The Innovation Company

LTG Aktiengesellschaft

Original Instructions for Installation, Use and Maintenance

Induction Unit QHG

LTG Aktiengesellschaft
D - 70435 Stuttgart, Grenzstraße 7
D – 70405 Stuttgart, Postfach 40 05 25
☎ +49 (0711) 82 01-0 Fax +49 (0711) 82 01-720
Internet: http://www.LTG-AG.de
E-Mail: info@LTG-AG.de

AG-B 212.1e (Feb. 10)

Table of contents

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:	**Induction Unit**
Machinery type:	**QHG** 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

LTG Aktiengesellschaft, Grenzstraße 7, D-70435 Stuttgart
Tel. +49 / 711 / 8201-0, Fax: +49 / 711 / 8201-720
Internet: www.LTG-AG.de, E-Mail: info@LTG-AG.de
Chairman of supervisory board: Dr. Franz Wimpffen
Executive board:
Dr.-Ing. Gerd Schaal (chairm.), Dipl.-Ing. Rolf-Herbert Fichter

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 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.

Electrical connections of control units, if any, must be realized, modified or removed by authorized personnel and according to local safety requirements only.

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.

The unit is supplied in corrugated board boxes secured with straps.

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

Using a round socket, primary air with general pressures of 150-300 Pa is introduced at high speed through plastic or aluminum nozzles into the induction unit. By injection effect, indoor air is sucked in, passing the heat exchanger cooling or heating it. This secondary air then enters the perimeter displacement distributing box along with the primary air.

Uniformity of discharge over the entire outlet is guaranteed by specially arranged guiding vanes.

Heat exchangers are usually provided with a filter to protect the unit.

Water is used as a means for thermal energy transport to the heat exchangers with temperatures between about 14°C (in case of low inlet temperatures condensate formation) up to 80°C.

Water connection to choice, on the left or right side.

Depending on the specific version, air connection may be performed laterally, on the right or left side, or from below.

If, in the cooling mode, the cold water temperature drops below dew point a condensate tray with possible connecting socket may be used to collect the condensate and for connection to a condensate drainage system.

Dimensioning of the unit should be in a way to avoid any condensate formation during routine operation since the unit has not been designed for an operation with continuous condensation. Furthermore, draught phenomena may occur with low diffused air temperatures.

Contol is performed via precision valves for units QHG without bypass (2 - pipe - system) and QHG (4 - pipe-system, one heat exchanger with two separate water circuits for cooling and heating). For QHG with bypass control is performed via motor controlled dampers, continous or 3-point or pneumatic.

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 trough the water flow rate, water and indoor air temperatures, and damper or valve setting.

The sound power depends on the initial pressure at the primary air inlet socket, the flow rate, the unit size, and the nozzle assembly.

Further data of interest when dimensioning the unit are the water mass flow rate and the heat exchanger's water-side pressure loss.

Comfort limits:

Comfort limits with this induction unit type are determined by three factors:
acoustics, temperature layer formation (temperatures at floor level), indoor air speed.
Select a maximum size air distribution box to minimize indoor air speeds.

2.1 Intended Use

The induction unit type QHG 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, 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.

Room Air Temperatures and Temperature Layer Formation QHG

Dimensioning of a displacement air system should not be based exclusively on performance data since the type of air guidance will, system-related, reach comfort limits even with moderate cooling loads.
In general, two criteria must be considered when dimensioning the system:

1. the diffused air temperature should not exceed 20 °C
2. the maximum temperature gradient in height must not exceed certain limits as specified in various standards.

Standard	**Maximum temperature gradient**
DIN 1946/2 January 1994	2 K / m [0.1 .. 1.1 m]
DIN ISO 7730 October 1987, draft	3 K / m [0.1 .. 1.1 m]
CEN/TC 156 WG 6 October 1993, draft Category A	2 K / m [0.1 .. 1.1 m]
CEN/TC 156 WG 6 October 1993, draft Category B	3 K / m [0.1 .. 1.1 m]
CEN/TC 156 WG 6 October 1993, draft Category C	4 K / m [0.1 .. 1.1 m]

Usually, displacement air systems meet indoor air speed requirements if temperature gradient requirements are taken into consideration with the parapet diffused air speed remaining below 20 cm/s.

Because of the indoor air flow's linear character it is advantageous to base the specific room load and air flow rates on the parapet length instead of the base surface since the entire air volume has to flow away from the parapet.

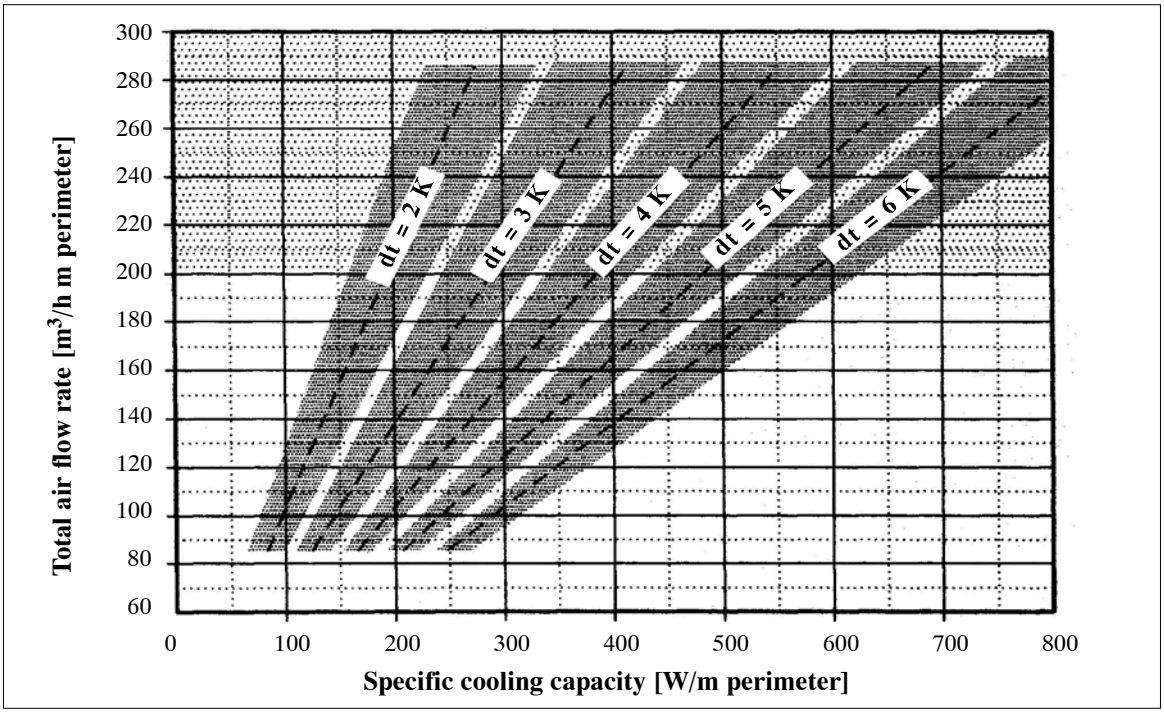
The following shows examples for displacement air system application areas.

These application areas depend on the parapet design, the room load distribution, and other factors which is why they must be determined through lab testing.

Application Area for Induction Units Type QHG (may vary depending on load distribution)

Maximum temperature gradient 1 to 1.5 m in front of parapet.

Temperature gradient dt at a height of 0.1 to 1.1 m.



3. Technical Specifications

3.1 Specification, Dimensions, Performance Data

Specification

Torsion-resistant casing of galvanized sheet steel. Heat exchanger designed for high output, consisting of copper tubing with press-fitted aluminum fins. Maximum operating pressure (standard version): 10 bar. Replaceable primary air nozzles of plastic, designed to produce induction and to provide a high grade of efficiency at low noise and an effective reflection of the primary sound.

Lateral connection of hot and cold water, condensate and primary air.

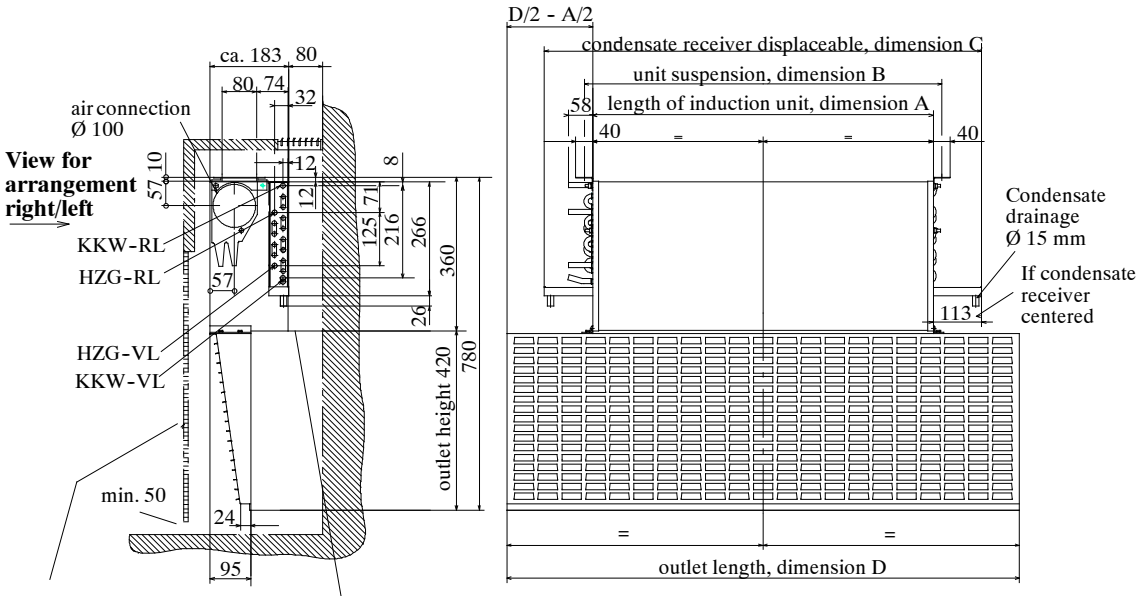
Primary air socket of plastic with an outer diameter of 100 mm.

Condensate receiver of galvanized sheet steel with a 15 mm diameter drainage socket on request.

Also on request, self-extinguishing easily replaceable secondary air filter of synthetically bonded polyamide fibres.

Easily detachable distribution box with guide vanes for air flow deflection at low pressure loss for uniform discharge and a secondary induction effect, adjustable to varying sill heights and widths.

Dimensions



The free area of the casing must at least be 50 %

To avoid short-circuits between the air intake and air outlet the unit will have to be insulated against the facade.

If water connection on the left (see figure)
heating directly on the unit
cooling with a distance to the unit

If water connection on the right
cooling directly on the unit
heating with a distance to the unit

Curved water connection always below

KKW-VL = cooling - water inlet
KKW-RL = cooling - water return

HZG-VL = heating - water inlet
HZG-RL = heating - water return

* Given outlet widths and heights may be adapted to the sill on request

Size	Dim. A	Dim. B	Dim. C	Dim. D*
500	497	537	585	800
630	642	682	730	1000
800	797	837	885	1200
1000	997	1037	1085	1400
1250	1242	1282	1335	1600

Performance Data

Size 500

Noz z	Δp [Pa]	V_P [m^3/h]	L_{A18} [dB(A)]	$Q_P/\Delta t_P$ [W/K]	$Q_k/\Delta t$ [W/K]	$Q_h/\Delta t$ [W/K]
Y	200	17	19	7	20	15
	300	21	25	9	24	18
	400	24	28	10	26	19
A	200	25	21	10	23	17
	300	30	25	13	26	20
	400	35	29	15	29	22
B	200	35	22	15	26	19
	300	42	27	18	29	22
	400	48	31	20	31	24

Q_{Ek} = 125 W
$w_{ok} / \Delta p_w$ = 80 / 2 [kg/h] / [kPa]
$w_{oh} / \Delta p_w$ = 80 / 2 [kg/h] / [kPa]

Size 630

Noz z	Δp [Pa]	V_P [m^3/h]	L_{A18} [dB(A)]	$Q_P/\Delta t_P$ [W/K]	$Q_k/\Delta t$ [W/K]	$Q_h/\Delta t$ [W/K]
Y	200	23	20	10	26	19
	300	28	26	12	30	22
	400	32	30	13	32	24
A	200	33	22	14	29	22
	300	41	28	17	34	25
	400	47	31	20	37	27
B	200	46	24	19	32	24
	300	56	29	23	37	27
	400	65	33	27	40	30

Q_{Ek} = 160 W
$w_{ok} / \Delta p_w$ = 100 / 3 [kg/h] / [kPa]
$w_{oh} / \Delta p_w$ = 100 / 2 [kg/h] / [kPa]

Size 800

Noz z	Δp [Pa]	V_P [m^3/h]	L_{A18} [dB(A)]	$Q_P/\Delta t_P$ [W/K]	$Q_k/\Delta t$ [W/K]	$Q_h/\Delta t$ [W/K]
Y	200	28	22	12	32	24
	300	35	28	15	38	28
	400	40	31	17	41	31
A	200	42	24	18	37	28
	300	51	29	21	43	32
	400	59	33	25	47	35
B	200	57	26	24	41	31
	300	70	32	29	47	35
	400	81	35	34	51	38

Q_{Ek} = 200 W
$w_{ok} / \Delta p_w$ = 120 / 5 [kg/h] / [kPa]
$w_{oh} / \Delta p_w$ = 120 / 3 [kg/h] / [kPa]

Size 1000

Noz z	Δp [Pa]	V_P [m^3/h]	L_{A18} [dB(A)]	$Q_P/\Delta t_P$ [W/K]	$Q_k/\Delta t$ [W/K]	$Q_h/\Delta t$ [W/K]
Y	200	34	24	14	40	30
	300	42	29	18	47	35
	400	48	33	20	52	39
A	200	50	26	21	46	35
	300	61	31	25	53	40
	400	70	35	29	58	43
B	200	69	29	29	51	38
	300	84	34	35	58	44
	400	97	38	40	63	47

Q_{Ek} = 250 W
$w_{ok} / \Delta p_w$ = 150 / 10 [kg/h] / [kPa]
$w_{oh} / \Delta p_w$ = 150 / 6 [kg/h] / [kPa]

Size 1250

Noz z	Δp [Pa]	V_P [m^3/h]	L_{A18} [dB(A)]	$Q_P/\Delta t_P$ [W/K]	$Q_k/\Delta t$ [W/K]	$Q_h/\Delta t$ [W/K]
Y	200	46	27	19	51	38
	300	56	32	23	59	44
	400	64	35	27	64	48
A	200	66	29	28	57	43
	300	81	34	34	66	50
	400	94	38	39	73	54
B	200	91	33	38	64	48
	300	112	38	47	73	55
	400	129	42	54	79	59

Q_{Ek} = 310 W
$w_{ok} / \Delta p_w$ = 170 / 16 [kg/h] / [kPa]
$w_{oh} / \Delta p_W$ = 170 / 9 [kg/h] / [kPa]

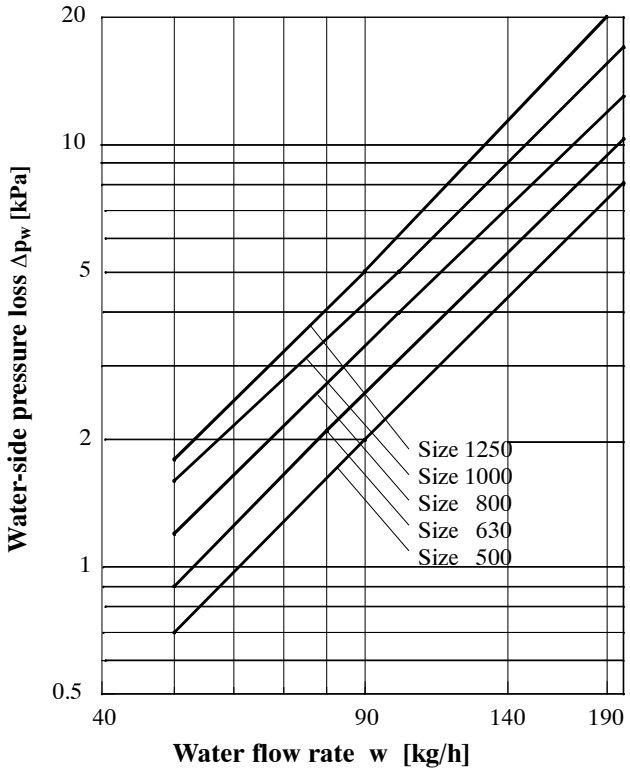
Legend

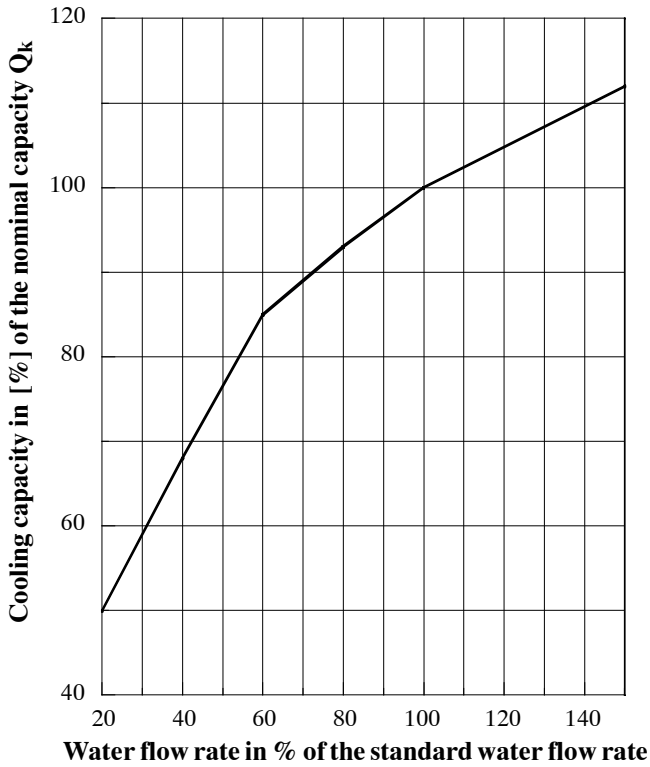
- Δp - static pressure at the primary air socket
- V_P - primary air flow rate (±10 %)
- L_{wA} - sound power level at 18 m^2 Sabine
- Q_P - cool. capacity of primary air (fresh air) (±5 %) (therm. room load µT = 0.8)
- Q_k - cool. capacity, secondary (heat exch.) (±5 %)
- Q_h - heating capacity, secondary (±5 %)
- Q_{Ek} - heating capacity with natural conv. Δt = 50 K
- w_{ok} - standard water flow rate at cooling capacity
- w_{oh} - standard water flow rate at heating capacity
- Δt - temparature difference between induction air temperature before entering the heat exchanger and water supply
- Δt_P - temperature difference between room air and primary air

Secondary outputs are based on the following:
- units with stand. flow rates (for corr. ref. to next pages)
- units without secondary air filter (with filter x 0.9).

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

4-pipe-unit

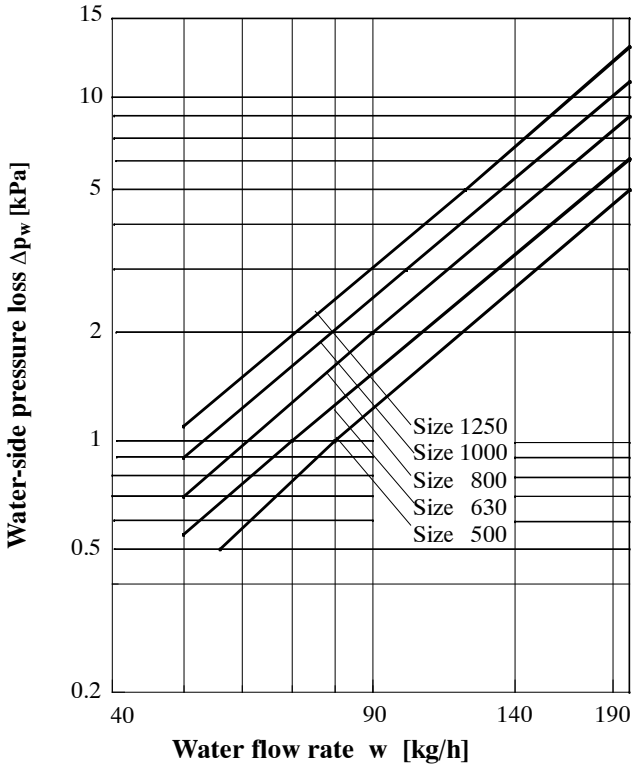




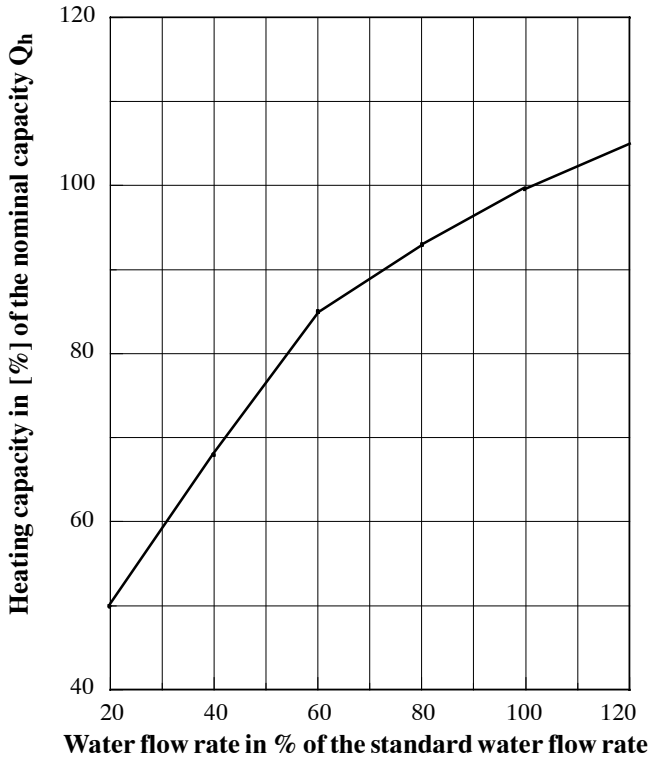
Note:
The minimum water flow rate must not be lower than 20% of the standard flow rate for cooling, considering the water-side pressure compensation.

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

4-pipe-unit



Note:
The minimum water flow rate must not be lower than 40% of the standard flow rate for heating, considering the water-side pressure compensation.



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%.

3.5 Weight

Weights (without packaging) in kg (approx.)

Unit type	Size 500	Size 630	Size 800	Size 1000	Size 1250
QHG with bypass	17	21	25	30	36
QHG with bypass	15	19	22	27	33

4. Installation

Units are installed using the two support brackets on the unit's top and two bolts.

4.1 Notes

Delivery of the units

If not otherwise required, units are delivered in wrap boxes which may be used for protection during installation. Boxes must be stored in an upright position (see arrow on box). The packaging is disposable and is not to be returned to LTG Aktiengesellschaft.

When to install

Installation should not be performed unless the prefabricated floor, the window sills, the intermediate ceiling, and any other dust producing work has been completed.

How to handle the units

Handle the units with care during transport and installation. Avoid dropping to the floor. Do not manually manipulate the damper-controlled units' kinematics. Do not remove the air motor piston rod manually. Operate the actuators with compressed air or voltage only (exception LM 24 with coupling, lateral black button). In case of nonobservance, LTG Aktiengesellschaft will not take responsibility for any damages to the motors. **Never** detach or readjust the damper levers since the kinematics is factory-set.

Unit description

The unit and its packaging are labelled (see example).
Special versions are provided with additional descriptions.

5510000 QHG-4 800 BB/DD 9/31 IV

Read as follows:

5510000	LTG Order No. (please state with any communication)
HFL	Unit type
800	Model size = length of heat exchanger
BB/DD	Nozzle size or nozzle combination
9/31	Number of nozzles: 9 x nozzle BB, 31 x nozzle DD
IV	Position of drive and of water and air connection

Position of drive and of water and air connection (R: right, L: left)

Arrangement	Water connection	Primary air connection	Damper actuator
I	R	R	L
II	L	L	R
III	R	L	L
IV	L	R	R
V	R	R	R
VI	L	L	L
VII	R	L	R
VIII	L	R	L
U	U in connection with the arrangement means air connection from below.		

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).

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.
3. fitting with special LTG olive and union nut to connect flexible hoses or copper tubes.

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.

Included in the unit price and also in general provided with the unit - (unless special fittings such as transitions, straight-way or angle valves or hose connections are ordered) is a complete compression fitting for unit-side water connection, appropriate to take copper pipes with a 12 mm outer diameter, wall thickness of 0.7 - 1.0 mm, suitable for connecting hoses. The union nut is fixed to the heat exchanger pipe's flared end, while olive and banjo bolt will be delivered in packs of 2 or 4 - according to type of unit - in a bag attached to 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:

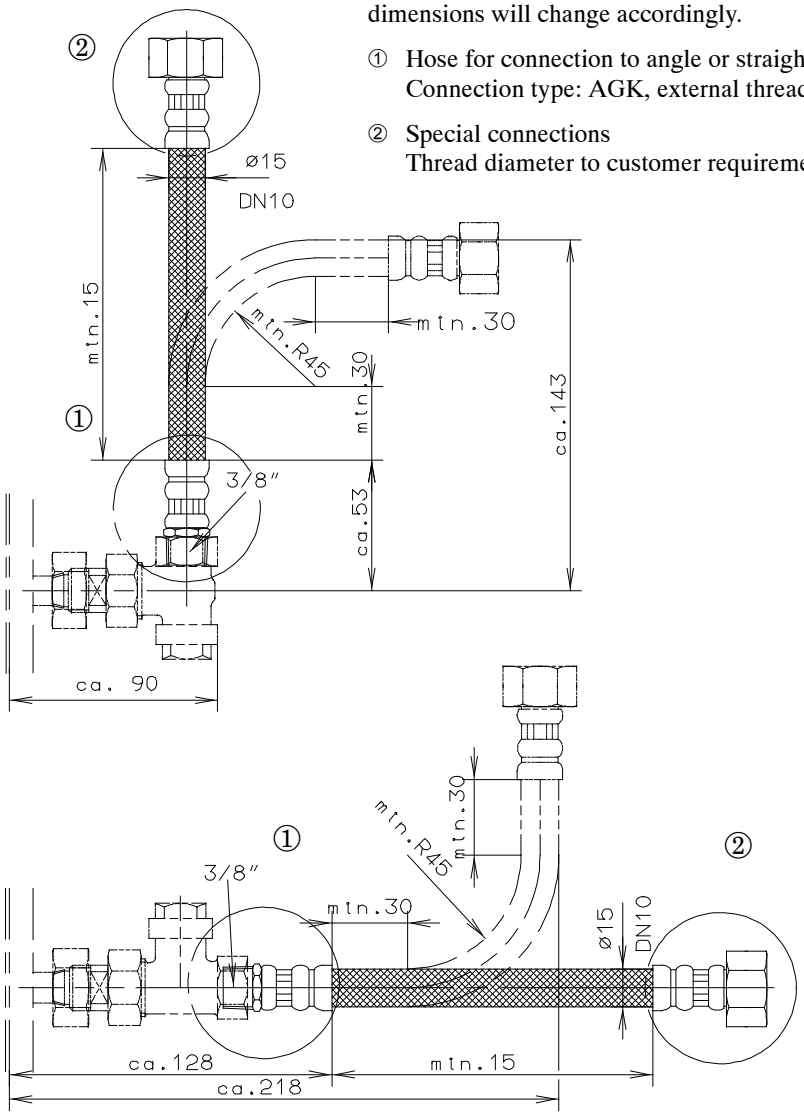
  unit's front side: water supply
  unit's back side: water return

Examples for water connections using angle or straight-way valves and flexible hoses

Please observe the hose manufacturer's instructions !
Hose without insulation. For insulated hoses, dimensions will change accordingly.

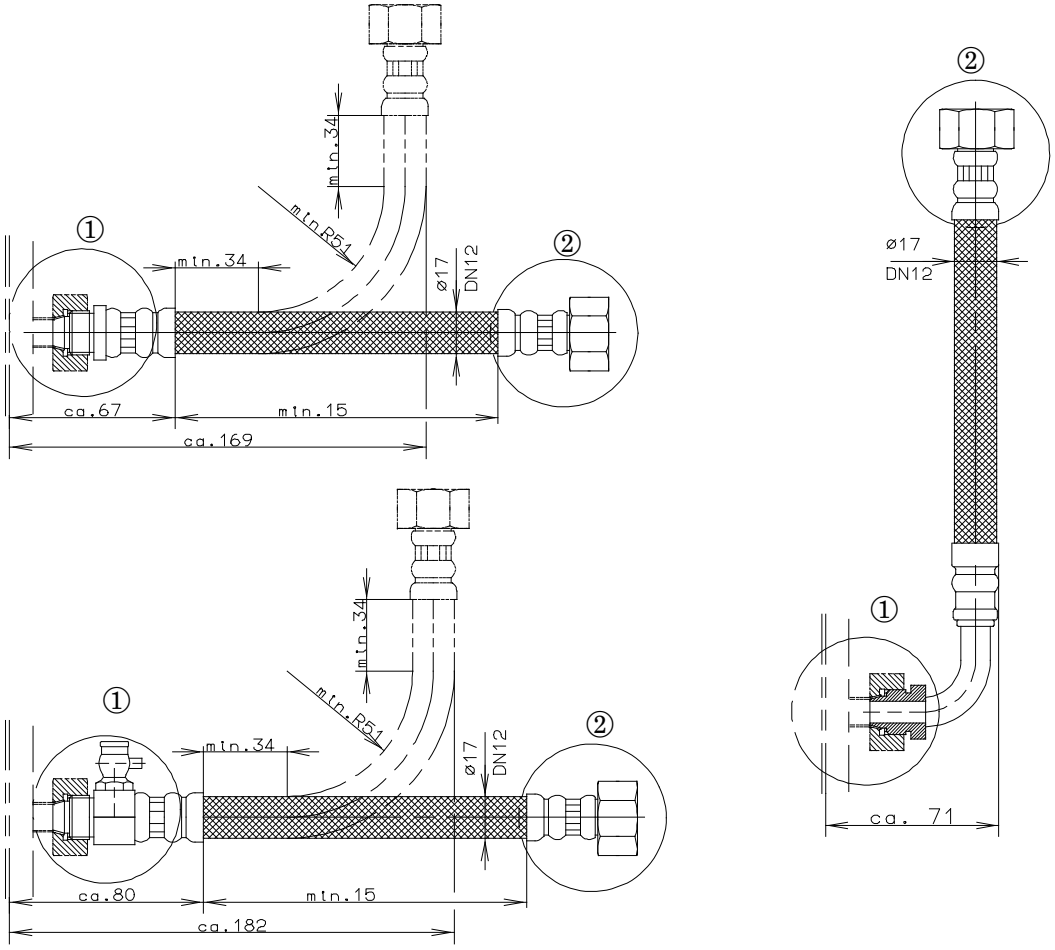
① Hose for connection to angle or straight-way valve
Connection type: AGK, external thread, tapered 3/8"

② Special connections
Thread diameter to customer requirement (or standard 3/8")



Examples for water connections using flexible hoses

(Special olive with external thread for LTG heat exchangers)



Please observe the hose manufacturer's instructions !
Hose without insulation. For insulated hoses, dimensions will change accordingly.

① Hose for connection to LTG heat exchangers (M18 x 1.5 - 15° olive)
Connection types: AGSK
AGSKEB + Eh
RBSK

② Special connections
Thread diameter to customer requirements (or standard 3/8")

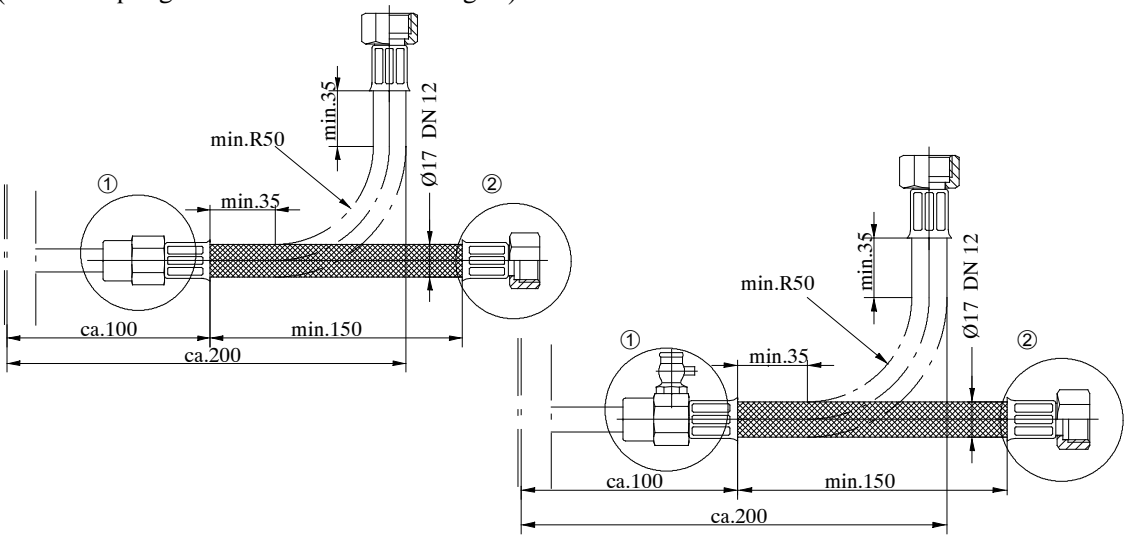
The water connection side is to be specified when ordering the unit. Some units offer a possibility to still change the side during installation by removing 4 bolts.

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)

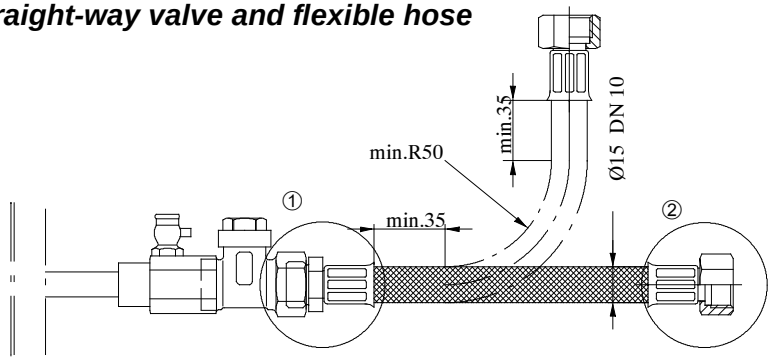


Hose without insulation. For insulated hoses, dimensions will change accordingly (10 mm Armaflex insulation).

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

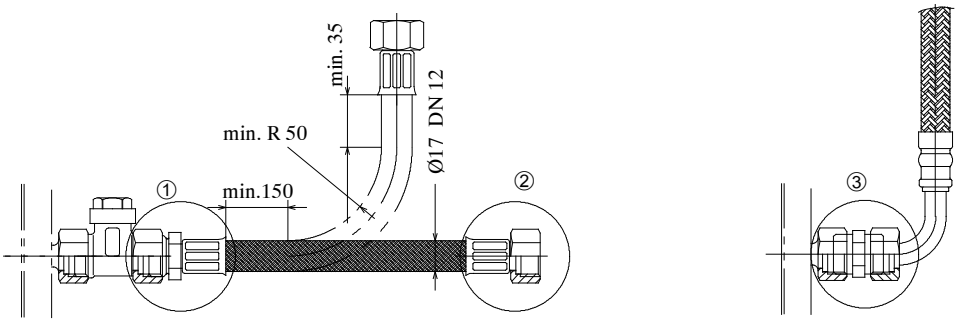


Hose without insulation. For insulated hoses, dimensions will change accordingly.

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)



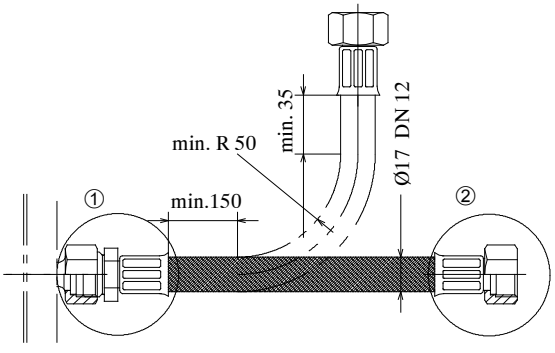
Hose without insulation. For insulated hoses, dimensions will change accordingly.
(10 mm Armaflex insulation

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



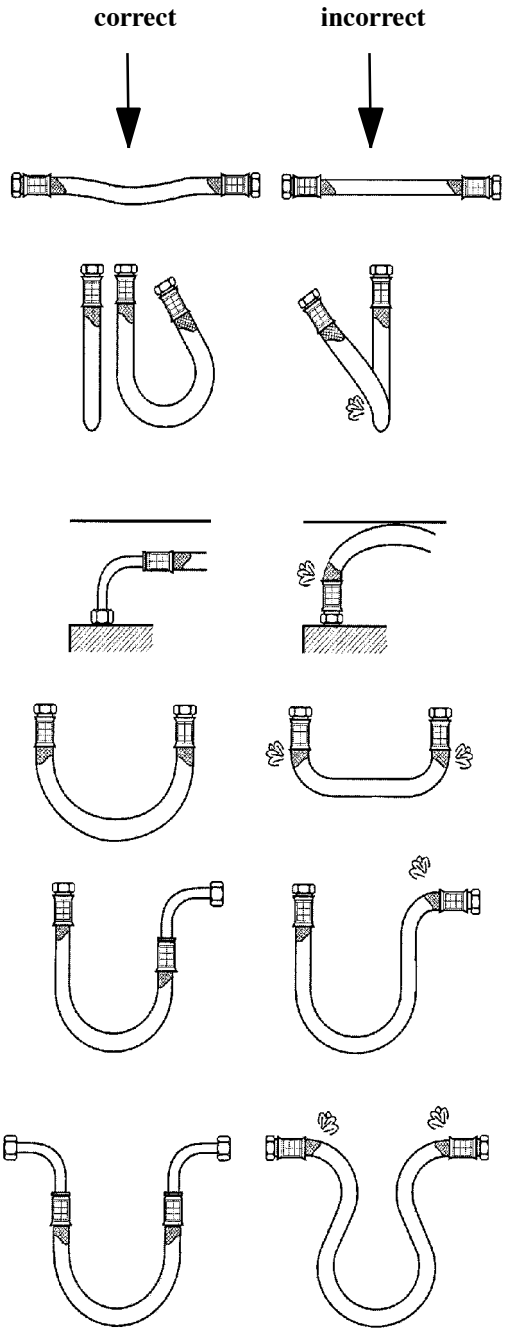
Hose without insulation. For insulated hoses, dimensions will change accordingly.

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

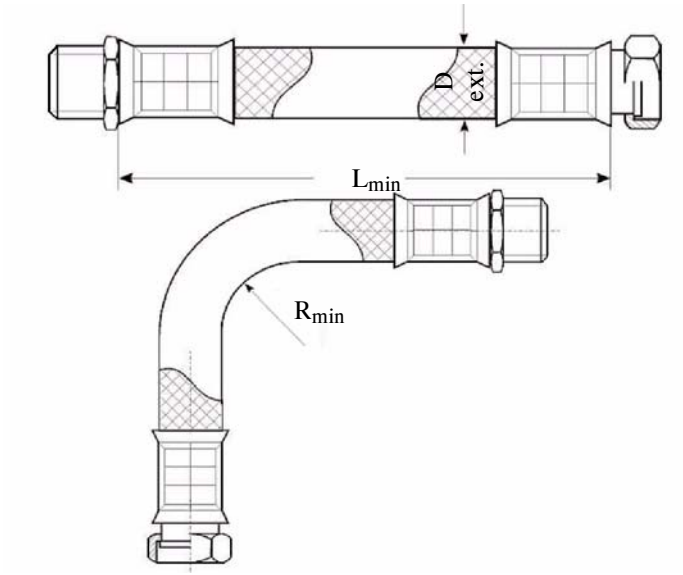
② Different hose connections, thread diameter acc. to customer requirements or standard 1/2”

4.2.1 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)

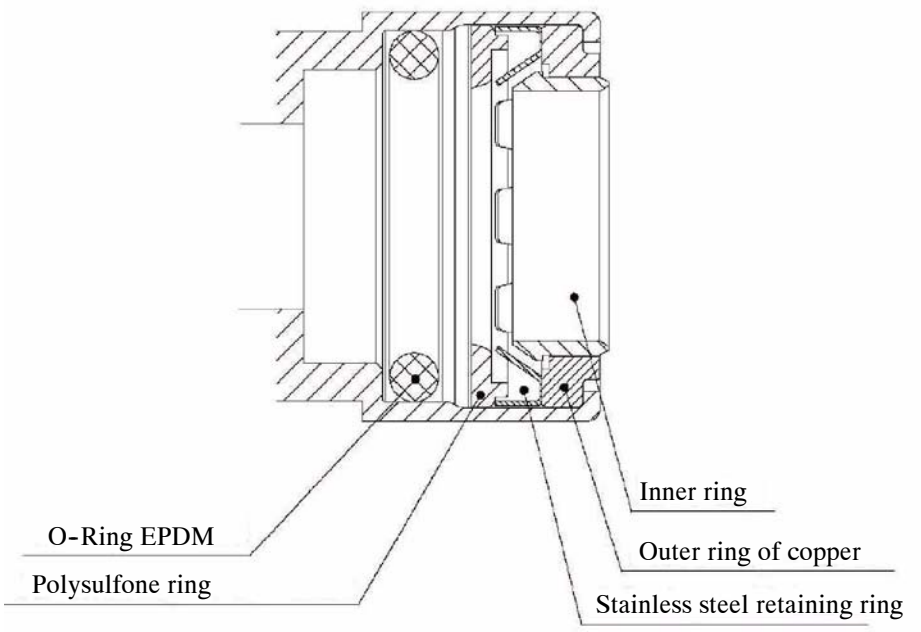
ND hose	D_A	PN [bar]	R_{min}	L_{min}	L_{min} α = 90°	L_{min} α = 180°	L_{min} α = 360°
06/08	12	15	27	60	140	180	260
10	14	15	40	60	190	250	260
12	18	15	60	80	260	360	550
15	22	12	70	95	300	420	640
19	27	10	80	100	350	480	730
25	34	10	100	125	430	590	900
32	44	10	160	140	650	900	1400
40	54	6	180	160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

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 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).

If specifically required, air connection may also be provided on the bottom side.

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).

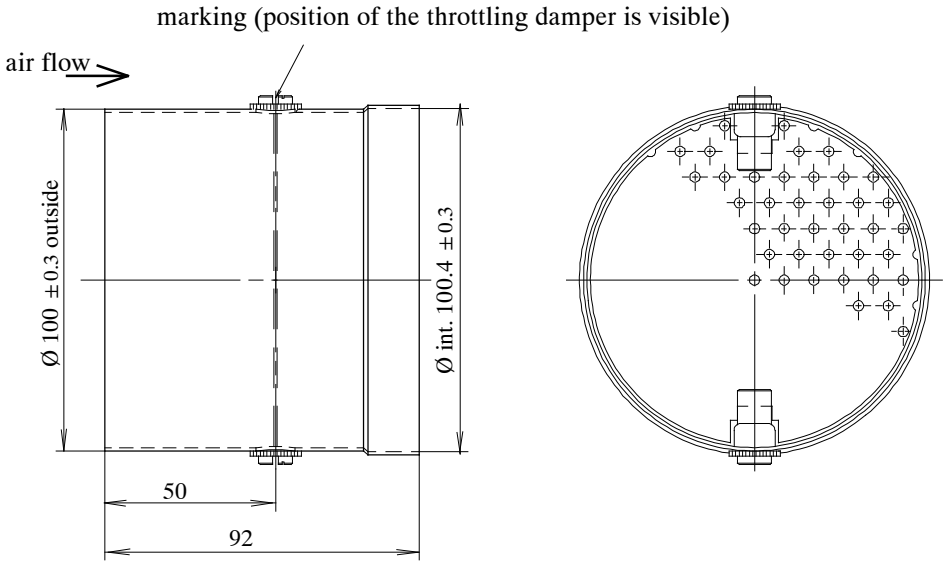
Throttling Damper for Primary Air - Type KLX / Type KLI

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).

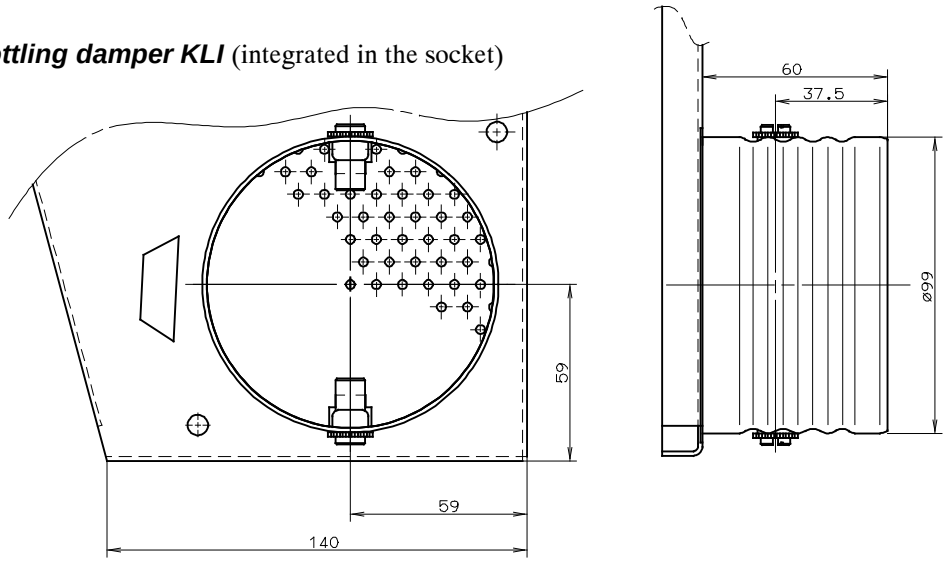
The dimensions of the throttling damper are given below. The free area is 10.7 %.

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.

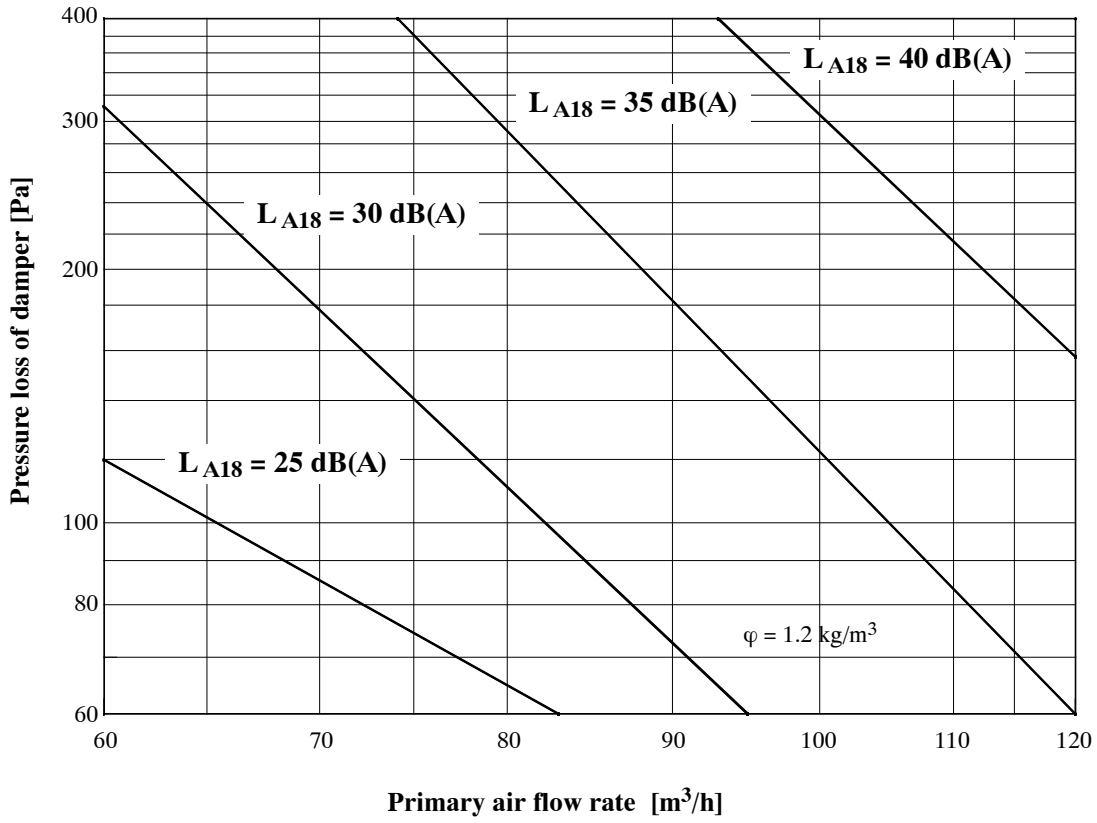
Throttling damper KLX (for subsequent duct installation)



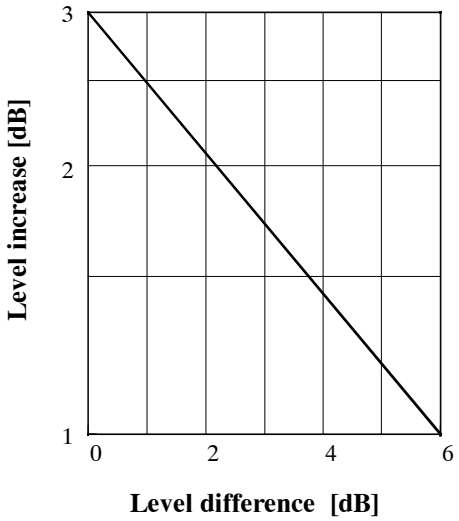
Throttling damper KLI (integrated in the socket)



Generated sound level of damper (room absorption: 18 m² Sabins)



Level totalling



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

4.4 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.

4.5 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 Two-pipe and Four-pipe System

Here a few explanations regarding **two-pipe systems** and **four-pipe systems** for easier understanding:

The **two-pipe system** has 2 water connections (supply and return) with one heat exchanger for either heating or cooling, or for heating in winter and cooling in summer.

The **four-pipe system** has 4 water connections (2 each for supply and return, one each for warm water and cold water) with 2 heat exchangers or one heat exchanger with separate water circuits, for heating and cooling.

6.4 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.

6.5 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.

6.6 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.

6.7 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.

6.8 Troubleshooting and Corrective Action

6.8.1 Room Temperature is not achieved

Trouble	Source	Action
No air movement at the unit's outlet grille	No primary air supply	Activate primary air supply unit, check fire protection flaps and, if necessary, open. It is imperative to investigate, find, and remedy the cause for the flaps closing. In case of shut-off flaps for entire floors and duct runs, check and, if necessary, open. Check control.
In case of a pneumatic control, no pressure (manometer reading, no fizzing noise when operating pressure connection is removed, in case of an electrical control, no voltage on the output terminals)	Control system lacks auxiliary energy	Pneumatic valve open, switch on, put compressed-air unit into operation, remove trouble if any
No damper actuator push rod and damper lever movement 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, maybe the actuator can thus be released. If unsuccessful, remove valve, clean or replace, check damper and damper bars, remove stuck items, clean, and ensure easy movement of joints and bearings.
Actuator motor remains in the end position with retracted push rod, independent of the temperature setting, however with the controller otherwise operating properly	Defect of the pneumatic or electrical servomotor	Replace servomotor Remove membrane
Unit is heating or cooling, but set temperature is not achieved	Window is open	Close window
No air movement, poor air movement or only perceivable in parts of the diffuser grille	Suction opening or diffuser opening blocked or serverely impeded	Remove objects from diffuser grille and protective grille. Observe a minimum distance of 10 cm in front of the induction unit casing (massive furniture to floor level, boxes etc.)

Trouble	Source	Action
Water supply lines to the unit and heat exchanger are at room temperature	No cold or hot water supply	Ensure cold and hot water supply, eliminate cold or hot water-related problems, open shut-off valves to supply
No control signal is applied to the (valve or damper) actuator, or it is not the one according to setting (Actuator performs wrong or no movement.) Refer to separate instructions for control.	Deficient control	Have unit checked by a specialized technician replacing or repairing broken parts
Only poor air movement perceivable on the induction unit diffuser	Filter or heat exchanger polluted	Replace filter, clean heat exchanger
	Primary air nozzles polluted and, thus, partly blocked	Replace nozzles* or clean, if possible (dust deposits are usually hard to remove which makes replacement, in general, more economical than cleaning). This may be performed through the unit neck without need to remove the induction unit by simply lifting the diffuser grille and the protective grille located underneath. It is imperative to check the filter in the primary air center. Check for existance of a 2-step filtering with the 2nd step meeting at least EU 7, better EU 8 requirements according to DIN 24185, Part 2.

* Order replacement nozzles with LTG Aktiengesellschaft stating the 7-digit LTG order number, unit type, and nozzle assembly.
These data may be taken from the oblong type plate.
Please contact LTG Aktiengesellschaft to first check since replacing older nozzles for new ones may not always be possible without certain restrictions.

6.8.2 Condensate formation

LTG induction units are **not** designed for operation with continuous condensate formation.
For a short-term condensate formation, units are provided with a condensate tray underneath the cooler which may also be connected to a drainage system. In case this condensate tray is not connected to a drainage system it may serve for short-term collection of condensate which will again evaporate from the tray. LTG Aktiengesellschaft does not recommend units without condensate drainage system unless either the windows cannot be opened or, in case the windows can be opened, all induction units of the corresponding room are automatically water-side disconnected. If there is no such device, users must reliably disconnect the induction units water-side whenever windows are opened and if cooling is required since the condensate trays would overflow when the unit is operated with a long-term condensate formation resulting in considerable damages to the building and equipment.

If, during operation, condensate is overflowing close open windows without delay. If all windows were already closed units must be disconnected. Immediately catch any overflown water and remove to minimize potential damages to building and equipment.

Then investigate and remedy the cause of such excessive condensate formation.

Trouble	Source	Action
Increased indoor humidity, increased condensate formation	Window open	Close window, continue unit operation
No air movement at the induction unit outlets	Primary air unit failure	Switch unit back on and remove trouble, if any (see specific instructions)
Diffused air temperature at the induction unit diffuser outlets is extraordinarily high, in the primary air center no or too little water precipitation on the cooler	No or too little cooling of the primary air unit, therefore no or too little dehumidification	Check cooling system, remove trouble if any, check shut-off valves and dirt trap in the cold water ducts; if necessary, open valves and clean dirt traps; check control including valves and actuators; if necessary readjust parameter settings; repair/replace broken parts
Increased indoor air humidity perceivable	Considerable moisture sources in the room	Remove moisture sources If impossible, temporarily shut off unit water-side
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
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

6.9 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.

Qty.	Ident-No.	Description	Minimum order quantity
		Control Units	
1	737794	Servomotor MOLG 15/2 short push rod SMA 1 EBM 160 abt. 40 mm	1
1	737786	Servomotor MOLG 14/2 long push rod SMA 2 EBM 278 abt. 200 mm	1
1	496720	PVC fitting/annular piece for SMA	20
1	204123	Pin 4 mm diameter	20
1	533936	Clamping ring 4 mm diameter	20
1	533944	Clamping ring 4 mm diameter	20
1		Elektrical drive Belimo / Siemens on request	1
		Base unit	
1	20280	Velcro 8 x 10 No. 151 - autoadhesive roll about 100 m	10
1	489775	Heat exchanger (6-tube), size 500, for QHG-2	1
1	489783	Heat exchanger (6-tube), size 630, for QHG-2	1
1	489791	Heat exchanger (6-tube), size 800, for QHG-2	1
1	489808	Heat exchanger (6-tube), size 1000, for QHG-2	1
1	489816	Heat exchanger (6-tube), size 1250, for QHG-2	1
1		Heat exchanger QHG-4, size 500	1
1		Heat exchanger QHG-4, size 630	1
1		Heat exchanger QHG-4, size 800	1
1		Heat exchanger QHG-4, size 1000	1
1		Heat exchanger QHG-4, size 1250	1
1	116906	Drain tray, galvanized, without drainage, size 500	10
1	116914	Drain tray, galvanized, without drainage, size 630	10
1	440066	Drain tray, galvanized, without drainage, size 800	10
1	500878	Drain tray, galvanized, without drainage, size 1000	10
1	531170	Drain tray, galvanized, without drainage, size 1250	10
1		Drain tray with drainage, lateral or bottom, size 500 - 1250	
1	489064	Plug for condensate receiver, accessorie: sealing strip	20
1	484501	Protective grille for size 1250	10
1	912502	Injection nozzles, plastic, black	20
1	912495	Injection nozzles, plastic, grey	20
1	912487	Injection nozzles, plastic, green	20
1	487365	Throttling damper KLXG 100/1	5

For heat exchangers please state connection (3/8", 1/2", smooth copper tube)

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.