			with filter		
	V [m³/h]	L_{wA} [dB(A)]	$Q_{k\,oF}/\Delta t$ [W/K]	V [m³/h]	L_{wA} [dB(A)]	$Q_{kmF}/\Delta t$ [W/K]	V [m³/h]	L_{wA} [dB(A)]	$Q_{k\,oF}/\Delta t$ [W/K]	V [m³/h]	L_{wA} [dB(A)]	$Q_{kmF}/\Delta t$ [W/K]
I	180	30	55	170	30	47	200	26	54	190	30	47
II	280	37	78	250	37	70	310	36	76	270	37	72
III	370	45	91	330	45	85	410	43	92	360	46	86
IV	450	50	112	410	50	98	490	48	106	440	51	101
V	590	54	120	530	58	118	630	54	122	570	58	116

$w_{ok} / \Delta p_w = 200$ [kg/h] / 25 [kPa]

V – flow rate (approx. values, tolerance ±10%)
L_{wA} – sound power level ±3 dB(A) (without casing)
Δt – temperature difference between induction air temperature before entering the heat exchanger and water supply

$Q_{k\,oF}$ – cooling capacity (without filter)
$Q_{k\,mF}$ – cooling capacity (with filter)
w_{ok} – standard flow rate at cooling capacity*
Δp_w – water-side pressure loss

Air Conditioning System Indivent® Ceiling Fan Coil Unit Type LVC-2 with Linear Diffuser LDB12/8/4 - Technical Data

Size 630

Speed	Box length 1000 mm						Box length 1500 mm					
	without Filter			with Filter			without Filter			with Filter		
	V [m³/h]	L_{wA} [dB(A)]	$Q_{k\,oF}/\Delta t$ [W/K]	V [m³/h]	L_{wA} [dB(A)]	$Q_{kmF}/\Delta t$ [W/K]	V [m³/h]	L_{wA} [dB(A)]	$Q_{k\,oF}/\Delta t$ [W/K]	V [m³/h]	L_{wA} [dB(A)]	$Q_{kmF}/\Delta t$ [W/K]
I	180	39	45	160	39	40	190	39	47	180	38	42
II	220	45	52	190	44	46	220	42	53	210	43	47
III	250	50	56	220	47	50	370	47	59	250	48	53
IV	290	52	61	260	52	58	310	51	64	280	50	61
V	320	53	70	290	54	63	340	52	70	310	58	63

$w_{ok} / \Delta p_w = 200$ [kg/h] / 20 [kPa]

Size 800

Speed	Box length 1000 mm						Box length 1500 mm					
	without Filter			with Filter			without Filter			with Filter		
	V [m³/h]	L_{wA} [dB(A)]	$Q_{k\,oF}/\Delta t$ [W/K]	V [m³/h]	L_{wA} [dB(A)]	$Q_{kmF}/\Delta t$ [W/K]	V [m³/h]	L_{wA} [dB(A)]	$Q_{k\,oF}/\Delta t$ [W/K]	V [m³/h]	L_{wA} [dB(A)]	$Q_{kmF}/\Delta t$ [W/K]
I	170	36	48	150	36	44	200	37	49	160	36	43
II	200	42	57	180	41	51	240	42	57	200	41	52
III	250	48	63	220	45	59	290	48	65	240	46	60
IV	290	49	69	260	49	65	340	51	73	290	49	67
V	330	52	76	290	52	71	390	52	79	330	51	73

$w_{ok} / \Delta p_w = 200$ [kg/h] / 22 [kPa]

Size 1000

Speed	Box length 1500 mm						Box length 2000 mm					
	without Filter			with Filter			without Filter			with Filter		
	V [m³/h]	L_{wA} [dB(A)]	$Q_{k\,oF}/\Delta t$ [W/K]	V [m³/h]	L_{wA} [dB(A)]	$Q_{kmF}/\Delta t$ [W/K]	V [m³/h]	L_{wA} [dB(A)]	$Q_{k\,oF}/\Delta t$ [W/K]	V [m³/h]	L_{wA} [dB(A)]	$Q_{kmF}/\Delta t$ [W/K]
I	170	27	48	160	30	43	240	26	60	170	29	44
II	250	40	67	230	39	64	300	38	72	260	39	64
III	320	46	79	290	46	75	440	46	83	330	47	77
IV	390	51	91	360	52	86	480	50	96	430	52	90
V	490	57	105	450	58	100	590	56	107	560	58	103

$w_{ok} / \Delta p_w = 200$ [kg/h] / 23 [kPa]

Size 1250

Speed	Box length 1500 mm						Box length 2000 mm					
	without Filter			with Filter			without Filter			with Filter		
	V [m³/h]	L_{wA} [dB(A)]	$Q_{k\,oF}/\Delta t$ [W/K]	V [m³/h]	L_{wA} [dB(A)]	$Q_{kmF}/\Delta t$ [W/K]	V [m³/h]	L_{wA} [dB(A)]	$Q_{k\,oF}/\Delta t$ [W/K]	V [m³/h]	L_{wA} [dB(A)]	$Q_{kmF}/\Delta t$ [W/K]
I	150	27	54	150	28	48	180	26	57	170	29	48
II	200	39	74	230	39	67	230	38	77	250	39	70
III	290	47	89	300	46	81	270	45	92	330	45	83
IV	370	51	100	340	50	94	320	51	103	370	50	96
V	480	57	116	440	57	107	360	58	118	480	58	113

$w_{ok} / \Delta p_w = 200$ [kg/h] / 25 [kPa]

V	– flow rate (approx. values, tolerance ±10%)		$Q_{k\,oF}$	– cooling capacity (without filter)
L_{wA}	– sound power level ±3 dB(A) (without casing)		$Q_{k\,mF}$	– cooling capacity (with filter)
Δt	– temperature difference between induction air temperature before entering the heat exchanger and water supply		w_{ok}	– standard flow rate at cooling capacity*
			Δp_w	– water-side pressure loss

Air Conditioning System Indivent® Ceiling Fan Coil Unit Type LVC-2
with separate Fresh Air Box and Linear Diffuser LDB 20/8/4 or LDB 12/8/4
Specification, Dimensions, Technical Specifications

Specification

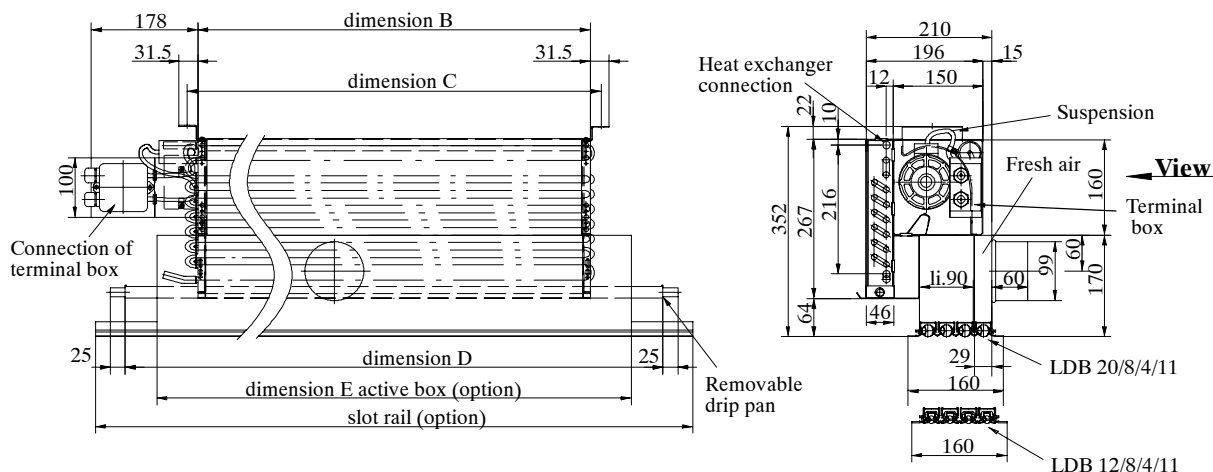Fan coil unit with one heat exchanger for heating or cooling the ambient air.
Central water-side control.

Vertical or horizontal installation (in the ceiling).
Water connection on the right or left with 1/2" internal thread and venting.

Dimensions

Size	B [mm]	C [mm]	D [mm]	Weight [kg] with slot length [mm]
630	627	663	885	26 / 1250
800	857	893	1085	31 / 1500
1000	1057	1093	1335	37 / 1750
1250	1257	1293	1535	44 / 2000

View always on outlet
- cross-flow fan motor always on the left
- side water connection LHS or RHS
(picture shows LHS)

Connection heat exchanger:

shown 12 mm Cu-tube,
other dimensions with connection 1/2" internal thread.

Please note:
Position and size of the inspection openings
must meet constructional requirements

Ceiling fan coil unit type LVC
with separate fresh air box with LDB 20/8/4 or LDB 12/8/4

Technical specifications
Electrical current and power consumption for units with and without filter

Size	Imax [mA]	Electrical power consumption P_{el} ($\pm$ 20 %) [W] Speed				
		I	II	III	IV	V
630 and 800	90	17 W	18 W	19 W	20 W	22 W
1000 and 1250	130	16 W	18 W	20 W	22 W	24 W

for more technical data, refer to pages 37 and 38

Speed control wiring diagram
(see page 42)

Air Conditioning System Indivent® Ceiling Fan Coil Unit Type LVC-2 with Linear Diffuser LDB 20/8/3 or LDB 12/8/3
Specification, Dimensions, Technical Specifications

Specification

Fan coil unit with one heat exchanger for heating or cooling the ambient air.
Central water-side control.

Vertical or horizontal installation (in the ceiling).
Water connection on the right or left with 1/2" internal thread and venting.

Dimensions

BG	B [mm]	C [mm]	D [mm]	Weight [kg] with slot length [mm]
630	627	663	885	26 / 1250
800	857	893	1085	31 / 1500
1000	1057	1093	1335	37 / 1750
1250	1257	1293	1535	44 / 2000
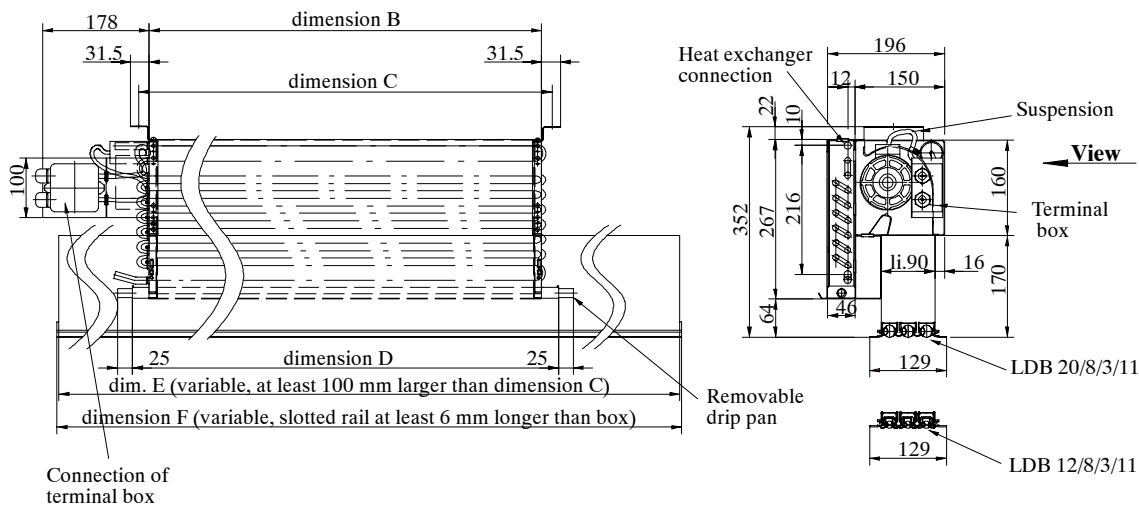
View always on outlet
– cross-flow fan motor always on the left
– side water connection LHS or RHS
(picture shows LHS)

Ceiling fan coil unit type LVC with LDB 20/8/3 or LDB 12/8/3

Connection heat exchanger:

shown 12 mm Cu-tube,
other dimensions with connection 1/2" internal thread.

Please note:
Position and size of the inspection openings
must meet constructional requirements

Technical specifications
Electrical current and power consumption for units with and without filter

Size	Imax [mA]	Electrical power consumption P_{el} ($\pm$ 20 %) [W] Speed				
		I	II	III	IV	V
630 and 800	90	17 W	18 W	19 W	20 W	22 W
1000 and 1250	130	16 W	18 W	20 W	22 W	24 W

for more technical data, refer to pages 37 and 38

Speed control wiring diagram
(see page 42)

Air Conditioning System Indivent® Ceiling Fan Coil Unit Type LVC-2
with LDB 20/8/4 with separate Fresh Air Box or with LDB 20/8/3

Size 630

Speed	Box length 1000 mm						Box length 1500 mm					
	without filter			with filter			without filter			with filter		
	V [m³/h]	L_{wA} [dB(A)]	$Q_{k\,oF}/\Delta t$ [W/K]	V [m³/h]	L_{wA} [dB(A)]	$Q_{kmF}/\Delta t$ [W/K]	V [m³/h]	L_{wA} [dB(A)]	$Q_{k\,oF}/\Delta t$ [W/K]	V [m³/h]	L_{wA} [dB(A)]	$Q_{kmF}/\Delta t$ [W/K]
I	180	40	46	180	40	43	190	37	47	180	38	45
II	210	45	52	190	43	48	220	43	53	210	42	50
III	260	51	58	230	48	55	260	47	61	240	48	57
IV	300	51	64	260	51	61	310	51	65	280	52	62
V	340	57	68	290	55	65	350	55	70	290	56	68

w_{ok} / Δp_w = 200 [kg/h] / 20 [kPa]

Size 800

Speed	Box length 1000 mm						Box length 1500 mm					
	without filter			with filter			without filter			with filter		
	V [m³/h]	L_{wA} [dB(A)]	$Q_{k\,oF}/\Delta t$ [W/K]	V [m³/h]	L_{wA} [dB(A)]	$Q_{kmF}/\Delta t$ [W/K]	V [m³/h]	L_{wA} [dB(A)]	$Q_{k\,oF}/\Delta t$ [W/K]	V [m³/h]	L_{wA} [dB(A)]	$Q_{kmF}/\Delta t$ [W/K]
I	190	34	49	170	35	46	200	38	52	160	36	47
II	210	40	57	200	40	52	240	44	59	200	41	54
III	250	47	64	240	45	61	280	47	71	240	46	62
IV	290	51	71	280	48	68	330	51	75	280	49	70
V	330	54	77	310	51	74	360	53	81	310	52	74

w_{ok} / Δp_w = 200 [kg/h] / 22 [kPa]

Size 1000

Speed	Box length 1500 mm						Box length 2000 mm					
	without filter			with filter			without filter			with filter		
	V [m³/h]	L_{wA} [dB(A)]	$Q_{k\,oF}/\Delta t$ [W/K]	V [m³/h]	L_{wA} [dB(A)]	$Q_{kmF}/\Delta t$ [W/K]	V [m³/h]	L_{wA} [dB(A)]	$Q_{k\,oF}/\Delta t$ [W/K]	V [m³/h]	L_{wA} [dB(A)]	$Q_{kmF}/\Delta t$ [W/K]
I	160	27	49	140	30	44	210	26	51	170	29	44
II	250	41	68	230	39	60	300	37	69	250	39	63
III	330	47	81	300	46	76	390	44	84	3330	45	77
IV	410	52	92	360	52	86	450	51	93	390	51	87
V	520	57	103	450	57	100	630	56	110	510	57	101

w_{ok} / Δp_w = 200 [kg/h] / 23 [kPa]

Size 1250

Speed	Box length 1500 mm						Box length 2000 mm					
	without filter			with filter			without filter			with filter		
	V [m³/h]	L_{wA} [dB(A)]	$Q_{k\,oF}/\Delta t$ [W/K]	V [m³/h]	L_{wA} [dB(A)]	$Q_{kmF}/\Delta t$ [W/K]	V [m³/h]	L_{wA} [dB(A)]	$Q_{k\,oF}/\Delta t$ [W/K]	V [m³/h]	L_{wA} [dB(A)]	$Q_{kmF}/\Delta t$ [W/K]
I	160	27	53	140	27	47	180	25	54	160	27	47
II	250	36	74	230	37	66	280	36	74	250	35	67
III	320	47	88	300	45	82	360	45	89	330	43	83
IV	400	51	99	360	49	93	440	51	102	390	50	95
V	520	58	112	470	56	109	560	56	116	510	56	109

w_{ok} / Δp_w = 200 [kg/h] / 25 [kPa]

Acoustic power level for separate fresh air box:

V_{prim} [m³/(hm)]	80	90	100
$L_{wA\,P}$ [dB(A)]	25	28	31

The **total acoustic power level** may be calcul. as follows:
$$L_{wA} = 10 * \log (10^{0.1*L_{wA\,P}} + 10^{0.1 * L_{wA,LVC}})$$

V	– flow rate (approx. values, tolerance ±10%)
L_{wA}	– sound power level ±3 dB(A) (without casing)
Δt	– temp. diff. between induction air temperature before entering the heat exchanger and water supply
V_P	– fresh air flow rate
$Q_{k\,oF}$	– cooling capacity (without filter)
$Q_{k\,mF}$	– cooling capacity (with filter)
w_{ok}	– standard flow rate at cooling capacity
Δp_w	– water-side pressure loss
$L_{wA\,P}$	– sound power level fresh air

Air Conditioning System Indivent® Ceiling Fan Coil Unit Type LVC-2
with LDB 12/8/4 with separate Fresh Air Box or with LDB 12/8/3

Size 630

Speed	Box length 1000 mm						Box length 1500 mm					
	without filter			with filter			without filter			with filter		
	V [m³/h]	L$_{wA}$ [dB(A)]	Q$_{k\,oF}$/Δt [W/K]	V [m³/h]	L$_{wA}$ [dB(A)]	Q$_{kmF}$/Δt [W/K]	V [m³/h]	L$_{wA}$ [dB(A)]	Q$_{k\,oF}$/Δt [W/K]	V [m³/h]	L$_{wA}$ [dB(A)]	Q$_{kmF}$/Δt [W/K]
I	170	39	43	160	40	39	180	40	44	170	37	42
II	190	45	49	180	45	45	210	45	51	200	43	49
III	220	51	54	210	48	51	240	49	58	220	48	54
IV	250	53	58	230	52	58	270	52	66	250	51	60
V	270	57	60	250	55	61	300	56	69	270	55	63

w_{ok} / Δp_w = 200 [kg/h] / 20 [kPa]

Size 800

Speed	Box length 1000 mm						Box length 1500 mm					
	without filter			with filter			without filter			with filter		
	V [m³/h]	L$_{wA}$ [dB(A)]	Q$_{k\,oF}$/Δt [W/K]	V [m³/h]	L$_{wA}$ [dB(A)]	Q$_{kmF}$/Δt [W/K]	V [m³/h]	L$_{wA}$ [dB(A)]	Q$_{k\,oF}$/Δt [W/K]	V [m³/h]	L$_{wA}$ [dB(A)]	Q$_{kmF}$/Δt [W/K]
I	160	36	44	140	36	39	180	36	49	160	35	44
II	190	41	52	170	40	47	200	41	53	190	40	53
III	220	46	60	200	45	54	250	49	64	220	45	61
IV	250	48	65	230	48	62	290	51	72	270	49	67
V	280	51	74	260	50	67	320	53	78	300	51	73

w_{ok} / Δp_w = 200 [kg/h] / 22 [kPa]

Size 1000

Speed	Box length 1500 mm						Box length 2000 mm					
	without filter			with filter			without filter			with filter		
	V [m³/h]	L$_{wA}$ [dB(A)]	Q$_{k\,oF}$/Δt [W/K]	V [m³/h]	L$_{wA}$ [dB(A)]	Q$_{kmF}$/Δt [W/K]	V [m³/h]	L$_{wA}$ [dB(A)]	Q$_{k\,oF}$/Δt [W/K]	V [m³/h]	L$_{wA}$ [dB(A)]	Q$_{kmF}$/Δt [W/K]
I	150	28	44	140	29	40	180	28	47	160	30	42
II	210	40	62	200	39	57	250	41	65	260	39	60
III	270	47	75	250	45	68	320	48	77	300	46	73
IV	330	52	82	300	50	78	400	52	88	360	51	83
V	410	57	95	370	56	94	510	58	101	460	57	95

w_{ok} / Δp_w = 200 [kg/h] / 23 [kPa]

Size 1250

Speed	Box length 1500 mm						Box length 2000 mm					
	without filter			with filter			without filter			with filter		
	V [m³/h]	L$_{wA}$ [dB(A)]	Q$_{k\,oF}$/Δt [W/K]	V [m³/h]	L$_{wA}$ [dB(A)]	Q$_{kmF}$/Δt [W/K]	V [m³/h]	L$_{wA}$ [dB(A)]	Q$_{k\,oF}$/Δt [W/K]	V [m³/h]	L$_{wA}$ [dB(A)]	Q$_{kmF}$/Δt [W/K]
I	130	28	49	120	23	42	150	25	49	140	27	45
II	210	40	67	180	34	61	240	36	69	200	36	65
III	270	44	80	240	43	75	310	45	85	270	48	77
IV	330	50	90	300	49	87	370	51	96	330	51	91
V	410	57	104	380	56	101	490	56	111	420	58	101

w_{ok} / Δp_w = 200 [kg/h] / 25 [kPa]

Acoustic power level for separate fresh air box:

V$_{prim}$ [m³/(hm)]	80	90	100
L$_{wA\,P}$ [dB(A)]	25	28	31

The **total acoustic power level** may be calcul. as follows:
$$L_{wA} = 10 * \log (10^{0.1 * L_{wA\,P}} + 10^{0.1 * L_{wA,LVC}})$$

V	-	flow rate (approx. values, tolerance ±10%)
L$_{wA}$	-	sound power level ±3 dB(A) (without casing)
Δt	-	temp. diff. between induction air temperature before entering the heat exchanger and water supply
V$_P$	-	fresh air flow rate
Q$_{k\,oF}$	-	cooling capacity (without filter)
Q$_{k\,mF}$	-	cooling capacity (with filter)
w$_{ok}$	-	standard flow rate at cooling capacity
Δp$_w$	-	water-side pressure loss
L$_{wA\,P}$	-	sound power level fresh air

Air Conditioning System Indivent® Ceiling Fan Coil Unit Type LVC-2 Selection Example

given values:

Required cooling capacity:	$Q_{k\ soll}$ =	840	W
Water inlet temperature:	t_{VL} =	16	°C

Room temperature/
Induction air temperature before
entering the heat exchanger: t_R/t_A =   26 °C

Fresh air flow rate:	V_P =	150	m^3/h
Fresh air temperature:	t_P =	18	°C
Installation dimensions / slot length:	L_S =	1500	mm

Cooling capacity fresh air: Q_P =   400 W (with $\Delta t_P = t_R - t_P$ = 8 K)

Secondary cooling capacity (heat exch.): Q_k = $Q_{k\ soll}$ - Q_P = 440 W

With $\Delta t = t_A - t_{VL}$ = 10 K
specific secondary cooling capacity $Q_k/\Delta t$ =   44 W/K

With a given box length of 1500 mm and $Q_k/\Delta t$ = 47 W/K, *the following unit may be selected:*

→ **LVC, Size 800 with LDB 20/8/4 with separate fresh air box at speed I**

The following total cooling capacity is obtained:

**Total cooling capacity at
standard water flow rate:** ($Q_{kmF + QP}$): **Q_{kges}** 470 W + 400 W = **870 W**

The total cooling capacity is larger than the required cooling capacity. Since the fresh air cooling capacity depends on the fresh air flow rate, and the latter is fixed by the required air change rate, the secondary cooling capacity may be reduced by changing the nominal water volume.

**Required secondary
cooling capacity:**   ($Q_{k\ soll}$ - Q_P)   **Q_{kerf}** 840 W - 400 W = **440 W**

**Share of the secondary cooling capacity in % when
using the nominal water volume:**   440 W / 470 W = **0.93 → 93 %**

According to the diagrams on page 43 the following is obtained:

Flow rate
at a 94% secondary cooling capacity: **160 kg/h**

Pressure loss at 160 kg/h: **abt. 16 kPa** (reading)

The secondary cooling capacity may be influenced by the choice of the size, the slot length and by the modification of the water flow rate.

Calculation of the total acoustic power level

The total acoustic power level is calculated by adding up the individual acoustic power levels:

Acoustic power level of the unit: $L_{wA,LVC}$ = 36 dB(A) (from the selection chart)

Acoustic power of fresh air: $L_{wA\ P}$ = 31 dB(A) (V_P = 100 m^3/hm)
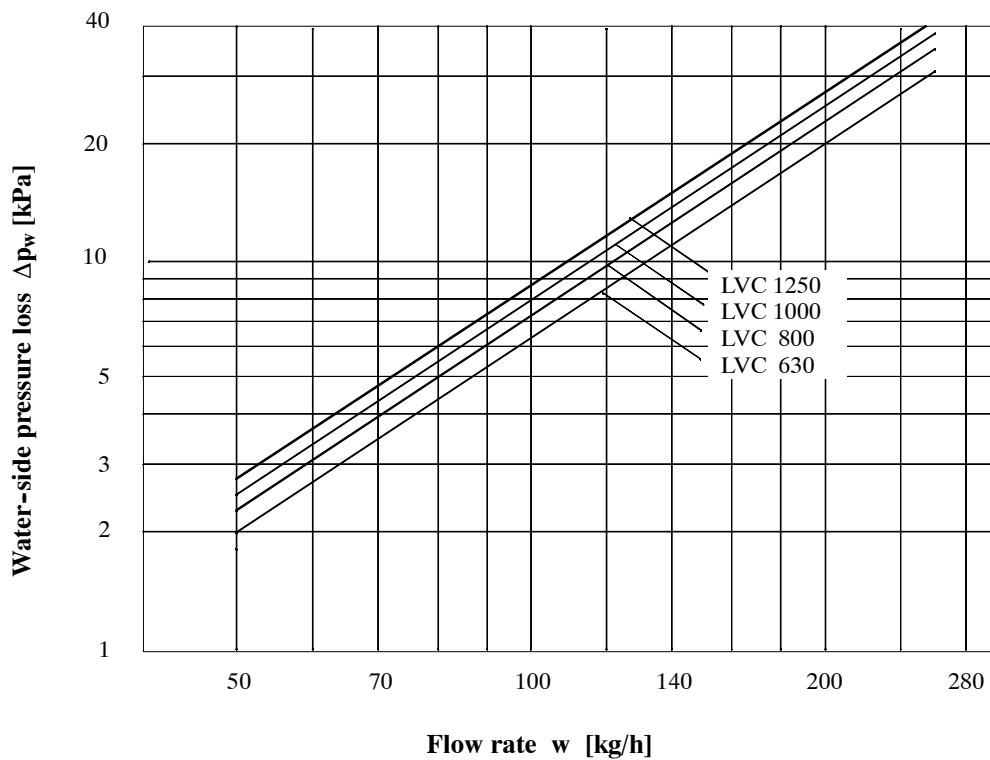
total acoustic power level of: **L_{wA}** = 10 * log ($10^{0.1*31}$ + $10^{0.1*35}$) = **37.4 dB(A)**

Air Conditioning System Indivent® Ceiling Fan Coil Unit Type LVC-2

Capacity with different water flow rates

Capacity in % of the nominal capacity Q

I
II
III   Speed
IV
V

Flow rate w [kg/h]
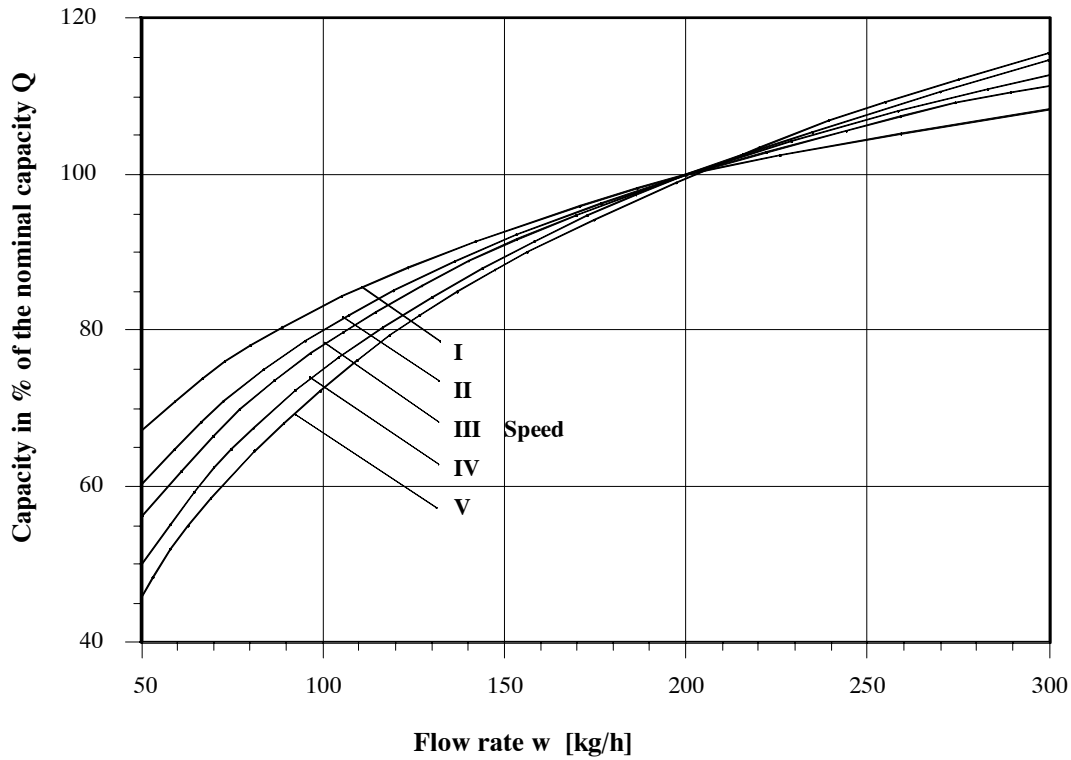
Water-side pressure loss for different water flow rates

Water-side pressure loss Δp_W [kPa]

LVC 1250
LVC 1000
LVC 800
LVC 630

Flow rate w [kg/h]

Air Conditioning System Indivent® Ceiling Fan Coil Unit Type LVC

Nomenclature   **LVC - 2 800 / S / F / L / - - - / D**

2-pipe unit **2**
4-pipe unit **4**
(valve-controlled)

size **630**
800
1000
1250

S = standard version **S**
R = special version **R**
(with inspection opening)

without filter **-**
with filter **F**

water connection on the left **L**
water connection on the right **R**

without fresh air connection **- - -**
with separate fresh air box **P . .**

straight-way 3-point valve **D**
3-way 3-point valve **3**
straight-way valve, thermal **T**

Nomenclature   **LDB 20 / 8 / 3 / 00 / - - / E6-EV1 / 2000 / S / 1**

diffuser type **LDB 12/8**
LDB 20/8

no. of slots **3**
4

border profile **(0...8)**
left - right

additional profile **(-, 1..7)**
left - right

surface
E2 = anodized, brushed; **E6** = anodized, unbrushed
LG = painted, gloss; **LM** = painted, matt
C = chromium-plated; R = unfinished; **X** = special finish

colour
painted = **RAL-shade**; anodized = anodizin shade

slot length **[mm]**

nozzle colour
S = black; **W** = white; **G** = grey aluminum; **C** = cromium-plated

end caps
- = without; **1** = both sides **2** = left; **3** = right

Speed Control Wiring Diagram Type VKH, VFC and LVC

Note: - Capacitor motor with 5 tappings.
- Multiple unit triggering possible.
- The technical data contain details about the current consumption and the corresponding electrical power.

Note :
For a smooth and safe start of the fan coil units, it is necessary to use speed III.
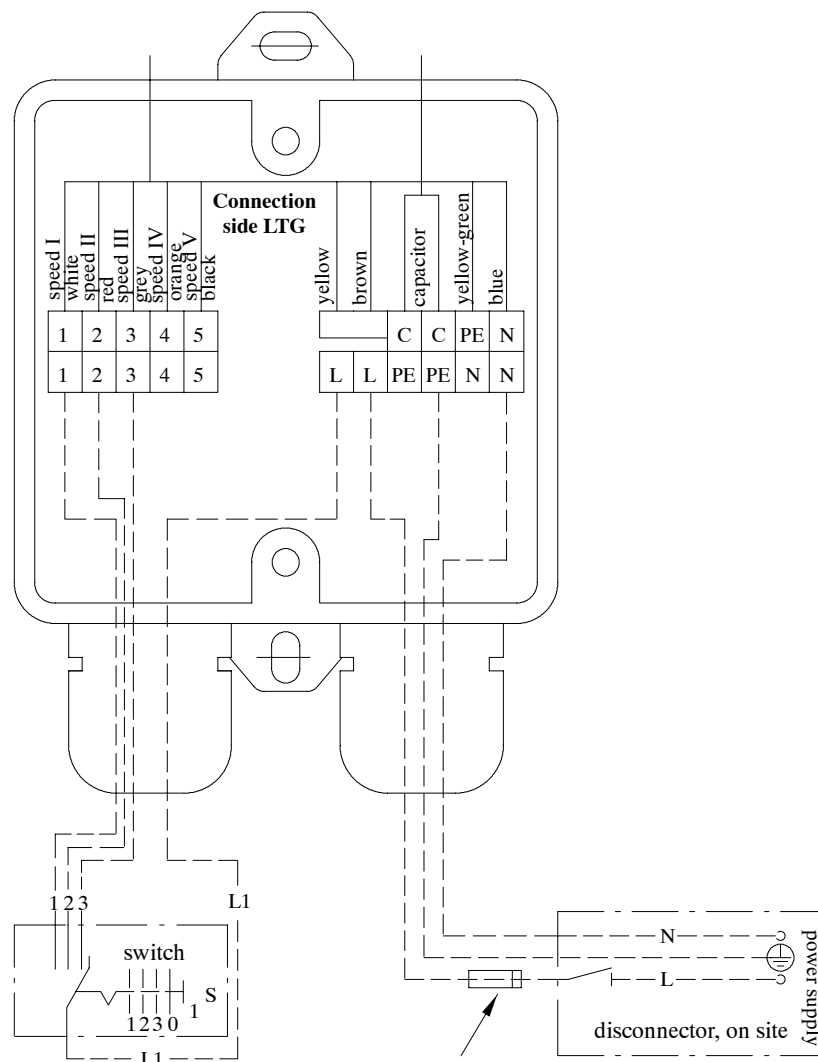
Fuse 2A: slow-blow, on site,
can vary acc. to project
(see design data)

VF-Decke-E-TP (10/05)

Qty	Description	Unit price in €	Total in €
	LTG A/C System Indivent® **Ceiling fan coil unit type LVC-2 (cooling)** Compact ceiling fan coil unit with low space requirement, combined with air diffuser, either with or without additional separate fresh air outlet, with integrated cooling for a constant primary air flow rate, to produce a combined mixed / displacement air flow with low air speed, avoiding temperature layer formations in the occupied zone. The unit includes: Housing of galvanized sheet steel. Angle brackets of sheet steel for on-site ceiling fixation using threaded rods. Cross-flow fan with steady characteristic and 5-speed, pole-changeable internal rotor capacitor motor with low energy consumption, terminal box wired. Triggering through individual switch. Heat exchanger for cooling for a high caloric output, made of copper tubing with press-fitted aluminium fins for a maximum operating pressure of the standard version of 10 bar, designed for connection to a chilled water supply system. Water connection using a smooth 12 x 1 copper tube for connection of a quick release coupling, on the right or left as required. Condensate receiver of galvanized sheet steel. Linearly adjustable air diffuser with cylindrical slot nozzles of natural colour anodized aluminium profiles. Direction of blown out air even subsequently adjustable by 180° without need for any additional mechanism, individually factory-set. Alternating long and short cylinders providing flow patterns from a flat jet close to the ceiling to a wide spreading of 25 micro-jets per meter diffuser length, with air distribution box of galvanized sheet steel. Technical specifications: Cooling mode: Room temperature: _____ °C Cooling capacity/unit: _____ W Cooling capacity Primary air: _____ W Total cooling capacity: _____ W Fresh air temperature: _____ °C Temperature of supplied chilled water: _____ °C Chilled water flow rate: _____ kg/h Water-side pressure loss: _____ kPa -2-		

Qty	Description	Unit price in €	Total in €
	-2-		
	Options:		
	Number of slot rows: _____		
	Length of slot rows: _____ mm		
	Colour of the cylinders: o black o white		
	Colour of the slot profiles: _____		

	o Aluminium profile finish
	     o painted according to RAL No.:_____
	     o anodized _____
	     o chromium-plated		

	o Profile adaptation to the ceiling using:
	     o special profile No.: _____
	     o additional profile No.: _____		

	o End piece on the face side of the profiles
	     o 15 mm wide
	     o 25 mm wide		

	o Variable diffuser neck length (max. 170 mm) Desired length in mm _____		
	Model sizes:		
	o 630 o 800 o 1000 o 1250		
	Accessories / Special versions		
	o With separate 1-slot supply air outlet Socket diameter in mm: _____		
	o Condensate receiver with socket		
	o Primary air throttling element KLX 100/1		
	o Flexible hose for chilled/hot water, operating pressure 16 bar LTG connection on one side, the other according to requirement _____ with / without insulation with / without venting Length in mm: _____		
	o Aluminium return air grille, natural colour anodized Length in mm: _____Width in mm: _____ Installation type: o vertical / horizontal Type LDC		

	o Air outlet frame for return air grille
	
	     o special version: grille / frame powder coated similar
	       to RAL No. _____		

	Manufacturer: LTG Aktiengesellschaft **Series: A/C System Indivent**® ** Ceiling Fan Coil Unit** **Type: LVC-2**		