The Innovation Company

LTG Aktiengesellschaft

Original Instructions for Installation, Use and Maintenance

Fan Coil Unit VKE

LTG Aktiengesellschaft
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AG-B 215.1 eng (Feb. 10)

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EC Declaration of Conformity

The Innovation Company
LTG Aktiengesellschaft

EC declaration of conformity

As defined by the EC Council Directive on Machinery 2006/42/EG, Annex II, Nr. 1A

We herewith declare that the machine described in the following conforms to all relevant provisions of the EC Machinery Directive 2006/42/EC.

Manufacturer:	**LTG Aktiengesellschaft, Grenzstr. 7, D-70435 Stuttgart**
Designation of machinery:	**Fan Coil Unit**
Machinery type:	**VKE** all sizes
Relevant EC Council Directives:	Machinery Directive (2006/42/EC)
Applied harmonized standards, in particular:	DIN EN ISO 13857, DIN EN 349, DIN EN ISO 12100-1, DIN EN ISO 12100-1, DIN EN 60335-1
Other standards:	VDI 6022

Stuttgart, 29.Dezember 2009

Signature of manufactorer

Position of signatory: Dr. Schaal ppa. Dehlwes

Air technology for humans and products. Since 1924

Konformitätserklärung-GB.docx/ Seite 1 of 1

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USt-/VAT-/TVA-/IVA-Id: DE 812753932
Trade register: district court Stuttgart, Nr. HRB 20451
Place of performance / court of jurisdiction Stuttgart
Landesbank Baden-Württemberg (600 501 01) 2 575 667
Commerzbank AG, Stuttgart (600 400 71) 7 550 031 00
HypoVereinsbank AG, Stuttgart (600 202 90) 3 887 729 64

Carefully read the safety instructions before using any LTG fan coil unit.
Always follow the safety instructions!

Safety Instructions

The units meet any pertinent safety standards.

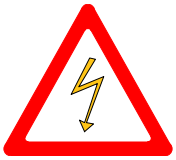
The installation and maintenance of air conditioning units may be dangerous because of high pressures and electrical components being alive. Therefore, the installation, maintenance, and repair must be performed by qualified and trained staff only.

In particular electrical connections are to be provided, removed, or modified by authorized persons only observing all relevant safety instructions.

Safety instructions in the technical documentation and on unit labels must be followed at all times.

Do not open the unit for cleaning, maintenance, or repair and do not remove covers and casings (air diffuser) unless all conducting lines have been completely disconnected. Do not connect or remove the plug-in connector when under tension.

Any work regarding the electrical equipment is to be performed by skilled and trained staff only. Connections to the main power supply and the safety earth terminal must be executed exactly as described in the wiring diagram.



Electrical operation of the unit in a partly disassembled condition or of individual components is not permitted since earth terminals might be interrupted.

The standard version of the heat exchangers is designed for an operating pressure of 10 bar (test pressure 16 bar). High water pressures may be hazardous. Higher operating pressures, therefore, require LTG's express permission. Wear safety glasses.

During continuous operation the motor may reach temperatures of up to 65 °C. If necessary, allow the motor to cool off or wear gloves.

Be careful when performing work on the heat exchangers. Blades and housing parts are sharp-edged. Wear gloves during work and handling.

Be careful when working overhead and provide protection against parts falling from above.

Keep objects and dirt from entering the impeller. A damaged fan impeller or objects being ejected by the impeller may be hazardous.

The casing on site also serves as a protection and should be removed for maintenance and cleaning only.

Avoid any additional load to the unit or the suspensions since stability might be insufficient.

In the heating mode a temperature of up to 80 °C may be achieved. Water-carrying parts may be hot so do not touch with your bare hands to avoid burns.

The unit must be checked by an expert immediately

- **if it has been mechanically damaged or is suffering from a water damage,**
- **if the fan shows signs of damages (imbalance, damage to the bearing or motor),**
- **if the suspension or the casing show clear signs of corrosion or ageing.**

Do not put the unit back into operation before all necessary maintenance and repair has been performed!

Take the unit entirely off the main power supply until all repairs have been completed even if this might result in not being able to operate undamaged units.

It is in any case imperative to take a damaged unit completely off the main power supply!

1. Transport and Storage

The unit requires dry and dust-free conditions during transport, storage, installation, and operation.

Units are stacked on Euro or single trip pallets and secured with straps. Pallets may be moved using forklifts or cranes.

Do not remove the packaging unless immediately prior to installation on site to protect the unit from pollution and damages.

LTG Aktiengesellschaft will not take responsibility for any pollution of or damages to the unit.

1.1 Transport Instructions

Handle units appropriately and with care during transport.

Do not throw, let drop to the ground or bump into other items or walls.

Make sure that units are safely fastened during transport and avoid damage through other items.

It is recommended to always have units handled by at least two persons.

The packaging is not weather-resistant.

1.2 Storage

Make sure that units are entirely protected against weathering, humidity, and other adverse conditions that might result in damages during storage.

The storage location must meet the following climatic requirements:

Temperature between +5 °C and +55 °C with a relative humidity of 90 % max. (non-condensing).

2. Function

The fan coil unit is a recirculating air unit for cooling **or** heating (2-pipe) or for cooling **and** heating (4-pipe) the air.

These fan coil units have been designed for installation in ceilings in office and conference rooms, hotel rooms, hospitals and other closed rooms for room air treatment.

The fan sucks in ambient air via a heat exchanger, heating or cooling the air and reintroducing it into the room.

The heat exchanger is usually equipped with a filter for protection.

Thermal energy transport to the heat exchanger is performed by water with a temperature between 5 °C and 80 °C; water connection on the right or left.

If the cold water temperature drops in the cooling mode below dew point the condensate will be collected by a condensate tray with possible connecting socket. For reasons of hygiene, the unit should be dimensioned in a way to ensure that no condensation occurs during standard operation. The limits of use with view to condensation are depicted in the Technical Data.

Output is water-side controlled by valves.

The fan speed is controlled by a five-speed capacitor motor and wired up to terminal box, with individual switch activation.

A controller made available as accessory by LTG Aktiengesellschaft allows for valve triggering and fan speed control.

Electrical components and wiring are located inside the unit and permit an easy and cost-effective installation.

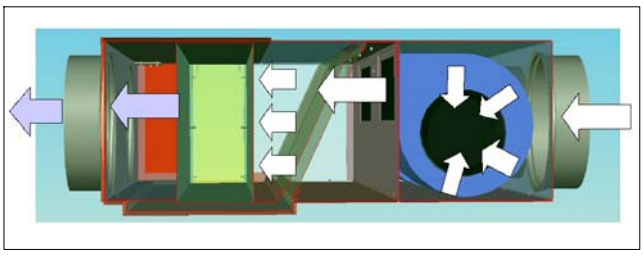
With view to dimensioning, the most important data are the caloric output, the sound power level and the air flow rate.

The units' caloric output is determined through the fan speed, the water flow rate.

The units' sound power and the air flow rate are determined through the fan speed.

Furthermore, performance data depend on the external air-side pressure loss to be determined based on the type of unit and installation situation.

Functional schematic:



2.1 Intended Use

The fan coil unit type VKE is intended for use in closed rooms.

It is designed for ambient temperatures of +5 °C to +40 °C and a maximum relative humidity of up to 90% (non-condensing).

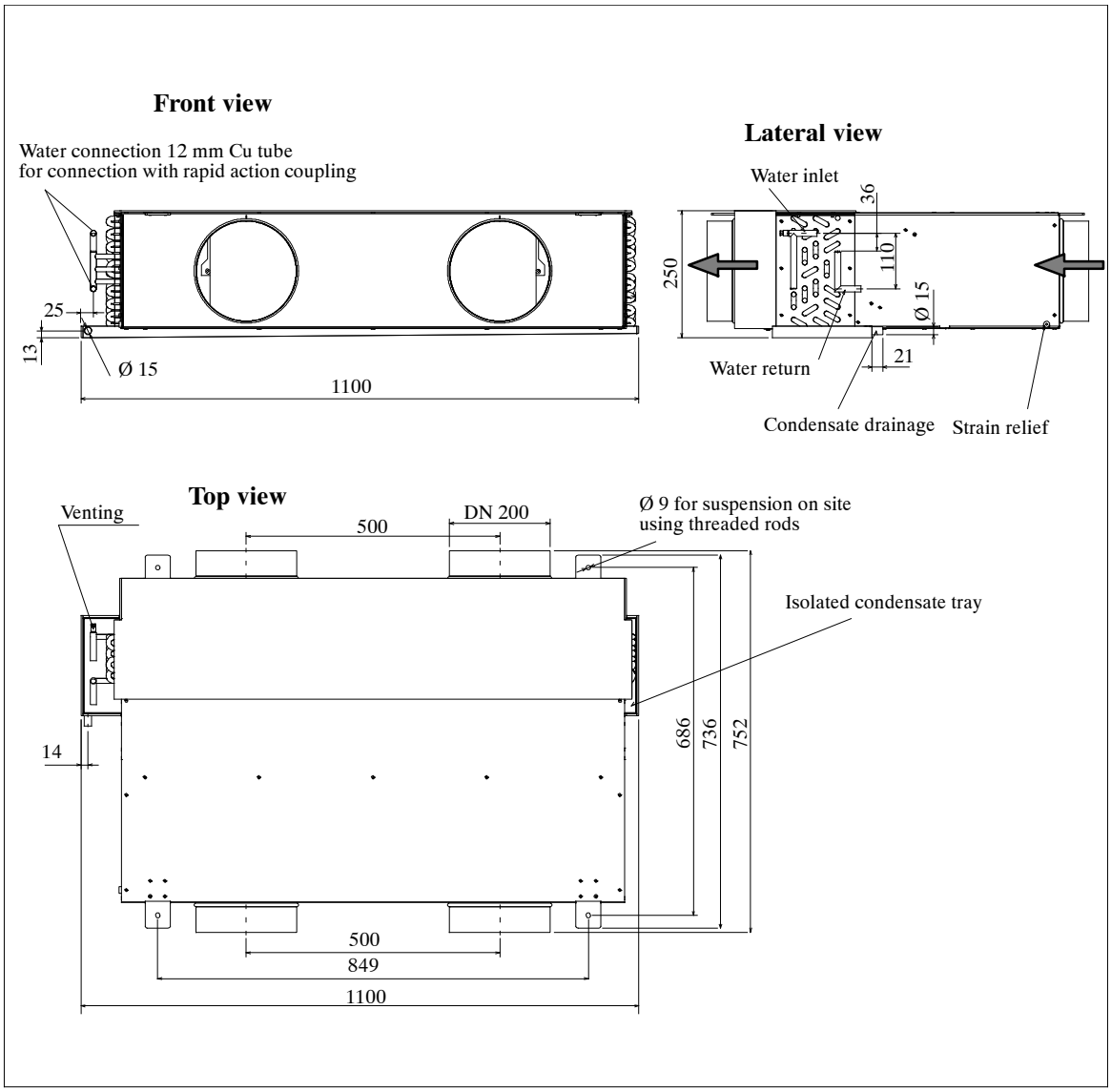
In order to ensure safe motor functioning the ambient temperature when installed should not exceed +40 °C.

The maximum admissible supply temperature is, therefore, limited to +80 °C.
Any other operating conditions require the express and written permission of LTG Aktiengesellschaft.

LTG Aktiengesellschaft does not assume responsibility for any damages resulting from unintended use.

3. Technical Specifications

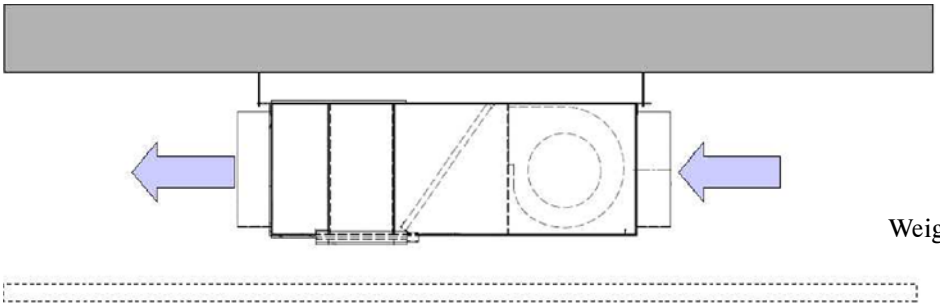
3.1 Dimensions and Performance Data



Performance Data

Standard application 0-0, free suction, free discharge

Acoustics data without impact of ceiling, including diffuser insertion loss and flow noise (improved sound levels depending on the outlets' position in the ceiling and the ceiling's insulating properties)



Weight 42 kg

n [-]	Δp_{ext} [Pa]	V [m^3/h]	L_{A18} [dB(A)]	L_{wA} [dB(A)]	$Q_k/\Delta t$ [W/K]	$Q_h/\Delta t$ [W/K]	$w_{ok}/\Delta p_w$ [kg/h]/[kPa]	$w_{oh}/\Delta p_w$ [kg/h]/[kPa]	P_{el} [W]
I	0	221	21	27	66	43	300/6	100/7	9
II		291	26	32	85	53			13
III		412	34	41	115	67			49
IV		569	43	50	149	77			60
V		728	49	55	178	79			75
I	10	136	25	32	42	28			9
II		224	29	35	67	44			13
III		357	35	42	102	61			47
IV		518	42	49	139	75			58
V		677	47	54	170	79			74
I	20	49	30	37	16	11			9
II		155	32	39	48	32			14
III		296	37	43	86	54			46
IV		462	42	49	126	71			57
V		620	47	54	159	79			72
II	30	84	35	42	27	18			14
III		231	39	45	69	45			44
IV		400	43	49	112	66			55
V		558	47	54	147	77			70
III	40	160	40	47	49	33			43
IV		332	44	50	96	58			54
V		490	47	54	133	73			69
III	50	84	42	48	27	18			41
IV		258	44	51	76	49			52
V		416	47	54	116	67			67
IV	60	179	45	52	54	36			50
V		337	47	54	97	59			65
IV	70	93	46	53	29	20			48
V		252	48	54	75	48			63
V	80	162	48	55	50	33			61
V	90	66	49	55	21	15			59

Condensing Operation (cold water inlet temperature 6 °C)

Standard Application 0-0

n [-]	Δp_{ext} [Pa]	V [m³/h]	L_{A18} [dB(A)]	L_{wA} [dB(A)]	$Q_{k\ ges}$ [W]	$Q_{k\ tot}$ [W]	$Q_h/\Delta t$ [W/K]	$w_{ok}/\Delta p_w$ [kg/h]/[kPa]	$w_{oh}/\Delta p_w$ [kg/h]/[kPa]	P_{el} [W]	$T_{disch.ar}$ [°C]
I	0	221	21	27	1975	1258	43	300/6	100/7	9	8,9
II		291	26	32	2379	1549	53			13	10,0
III		412	34	41	2873	1973	67			49	11,6
IV		569	43	50	3294	2451	77			60	13,1
V		728	49	55	3607	2907	79			75	14,0
I	10	136	25	32	1330	834	28			9	7,6
II		224	29	35	1994	1271	44			13	9,0
III		357	35	42	2675	1790	61			47	10,9
IV		518	42	49	3173	2300	75			58	12,7
V		677	47	54	3522	2767	79			74	13,7
I	20	49	30	37	514	323	11			9	6,4
II		155	32	39	1492	937	32			14	7,9
III		296	37	43	2406	1570	54			46	10,1
IV		462	42	49	3024	2130	71			57	12,2
V		620	47	54	3409	2603	79			72	13,4
II	30	84	35	42	860	538	18			14	6,8
III		231	39	45	2036	1300	45			44	9,1
IV		400	43	49	2833	1934	66			55	11,5
V		558	47	54	3269	2419	77			70	13,0
III	40	160	40	47	1530	962	33			43	8,0
IV		332	44	50	2572	1702	58			54	10,6
V		490	47	54	3101	2216	73			69	12,4
III	50	84	42	48	862	539	18			41	6,8
IV		258	44	51	2202	1417	49			52	9,5
V		416	47	54	2887	1987	67			67	11,7
IV	60	179	45	52	1674	1056	36			50	8,3
V		337	47	54	2594	1721	59			65	10,7
IV	70	93	46	53	947	592	20			48	7,0
V		252	48	54	2168	1393	48			63	9,4
V	80	162	48	55	1543	971	33			61	8,0
V	90	66	49	55	679	425	15			59	6,7

Legend

n - speed

Δp_{ext} - external pressure loss without filter and connection boxes

V - flow rate (approx. values, tolerance ± 10%)

L_{A18} - sound pressure level, 18 m² Sabine

L_{wA} - sound power level ± 3 dB(A) including suction-side, discharge-side, and structure-borne sounds

$Q_{k\ tot}$ - total cooling capacity at 26 °C /50% rF and 6 °C cold water inlet temperature

$Q_{k\ sens}$ - sensible cooling capacity at 26 °C / 50% rF and 6 °C cold water inlet temperature

Q_h - total heating capacity

Δt - temperature difference between suction air temperature before entering the heat exchanger and water supply

w_{ok} - standard flow rate at cooling capacity

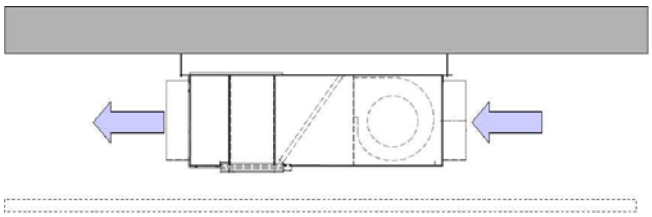
w_{oh} - standard flow rate at heating capacity

Δp_w - water-side pressure loss

P_{el} - electric power consumption (± 20%)

Standard application 0-0, free suction, free discharge

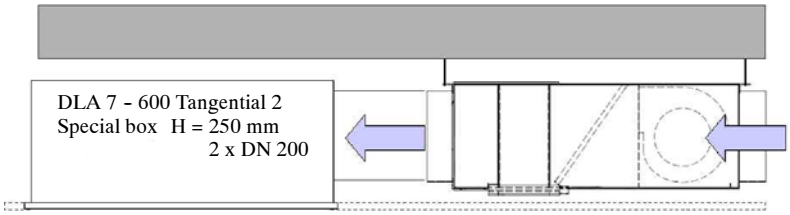
Acoustics data without impact of ceiling, including diffuser insertion loss and flow noise (improved sound levels depending on the outlets' position in the ceiling and the ceiling's insulating properties



n [-]	Pressure increase Return air [Pa]	Supply air [Pa]	Δp [Pa]	L_{wA} [dB(A)]	V [m^3/h]	P_{el} [W]	Q_k [W/K]	Q_h [W/K]
I	0	0	0,0	27	221	9	66	43
II	0	0	0,0	32	291	13	85	53
III	0	0	0,0	41	412	46	115	67
IV	0	0	0,0	50	569	55	149	77
V	0	0	0,0	55	728	68	178	79

Standard Application DLA 7-0

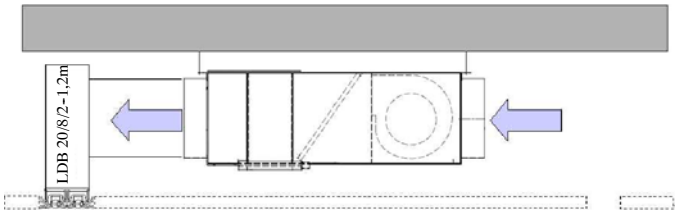
Acoustics data without impact of ceiling, including DLA 7 insertion loss and diffuser flow noise (maximum improvement of sound levels ~ 2 dB depending on the outlets' position in the ceiling and the ceiling's insulating properties)



n [-]	Pressure increase Return air [Pa]	Supply air [Pa]	Δp [Pa]	L_{wA} [dB(A)]	V [m^3/h]	P_{el} [W]	Q_k [W/K]	Q_h [W/K]
I	0	2,7	2,7	27	198	9	60	39
II	0	4,5	4,5	32	261	13	77	49
III	0	9,3	9,3	42	361	47	103	62
IV	0	17	17,0	49	479	57	130	72
V	0	26	26,0	54	584	71	152	78

Standard application Z2-0, LDB 20/8/2 pressure side

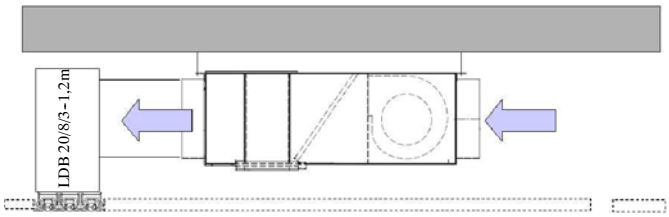
Acoustics data without impact of ceiling, including diffuser insertion loss and flow noise (maximum improvement of sound levels ~ 2 dB depending on the outlets' position in the ceiling and the ceiling's insulating properties)



n [-]	Pressure increease Return air [Pa]	Supply air [Pa]	Δp [Pa]	L_{wA} [dB(A)]	V [m^3/h]	P_{el} [W]	Q_k [W/K]	Q_h [W/K]
I	0	5	5,0	29	179	9	54	36
II	0	8,5	8,5	35	234	13	70	45
III	0	16,8	16,8	44	316	46	92	57
IV	0	28,3	28,3	51	411	55	115	67
V	0	41,2	41,2	55	481	68	131	73

Standard application Z3-0, LDB 20/8/3 pressure side

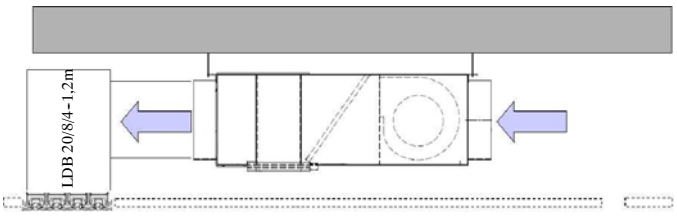
Acoustics data without impact of ceiling, including diffuser insertion loss and flow noise (maximum improvement of sound levels ~ 2 dB depending on the outlets' position in the ceiling and the ceiling's insulating properties)



n [-]	Pressure increase Return air [Pa]	Supply air [Pa]	Δp [Pa]	L_{wA} [dB(A)]	V [m^3/h]	P_{el} [W]	Q_k [W/K]	Q_h [W/K]
I	0	2,6	2,6	28	199	9	60	40
II	0	4,9	4,9	33	258	13	77	49
III	0	9,5	9,5	42	359	46	102	62
IV	0	17,3	17,3	49	478	55	130	72
V	0	26,2	26,2	55	582	68	152	78

Standard application Z4-0, LDB 20/8/4 pressure side

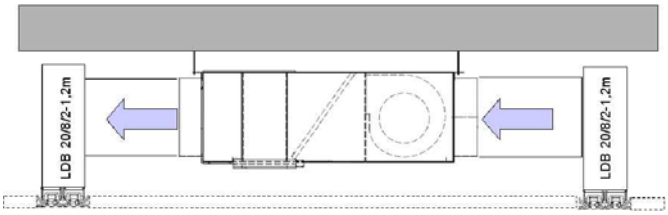
Acoustics data without impact of ceiling, including diffuser insertion loss and flow noise (maximum improvement of sound levels ~ 2 dB depending on the outlets' position in the ceiling and the ceiling's insulating properties)



n [-]	Pressure increase Return air [Pa]	Supply air [Pa]	Δp [Pa]	L_{wA} [dB(A)]	V [m^3/h]	P_{el} [W]	Q_k [W/K]	Q_h [W/K]
I	0	1,7	1,7	28	207	9	62	41
II	0	3,2	3,2	33	270	13	80	50
III	0	5,9	5,9	44	380	46	107	64
IV	0	10,9	10,9	49	513	55	140	75
V	0	16,5	16,5	55	641	68	163	79

Standard application Z2-A2, LDB 20/8/2 pressure side, LDB 20/8/2 suction side

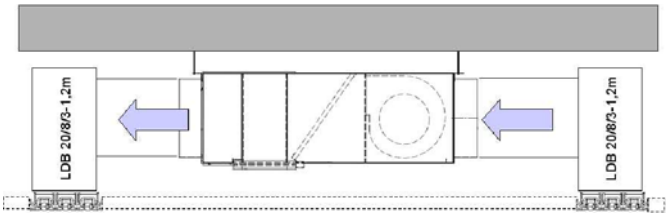
Since structure-borne sound is low, ceiling will not result in significant improvement of sound levels. Acoustics data without impact of ceiling



n [-]	Pressure increase Return air [Pa]	Supply air [Pa]	Δp [Pa]	L_{wA} [dB(A)]	V [m^3/h]	P_{el} [W]	Q_k [W/K]	Q_h [W/K]
I	-7,7	3,1	10,8	31	129	9	40	27
II	-12,9	6,1	19,0	37	162	13	50	33
III	-22,9	10,4	33,3	46	208	46	63	41
IV	-36,1	16,8	52,9	51	236	55	70	45
V	-47,3	22,1	69,4	55	257	68	76	49

Standard application Z3-A3, LDB 20/8/3 pressure side, LDB 20/8/3 suction side

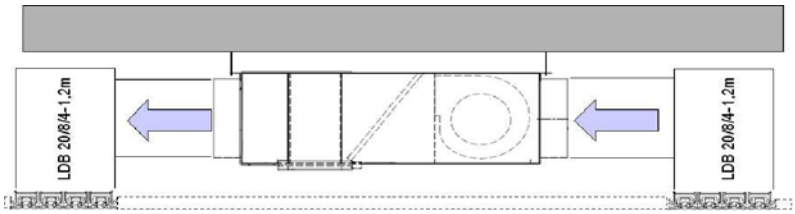
Since structure-borne sound is low, ceiling will not result in significant improvement of sound levels. Acoustics data without impact of ceiling



n [-]	Pressure increase Return air [Pa]	Supply air [Pa]	Δp [Pa]	L_{wA} [dB(A)]	V [m^3/h]	P_{el} [W]	Q_k [W/K]	Q_h [W/K]
I	-5,3	2,3	7,6	29	157	9	48	32
II	-8,5	3,6	12,1	35	210	13	63	41
III	-16,6	6,3	22,9	44	278	46	82	51
IV	-28	11,3	39,3	50	337	55	97	59
V	-39,2	15,5	54,7	54	380	68	107	64

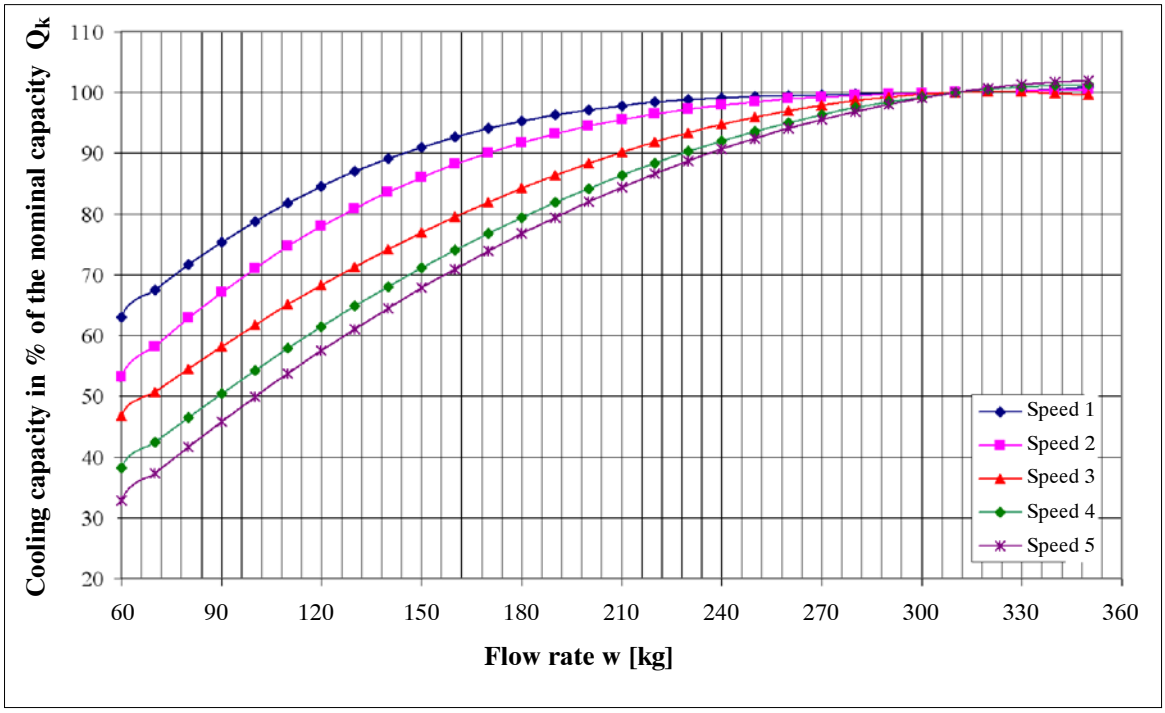
Standard application Z4-A4, LDB 20/8/4 pressure side, LDB 20/8/4 suction side

Since structure-borne sound is low, ceiling will not result in significant improvement of sound levels. Acoustics data without impact of ceiling

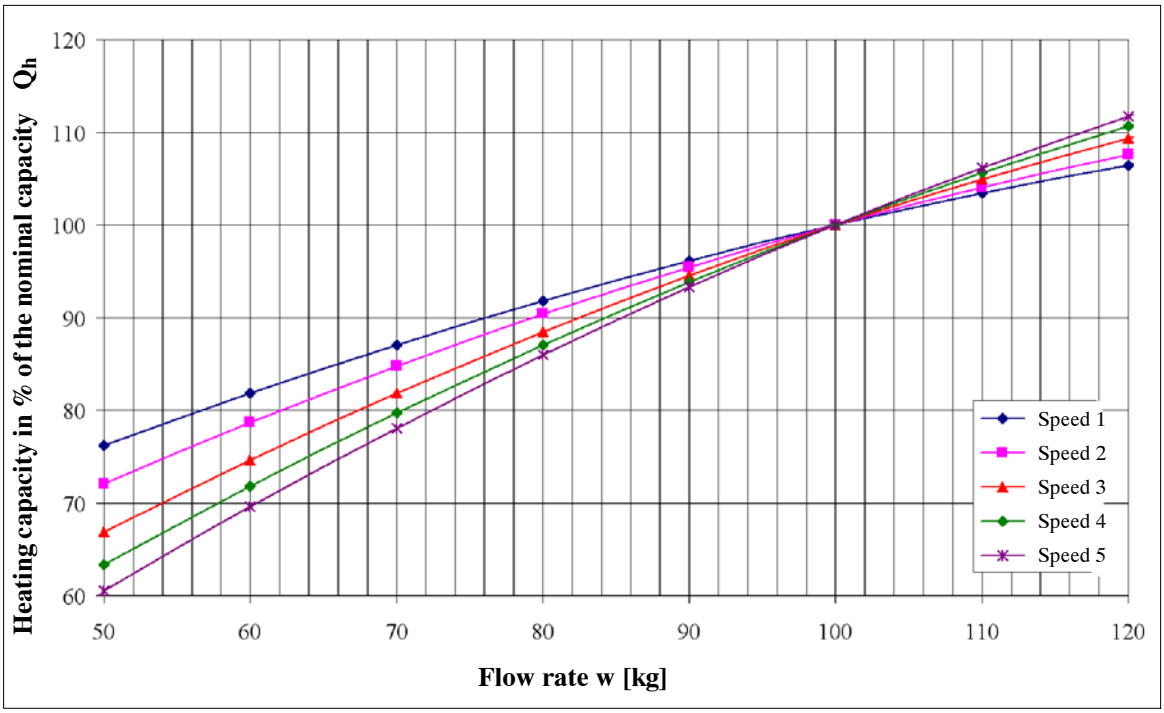


n [-]	Pressure increase Return air [Pa]	Supply air [Pa]	Δp [Pa]	L_{wA} [dB(A)]	V [m^3/h]	P_{el} [W]	Q_k [W/K]	Q_h [W/K]
I	-4,4	1,7	6,1	28	169	9	52	35
II	-6,9	2,7	9,6	33	227	13	68	44
III	-13	5,2	18,2	43	307	46	89	55
IV	-22,9	9,1	32,0	50	387	55	109	64
V	-33,3	13,1	46,4	55	443	68	122	70

Cooling capacity for different water flow rates



Heating capacity for different water flow rates



3.2 Caloric Output Data

Caloric output data were determined at a test stand in the LTG test lab.

Data are valid if the following applies:

- unit at operating temperature, steady-state condition
- steady-state condition during measurements
- no condensation at the heat exchanger in the cooling mode
- water without additives (drinking water quality)*
- water supply temperatures from 12 °C - 16 °C in the cooling mode and 50 °C - 60 °C in the heating mode.

Parameters used:

- specific heat capacity of the water 4186 J/(kgK)
- specific heat capacity of the air 1004 J/(kgK)
- air density 1.2 kg/m^3

To ensure easy transferability, the specific caloric outputs - i.e. the absolute caloric outputs in relation to the temperature difference between water intake and induction air before entering the heat exchanger - are given with varying fan speeds.

The outputs given in the chart do apply with specific nominal flow rates only. These are stated for each type and size.

The correction charts give a graphic illustration of how outputs change with other flow rates compared to nominal flow rate output.

Flow rates have been determined through calculation and may vary by about 10%.

* **Addition of ethylene glycol to lower the freezing point:**

To lower the freezing point, cooling water is often added some ethylene glycol. The lower specific thermal capacity of the mixture reduces the unit's cooling capacity.

3.4 Acoustic Data

Acoustic data have been determined in a reverberation chamber in the LTG test lab.
The technical data sheet contain the A weighted sound pressure levels L_{A18} for different fan speeds.

Sound pressure levels apply to a room absorption surface of 18 m^2 which equals a room absorption of about 6 dB(A). Thus, sound power levels may easily be calculated.

$L_{WA} = L_{A18} + 6$ dB(A)

The data given apply to one unit, i.e. one room axle. If more than one unit is installed in the same room, the sound pressure level will rise accordingly.

Increase in sound level with several sound sources of the same type:

Number of sound sources of the same type	1	2	3	4
Sound level increase [dB]		3	5	6

Measuring accuracy is ± 10%.

3.3 Hydraulic Data

Heat exchangers are approved for an operating pressure of 10 bar max. (test pressure 16 bar).
Pressures exceeding 10 bar require the express permission of LTG.

Water-side pressure losses have been measured directly at the heat exchanger connections.
Further resistances will have to be added.

Measuring accuracy is ± 10%.

3.5 Weight

Weights (without packaging) in kg (approx.)

Size	2- and 4-pipe-unit
VKE 1100	47

subtract 1 kg for version without control

Size	Water volume circuit
VKE 1100	12,4

3.6 Electrical Data

3.6.1 Electrical Connection (on-site control)

Connect the unit to a residual current device (RCD).

All units are provided with a terminal box installed inside the unit, degree of protection IP 44.

A total of 5 units may be connected in parallel and triggered through a single switch.

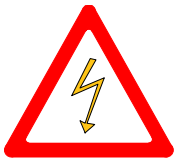
Take care to connect in parallel identical speeds only, i.e. connect speed I of unit 1 to speed I of unit 2, etc.

For a safe start of the fans it is indispensable to use speed III.

The main power supply on site is to be performed according to the wiring diagram and by skilled and trained staff only.

Electrical lines on site must be realized using the outputs on the terminal box and on the unit housing.

It is not permitted to work on the electrical equipment with the unit being alive.



Units must be provided with a possibility to completely disconnected them from the main power supply!

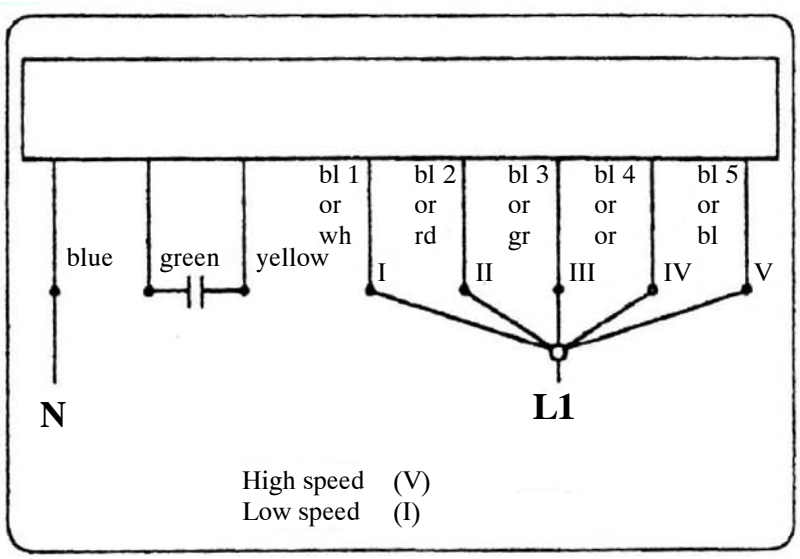
Any work must be performed in compliance with national regulations and safety instructions.

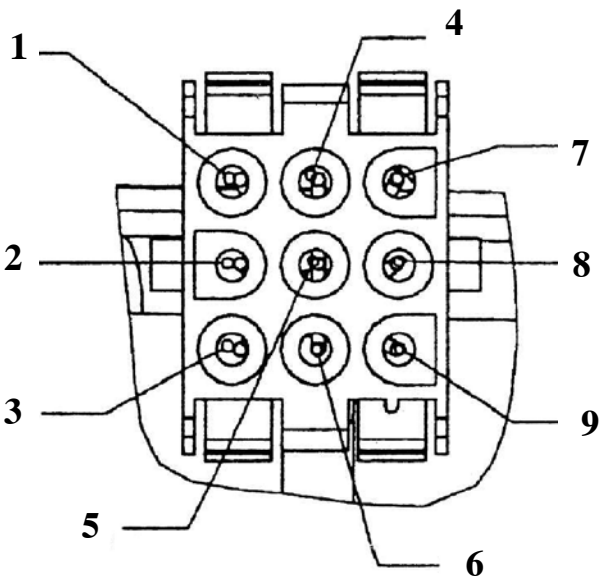
The technical specifications contain the electrical output data for the units.

Connection to the main power supply on site is to be performed according to the wiring diagram and by skilled and trained staff only.
Connections to the safety earth terminal must be executed exactly as described in the wiring diagram.
It is not permitted to work on the electrical equipment with the unit being alive.
Units must be provided with a possibility to completely disconnect them from the main power supply.
It is not permitted to operate the units in a partly disassembled condition

Note: - 5-speed capacitor motor (internal switching of temperature controller)
- group activation possible
- for power consumption and output refer to technical data

A 2.3 m cable and mating connector are included in the delivery.





1: L1 white
2: L2 red
3: L3 grey
4: L4 orange
5: L5 black
6: -
7: -
8: N blue
9: PE green/yellow

4. Installation

4.1 Suspension of the Units

Please consider the following when installing the units:

- To ensure unit stability and rigidity, use screws of at least the stated property class when fixing the unit. Fixings required for installation are not included.
- Use only the existing holes on the unit for the fixing elements.
- **Do not use** the air conditioning units as supporting elements for other components and avoid loading them in any other way.

Do not operate the unit unless properly installed and fixed!

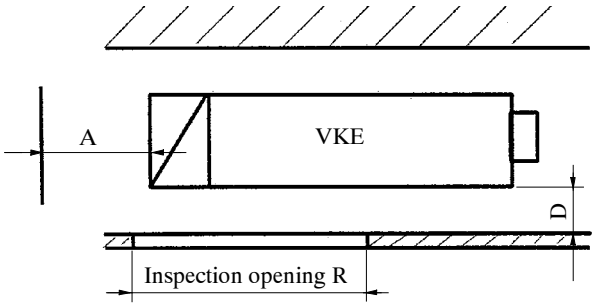
Protect yourself from parts falling from above when working overhead!

The fixing elements are not included in the delivery of LTG Aktiengesellschaft.

The units are provided with holes to take fixing elements.
For suspension hole details refer to section 4.

It is the installer's responsibility to ensure that units are fixed using the fixations provided for on the unit and in a way to ensure sufficient rigidity and stability.

Please, respect all notes!



For dimensions refer to section 4

R: Inspection opening to grant access to the unit (especially the electric and the water connections) for maintenance and installation must be provided

VKD 1100: 700 x 1200

D: Clearance to intermediate ceiling at least 20 mm

A: Suction clearance should be at least 200 mm

Please note:

- Fix the unit with a minimum of 4 fixing elements (e.g. threaded rods) and do not use but the holes provided for on the unit (at least 2 on each unit side).
- Fixing elements must be at least property class M6 (4.6) to ensure sufficient rigidity and stability.
- Avoid any contact with ceiling elements and connected air diffusion boxes since such contact would result in structure-borne sound transmission.
- Use vibration dampers when fixing the units to muffle structure-borne sound.

For unit weights refer to section 3.5.

4.2 Water Connections

Remove the heat exchanger plugs prior to water connection!

Units are provided with heat exchangers with copper tubes and aluminum blades for 4-pipe operation with separate heating and cooling circuits or for 2-pipe operation.

The heat exchangers have been approved for a maximum operating pressure of 10 bar (other pressures on request).

Always follow the installation instructions for the water connections attached to each unit.

Connections must be strainless.

Connecting lines must be able to expand.

Attention:
Prior to allowing water to enter the unit the flexible water connection hoses will have to be checked for proper and leakproof fixation. Even though hoses to the heat exchanger are preinstalled, fixations might have loosened during transport or installation of the unit on site.

You may use off-the-shelf control valves and shut-off valves.

When tightening the fittings, avoid damaging the heat exchanger pipes through bending or twisting. Pipe fittings must always be flush.

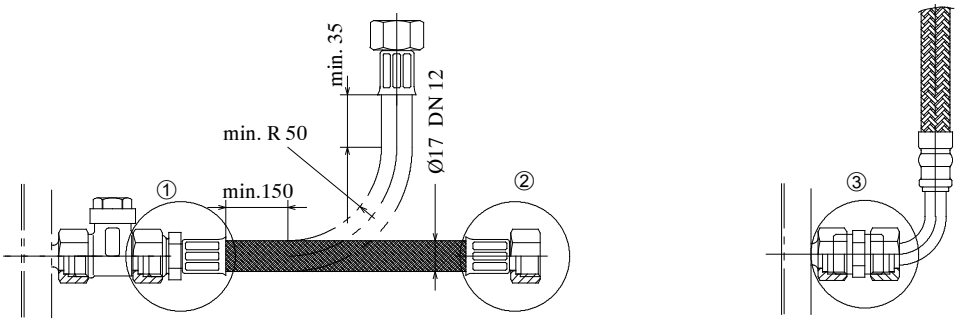
In order to adjust the water volume specified in the selection data, a regulating device or restricting olive will be required. If identical units with exactly the same water volume and pressure losses are used, an individual regulating device for each unit is superfluous. In this case, one regulating device for the entire line may be sufficient. Otherwise, a regulating device will be required for each heat exchanger.

If removal of a heat exchanger without draining the entire system is a requirement, two or four isolation valves will have to be provided for each unit. You may use off-the-shelf shut-off valves.

The unit fitting will only be provided with an integrated vent if specifically asked for. The water speed inside the heat exchanger is usually sufficient to carry along air bubbles and one ventilation device per line is therefore appropriate. In a case of emergency, the line may be ventilated by slightly loosening the standard fitting of the unit.

Due to possible condensation, the connections to the heat exchanger for cooling should be insulated, e.g. using Armaflex insulation.

Example for water connection using valve and flexible hose (straight and 90 ° variant)



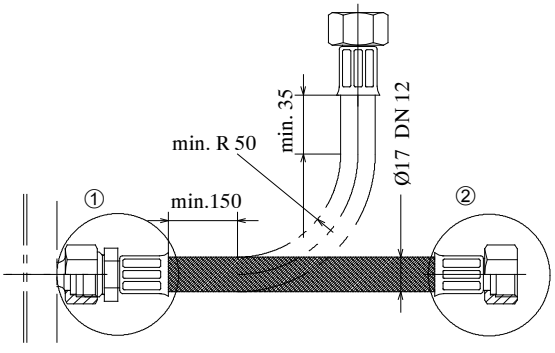
Hose without insulation. For insulated hoses, dimensions will change accordingly (10 mm Armaflex insulation).

① Hose for connection to angle or straight-way valve, connection type AGK, external thread, tapered 1/2”

② Different hose connections, thread diameter acc. to customer requirements or standard 1/2”

③ Connection for direct screwing into the heat exchanger in case of angle connection, connection type: double nipple 1/2”-1/2”; UFD hose connection, 1/2” flat seal union nut

Example for water connection for direct screwing into the heat exchanger



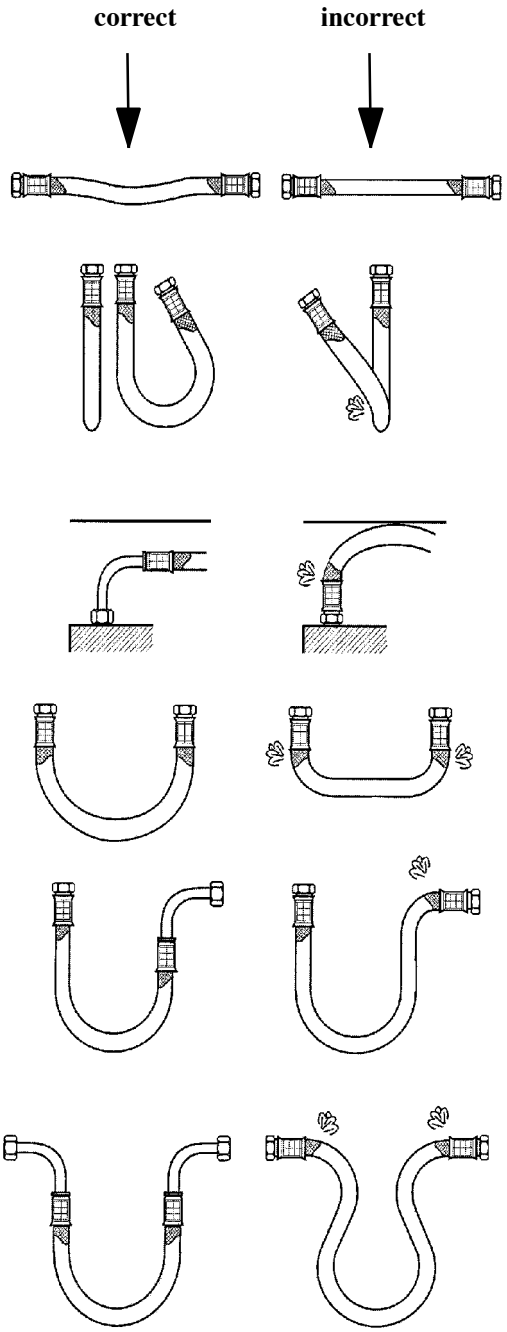
Hose without insulation. For insulated hoses, dimensions will change accordingly.

① Connection for direct screwing into the heat exchanger, connection type: AGK, external thread, tapered 1/2”

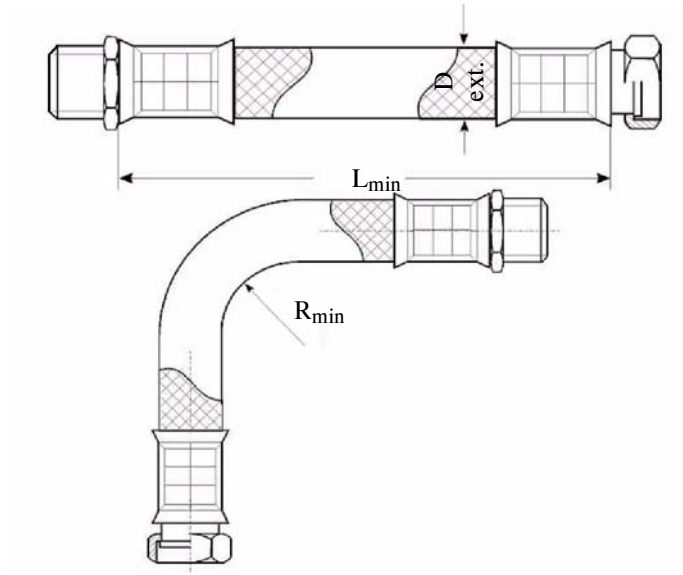
② Different hose connections, thread diameter acc. to customer requirements or standard 1/2”

4.2.1 Instructions for Installation of Water Connections Using Flexible Hoses

Warranty will only apply if the following instructions are observed and if installation is performed in compliance with DIN-EN regulations.
In particular, corrosive, electrochemical, and bacteriological charges are to be excluded taking appropriate preventive measures.



- Pressure and exposition to heat may result in slight elongation of the hose. Therefore, newly placed hoses must consider such potential elongation.
- Do not fall below the admissible bending radius R_{min} (chart), neither during transport, nor during installation or when installed.
  If it should turn out impossible to keep the admissible bending radius, choose a different installation type.
- For minimum length see chart below.
  If the hose is being placed by bending it, check whether there is sufficient hose length to allow for an open bow in order to avoid kinking and destruction of the hose at the connecting points.
- Absolutely avoid distorting or kinking the flexible connection.
- Do not subject the hose to any tensile or pressure loads applied from outside, neither during installation nor operation.
- Do not retighten rigid connections (outer thread) after fixing the second connection since this might result in distortion of or damage to the hose.
- In general, tightness of the connection (hose/connector) is the responsibility of the technician performing the installation.
- Any sealing material included in the delivery is to be verified by the technician for its suitability since the hose manufacturer has no information about the material or geometry of the connections.



Armoured hose Oxystop up to +70 °C (diffusion inhibiting, marked through weaved-in blue strip)
Armoured hose EPDM up to +93 °C (vapour permeable, not marked)

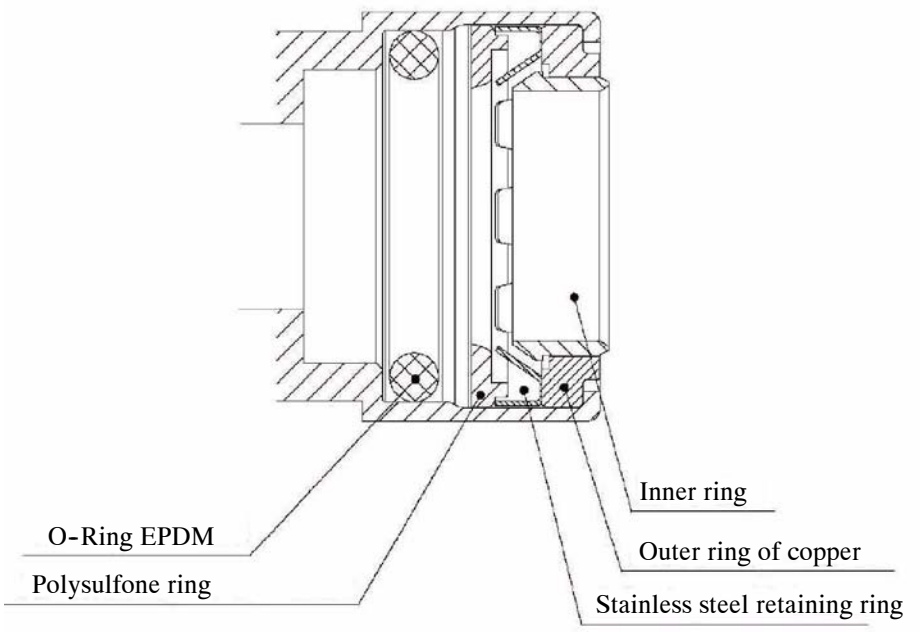
ND hose	D_A	PN [bar]	R_{min}	L_{min}	L_{min} α = 90°	L_{min} α = 180°	L_{min} α = 360°
06/08	12	15	27	60	140	180	260
10	14	15	40	60	190	250	260
12	18	15	60	80	260	360	550
15	22	12	70	95	300	420	640
19	27	10	80	100	350	480	730
25	34	10	100	125	430	590	900
32	44	10	160	140	650	900	1400
40	54	6	180	160	750	1030	1600
50	64	6	230	210	940	1300	2020

Armoured hose Oxyblock

* at + 30 °C / 10 bar at + 50 °C (vapour impermeable, marked through weaved-in blue-white strip)

ND hose	D_A	PN [bar]	R_{min}	L_{min}	L_{min} α = 90°	L_{min} α = 180°	L_{min} α = 360°
08	13,5	16 *	110	100	310	490	830
10	16	16 *	130	100	380	580	990
12	17	16 *	150	100	450	680	1150

4.2.2 Plug-in Connection Cuprofit



Tube connection of plug-in fitting and bright copper tube according to EN 1057 and RAL 641/1 or suitable brass or red brass socket.

Components used meet KTW (Plastics in Drinking Water) recommendations.
The Cuprofit plug-in connection has been evaluated based on DVGW (German Association of the Gas and Water Industries) Worksheet W 534, in connection with the use of Wieland copper tubing. This permanently tight connection is suitable for concealed installation.

Using special tools, this connection may be detached up to three times when not under pressure.
Prior to reconnection, check for undamaged condition of the seal.

Check every installation for tightness when completed.

Due to their specific design, Cuprofit connectors are not suitable for use as grounding conductors for electrical installations and therefore not to be considered in the compensation of potential.

Maximum operating pressure 10 bar / 93 °C. Test pressure 16 bar / 30 °C.

4.3 Condensate Connection

Remove the condensate drainage plugs before connecting the condensate lines!

Condensate formation occurs when the cold water supply temperature is below the ambient air dew point temperature. Neither LTG Induction Units nor LTG Fan Coil Units have been designed for an operation with steady condensate formation which is why special care must be taken when setting the water inlet temperature not to fall below the dew point temperature. If necessary, provide a continuous control of the water temperature based on outside air humidity.

- **Air conditioning with centralized cooling and dehumidification** (water temperature > 13 °C)
  A certain water supply temperature will result in condensate formation since the temperature is below the ambient air dew point. This dew point, however, depends on indoor air humidity. The water supply temperature may be 1-2 K below the dew point of the air since the air temperature on the pipes is higher than the actual water temperature.
  If rooms are ventilated with a maximum supply air humidity of e.g. 8.5 g/kg L_{tr} the water supply temperature may be lowered to 15°C without risk of condensate formation.
  In case of an increased humidity of the air, there a two solutions:

  Case A: Condensate tray not connected (condensate socket closed by plug)
  - If outside air humidity is high keep windows closed.
  - Alternative: If windows are opened use a window contact with closing/time-delayed opening system.
  - Alternative: A central system controls the water supply temperature based on the outside air humidity whenever windows are opened, i.e. in case of a high humidity of the air the water supply temperature is increased. This will, however, reduce the cooling capacity.

  Case B: Condensate tray connected
  - No need for a window contact or central cold water supply temperature raise in case of high outside air humidity.
  - If a short-term increase of the indoor air humidity is probable (unit in the intermediate ceiling above a wet room, e.g. a hotel) it is recommended to provide the tray with a thermal insulation.
  - In general, VPI 6022 requirements are to be met with the installation of any condensate drain connection on site.

- **Ventilation without dehumidification or window opening** (water temperature > 16 °C)
  In case of a ventilation without dehumidification the water supply temperature must be 16 °C or up.
  If the supply air is not dehumidified or the ventilation is realized by opening windows, the air humidity might be very high which is why the following case will have to be considered:

  The condensate tray must be connected.
  - A central cold water control and weather related cold water supply temperature raise is recommended since opening the windows might result in outside air with a high humidity entering the room and the temperature dropping below the air's dew point.

Whatever the case of application, all water carrying pipes and fittings outside the condensate tray's range must be insulated.
If a condensate drainage system is connected there must be sufficient slope and proper drainage of the condensate produced. Condensate trays and the condensate drainage system require cleaning and sanitation checks on a regular basis.

4.4 Check after Installation

Verify for the unit's proper connection to a residual current device (RCD).

Mechanical Check

Having completed the installation the unit is to be checked for any mechanical damages. Remainders of the packaging material and dust in or on the unit must be removed.

Check the following:

- leakproofness of the water connections (including heat exchanger connections),
- the insulation of all cold water carrying components to the heat exchanger for damage,
- the condensate drainage (optional) for clear passage and sufficient slope,
- the fixing screws for proper fit,
- the suspension for rigidity and sufficient load-bearing capacity (ceiling units),
- the unit for not contacting the facade and the raw floor except via the seals provided and the supporting feet (floor units),
- the line voltage and frequency to match the data given on the type plate,
- the electrical connections for proper execution and conformity to pertinent regulations,
- proper functioning of the control (optional),
- proper functioning of the motors (fan, actuators) without friction noises,
- the unit's fixation,
- the diffusion area/diffusion grille of the unit to be free of any obstructions,
- proper horizontal alignment, accurate to dimension,
- sufficient water hose lengths and strainless laying,

Check for Media Supply

- Check for proper availability of primary air, cold water, warm water, and electrical power or compressed air for the control.
- Check whether voltage and line frequency comply with the data given on the actuator's type plate. Never operate control devices with inappropriate voltage or frequency since this might result in destruction of the units and put people at risk.

Control Technical Equipment

Supply of control devices by LTG Aktiengesellschaft is optional, however it is the rule for actuators for units with dampers. Control valves are often factory-mounted.

Check for Proper Functioning

Turn the temperature control's selection knob slowly from one end position to the other while keeping an eye on the control dampers and linkage or the valves. Dampers and valves must move correspondingly quite smoothly and without rattling noises from one end position to the other. No exceptional noise must be produced by the electric actuators. In case the units show damages have them properly repaired by an expert. Damper linkages have been gauge adjusted in the factory and, therefore, require LTG Aktiengesellschaft's skilled personnel for readjustment.

Starting Standard Operation

Then set the temperature controller to the desired temperature. After a certain time the indoor air temperature should meet the setpoint.

5. First Use

Prior to first use any installation work and all checks must have been completed.

Check for proper water and power supply.

Having started the unit an air flow should be perceivable from the outlet grille. Only very minor air diffusion and motor sounds should be audible. Other sounds such as friction or impact might indicate damages resulting from transport or installation.

6. Operation, Maintenance and Repair

All units are virtually maintenance free, however certain things should be observed.

Any maintenance and repair work must be performed by skilled and trained staff only.

Before starting any maintenance or repair work the unit is to be completely disconnected from the main power supply!

6.1 Heat Exchanger, Water Connections and Condensate Tray

It is recommended to vacuum clean the heat exchanger and the dry condensate tray on a regular basis.

The heat exchanger blades are sharp-edged. Wear gloves for protection!

Check water connections and heat exchanger for tightness and possible corrosion damages.
If corrosion occurs inside the heat exchangers skilled staff must check the water treatment.
In case of condensation and existing condensate drainage the condensate tray will have to be wet cleaned and checked for contamination on a regular basis as required by VDI 6022.
Regarding the unit control the following must be considered: Having switched off the unit from condensing operation the fan must be kept running to achieve complete drying of the heat exchanger and condensate tray, i.e. for 3 hours or longer.

6.2 Filter

Unit with filter

If a recirculated air filter exists it requires replacement about 2-3 months after first use of the unit. By that time, it will probably be saturated from carpet lints and construction dust residues.
Exact timing is subject to local conditions.
The filter must be replaced on a regular basis, every 6 months to 2 years depending on dust formation.
A 6-month filter change interval will be required if the unit is operated in an environment with heavy dust load, a lot of foot traffic, and only minimum primary air filter quality.
A 2-year filter change interval might be appropriate if the unit is operated under conditions without foot traffic, in a clean environment, and with a very good primary air filter quality.

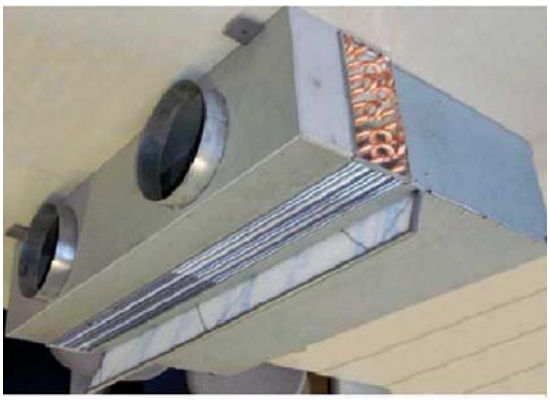
6.3 Fan

The fan is virtually maintenance-free. However, after an operating time of about 20,000 hours a failure of the fan may occur. The fan must be checked for smooth and proper running, possible imbalance, and damages to the bearing. The fan must also be checked on a regular basis, every 6 to 12 months, for potential dust and foreign bodies on the impeller. Severe pollution and foreign bodies may result in premature wear of the bearing and fan.

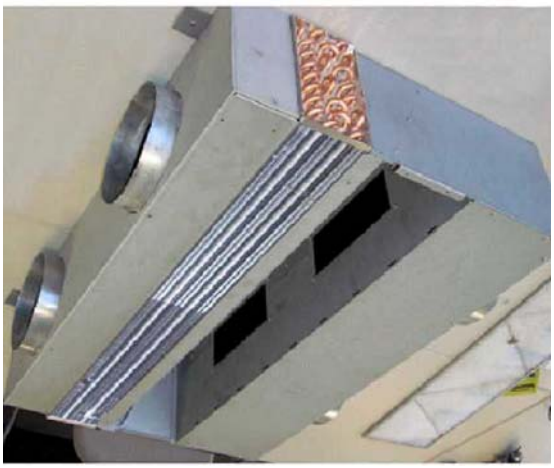
6.4 Condensate Tray

The condensate tray must be cleaned about 2 to 3 months after first putting into operation.
After that, the condensate tray requires maintenance every 3 months during the dehumidification period in compliance with VDI 6022.

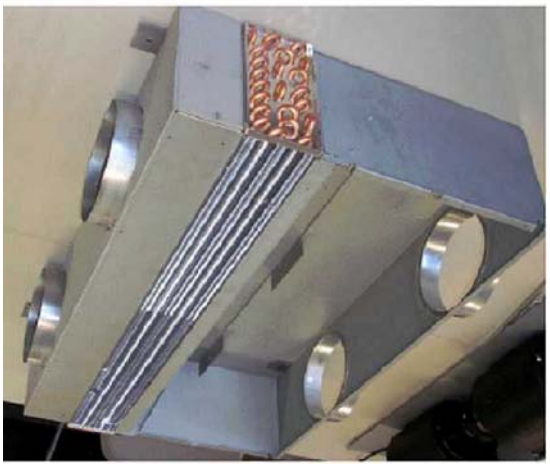
1. Removal/cleaning of condensate tray



2. Replacement of plug-in filter



3. Removal of lower plate / vacuum-cleaning of heat exchanger on the pressure side



4. Removal of fan unit including mounting flange

6.5 Troubleshooting and Corrective Action

Trouble	Source	Action
No cooling or heating effect despite of proper fan movement	No cold or hot water supply Heat exchanger and water ducts are at room air temperature	Ensure cold and hot water supply, eliminate water-related problems, check shut-off valves to fan coil unit
No air movement at the unit's outlet grille	The unit's fan is not operating	Put fan into operation. If necessary, force starting with highest speed level Check fan power supply. If necessary, replace fuses or switch on main power supply Replace drive unit.
No control signal is applied to the (valve) actuator, or it is not the one according to setting	Deficient control	Have unit checked by a specialized technician replacing or repairing broken parts
No damper mechanism or valve spindle movement when actuator motor signal is being changed	Actuator is stuck	Try to release the stuck actuator by setting the temperature controller from "max. hot" to "max. cold" and vice versa. If unsuccessful, remove actuator, clean or replace
Unit is heating or cooling, but set temperature is not achieved	Window is open	Close window
Despite highest fan speed only weak air movement at the fan diffuser	Filter or heat exchanger polluted Suction or diffuser opening blocked or polluted	Replace filter Clean heat exchanger Remove objects in front of the diffuser and protective grille. Observe a minimum distance of 10 cm in front of the casing. Clear of objects
Measured cold water temperature is lower than the setting (ask technician for setting). Therefore, diffused air temperature is extremely low	Cold water temperature to the units is too low	Check cold water control including valve and actuator. If necessary, restore proper settings, replace or repair broken parts

Trouble	Source	Action
Part of the condensate trays is overflowing despite of drainage system	Condensate drainage system clogged	Remove clogging In the meantime, increase inlet temperature or shut off unit
Unit is dripping	Leaking or overflowing condensate tray	Replace leaking condensate tray Check condensate pump Check drainage system
	Inlet temperature too low.	Increase inlet temperature
	Below dew point with window ventilation even if inlet temperatures are relatively high	Close window and, if necessary, increase inlet temperatures
Increased indoor air humidity perceivable	Considerable moisture sources in the room	Remove moisture sources If impossible, temporarily shut off unit water-side
Water inlet/return temperature difference too low	Water volume possibly too high	Check water volume balancing
	Fan not running or not conveying sufficient air	Check fan and terminals Maybe speed is too low
		Heat exchanger and filter polluted
	Inlet temperature too high in the cooling mode	Check temperature and cooling circuit
Audible impact noises	Fan bearing damage	Replace bearing or drive (only by LTG Aktiengesellschaft)
	Foreign bodies in the fan	Remove foreign body from impeller (only with the unit off)
Audible buzzing	Starting voltage too low	Increase starting voltage
	Fan running out of balance	Check balance and true running
Vibration sounds	Structure-borne sound transmission due to - rigid fixation - contact of casing components or diffuser boxes with ceiling elements	Check suspension and casing components for contact with ceiling elements

6.6 Repair

If the damage is not obviously a mere ”damage to the bodywork”, e.g. on the condensate tray or outlet, units should be completely replaced and checked by the factory (in case of defects to the fan it might be sufficient to replace the fan unit without need to disconnect the system entirely from the water supply system).

First, the unit is to be completely disconnected from the power supply by an expert.

The filter in front of the heat exchanger is easy to replace since it is fixed to the unit with a simple adhesive strip.

Replacement of the control unit should be performed by skilled staff only or by the factory.

Replacement of individual components, e.g. a fan bearing, is not recommended since the greater number of settings can only be performed in the factory using special equipment.

Warranty applies to complete fans only.

6.7 Maintenance Intervals of the Individual Components

Component	Activity	To perform	
		months	as required
Unit, in general	Check for pollution, damage, corrosion, correct positioning and fixation	**12**	
Filter	Check for pollution, damage and odours	**3**	
	Check the filter layer for tightness	**3**	
	Replace filter medium (document)	**12***	**x**
	Check for hygienic condition	**3**	
Heat exchanger	Check for pollution, damage and corrosion	**6**	
	Clean to maintain function	**6**	**x**
	Check water connections	**12**	
	Check proper function of entry and return	**12**	
	Vent		**x**
	Check for hygienic condition	**6**	
Dirt and condensate tray	Check for pollution, damage, leak tightness and corrosion	**3**	
	Clean to maintain function		**x**
	Check for hygienic condition	**3**	
	Check heat insulation for damage (visual check)		**x**
	Check drain and siphon for proper functioning		**x**
Fan	Check for pollution, damage, corrosion and proper fixation	**6**	
	Clean to maintain function		**x**
	Check impeller for imbalance	**12**	
	Check bearing for noises	**12**	
	Check vibration damper for proper functioning	**12**	
	Check safety device for proper functioning	**12**	
	Clean chambers from the inside		**x**
	Check for hygienic condition	**6**	

*Shorten replacement intervals if outside or recirculating air are extremely dust loaded.

VDI 6022 sanitation requirements must be observed.

7. Spare Parts

The following spare parts are available and may be ordered from LTG Aktiengesellschaft stating unit type and description.

Quantity	Ident No.	Description	Minimum order quantity
1	1035458	2-pipe heat exchanger size	1
1	1036317	Condensate tray	1
1	1035511	Radial drum motor double	1
1	1035999	Plug	1
1	110670	Filter with frame	1

8. Decommissioning, Disposal

When the fan is taken out of service, is no longer used and is disposed of as waste, the following must be complied with:

- all steel parts are waste for recycling
- all plastic parts are waste for recycling
- all secondary substances and lubricants must be disposed of in accordance with the provisions of the EWC (European Waste Catalogue) classification.