The Innovation Company

LTG Aktiengesellschaft

Original Instructions for Installation, Use and Maintenance

Induction Unit HFB

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Carefully read the safety instructions before using any LTG induction 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.

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

Die elektrischen Anschlüsse eventueller Regelgeräte dürfen nur von hierzu befugten Personen entsprechend den örtlichen Sicherheitsvorschriften hergestellt, abgebaut oder geändert werden.

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.

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.

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.

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 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!

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.

The protective board (chipboard) serves to protect the unit from dust and damages. Do not remove it during construction!

In case it is indispensable to remove the protective board, e.g for installation or a check of the flexible water connection hoses, it will have to be reinstalled right afterwards in its original position (clean side to the bottom). Be careful to keep any dust from entering the unit during removal or reinstallation of the protective board.

Do not replace the protective board with the grille unless any pollution of or damage to the unit is excluded, i.e. any subsequent work or activities in the unit's vicinity have been completed.

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

Induction units of type HFB are recirculating air units for cooling (2-pipe) or for cooling and heating (4-pipe).

These induction units have been designed for installation in false floors in office and conference rooms, hotel rooms and other closed rooms for indoor air treatment.

The primary air (processed fresh air from the main plant), is led through a detachable nozzle box with replaceable nozzles (only in case of plastic nozzles).

The primary air jets induce a larger secondary air flow of room air in which is drawn across a flat heat exchanger.
After a 90° deflection, the mixed air flow is expelled into the room in a vertical direction close to the facade via a ventilation grille on the floor.

In summer, this supply air mixes with the heated room air in front of the facade, in winter with the descending cold air close to the window (mixed air flow close to the facade).
In the cooling mode, the supply air, having passed the mixing air zone, passes through the room in by displacement.
The unit may be used as an underfloor convector for heating the room whenever the ventilation or air conditioning plant is isolated.

Thermal energy transport to the heat exchanger is performed by water.

For reasons of hygiene, the unit should be dimensioned in a way to ensure that no condensation occurs during standard operation.

Water-side control by valves.

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, and the valve setting which may be controlled by a regulating device.

Versions

The LTG induction unit for installation in access floors type HFB is available in two versions:

HFB-Z
with two-row heat exchanger for high caloric output with high primary air volume

HFB-D
with three-row heat exchanger for high caloric output with low primary air volume

Both versions are available in identical lengths and grille widths.

2.1 Intended Use

The LTG induction unit type VKB-EB 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).

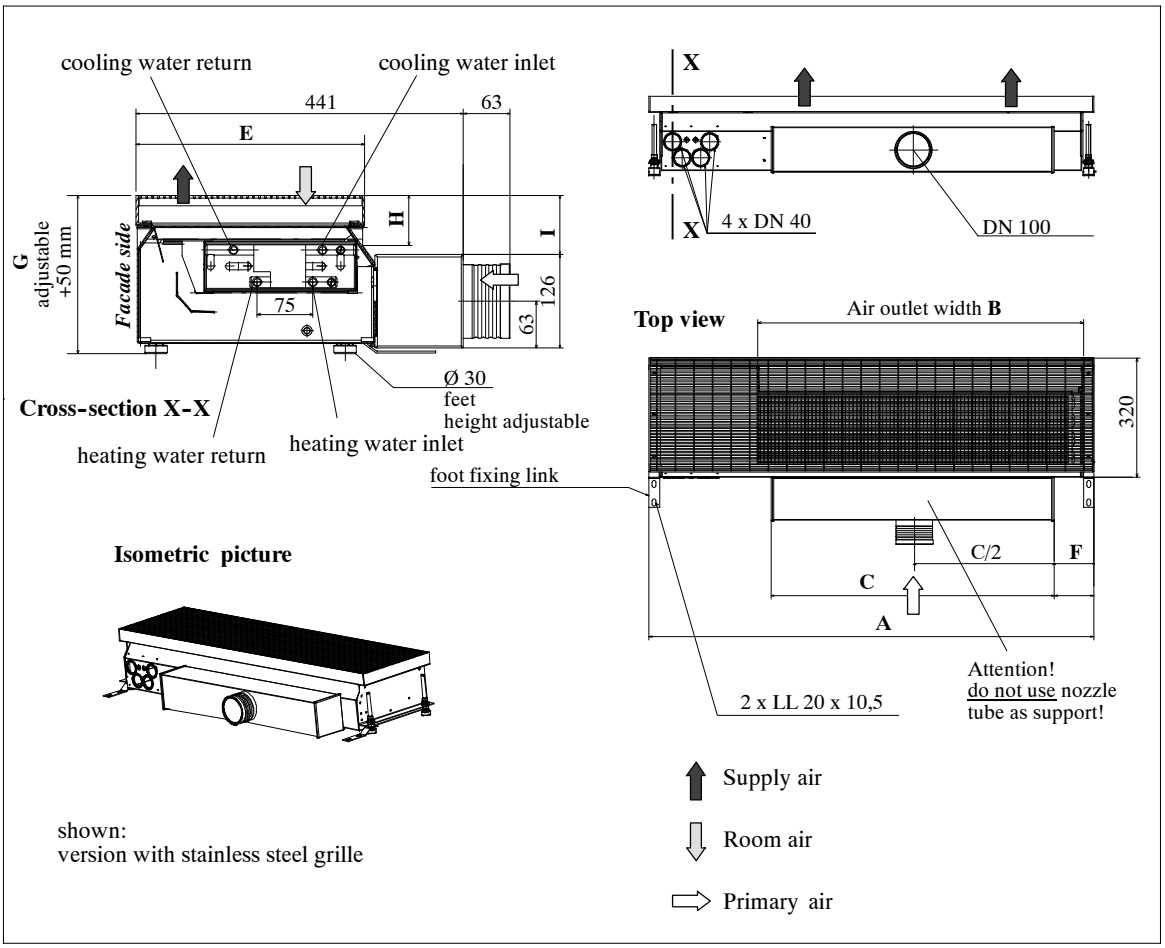
The maximum admissible supply temperature is limited to +80 °C.
Any other operating conditions require the written permission of LTG Aktiengesellschaft.

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

3. Technical Specifications

3.1 Dimensions and Technical Specifications

Dimensions Type HFB-D



Size	A	B	C	F
630	988	626	593	40
800	1198	856	763	95
1000	1398	1056	963	95
1250	1598	1256	1163	95

Version:	E	H	I	G_{min}
with stainless steel grille:	305	44	55	187
with aluminium roller grille:	308	48	59	191
with aluminium grille:	308	48	59	191

Technical Specifications Type HFB-D, 4-pipe System

Size 630

V_P [m^3/h]	Δp [Pa]	L_{A18} [4)] [dB(A)]	L_{wA} [4)] [dB(A)]	$Q_{kP}/\Delta t_P$ [W/K]	$Q_k/\Delta t$ [1)] [W/K]	$Q_h/\Delta t$ [W/K]	Q_{Ek} [3)] [W]	$w_{ok}/\Delta p_w$ [kg/h]/[kPa]	$w_{oh}/\Delta p_w$ [kg/h]/[kPa]	Q_k [1)] [W]	Q_{kP} [2)] [W]
35	150	21	27	12	17	10	180	100/1.2	100/1.8	170	120
35	250	22	28	12	20	12				200	120
45	150	24	30	15	21	13				210	150
45	250	26	32	15	26	16				260	150
60	150	26	32	20	28	18				280	200
60	250	28	34	20	33	20				330	200
80	150	28	34	27	32	20				320	270
80	250	33	39	27	36	22				360	270
100	150	31	37	33	34	21				340	330
100	250	33	39	33	39	24				380	330

Size 800

V_P [m^3/h]	Δp [Pa]	L_{A18} [4)] [dB(A)]	L_{wA} [4)] [dB(A)]	$Q_{kP}/\Delta t_P$ [W/K]	$Q_k/\Delta t$ [1)] [W/K]	$Q_h/\Delta t$ [W/K]	Q_{Ek} [3)] [W]	$w_{ok}/\Delta p_w$ [kg/h]/[kPa]	$w_{oh}/\Delta p_w$ [kg/h]/[kPa]	Q_k [1)] [W]	Q_{kP} [2)] [W]
45	150	22	28	15	25	15	225	120/2.5	120/3	250	150
45	250	23	29	15	31	19				310	150
60	150	24	30	20	34	20				340	200
60	250	25	31	20	39	24				390	200
80	150	26	32	27	38	23				380	270
80	250	30	36	27	43	26				430	270
100	150	29	35	33	40	25				400	330
100	250	31	37	33	46	28				460	330
120	150	32	38	40	43	26				430	400
120	250	34	40	40	48	29				480	400

1) Water supply temperature: 16°C, induction air temperature before entering the heat exchanger: 26°C, non-condensing operation (induction air temperature may vary from ambient air temperature)
2) Primary air temperature: 16°C, air inlet temperature: 26°C
3) Water supply temperature 70°C, air inlet temperature: 20°C
4) Acoustical data for plastic nozzles; aluminium nozzles: sound power level + 3 dB

V_P - primary air flow rate (±10%)
Δp - static pressure of primary air
L_{A18} - sound pressure level at a room absorption of 18 m^2 Sabine
L_{wA} - sound power level ±3 dB(A) (with plastic nozzles)
Q_{kP} - cooling capacity primary air
Δt_P - temperature difference between ambient air and primary air
Q_k - secondary cooling capacity (heat exchanger)
Q_h - heating capacity
Δt - temperature difference between induction air temperature before entering the heat exchanger and water supply
Q_{Ek} - heating capacity by natural convection
w_{ok} - standard water flow rate (cooling)
w_{oh} - standard water flow rate (heating)
Δp_w - water-side pressure loss

Technical Specifications Type HFB-D, 4-pipe System

Size 1000

V_P [m^3/h]	Δp [Pa]	L_{A18} [4)] [dB(A)]	L_{wA} [4)] [dB(A)]	$Q_{kP}/\Delta t_P$ [W/K]	$Q_k/\Delta t$ [1)] [W/K]	$Q_h/\Delta t$ [W/K]	Q_{Ek} [3)] [W]	$w_{ok}/\Delta p_w$ [kg/h]/[kPa]	$w_{oh}/\Delta p_w$ [kg/h]/[kPa]	Q_k [1)] [W]	Q_{kP} [2)] [W]
60	150	22	28	20	40	24	280	150/4	150/4.6	400	200
60	250	24	30	20	47	28				470	200
80	150	26	32	27	46	27				460	270
80	250	29	35	27	52	31				510	270
100	150	28	34	33	50	30				500	330
100	250	31	37	33	55	33				550	330
120	150	30	36	40	53	32				530	400
120	250	33	39	40	58	35				580	400
140	150	32	38	47	56	33				560	470
140	250	35	41	47	60	36				600	470

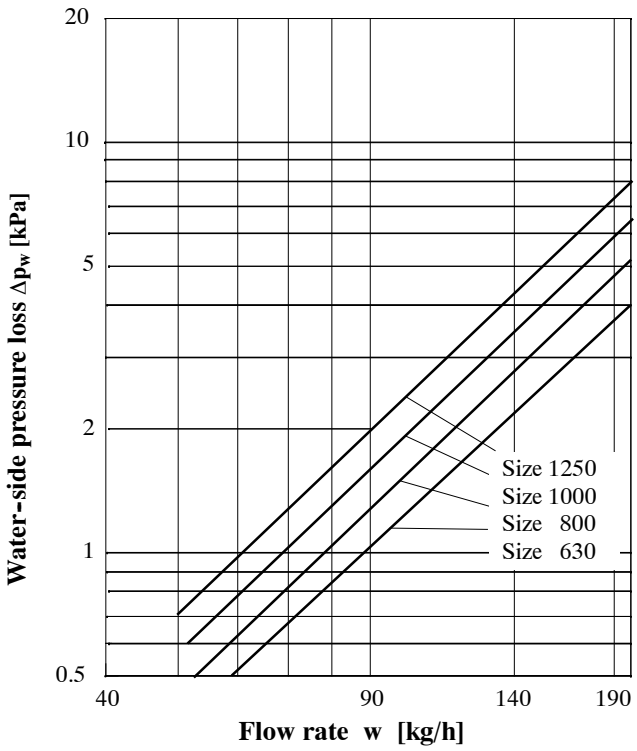
Size 1250

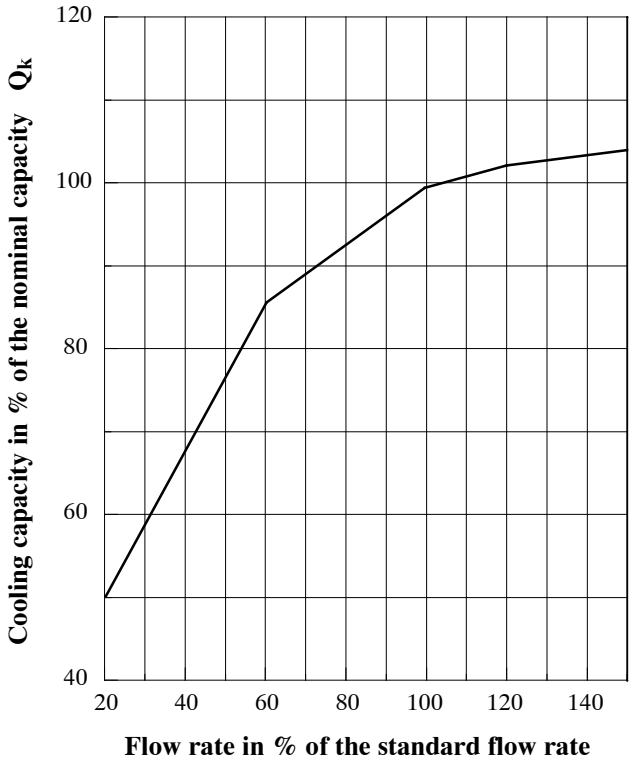
V_P [m^3/h]	Δp [Pa]	L_{A18} [4)] [dB(A)]	L_{wA} [4)] [dB(A)]	$Q_{kP}/\Delta t_P$ [W/K]	$Q_k/\Delta t$ [1)] [W/K]	$Q_h/\Delta t$ [W/K]	Q_{Ek} [3)] [W]	$w_{ok}/\Delta p_w$ [kg/h]/[kPa]	$w_{oh}/\Delta p_w$ [kg/h]/[kPa]	Q_k [1)] [W]	Q_{kP} [2)] [W]
80	150	25	31	27	53	32	345	180/5.8	180/7.5	530	270
80	250	28	34	27	58	35				580	270
100	150	27	33	33	57	34				570	330
100	250	30	36	33	61	37				610	330
120	150	30	36	40	62	38				620	400
120	250	32	38	40	67	41				670	400
140	150	31	37	47	68	42				680	470
140	250	34	40	47	71	44				710	470
160	150	35	40	53	73	45				730	530
160	250	36	43	53	76	47				760	530

1) Water supply temperature: 16°C, induction air temperature before entering the heat exchanger: 26°C, non-condensing operation (induction air temperature may vary from ambient air temperature)
2) Primary air temperature: 16°C, air inlet temperature: 26°C
3) Water supply temperature 70°C, air inlet temperature: 20°C
4) Acoustical data for plastic nozzles; aluminium nozzles: sound power level + 3 dB

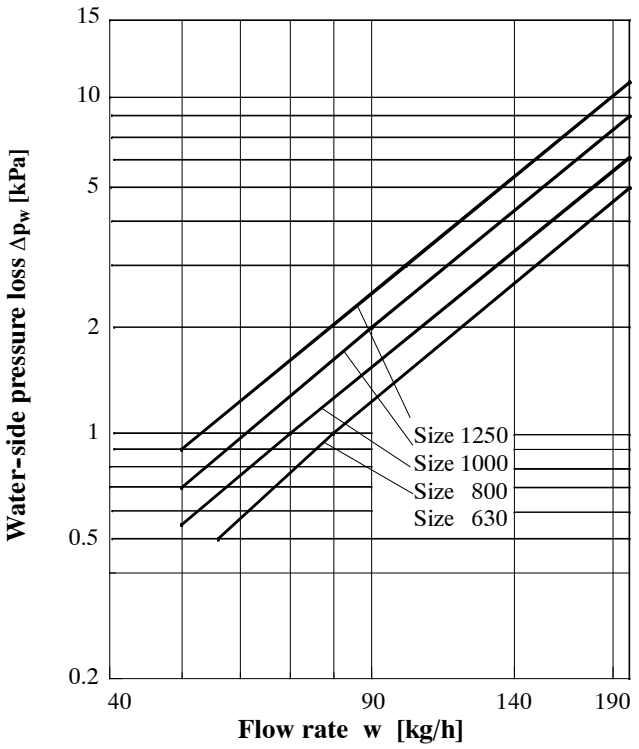
V_P - primary air flow rate (±10%)
Δp - static pressure of primary air
L_{A18} - sound pressure level at a room absorption of 18 m^2 Sabine
L_{wA} - sound power level ±3 dB(A) (with plastic nozzles)
Q_{kP} - cooling capacity primary air
Δt_P - temperature difference between ambient air and primary air
Q_k - secondary cooling capacity (heat exchanger)
Q_h - heating capacity
Δt - temperature difference between induction air temperature before entering the heat exchanger and water supply
Q_{Ek} - heating capacity by natural convection
w_{ok} - standard water flow rate (cooling)
w_{oh} - standard water flow rate (heating)
Δp_w - water-side pressure loss

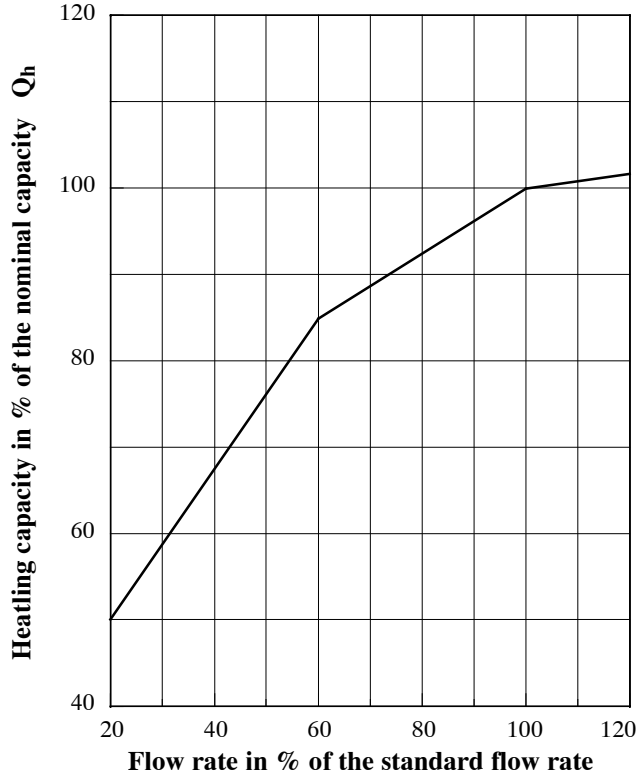
Water-side Pressure Loss and Cooling Capacity for different Flow Rates Type HFB-D



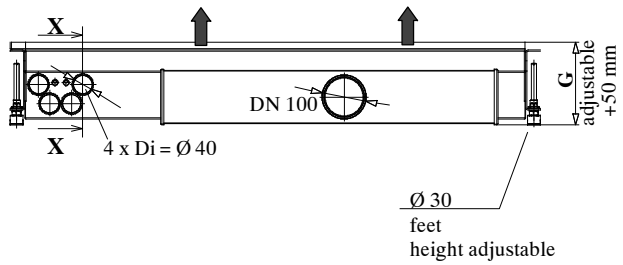


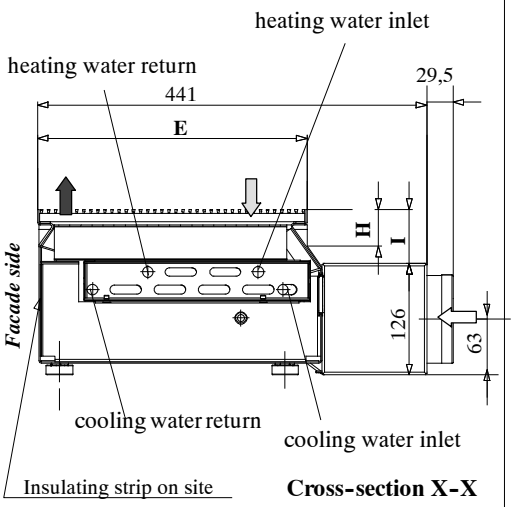
Water-side Pressure Loss and Heating Capacity for different Flow Rates Type HFB-D



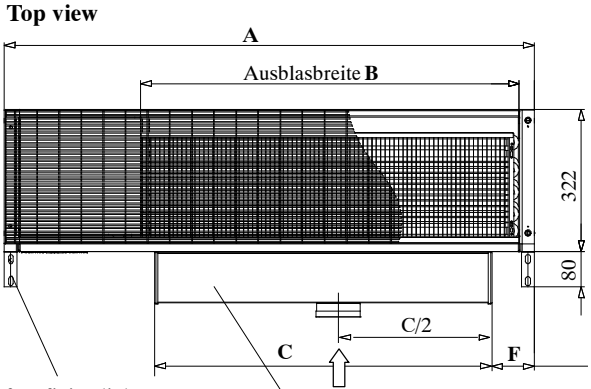


Dimensions Type HFB-Z





Top view

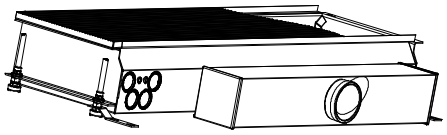


Supply air

Room air

Primary air

Isometrische Darstellung



shown:
version with stainless steel grille

Size	A	B	C	F
630	988	626	593	40
800	1198	856	763	95
1000	1398	1056	963	95
1250	1598	1256	1163	95

Version:	E	H	I	G_{min}
with stainless steel grille:	305	44	55	187
with aluminium roller grille:	308	48	59	191
with aluminium grille:	308	48	59	191

Technical Specifications Type HFB-Z, 4-pipe System

Size 630

V_P [m^3/h]	Δp [Pa]	L_{A18} [4)] [dB(A)]	L_{wA} [4)] [dB(A)]	$Q_{kP}/\Delta t_P$ [W/K]	$Q_k/\Delta t$ [1)] [W/K]	$Q_h/\Delta t$ [W/K]	Q_{Ek} [3)] [W]	$w_{ok}/\Delta p_w$ [kg/h]/[kPa]	$w_{oh}/\Delta p_w$ [kg/h]/[kPa]	Q_k [1)] [W]	Q_{kP} [2)] [W]
35	150	< 22	< 28	12	16	13	165	100/3	100/2	160	120
35	250	< 22	< 28	12	18	15				180	120
45	150	< 22	26	15	17	15				170	150
45	250	23	29	15	20	17				200	150
60	150	24	30	20	22	19				220	200
60	250	27	33	20	25	21				250	200
80	150	28	34	27	29	25				290	270
80	250	30	36	27	33	28				330	270
100	150	33	39	33	35	30				350	330
100	250	35	41	33	39	34				390	330

Size 800

V_P [m^3/h]	Δp [Pa]	L_{A18} [4)] [dB(A)]	L_{wA} [4)] [dB(A)]	$Q_{kP}/\Delta t_P$ [W/K]	$Q_k/\Delta t$ [1)] [W/K]	$Q_h/\Delta t$ [W/K]	Q_{Ek} [3)] [W]	$w_{ok}/\Delta p_w$ [kg/h]/[kPa]	$w_{oh}/\Delta p_w$ [kg/h]/[kPa]	Q_k [1)] [W]	Q_{kP} [2)] [W]
45	150	< 20	23	15	19	16	210	120/5	120/3.3	190	150
45	250	< 20	25	15	23	19				230	150
60	150	< 20	25	20	25	21				250	200
60	250	22	28	20	29	25				290	200
80	150	23	29	27	33	28				330	270
80	250	27	33	27	38	32				380	270
100	150	28	34	33	40	34				400	330
100	250	31	37	33	45	38				450	330
120	150	32	38	40	47	39				470	400
120	250	35	41	40	53	45				530	400

1) Water supply temperature: 16°C, induction air temperature before entering the heat exchanger: 26°C, non-condensing operation (induction air temperature may vary from ambient air temperature)
2) Primary air temperature: 16°C, air inlet temperature: 26°C
3) Water supply temperature 70°C, air inlet temperature: 20°C
4) Acoustical data for plastic nozzles; aluminium nozzles: sound power level + 3 dB

V_P - primary air flow rate (±10%)
Δp - static pressure of primary air
L_{A18} - sound pressure level at a room absorption of 18 m^2 Sabine
L_{wA} - sound power level ±3 dB(A) (with plastic nozzles)
Q_{kP} - cooling capacity primary air
Δt_P - temperature difference between ambient air and primary air
Q_k - secondary cooling capacity (heat exchanger)
Q_h - heating capacity
Δt - temperature difference between induction air temperature before entering the heat exchanger and water supply
Q_{Ek} - heating capacity by natural convection
w_{ok} - standard water flow rate (cooling)
w_{oh} - standard water flow rate (heating)
Δp_w - water-side pressure loss

Technical Specifications Type HFB-Z, 4-pipe System

Size 1000

V_P [m^3/h]	Δp [Pa]	L_{A18} [4)] [dB(A)]	L_{wA} [4)] [dB(A)]	$Q_{kP}/\Delta t_P$ [W/K]	$Q_k/\Delta t$ [1)] [W/K]	$Q_h/\Delta t$ [W/K]	Q_{Ek} [3)] [W]	$w_{ok}/\Delta p_w$ [kg/h]/[kPa]	$w_{oh}/\Delta p_w$ [kg/h]/[kPa]	Q_k [1)] [W]	Q_{kP} [2)] [W]
60	150	21	27	20	34	28	260	150/10	150/6	340	200
60	250	23	29	20	39	33				390	200
80	150	23	29	27	38	32				380	270
80	250	26	32	27	44	37				440	270
100	150	28	34	33	43	36				430	330
100	250	30	36	33	49	41				490	330
120	150	32	38	40	47	39				470	400
120	250	34	40	40	54	45				540	400
140	150	35	41	47	51	43				510	470
140	250	37	43	47	58	49				580	470

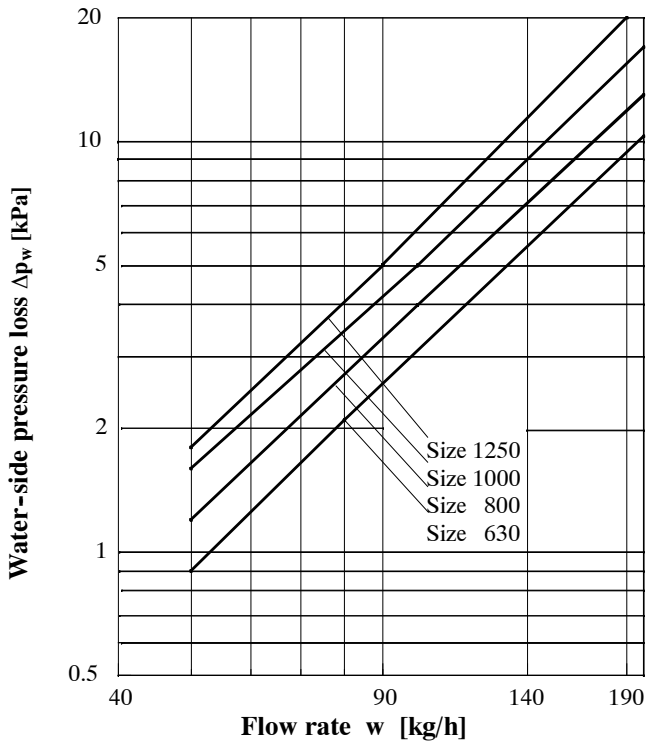
Size 1250

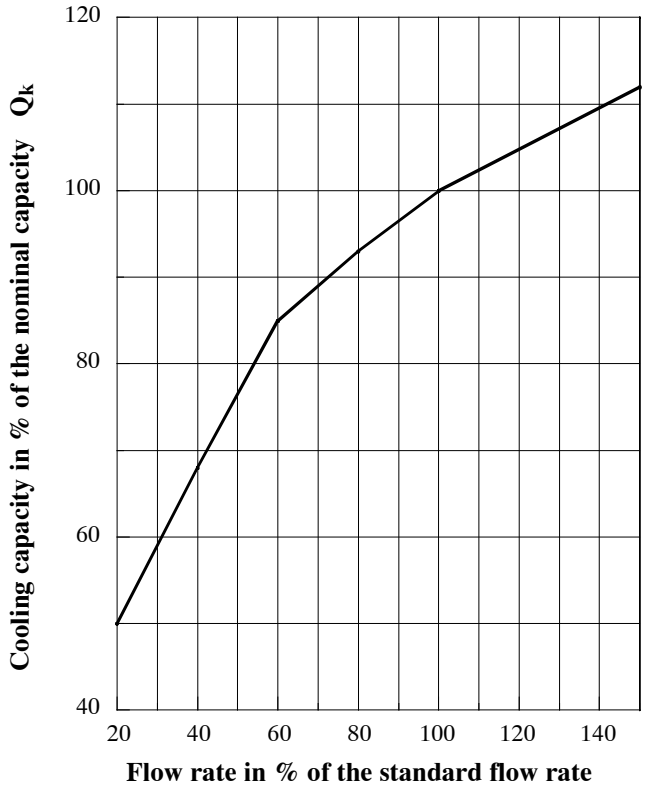
V_P [m^3/h]	Δp [Pa]	L_{A18} [4)] [dB(A)]	L_{wA} [4)] [dB(A)]	$Q_{kP}/\Delta t_P$ [W/K]	$Q_k/\Delta t$ [1)] [W/K]	$Q_h/\Delta t$ [W/K]	Q_{Ek} [3)] [W]	$w_{ok}/\Delta p_w$ [kg/h]/[kPa]	$w_{oh}/\Delta p_w$ [kg/h]/[kPa]	Q_k [1)] [W]	Q_{kP} [2)] [W]
80	150	22	28	27	45	36	325	180/16	180/10	450	270
80	250	25	31	27	51	43				510	270
100	150	24	30	33	52	44				520	330
100	250	27	33	33	59	50				590	330
120	150	28	34	40	56	47				560	400
120	250	31	37	40	63	53				630	400
140	150	32	38	47	60	51				600	470
140	250	35	41	47	68	58				680	470
160	150	35	41	53	65	55				650	530
160	250	38	44	53	73	62				730	530

1) Water supply temperature: 16°C, induction air temperature before entering the heat exchanger: 26°C, non-condensing operation (induction air temperature may vary from ambient air temperature)
2) Primary air temperature: 16°C, air inlet temperature: 26°C
3) Water supply temperature 70°C, air inlet temperature: 20°C
4) Acoustical data for plastic nozzles; aluminium nozzles: sound power level + 3 dB

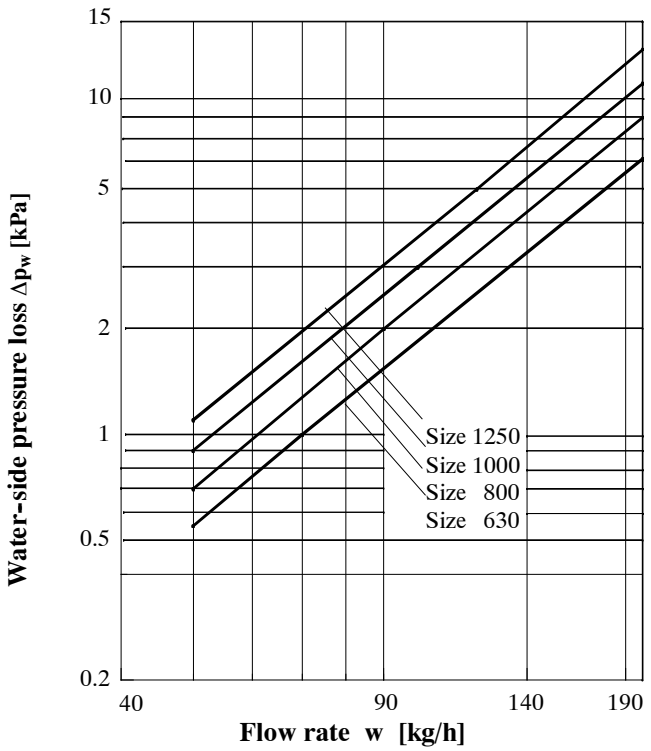
V_P - primary air flow rate (±10%)
Δp - static pressure of primary air
L_{A18} - sound pressure level at a room absorption of 18 m^2 Sabine
L_{wA} - sound power level ±3 dB(A) (with plastic nozzles)
Q_{kP} - cooling capacity primary air
Δt_P - temperature difference between ambient air and primary air
Q_k - secondary cooling capacity (heat exchanger)
Q_h - heating capacity
Δt - temperature difference between induction air temperature before entering the heat exchanger and water supply
Q_{Ek} - heating capacity by natural convection
w_{ok} - standard water flow rate (cooling)
w_{oh} - standard water flow rate (heating)
Δp_w - water-side pressure loss

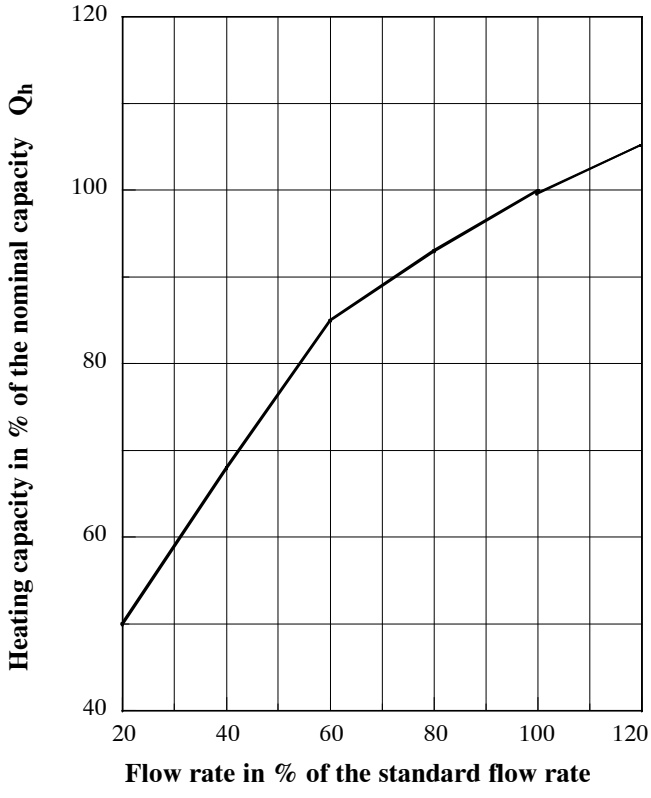
Water-side Pressure Loss and Cooling Capacity for different Flow Rates Type HFB-Z





Water-side Pressure Loss and Heating Capacity for different Flow Rates Type HFB-Z





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 to 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.

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.

3.3 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 primary air flow rates/static pressures at primary air socket.

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%.

3.4 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%.

4. Installation

4.1 Installation Instructions

The unit is usually supplied as described in the following:

- Unit with completely retracted feet and slightly fixed counternuts and a protective board (chipboard) inserted instead of the foot traffic resistant grille.
- Connecting cords coiled up on the unit (if included in the delivery)
- Required installation material and parts, if any, such as rivets, screws, bolts, junction sheets, fixing links, air duct are included in the delivery.

The following points must always be observed when installing the unit:

- Do not remove the **protective board** (chipboard) unless to execute the water connections. Reinstall the protective board until the grille is inserted into the unit to avoid damages to and pollution of the unit.
- **Any work in connection with the water connections is to be performed by skilled and trained staff only.**
- When installing the unit **on site** an **insulating strip** is to be used between the unit and the facade and between the unit and the floor boards.
- The **counternuts** of the supporting feet are to be fastened using a 3 Nm torque.
- When fixing the units to the floor using the **fastening brackets** included in the delivery, a **sound insulation** is to be installed on the bottom side of the brackets to avoid sound transmission.

4.2 Unit Installation

Please observe the following when installing the unit:

- Supporting feet must be preadjusted to ensure that the unit's own weight is carried by the supporting feet and not by the outside air socket.
- Tighten the supporting feet's lock nuts observing a torque of 3 Nm.
- Secure the unit against horizontal shifting, e.g. by using the fixing links available as accessories.
- Do not fix other components to the unit unless with LTG Aktiengesellschaft's express permission and prior release.
- Take care to avoid any direct contact between the unit and the raw floor except by the supporting feet to eliminate sound and foot traffic noise transmission.
- Take care to avoid any direct contact between the unit and the facade and suction duct to avoid sound transmission, except via seals designed for this purpose (VDE 6022, hydrophobic and closed pored).

Laying the Floor

- When laying the floor take special care to avoid any direct contact between the floor boards and the unit, i.e. do not place floor boards directly on the unit and avoid their touching laterally. Ensure the use of a sound insulation element in between or use an appropriate sealant (see above) between the unit and the false floor's boards.

4.3 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).

Depending on the unit type, water connections are supplied in the following versions:

1. copper fitting with 12 mm outer diameter.
   This connection is only suitable for flexible connection with quick coupling.
2. 1/2” internal thread fitting, conical and sealing.

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.

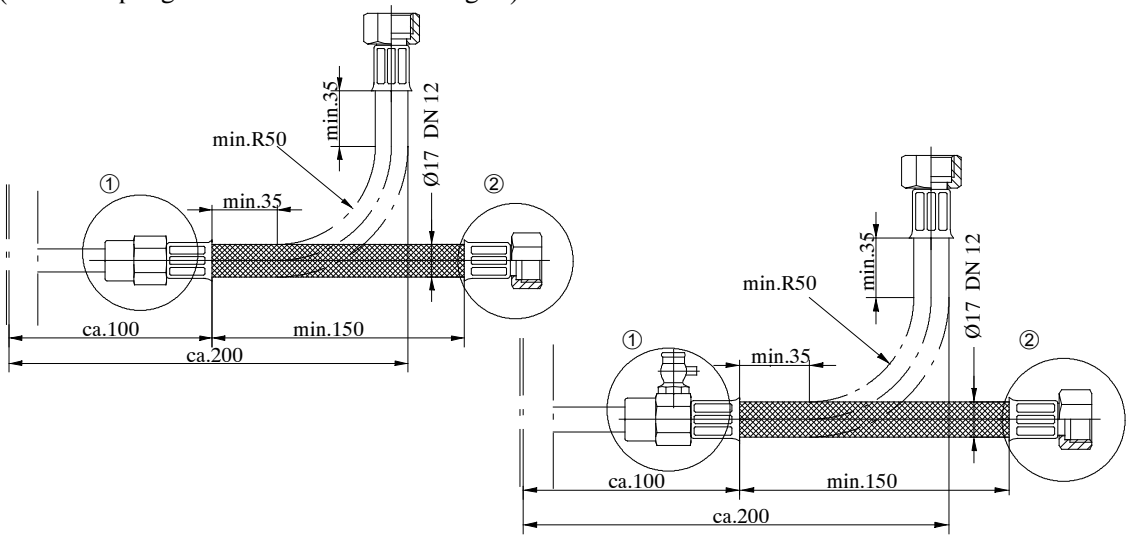
The water connection side is to be specified when ordering the unit. Some units offer a possibility to still change the side during installation by removing 4 bolts.

Execute the heat exchanger connection as follows:

- Vertical heat exchangers: water supply below, water return above
- Horizontal heat exchangers: unit's front side: water supply, unit's back side: water return

Example for water connection using flexible hose

(Quick coupling connection to heat exchangers)

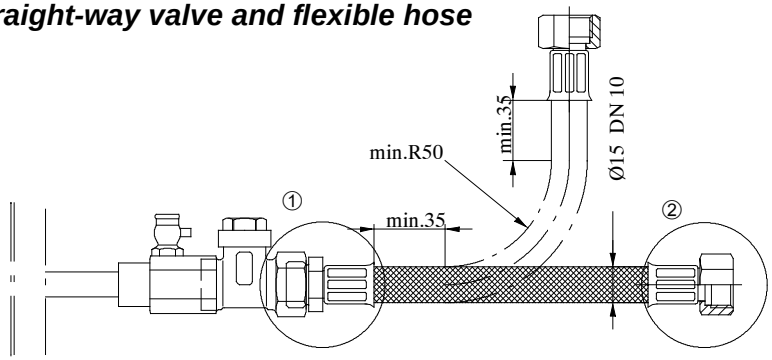


Hose without insulation. For insulated hoses, dimensions will change accordingly (10 mm Armaflex insulation).

① Hose for connection to heat exchanger with smooth tube end diameter 12 mm, connection types: quick coupling, quick coupling with venting

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

Example for water connection using transition - LTG description VSG 10/ 2 EH (venting) -, straight-way valve and flexible hose

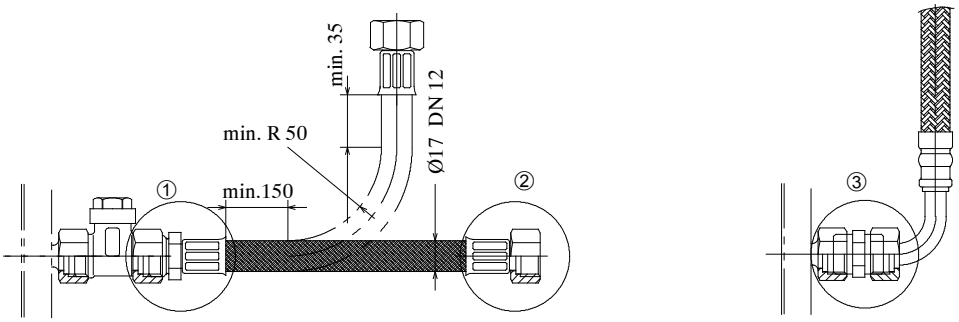


Hose without insulation. For insulated hoses, dimensions will change accordingly.

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"

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



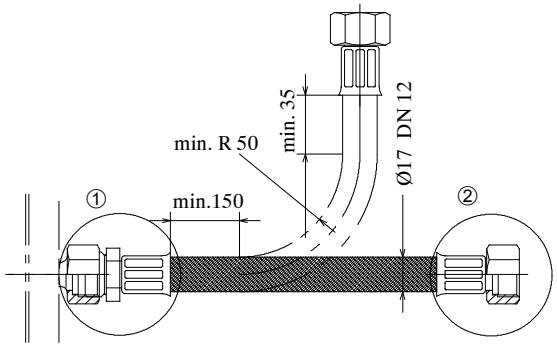
Hose without insulation. For insulated hoses, dimensions will change accordingly.
(10 mm Armaflex insulation

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



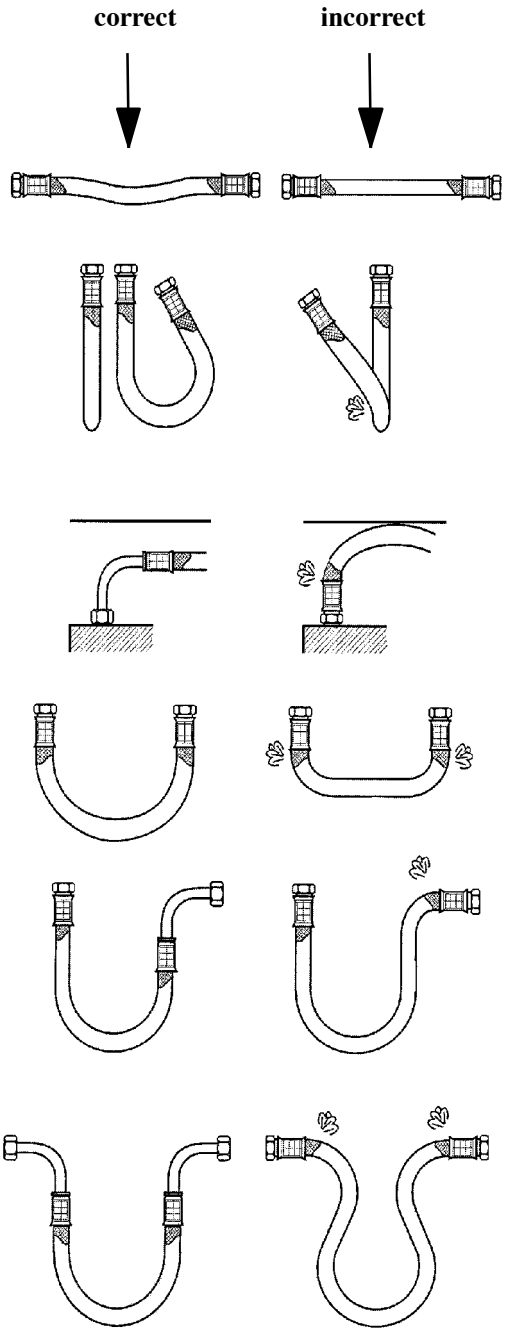
Hose without insulation. For insulated hoses, dimensions will change accordingly.

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

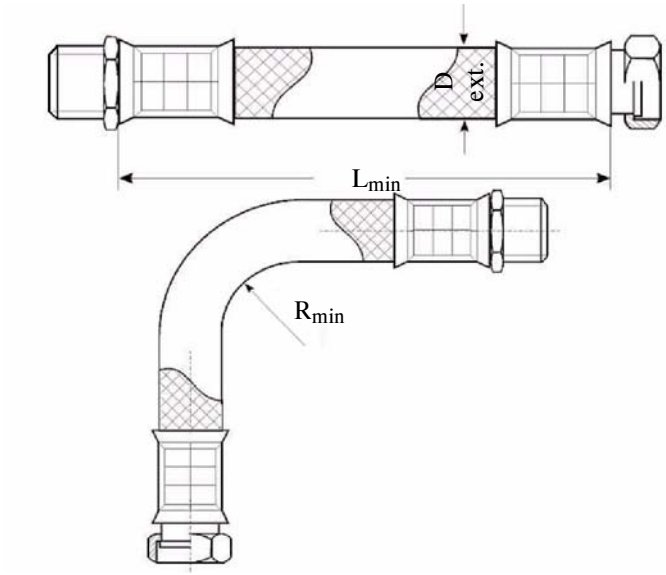
② Different hose connections, thread diameter acc. to customer requirements or standard 1/2”

4.3.1 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)

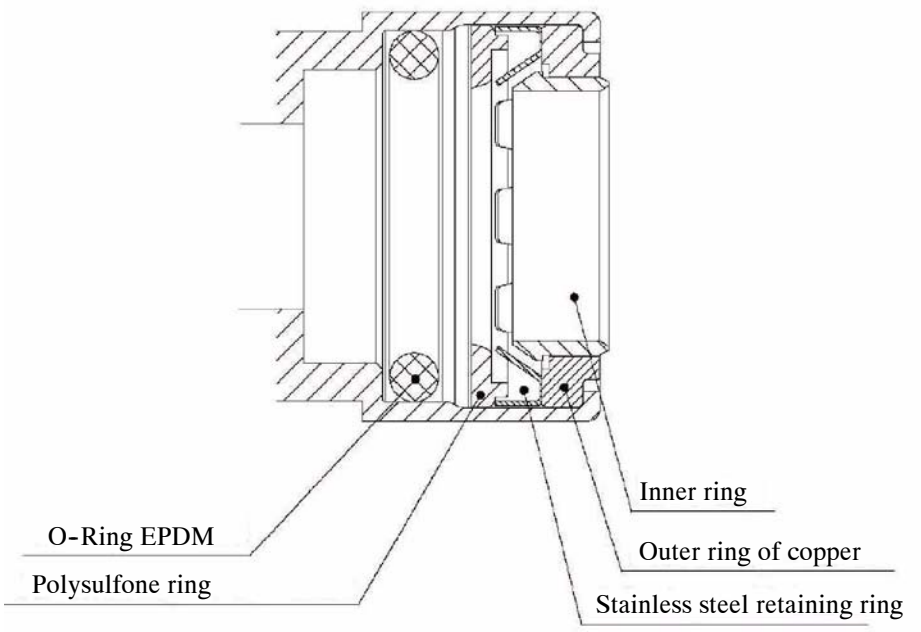
ND hose	D_A	PN [bar]	R_{min}	L_{min}	L_{min} α = 90°	L_{min} α = 180°	L_{min} α = 360°
06/08	12	15	27	60	140	180	260
10	14	15	40	60	190	250	260
12	18	15	60	80	260	360	550
15	22	12	70	95	300	420	640
19	27	10	80	100	350	480	730
25	34	10	100	125	430	590	900
32	44	10	160	140	650	900	1400
40	54	6	180	160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

4.3.2 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.

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.

4.4 Primary Air

Connection

All units are provided with primary air sockets with a (normally) 100 mm outer diameter (special versions: DN 80 or 125). Sockets are in general provided on both sides so that your mechanic can change the connection side, if required (floor units: connection on front).

Connection may be performed using e.g. flex tubes fixed with pipe clips. When installing the flex tubes take special care to ensure free movement of the clamping lever. Absolutely avoid any contact between the clip and the lever.

It is, therefore, recommended to use a thin flexible hose and to install the clip in a way to ensure a 2 mm minimum clearance between clamping screw and clip.

Primary air side pressure balance

One way to adjust the primary air volume is the use of a throttling device which may be integrated in the socket as original equipment (KLI 100/1) or retrofitted as an accessory (KLXG 100/1).

If supplied as an accessory (KLXG) it must be installed and will thus increase the constructional length.

Primary air flow control

When dimensioning the units the nozzle pressure and the corresponding flow rate are defined through selection of the nozzles with their specific diffusion section.

The air volume meets the calculated data if the set nozzle pressure is present. It is, therefore, highly recommended to random check the unit's nozzle pressure during the adjustment at start-up. The air volume cannot be measured directly at the socket. It requires sufficient measuring length. If the expected output is not achieved while water side conditions are alright, it means that something is wrong with the nozzle pressure since the nozzle sections are very precise as lab measurements have documented.

Use a pressure gauge to determine the pressure by inserting a hose into the nozzle.

If subsequently changing the air volume is a requirement, nozzles may be replaced (simply remove the plastic nozzles and carefully insert and fix the new nozzles).

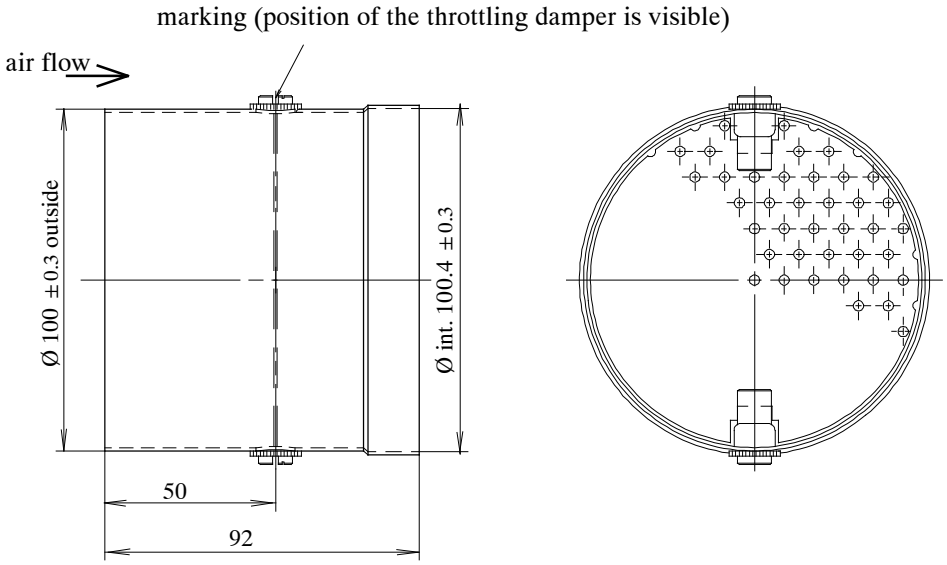
Throttling Damper for Primary Air - Type KLX / Type KLI

If required, a throttling damper for adjusting the primary air volume may be provided at the inlet socket of the unit (type KLX 100/1, delivered in a separate bag for subsequent installation) or may be factory-installed in the socket (type KLI) (please specify in your order). However, this device for adjusting the air volume should only be used if other means have failed to result in pressure compensation, (balancing should be as far from outlet as possible).

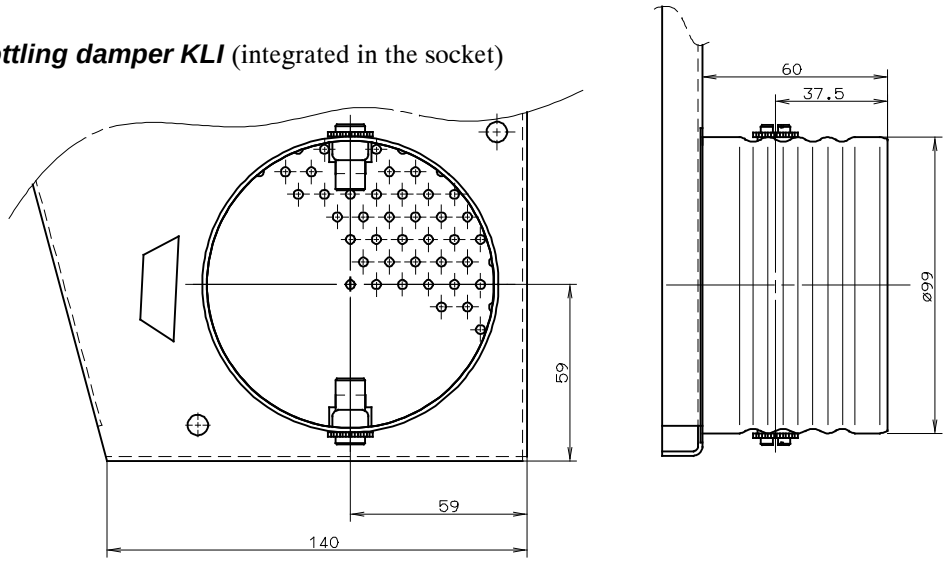
The dimensions of the throttling damper are given below. The free area is 10.7 %.

The diagram on the following page shows the throttling damper resistance and the sound level area. The noise perceivable in the room may be determined by adding the noise of the air conditioning unit and the noise of the damper, using the graph for level totalling.

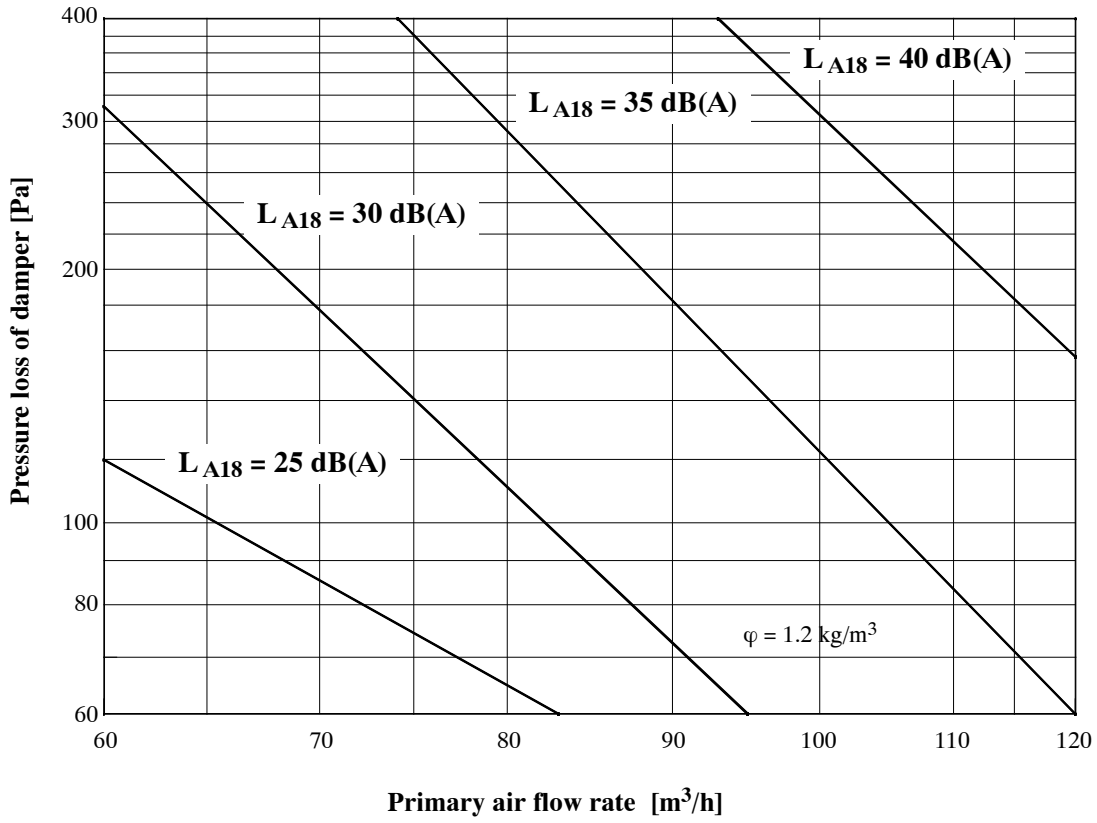
Throttling damper KLX (for subsequent duct installation)



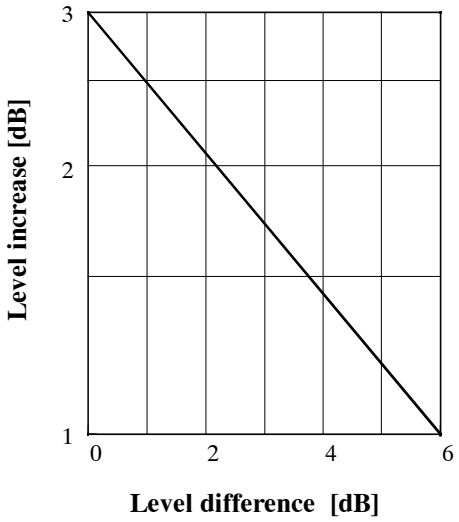
Throttling damper KLI (integrated in the socket)



Generated sound level of damper (room absorption: 18 m^2 Sabins)



Level totalling



The total sound level of the damper and of the air conditioning unit may be added using this graph.

4.5 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.

On request, units are available in a special insulated version for condensing operation (please consider when designing and ordering). In any case, please observe the following:

- **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.

4.6 Check after Installation

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.

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.

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.

Unit without filter

The exchanger(s) is/are to be vacuum cleaned about 2 to 3 months after their putting into operation. By that time, heat exchangers are usually visibly polluted from carpet lints and construction dust remainders. Exact timing is subject to local conditions.
Heat exchanges will then have to be vacuum cleaned on a regular basis, every 6 months to 2 years depending on dust formation. This gains particular importance considering that condensate formation might result in hard-to-remove dust caking.
A 6-month cleaning interval might 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, in case of condensate formation on the cooler even sooner.
A 2-year cleaning interval might be appropriate if the unit is operated under conditions without foot traffic, in a clean environment, with a very good primary air filter quality and without condensate formation on the cooler.

6.3 Selecting the Room Temperature

Set the room temperature controller to the desired value (usually in the range's center). If, after a certain time, you consider this too cold turn the knob in direction of "warmer". If considered too warm, turn the knob in direction of "cooler".

In order to find the right setting meeting your personal needs adjust in small steps and allow sufficient time for walls, ceilings, floors, and furniture to adapt (about 1/2 to 1 hour).

There is a wide variety of temperature selectors with scales in ° C, in temperature steps such as 1 to 10, or only "warmer" - "cooler" (+1-, red for warmer, blue for cooler etc.). For more information check with the installation manufacturer.

6.4 Excessive Noise and Draught

It might occur, especially after cleaning, that the units display increased noise and draught. It means that primary air duct nozzles have loosened or fallen off. Reinstall or replace them. Some units on the same pipe run may be blocked (e.g. polluted nozzles) resulting in the unit being operated with an increased primary air volume. In that case have the unit repaired.

6.5 Out-of-service Times

If the primary air system is not to be operated for a longer period of time in summer, shut off the cold water supply to the induction units' heat exchangers to avoid condensate formation, overflow, and thus damages.

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.

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 is not recommended since the greater number of settings can only be performed in the factory using special equipment.

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**

*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		Heat exchanger size___ for HFB connection for quick action coupling	1
1	1019056	Rubber support for stainless steel grille 12 x 2 mm	10 m
1	33423	Self-adhesive magnetic tape	10 m
1	1017421	Edge protection profile for hose feed-throughs	10 m
1	106458	Sleeve for cable feed-throughs	50
1		Stainless steel grille	1

8. Decommissioning and disposal

When the unit 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.