Precision Cooling for
Business-Critical Continuity

Liebert HPM “Digital”

13-85 kW Indoor Room Cooling Units with Modulating Capacity

A/W/F/D/H Versions

PRODUCT DOCUMENTATION

Liebert HPM Digital – PD – 273560 – 01.02.2011

Liebert®

EMERSON
Network Power

Introduction

Liebert HPM

Liebert HPM is the new serie of air conditioners developed by **Emerson Network Power** to allow maximum flexibility of application in technological environments, from data processing centers to manned control rooms and electronic centers for telecommunication. This series includes units with a rated cooling capacity ranging from 13 to 85 kW.

Complete environmental control and reliability are paramount to ensure faultless operation of computer rooms, telecom installations, data centres and technical applications. **Emerson Network Power** products have traditionally set the industry standards. But today's world requires more than just environmental control and reliability; it requires increasingly higher levels of overall performances. While still offering unmatched environmental control and reliability, the new Liebert HPM range raises the bar of performance in Precision Air Conditioning setting new standards in terms of Energy Efficiency, Compactness and Sound emissions.

The new Liebert HPM range is available in a number of airflow versions: with upflow, downflow and displacement airflow patterns across a full range of cooling modes: direct expansion, chilled water, freecooling, dual fluid and constant (for an ultra high temperature and humidity control and air filtration).

UNDER

OVER

Contents

The Quality Management System of Emerson Network Power S.r.l. High Performance Air Conditioning has been approved by Lloyd's Register Quality Assurance to the standard ISO 9001:2008

The product conforms to European Union directives 2006/42/EC; 2004/108/EC; 2006/95/EC; 97/23/EC.
Units are supplied complete with a Test Certificate Conformity Declaration and Component List.

Liebert HPM units are CE marked as they comply with the European directives concerning mechanical, electrical, electromagnetic and pressure equipment safety.

1 Features and Benefit

The new Liebert HPM

The EC fan technology with generously dimensioned heat exchanger, scroll compressors and optimised cooling circuits, maximise efficiency by operating at low levels of energy consumption. We underline the complete range with all models in Displacement version and in Constant configuration.

The down—flow version achieves the highest levels of efficiency (EER is 20% better than industry average). The fan in this case is positioned upstream of the evaporator optimising airflow over the coil. Also in the Under versions, silencer cartridges can be used to further reduce the sound pressure level by up to a 5 dBA.

The new HPM Digital range equipped with “Digital” Scroll compressor and the electric expansion valve drive through a precise watching between load and cooling capacity.

The new Liebert HPM has been designed to have the smallest possible overall footprint. The compactness of the unit is fully evident for some capacities. For instance:

- in the D2E, where 23 kW in direct expansion mode have been reached with footprint of 750 x 750 mm;
- in the D3A, where 29 kW have been reached with footprint of 1000 x 850 mm
- in the D5D and D7L, where in the 1750 x 850 mm footprint we have upflow and downflow configurations for air and water cooled units.
- in the D8F, where in the 2550 x 890 mm footprint we have downflow configurations for air and water cooled units.

Low sound levels are the result of fan design, optimised airflows and doubled skin insulated panels.

Attention to design detail means low operational costs including product maintenance through high levels of reliability and a service friendly design. As an example, all the crucial parts of the refrigeration circuit (i.e.: thermostatic valves, sight glasses and liquid line driers) are grouped together and accessible simply by opening the front door.

Energy Efficiency

EC Fan (Plug—in Electronically Commutated Fan)

Liebert HPM units are supplied with an exclusive fan type, this enables you to greatly increase the unit’s efficiency and therefore significantly reduce operating costs.

EC fans [Electronically Commutated DC motors] have the added advantage of higher fan shaft motor efficiency: from 45% of 1— phase motors, to 65% of 3—phase motors and to 85—90% of EC fans.

Additional benefits are that, on start up, the Liebert HPM peak inrush current is lower than the operating current. This means the EC fan option features a true **soft start**. Also compared to AC fan supplied by the frequency converter, the advantages are evident and the input power is clearly inferior: from 13 to 38% as a function of the working point.

The internal electronics of the EC fan are integrated into Emerson Network Power’ controls.

The EC fan design allows a new approach in regulating environmental parameters within HPAC applications. To name a few:

- constant air volume
- constant external static pressure
- sound emission optimisation
- power input optimisation
- cooling capacity regulation (on request)

This enables each system to be optimized for the installation.

These features are available from standard Liebert HPM units supplied with the EC fan option and we can summarized that with two words: versatility and efficiency.

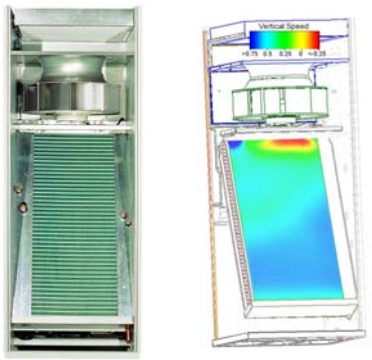
Features and Benefit

Heat Exchanger Section: Net Sensible Capacity matters

Efficiency is a fundamental requirement in all applications today. Even more so for technological applications where the operational costs are by far the most significant consideration. Sensible Heat Ratio (SHR) values of greater than 0.90 are required to reduce to a minimum the energy spent controlling humidity during normal operating conditions.

Heat exchanger design and a correct air distribution within the unit are two of the most important factors required to achieve optimum performance.

Liebert HPM units feature a very high coil heat exchanger surface respect the exchanged power. Using the index [frontal Surface x Rows / refrigeration Power] values of over 100 mm2/W are obtained.



Study of the components of the vector velocity through the coil: vertical speed

Sophisticated design and development tools, such as Particle Image Velocimetry and Computational Fluid Dynamics are used by Emerson Network Power to identify the best components layout in order to achieve an even and pressure–equalised airflow distribution within the unit which optimises the entire coil surface area in the heat exchanging process.

Easy maintenance

All components are easly accessible from the front of the room unit. The service compartment facilitates checking and setting of refrigeration circuit, without changing aeraulic conditions.
The access to the compressor is possible even when the unit is operating by removing the front panel. The access to the fan is executed with the greatest care for easier interventions (maintenance and/or fan replacement).

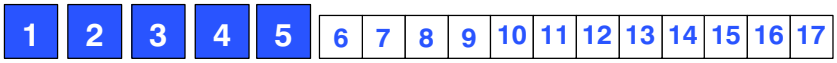
One very important feature, for example, is the possibility to check the total pressure drop of the high pressure piping using the schrader connections available in the front part of the machine(see below).

Liebert HPM front view

2 Model Configuration

Digit Nomenclature

The unit is fully defined by seventeen digits.



D 1E U A

Digit 1

Family
D Digital

Digit 2 and 3

Size: Cooling Capacity
‘kW” (approx.) tenths of kilowatt

Digit 4

Air distribution
U Downflow
O Upflow
D Displacement

Digit 5

Version
A Air Cooled
W Water Cooled
F Freecooling
D Dualfluid Air Cooled
H Dualfluid Water Cooled

Digit 6 – Fan
1 EC fan

Digit 7 – Main Power Supply
0 400 V/3 Ph/50 Hz

Digit 8 – Electric heating
0 None
1 Electric heating

Digit 9 – Humidification
0 None
V Electrode humidifier

Digit 10 – Microprocessor Control
2 ICOM & Inner Display with Temperature Control
3 ICOM & Inner Display with Temperature and Humidity Control
A ICOM & Coldfire Display Small with Temperature Control
B ICOM & Coldfire Display Small with Temperature and Humidity Control
C ICOM & Coldfire Display Large with Temperature Control
D ICOM & Coldfire Display Large with Temperature and Humidity Control

Digit 11 – Reheating System
0 None
G Hot gas coil
W Hot water coil

Digit 12 – Air Filter Efficiency
0 G4
1 F5
2 G4; with Clogged Filter Pressure Switch
3 F5; with Clogged Filter Pressure Switch

Digit 13 – Expansion valve
1 R410A (TXV)
3 R410A (EEV)

Digit 14 – Paint
0 RAL 7035 Colour
1 CHARCOAL GREY Colour
2 BLACK Emerson 7021 Colour

Digit 15 – On board MCB, for Remote Air Condenser
0 No MCB
1 MCB 6 A single circuit condenser
2 MCB 10 A single circuit condenser

Digit 16 – Packing
P PLP and Pallet
C Cardboard and Wooden Crate
S Seaworthy

Digit 17 – Special Requirements
0 Standard Emerson Network Power
X Special Emerson Network Power

Model Configuration

Digital range (D as first digit)

Liebert HPM Dxxxx "Digital" is the new series of air conditioners developed by Emerson Network Power which are powered by the innovative Copeland's Digital Scroll.
This series includes units with a rated cooling capacity ranging from 13 to 85 kW.

Thanks to Digital scroll and electronic expansion valve, Liebert HPM Digital can achieve a continuous spectrum of capacity output, ensuring a very tight and precise control on room temperature.

Liebert HPM Digital can rapidly change from one capacity duty to another. Therefore it controls environmental parameters even working with swiftly changing heat loads. The modulating capacity range is between 30 and 100% of the nominal capacity: even if the compressor could go down to 10%, the system control limits the capacity at the 30% to avoid decrease in efficiency.

Thanks to the capacity modulation we can reduce the starting and stopping the compressor which uses a lot of power and puts a great amount of stress on the components; therefore we can enhance efficiency and life of the system.

With the HPM Digital range we are able to manage unexpected very high ambient temperatures, maintaining the system active, reducing HP alarm and troublesome stops of the unit. Infact, when the discharge pressure reaches the limit value, the compressor capacity is limited to a fraction of the actual request, in this way restricting the heat rejection and allowing the system running without interruptions. If, after a defined time, the condensing pressure comes back within the limit, the capacity will be modulated in the usual way.

Reliability of the Liebert HPM D is also maximized, thanks to the fewer system parts and simple electronic controls which reduces as well unit maintenance.
Digital Scroll motor runs at a constant speed throughout the operating range.
This unique feature increases the applicability of the Liebert HPM units into technological rooms, as it eliminates the need for expensive electromagnetic suppression electronics required to ensure electromagnetic compatibility.

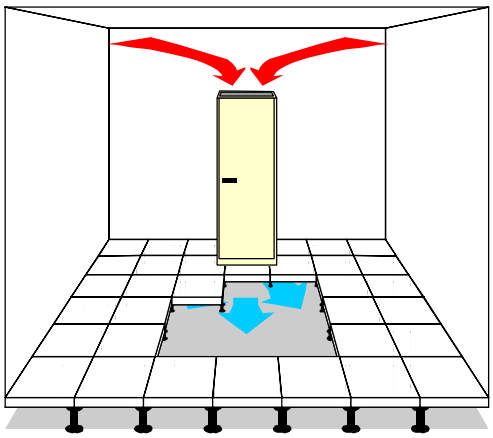
The Digital function maintains the maximum refrigerant velocity through the pipes. As a result of these reasons, Liebert HPM units do not need oil return components.

Model Configuration

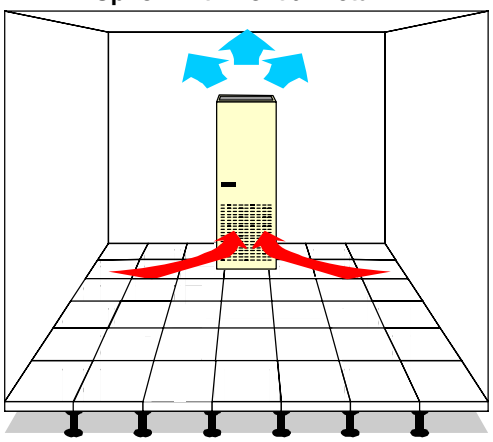
Air Distribution (4° Digit)

All units are available in the four configurations shown below.

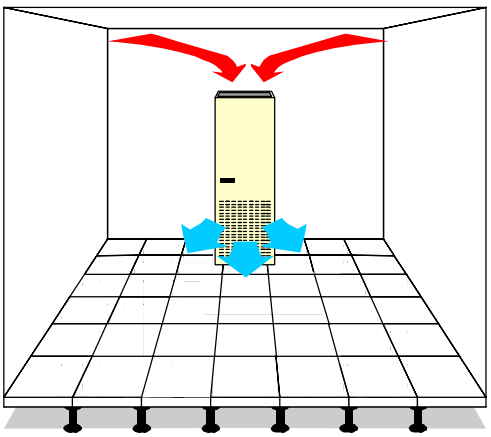
U / UNDER
Downflow



O / OVER
Upflow with front air return



D / DISPLACEMENT
Frontal air discharge at floor level



see page 2–12

Versions (5° Digit)

Version A

Direct expansion units with air–cooled condenser

Refrigeration circuit

The compressor (1) pumps the hot gaseous refrigerant into an outdoor air–cooled condenser (2). The liquefied refrigerant arrives to a liquid receiver (3) that ensures a constant and even refrigerant flow to the thermostatic expansion valve (4) and then arrives to the evaporator (5). Here the refrigerant, thanks to the heat – exchanged with the room air moved by the fan (6) – evaporates and returns to the compressor (1); from this, the refrigerant begins a new refrigeration cycle. To maintain the correct refrigerant discharge pressure, the speed of the motor fan (8) is controlled (on–off or proportional mode).

Shut–off valves are provided as standard to assist with routine maintenance.
The compressor (1) has a built–in non–return valve to avoid return of liquid refrigerant from the condenser in summertime, thus protecting the compressor from undesired refrigerant slugging during the start up. A second non–return valve (7) is recommended to avoid – in wintertime – refrigerant migration from the liquid pipes and the receiver (3) to the condenser (2), that should be responsible of low pressure intervention at the start–up of compressor.

For safety reason, a relief valve (9) is installed on the liquid receiver (3); this valve is equipped with flanged connections so that the refrigerant may be discharged to the outside.

External air–cooled condenser (2)

The units may be connected with a wide range of our condensers in standard or low noise version. For technical data and performance, refer to the relevant technical documentation. Chap. 5 gives the recommended matching condenser for Liebert HPM units as a function of outdoor air temperature.

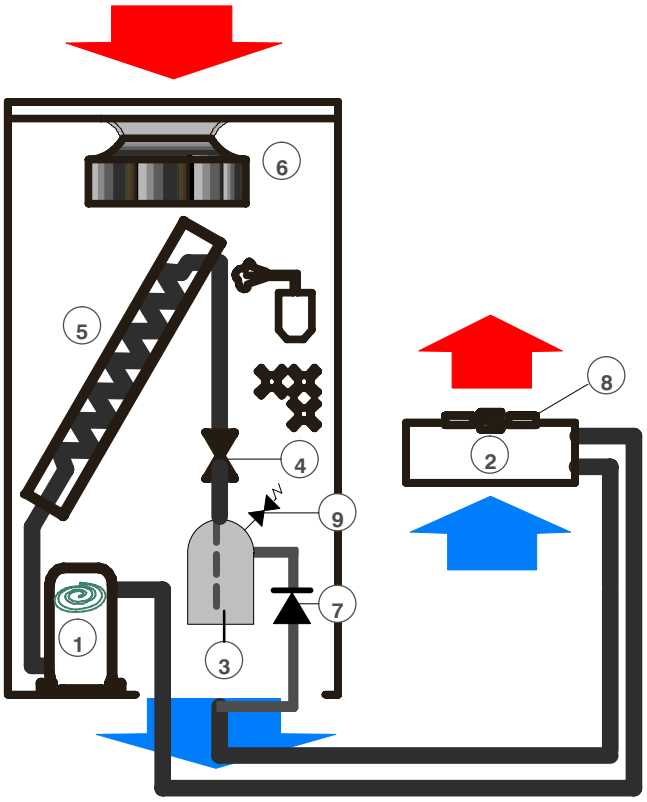
Note 1. *Units and external condensers are supplied separately.*

Note 2. *The room unit refrigeration circuit is pressurised with helium at 3 bar and the condenser refrigeration circuit at 2 bar with dry air.*

Note 3. *The customer is responsible for making connections between the Unit and the external condenser and for charging with refrigerant (standard R410A) and oil, when request.*

Full instructions for these operations are given in the Service Manual.

DxxUA Units



Version W

Direct expansion units with water–cooled condenser

Refrigeration circuit

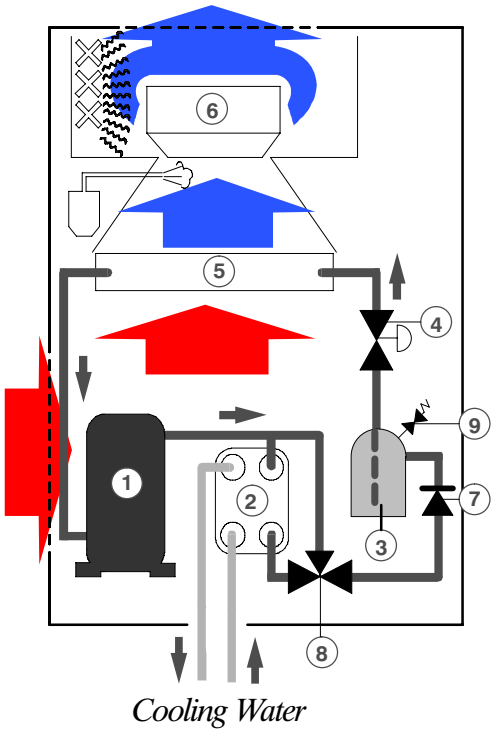
The compressor (1) pumps the hot gaseous refrigerant into a water–cooled condenser (2). The liquefied refrigerant arrives to a liquid receiver (3) that ensures a constant and even refrigerant flow to the thermostatic expansion valve (4) and then arrives to the evaporator (5). Here the refrigerant, thanks to the heat – exchanged with the room air moved by the fan (6) – evaporates and returns to the compressor (1); from this, the refrigerant begins a new refrigeration cycle.
Shut–off valves are provided as standard to assist with routine maintenance.
The compressor (1) has a built–in non–return valve to avoid return of liquid refrigerant from the condenser, thus protecting the compressor from undesirable refrigerant slugging during the start up. A second non–return valve (7) is recommended to avoid refrigerant migration from the liquid pipes and the receiver (3) to the condenser (2), that should be responsible of high pressure intervention at the start–up of compressor.
For safety reason, a relief valve (9) is installed on the liquid receiver (3); this valve is equipped with flanged connections so that the refrigerant may be discharged to the outside.

Water–cooled condenser

These units are provided with one very efficient stainless steel brazed–plate water–cooled condenser (2). The condenser is fitted with an head–pressure regulating valve (8) for the automatic control of condensing pressure.
The units operate with **mains water** or **closed circuit with an external Dry Cooler**. When operating in a closed circuit, to avoid undesired ice formation in wintertime, it is advisable to use water/glycol mixture: refer to Chap. 5 for the percentages to be used at minimum ambient temperatures. Dry Coolers are available as an option; water–glycol mixture and circulation pump(s) are normally supplied by others.
If mains water is used, a mechanical filter must be fitted in the water circuit to protect the plate condenser (2) (for other information see the Service Manual).
To reduce water and energy consumption (pump), it's advisable to adopt a cooling water control valve (by the user), able to stop water feeding when unit is off.
Unit microprocessor control gives a 24V contact (10VA max, please refer to the relevant Wiring Diagram, 58 and G terminals) to drive that valve.

Note. *The water–cooled Liebert HPM versions are filled with the complete charge of the requested refrigerant (standard R410A).*

DxxOW Units



Version F

Freecooler units

Freecooling mode

The Freecooler unit cools the air flow by means of the air refrigerant coil (5) in direct expansion rows [direct expansion mode] or, as an alternative, the air/water coil (5) in freecooling rows [freecooling mode]. Whenever the outdoor temperature is at least 5 degrees below the indoor return temperature, the water flow is cooled by an external Dry Cooler (10) and passes through the coil (5). When the external temperature is higher than ZET (Zero Energy Temperature), the water exchanges heat with the refrigerant in the water−cooled plate condenser (2). When the external temperature is below ZET, the water is cooled as much as to cool the room air directly in the air/water coil (5, freecooling rows).

Refrigeration circuit

The compressor pumps the hot gaseous refrigerant into a water−cooled condenser (2). The liquefied refrigerant arrives to a liquid receiver (3) that ensures a constant and even refrigerant flow to the thermostatic expansion valve (4) and then arrives to the direct expansion rows of the evaporator (5). Here the refrigerant, thanks to the heat − exchanged with the room air moved by the fan (6) − evaporates and returns to the compressor (1); from this, the refrigerant begins a new refrigeration cycle.

Shut−off valves are provided as standard to assist with routine maintenance.

The compressor (1) has a built−in non−return valve to avoid return of liquid refrigerant from the condenser, thus protecting the compressor from undesired refrigerant slugging during the start up. A second non−return valve (7) is recommended to avoid refrigerant migration from the liquid pipes and the receiver (3) to the condenser (2), that should be responsible of high pressure intervention at the start−up of compressor.
For safety reason, a relief valve (9) is installed on the liquid receiver (3); this valve is equipped with flanged connections so that the refrigerant may be discharged to the outside.

Note. *The Liebert HPM Freecoolers are filled with the complete charge of the requested refrigerant (standard R410A).*

Water−cooled condenser

These units are provided with one very efficient stainless steel brazed−plate water−cooled condenser (2). The condenser is fitted with an head−pressure regulating valve (8) for the automatic control of condensing pressure.
To reduce water and energy consumption (pump), it's advisable to adopt a cooling water control valve (by the user), able to stop water feeding when unit is off.
Unit microprocessor control gives a 24V contact (10VA max, please refer to the relevant Wiring Diagram, 58 and G terminals) to drive that valve.

Water/glycol circuit

The units operate with **water in closed circuit with an external Dry Cooler** (10), cooled by the outside ambient air. To avoid undesired ice formation in wintertime, it is advisable to use water/glycol mixture: refer to the Service Manual for the percentages to be used at minimum ambient temperatures. The circulation of the water−glycol mixture is forced (the pump (11) and the water−glycol mixture are not supplied).

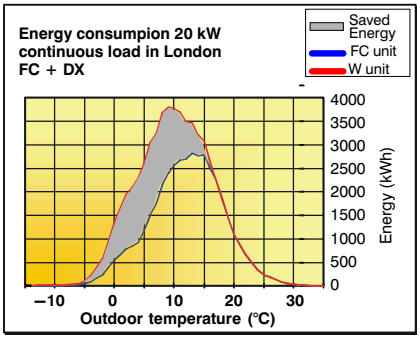
The unit is provided with 2−way modulating valve (12) to control the glycoled−water flow passing through the water/glycol coil. A solenoid valve (13) allows the water flow to the condenser.
The opening or closing signals, generated by the electronic controller, manage the valve actuator movement in order to maintain the desiderd conditions in the conditioned room.

Model Configuration

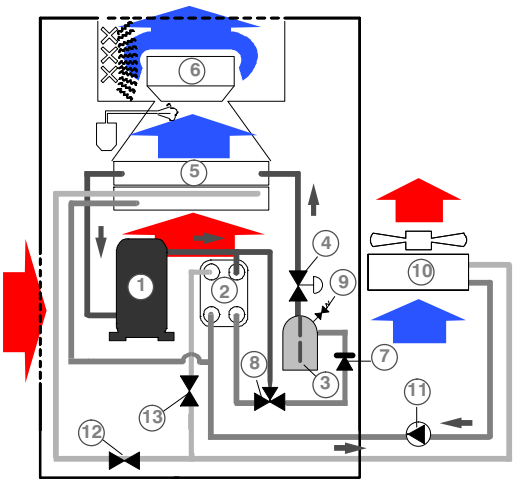
Contemporary DX and FC operation

In this way the air, before passing through the evaporating coil, is precooled in the the freecooling coil. Thanks to this feature the energy saving is considerably increased, during temperate seasons, exploiting the outdoor temperature that is a little bit inferior to indoor one. Furthermore the total cooling capacity is increased and can satisfy peak cooling requests. This function is not available in D8FU unit.

Liebert HPM: Annual Energy Consumption F unit vs W unit. This diagram is referred to 365 days and 24 hours running time.
The saved Energy in one year is equivalent to [61323 – 42328] = 18995 kWh



DxxOF Units



Version D

Air–cooled condenser dualfluid units

Dualfluid modes

The Dualfluid unit cools the air flow by means of the air refrigerant coil (5) in direct expansion rows [direct expansion mode: see refrigeration circuit] or, as an alternative, the air/water coil (5) in the chilled water rows [chilled water mode].

Refrigeration circuit

The compressor (1) pumps the hot gaseous refrigerant into an outdoor air–cooled condenser (2). The liquefied refrigerant arrives to a liquid receiver (3) that ensures a constant and even refrigerant flow to the thermostatic expansion valve (4) and then arrives to the evaporator (5). Here the refrigerant, thanks to the heat – exchanged with the room air moved by the fan (6) – evaporates and returns to the compressor (1); from this, the refrigerant begins a new refrigeration cycle. To maintain the correct refrigerant discharge pressure, the speed of the motor fan (8) is controlled (on–off or proportional mode).
Shut–off valves are provided as standard to assist with routine maintenance.
The compressor (1) has a built–in non–return valve to avoid return of liquid refrigerant from the condenser in summertime, thus protecting the compressor from undesired refrigerant slugging during the start up. A second non–return valve (7) is recommended to avoid – in wintertime – refrigerant migration from the liquid pipes and the receiver (3) to the condenser (2), that should be responsible of low pressure intervention at the start–up of compressor.
For safety reason, a relief valve (9) is installed on the liquid receiver (3); this valve is equipped with flanged connections so that the refrigerant may be discharged to the outside.

External air–cooled condenser (2)

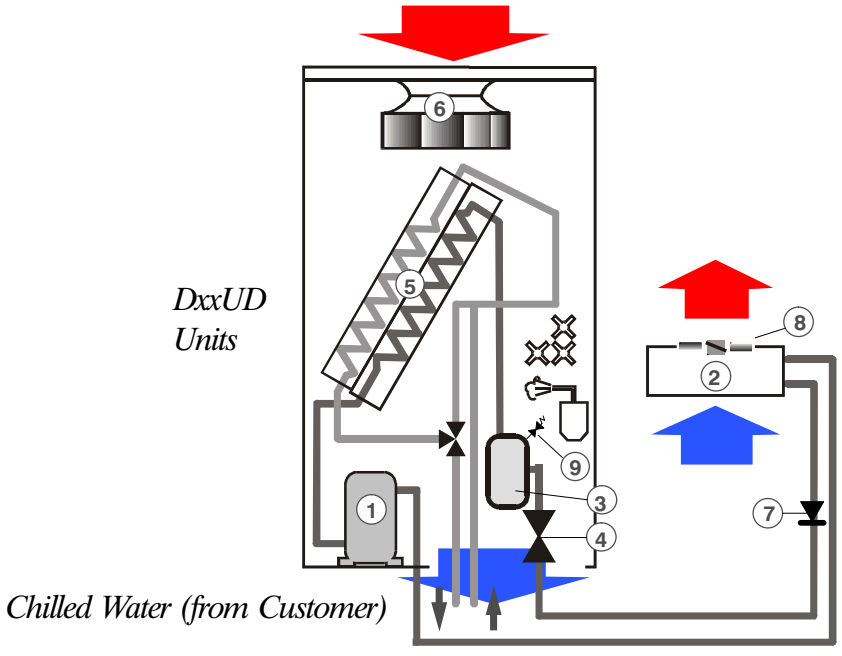
The units may be connected with a wide range of our condensers in standard or low noise version. For technical data and performance, refer to the relevant technical documentation. Chap. 5 gives the recommended matching condenser for Liebert HPM units as a function of outdoor air temperature.

Note 1. *Units and external condensers are supplied separately.*

Note 2. *The room unit refrigeration circuit is pressurised with helium at 3 bar and the condenser refrigeration circuit at 2 bar with dry air.*

Note 3. *The customer is responsible for making connections between the Unit and the external condenser and for charging with refrigerant (standard R410A).*

Full instructions for these operations are given in the Service Manual.



Version H

Water−cooled condenser dualfluid units

Dualfluid mode

The Dualfluid unit cools the air flow by means of the air−refrigerant coil (5) in direct expansion rows [direct expansion mode: see refrigeration circuit] or, as an alternative, the air/water coil (5) in the chilled water rows [chilled water mode].

Refrigeration circuit

The compressor (1) pumps the hot gaseous refrigerant into a water−cooled condenser (2). The liquefied refrigerant arrives to a liquid receiver (3) that ensures a constant and even refrigerant flow to the thermostatic expansion valve (4) and then arrives to the evaporator (5). Here the refrigerant, thanks to the heat − exchanged with the room air moved by the fan (6) − evaporates and returns to the compressor (1); from this, the refrigerant begins a new refrigeration cycle.
Shut−off valves are provided as standard to assist with routine maintenance.
The compressor (1) has a built−in non−return valve to avoid return of liquid refrigerant from the condenser, thus protecting the compressor from undesirable refrigerant slugging during the start up. The second non−return valve (7) avoids refrigerant migration from the liquid pipes and the receiver (3) to the condenser (2), that should be responsible of high pressure intervention at the start−up of compressor.
For safety reason, a relief valve (9) is installed on the liquid receiver (3); this valve is equipped with flanged connections so that the refrigerant may be discharged to the outside.

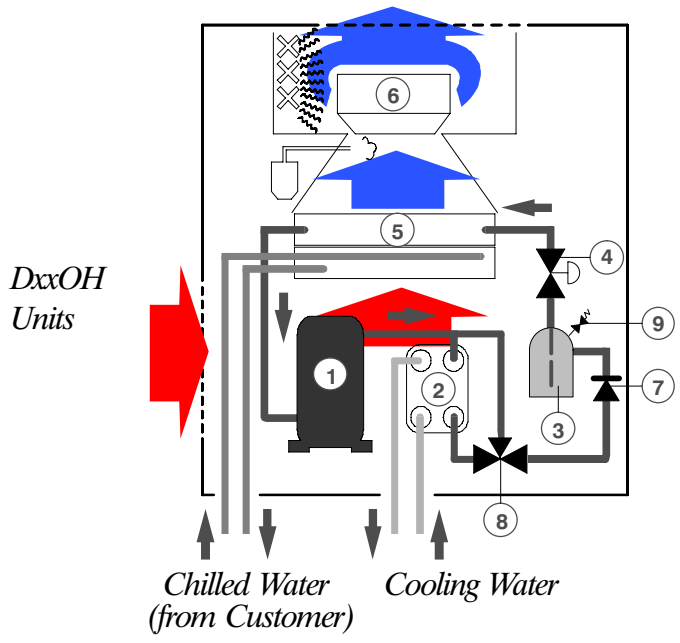
Water−cooled condenser

These units are provided with one very efficient stainless steel brazed−plate water−cooled condenser (2). The condenser is fitted with an head−pressure regulating valve (8) for the automatic control of condensing pressure.
The units operate with **mains water or open cooling tower water**.
If mains water or open tower water are used, a mechanical filter must be fitted in the water circuit to protect the condenser (for other information see the Service Manual).

To reduce water and energy consumption (pump), it's advisable to adopt a cooling water control valve (by the user), able to stop water feeding when unit is off.
Unit microprocessor control gives a 24V contact (10VA max, please refer to the relevant Wiring Diagram, 58 and G terminals) to drive that valve.

Note 1. *The water−cooled Dualfluid versions are filled with the complete charge of the requested refrigerant (standard R410A).*

Note 2. *To complete the Dualfluid system it is necessary to connect the chilled water coming from the external source to the air/water coil connections (5).*



Displacement D

Top air inlet, Front air discharge

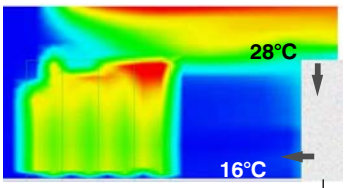
The Packaged Indoor Liebert HPM Displacement units, inject air next to the floor at low speed and take it in again from above, in the room upper part. The injected air generates a fresh air front hitting and moving the existing room air. The heat sources, on their turn, originate hot air ascensional currents to the room upper part due to natural convection. The hot air, limited and stratified above, is then taken in again by the conditioner.

The air diffusion limits the mixing between injected air mass and existing air, causing a useful temperature stratification in the room.
The Displacement system is suitable for industrial rooms and for telecom unmanned sites with very high specific load [kW/m^2].

The main advantages are:

- a better efficiency (more than 10%) of the cooling process 1, acting on air with temperature higher than the room average value;
- better efficiency of the ventilation process, needing lower exit speeds;
- lower installation costs: the false floor is not request as per Under units.
- lower operating costs: due to better efficiencies.

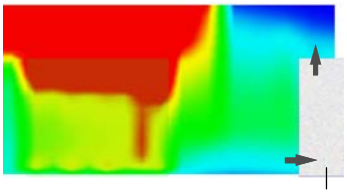
Note. *Emerson Network Power has a Flovent simulation program (arrangeable on Customer request)*



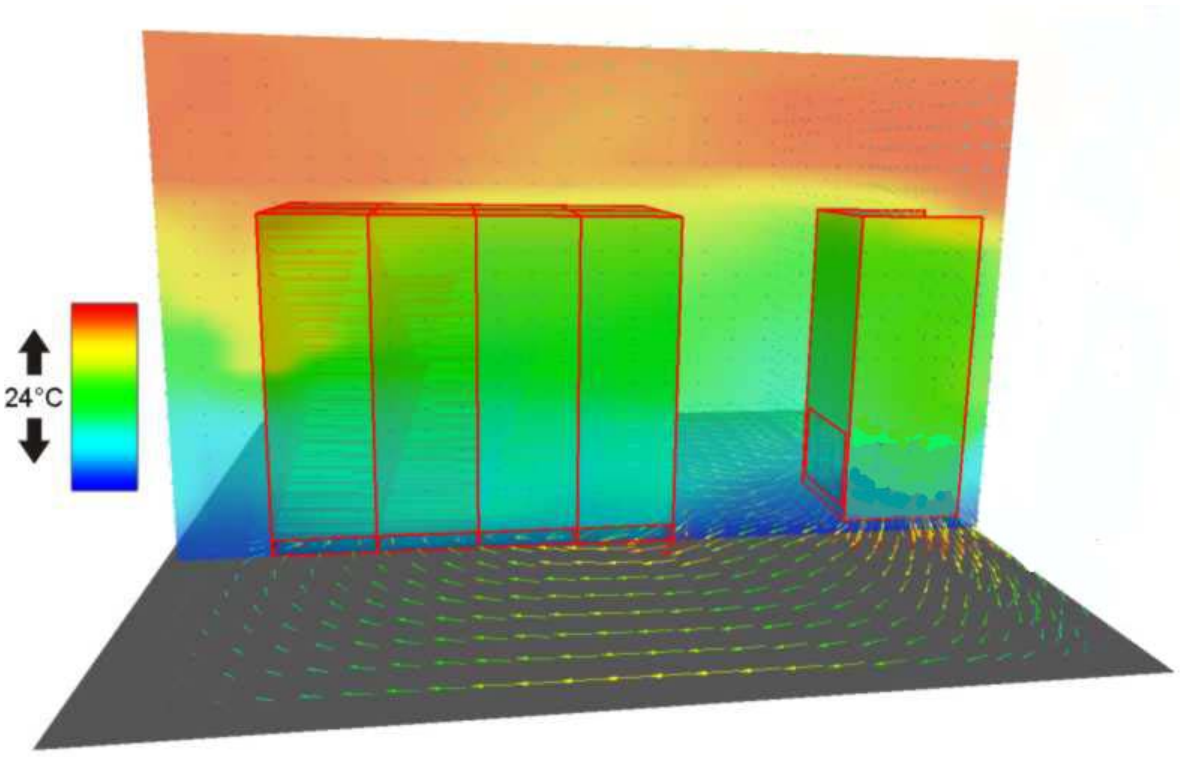
Liebert HPM Displacement

Test simulation at Emerson Network Power facilities with CFD calculation code "Flovent" FLOMERICS^{tm}

Room with 16 kW heat load. Air temperature distribution of Displacemetn configuration (top) versus Upflow configuration.



Liebert HPM Over



3 Operating Range

Liebert HPM units are provided for operating within the following working ranges (the limits concern new units on which correct installation have already been made):

All versions

Room air conditions	from:	18°C, 45% R.H.
		for D8FUx 21°C, 40% R.H.
	to:	27°C, 55% R.H
Hot water circuit	inlet water temperature	max. 85°C
	water pressure	max. 8.5 bar
Storage conditions	from:	– 20°C
	to:	50°C
Power supply tolerances		V ± 10%, Hz ± 2

For A and D units

Outdoor temperature: lower limit		
Exceeding of winter lower limits will temporarily cause a compressor stop.		
down to +10°C	from +9°C to –20°C	below –21°C
standard unit	VARIEX required	Consult HPAC Technical Sales Support
Outdoor temperature: higher limit		
This limit is determined by coupled condenser model. Exceeding of this limit (or a lack of maintenance), will caused a compressor stop by HP safety thermostat. Reset to normal operation can only be carried out manually.		

Relative position room unit vs. remote condenser		
From unit to condenser max distance	up to 30 m equivalent length	from 30 to 50 m equivalent length
From unit to condenser max geodetic height (1) (2)	from 20 m to –3 m	from 30 m to –8 m
Requirements		
Pipe diameter	see Tab 12c	see Tab 12c
Oil traps on vertical line of gas refrigerant	every 6 m, max	every 6 m, max
Extra oil charge	see Service Manual	see Service Manual
Variex installation	as standard	as standard
Condenser	design	oversized +15%
Hot gas reheat	allowed	NOT allowed
Additional non return valve on delivery line, at 2 m from compressor	not necessary	mandatory

Operating Range

For W, F and H units

Water or mixture temperature to condenser, lower limit (other information Service Manual)	min. 5°C

For F, D and H units

Chilled water circuit	
inlet water temperature	**min. 5°C**
water pressure	**max. 16 bar**
Max. differential pressures on the modulating valve (2 or 3 ways) – Max. differential pressure through the closed valve: Δp_{cv} – Max. differential pressure across the valve for modulating service: Δp_{ms}	

D models	Δp_{cv} (kPa)	Δp_{ms} (kPa)
D1Gx**F/D/H**	300	300
D2Ex**F/D/H**	300	300
D3Ax**F/D/H**	300	300
D3Fx**F/D/H**	175	175
D3Gx**F/D/H**	175	175
D4Ex**F/D/H**	175	175
D4Hx**F/D/H**	175	175
D5Dx**F/D/H**	175	175
D8FUF/D/H	175	175

(1) Positive difference in height: condenser above conditioner
(2) Negative difference in height: condenser below conditioner
Other information in Service Manual.

4 Technical Data

Tab. 4a — Digital direct expansion unit @ 100% cooling capacity
DxxU/O A/W series

MODEL		D1E	D1G	D2E	D3A	D3G	D4E	D3F	D4H	D5D	D7L	D8F
Power supply voltage (V ± 10%)	V/Ph/Hz						400/3/50					
Refrigerant circuit		single	single	single	single	single	single	double	double	double	double	double
PERFORMANCES (1)												
air flow	m^3/h	4200	4930	5750	7080	9540	11230	9490	11370	12910	13470	20020
ESP (Under)	Pa	20	20	20	20	20	20	20	20	20	20	20
ESP max (Under) (2)	Pa	400	410	200	206	440	326	440	330	249	129	110
ESP (Over)	Pa	50	50	50	50	50	50	50	50	50	50	–
ESP max. (Over) (2)	Pa	420	430	220	245	450	277	476	330	204	137	–
SPL (Sound Pressure Level) (3) (Under)	dB(A)	46.4	49.2	50.0	55.4	55.8	57.4	56.0	58.3	58.7	60.0	67.4
SPL (Sound Pressure Level) (3) (Over)	dB(A)	51.2	50.2	52.9	57.1	55.2	58.7	55.3	61.2	59.9	59.8	_
Refrigerant												
total cooling capacity	kW	16.1	18.1	24.0	29.7	36.8	46.1	37.1	46.5	60.1	70.0	85.5
sensible cooling capacity	kW	14.7	16.8	21.8	26.9	35.1	43.2	34.9	43.8	52.3	58.4	77.7
SHR (Sensible Heat Ratio)	–	0.91	0.93	0.91	0.91	0.95	0.94	0.94	0.94	0.84	0.83	0.91
compressor power input	kW	3.43	4.07	5.50	6.43	7.56	9.61	7.86	10.06	12.76	14.82	18.84
fan power input	kW	0.68	0.72	1.38	1.44	2x0.65	2x0.98	2x0.65	2x0.99	2x 1.52	2x1.94	2x2.70
full power input (compressor + fan)	kW	4.11	4.79	6.88	7.87	8.86	11.57	9.16	12.04	15.80	18.70	24.24
EER (Energy Efficiency Ratio—compr. and fan)		3.92	3.78	3.44	3.77	4.15	3.98	4.05	3.86	3.80	3.74	3.53
Condensing section (W models only)												
water inlet temperature: 30°C — condensation temperature: 45°C (mid point)												
condenser type							plate type exchanger in AISI 316					
water flow	l/s	0.348	0.44	0.73	0.85	0.83	1.05	2x 0.45	2x 0.55	2x 0.83	2x 0.80	2x0.94
water side pressure drop	kPa	16	24	52	43	22	26	22	31	42	20	20
water connections	inch	¾ F	¾ F	¾ F	1F	1.¼ F	1.¼ F	2x ¾ F	2x ¾ F	2x1.¼ F	2x1.¼ F	1.¼ F
CHILLED WATER CONTENT												
Total chilled water internal volume	dm^3	1.52	1.52	1.52	1.73	2.89	3.76	2.89	2.58	3.46	5.79	7.9
DIMENSIONS												
length	mm	750	750	750	1000	1750	1750	1750	1750	1750	1750	2550
depth	mm	750	750	750	850	850	850	850	850	850	850	890
height	mm	1950	1950	1950	1950	1950	1950	1950	1950	1950	1950	1950
footprint	m^2	0.56	0.56	0.56	0.85	1.49		1.49	1.49	1.49	1.49	2.27
WEIGHTS												
net	kg	240	260	270	425	580	600	590	600	635	670	950
gross (standard packing see Fig. 12j)	kg	250	270	280	435	590	610	600	610	645	680	965

***(1) ON THE FOLLOWING STANDARD CONDITIONS**: Room conditions 24°C bs; 50% R.H. (17°C wb) — Condensing temperature: 45°C (mid point) — **EER** refers to the indoor unit only — Air flow of the units refers to the standard configuration with G4 class filter.*
***Note**: Cooling capacities are gross. To obtain the net cooling capacities the fan power input must be substracted.*
***(2)** Max. external static pressure for the indicated air flow*
***(3)** Measured in the front part at 1.5 m height, 2 m distance, referred to free field, with fan and compressor in operation. Ducted Over unit.*
(*) To be defined

Technical Data

Follows Tab. 4a.

MODEL		D1E	D1G	D2E	D3A	D3G	D4E	D3F	D4H	D5D	D7L	D8F
Power supply voltage (V ± 10%)	V/Ph/Hz	400/3/50										
FAN (4)												
type		centrifugal with backward blades										
quantity	no.	1	1	1	1	2	2	2	2	2	2	2
poles	no.	4	4	4	4	4	4	4	4	4	4	4
fan FLA – EC fan	A	4.0	4.0	4.0	4.0	2x 4.0	2x 4.0	2x 4.0	2x 4.0	2x 4.0	2x 4.0	2x5.0
fan LRA – EC fan	A	0.1	0.1	0.1	0.1	2x 0.1	2x 0.1	2x 0.1	2x 0.1	2x 0.1	2x 0.1	2x 0.1
COMPRESSOR (5)												
quantity / type	no.			1 / Digital Scroll					1 / Scroll + 1 / Digital Scroll			
compressor OA	A	6.34	7.37	10.51	12.64	14.16	18.24	14.24	18.66	24.81	28.14	35.55
compressor FLA	A	10.0	11.8	16.5	21	22	27	2x 11.8	2x 16.5	2x 21	2x 22	2x 31
compressor LRA	A	62.0	64.0	101	111	118	140	2x 64	2x 101	2x 111	2x 118	2x 140
EVAPORATING COIL												
quantity / configuration	no.	1 / inclined										
pipes/fins		Copper/treated alluminium										
pitch fins	mm	1.8	1.8	1.8	2.1	1.8	1.5	1.8	1.8	1.8	1.8	1.6
rows	no.	4	4	5	5	4	5	4	4	5	6	5
front surface	m^2	0.65	0.65	0.65	0.85	1.71	1.71	1.71	1.71	1.71	1.71	2.2
REFRIGERANT CONNECTIONS (6)		**Refrigerant connecting pipe diameter: see Tab. 12c, Chap. 12**										
gas connect. (pipe to be welded, o.d.)	mm	18	18	18	18	18	18	18	18	18	18	18
liquid connec. (pipe to be welded, o.d.)	mm	16	16	16	16	16	16	16	16	16	16	16

(4) *Fan OA is for standard unit operating at the standard pressure drop (Under 20 Pa, Over 50 Pa).*
(5) *Condensing temperature: 45°C (mid point).*
(6) *The refrigerant connections on the unit are closed with blind welded flanges.*
(*) To be defined

Options (further information: Chap. 8)

MODEL		D1E	D1G	D2E	D3A	D3G	D4E	D3F	D4H	D5D	D7L	D8F
Power supply voltage (V ± 10%)	V/Ph/Hz	230/1/50	230/1/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50
Electrical heating												
FLA	A	8.6	8.6	8.6	11.0	22.0	22.0	22.0	22.0	22.0	22.0	26.0
total power / steps	kW/no.	5.85/3	5.85/3	5.85/3	7.5/1	15.0/2	15.0/2	15.0/2	15.0/2	15.0/2	15.0/2	18.0/3
Humidifier												
FLA	A	9.0	9.0	9.0	9.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0
nominal power	kW	5.8	5.8	5.8	5.8	9.0	9.0	9.0	9.0	9.0	9.0	9.0
Re–heating mode												
Hot gas coil												
heating capacity (at 24°C, 50%, condensing temp. 45°C)	kW	10.5	10.6	14.2	17.3	21.3	26.7	10.8	13.6	17.5	20.4	28.2.
Hot water coil												
heating capacity (at 24°C, 50%, water in/out 80/65°C)	kW	10.3	11.4	12.1	16.3	34.5	38.4	34.2	38.3	40.8	43.9	32.2
Heating mode												
Hot water coil												
heating capacity (at 24°C, 50%, water in/out 80/65°C)	kW	7.7	8.6	8.9	12.4	27.4	30.2	27.3	30.5	31.8	33.7	25.6

Technical Data

Tab. 4b — Displacement, digital direct expansion unit, DxxD A/W series

MODEL		D1ED	D1GD	D2ED	D3AD
power supply voltage (V ±10%)	V/Ph/Hz		400/3/50		
PERFORMANCE (1)					
airflow	m^3/h	3790	4430	5330	5780
external static pressure ESP	Pa	0	0	0	0
sound pressure level (3)	dB(A)	73.7	73.6	77.3	7.5
Refrigerant			**R410A**		
total cooling capacity	kW	15.9	17.7	23.6	28.8
sensible cooling capacity	kW	13.9	15.8	21.4	24.1
SHR (sensible/total ratio)		0.87	0.89	0.91	0.84
compressor absorbed power	kW	3.43	4.07	5.49	6.42
fan absorbed power	kW	0.60	0.64	1.34	0.73
unit absorbed power (compr. & fan)	kW	4.03	4.71	6.83	7.15
EER (in/output energy) — (compr. and fan)		3.96	3.76	3.46	4.63
Condensing section (W model only) **water inlet temperature: 30°C — condensation temperature: 45°C(mid point)**					
condenser type			plate type exchanger in AISI 316		
water flow	l/s	0.345	0.43	0.72	0.83
water side pressure drop	kPa	15	23	51	42
water connections	inch	¾ F	¾ F	¾ F	1 F
CHILLED WATER CONTENT					
Total chilled water internal volume	dm^3	1.52	1.52	1.52	1.73.
DIMENSIONS					
length	mm	750	750	750	1000
depth	mm	750	750	750	850
height	mm	1950	1950	1950	1950
footprint	m^2	0.56	0.56	0.56	0.85
WEIGHTS					
net	kg	240	250	260	425
gross (standard packing see Fig. 12j)	kg	250	260	270	435

***(1) ON THE FOLLOWING STANDARD CONDITIONS**: Room conditions 24°C bs; 50% R.H. (17°C wb) — Condensing temperature: 45°C (mid point) — **EER** refers to the indoor unit only — Air flow of the units refers to the standard configuration with G4 class filter.*
***Note**: Cooling capacities are gross. To obtain the net cooling capacities the fan power input must be substracted.*
***(2)** Max. external static pressure for the indicated air flow*
***(3)** Measured in the front part at 1.5 m height, 2 m distance, referred to free field, with fan and compressor in operation.*
(*) To be defined

Technical Data

Follows Tab. 4b.

MODEL		D1ED	D1GD	D2ED	D3AD
power supply voltage (V ±10%)	V/Ph/Hz		400/3/50		
FANS (4)					
type			centrifugal with backward blades		
quantity	no.	1	1	1	1
speed	RPM	9418	917	1200	988
poles	no.	4	4	4	4
fan OA	A	0.96	1.02	2.15	1.19
fan FLA	A	4.0	4	4	4
fan LRA	A	0.1	0.1	0.1	0.1
COMPRESSOR (5)					
quantity / type			1 / Digital Scroll		
Compressor rated power	Hp	3.34	5.0	7.8	7.8
compressor OA	A	5.59	7.36	10.51	16.62
compressor FLA	A	9.5	11.8	16.5	16.5
compressor LRA	A	52	64	101	101
EVAPORATING COIL					
Quantity	no.	1	1	1	1
pipes/fins			Copper/treated alluminium		
fin pitch / rows	mm/no.	1.8/3	1.8/3	1.8/5	1.8/5
front surface	m^2	0.65	0.65	0.65	0.65

(4) *Fan OA is for standard unit operating at the standard pressure drop (Under 20 Pa, Over 50 Pa).*
(5) *Condensing temperature: 45°C (mid point).*

Options (further information: Chap.8)

MODEL		D1ED	D1GD	D2ED	D3AD
power supply voltage (V ±10%)	V/Ph/Hz		400/3/50		
Electrical heating					
FLA	A	8.6	8.6	8.6	11.0
total power / steps	kW/no.	5.85/3	5.85/3	5.85/3	7.5/1
Re—heating mode					
Hot—gas coil					
heating capacity (@24°C, 50%R.H., 45°C condens. temp.)	kW	9.3	10.5	14	16.9
Hot—water coil					
heating capacity (@24°C, 50%R.H., 45°C condens. temperature, 80/65°C water temp.)	kW	9.8	10.8	12.7	15.6
Heating mode					
Hot—water coil					
heating capacity (@24°C, 50%R.H., 80/65°C water temp.)	kW	7.1	8.0	9.0	11.7

Technical Data

Tab. 4c — Freecooling, digital direct expansion unit
Dxx U/O F series

MODEL		D1GxF	D2ExF	D3AxF	D3GxF	D4ExF	D3FxF	D4HxF	D5DxF	D8FUF
power supply voltage (V ±10%)	V/Ph/Hz					400/3/50				
Refrigerant circuit		single	single	single	single	single	double	double	double	double
PERFORMANCE (1)										
airflow	m^3/h	4685	5460	7080	9540	11230	9490	11370	12910	19010
external static pressure (Under) ESP	Pa	20	20	20	20	20	20	20	20	20
max available external static pressure (Under) (2)	Pa	382	195	101	407	279	414	268	136	242
external static pressure (Over) ESP	Pa	50	50	50	50	50	50	50	50	–
max available external static pressure (Over) (2)	Pa	410	214	130	421	274	426	262	133	–
unti power input (compressor and EC fan)	kW	5.82	7.97	8.18	10.78	14.17	11.19	14.83	18.54	2.50
ethylene glycol	%	30	30	30	30	30	30	30	30	30
proposed Dry Cooler		ESM018	EST028	EST028	EST028	EST040	EST028	EST040	EST060	EST080
SPL sound pressure level (3) Under	dB(A)	49.5	52.0	53.1	57.2	57.7	57.3	54.7	57.7	65.0
SPL sound pressure level (4) Under	dB(A)	49.2	51.5	52.8	56.9	57.4	57.0	54.3	57.3	64.8
SPL sound pressure level (3) Over	dB(A)	51.0	53.7	54.3	56.8	58.4	56.5	57.9	60.8	–
SPL sound pressure level (4) Over	dB(A)	50.3	52.5	52.7	55.1	56.7	55.7	57.1	59.0	–
MECHANICAL COOLING PERFORMANCE (@ 35.0°C outdoor air temperature)										
Refrigerant						**R410A**				
total cooling capacity	kW	16.0	19.9	21.7	31.8	39.4	31.5	38.5	52.1	76.2
sensible cooling capacity	kW	15.3	18.8	21.3	31.1	38.2	30.7	37.8	46.4	68.8
SHR (sensible/total ratio)		0.96	0.94	0.98	0.98	0.97	0.97	0.98	0.89	0.90
compressors absorbed power	kW	5.11	6.62	6.21	9.36	12.05	9.77	12.69	15.50	21.64
EC fans absorbed power	kW	0.71	1.35	1.97	2x 0.71	2x1.06	2x0.71	2x1.07	2x 1.52	2x 1.93
EER (Energy Efficiency Ratio — compr. and EC fan)		2.75	2.50	2.65	2.85	2.78	2.82	2.38	2.81	2.99
mixture flow	l/s	0.58	0.69	1.01	1.26	1.60	2x0.65	2x 0.78	2x 0.97	2x 1.81
mixture condenser pressure drop	kPa	35	47	55	33	32	34	47	51	37
Unit total pressure drop	kPa	46	53	69	54	66	48	67	64	80
FREECOOLING PERFORMANCE (@ 5.0°C outdoor air temperature)										
total cooling capacity	kW	9.8	12.5	20.3	25.6	32.3	25.8	33.1	36.9	68.3
sensible cooling capacity	kW	9.8	12.5	20.3	25.1	32.3	25.8	33.1	36.9	64.9
SHR (sensible/total ratio)		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95
mixture flow	l/s	0.58	0.69	1.01	1.36	1.60	1.30	1.56	1.94	3.61
unit total pressure drop	kPa	79	83	69	47	46	50	58	86	62
dry—cooler pressure drop	kPa	25	17	43	53	60	56	27	10	20
CHILLED WATER CONTENT										
Total chilled water internal volume	dm^3	10.4	12.7	21.1	36.8	45.1	36.2	43.6	44.5	93.0
DIMENSIONS										
length	mm	750	750	1000	1750	1750	1750	1750	1750	2250
depth	mm	750	750	850	850	850	850	850	850	890
height	mm	1950	1950	1950	1950	1950	1950	1950	1950	1950
footprint	m^2	0.56	0.56	0.85	1.49	1.49	1.49	1.49	1.49	2.27
WEIGHTS										
net	kg	290	320	510	720	730	725	745	755	1115
gross (std. packing see Fig. 12j)	kg	300	330	520	730	740	735	755	765	1125

***(1) ON THE FOLLOWING STANDARD CONDITIONS**: Room conditions 24°C bs; 50% R.H. (17°C wb) — **EER** refers to the indoor unit only — Air flow of the units refers to the standard configuration with G4 class filter.*
***Note**: Cooling capacities are gross. To obtain the net cooling capacities the fan power input must be substracted.*
***(2)** Max. external static pressure for the indicated air flow*
***(3)** Measured in the front part at 1.5 m height, 2 m distance, referred to free field, with fan and compressor in operation.*
***(4)** Measured in the front part at 1.5 m height, 2 m distance, referred to free field, with only fan in operation.*

Technical Data

Follows Tab. 4c.

MODEL		D1GxF	D2ExF	D3AxF	D3GxF	D4ExF	D3FxF	D4HxF	D5DxF	D8FUF
power supply voltage (V ±10%)	V/Ph/Hz	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50
FAN (5)										
type		centrifugal with backward blades								
quantity	no.	1	1	1	2	2	2	2	2	2
speed	RPM	990	1200	1339	1003/989	1129	989	1200	1200	1079
poles	no.	4								
fan OA	A	1,15	2,17	3.17	2x 1.16	2x 1.73	2x 1.15	2x 2.20	2x 3.08	2x 2.98
fan FLA	A	4.0	4.0	4.0	2x 4.0	2x 4.0	2x 4.0	2x 4.0	2x 4.0	2x 5.0
fan LRA	A	0.1	0.1	0.1	2x 0.1	2x 0.1	2x 0.1	2x 0.1	2x 0.1	2x 0.10
COMPRESSOR (6)										
quantity / type		1 / Digital Scroll					2 / 1 Digital Scroll + 1 fixed capacity			
Compressor rated power	Hp	5,1	7.8	7.8	7.55	9.59	2x 3.9	2x 5.0	2x 6.37	2x 9.39
compressor OA (R410A)	A	8.69	10.48	10.50	14.15	18.20	14.27	18.63	24.78	35.47
compressor FLA	A	12.8	16.5	16.5	22.0	27.0	2x12.8	2x16.5	2x23.0	2x31.0
compressor LRA	A	64	101.0	101.0	125	140	2x64	2x101.0	2x86	2x140
EVAPORATING COIL										
quantity / position	no.	1 / inclined								
pipes/fins		Copper / treated alluminium								
fin pitch / rows	no.	2,1 / 4	2,1 / 5	2,1 / 5	2.1/4	2.1/5	2.1/4	2.1/5	2.1/5	1.8/5
front surface	m^2	0,56			1.51	1.51	1.51	1.51	1.51	2.1
CHILLED WATER COIL										
quantity / position		1 / inclined								
pipes/fins		Copper / treated alluminium								
fin pitch / rows	no.	2,1 / 3	2,1 / 4	2.1 / 6	2.1/5	2.1/6	2.1/5	2.1/6	2.1/6	1.875
front surface	m^2	0,56			1.51	1.51	1.51	1.51	1.51	2.1

(5) *Fan OA is for standard unit operating at the standard pressure drop (Under 20 Pa, Over 50 Pa).*
(6) *Condensing temperature: 45°C (mid point).*

Technical Data

Tab. 4d — Dualfluid air—cooled, digital direct expansion unit
Dxx U/O D series

MODEL		D1GxD	D2ExD	D3AxD	D3GxD	D4ExD	D3FxD	D4HxD	D5DxD	D8FUD
power supply voltage (V ±10%)	V/Ph/Hz	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50
Refrigerant circuit		single	single	single	single	single	double	double	double	double
PERFORMANCE (1)										
airflow	m^3/h	4685	5460	7080	9540	11230	9490	11370	12910	19010
external static pressure (Under) ESP	Pa	20	20	20	20	20	20	20	20	20
max available external static pressure (Under)(2)	Pa	380	193	91	406	269	408	257	124	237
external static pressure (Over) ESP	Pa	50	50	50	50	50	50	50	50	–
max available external static pressure (Over)(2)	Pa	408	214	126	415	272	420	261	131	–
unit power input	kW	4.78	6.91	7.45	8.97	11.71	9.29	12.17	12.17	22.64
ethylene glycol	%	0	0	0	0	0	0	0	0	0
SPL sound pressure level (3) Under	dB(A)	49.5	52.0	53.1	57.2	57.7	57.3	55.9	59.1	65.0
SPL sound pressure level (4) Under	dB(A)	49.2	51.5	52.8	56.9	57.4	57.0	55.5	58.7	64.8
SPL sound pressure level (3) Over	dB(A)	51.0	51.8	52.8	54.9	57.3	54.5	57.9	60.8	–
SPL sound pressure level (4) Over	dB(A)	50.3	50.3	51.2	53.2	55.6	53.7	55.9	59.0	–
MECHANICAL COOLING PERFORMANCE (1)										
Refrigerant						**R410A**				
total cooling capacity	kW	17.9	22.0	22.6	35.1	44.2	34.9	43.4	57.1	81.0
sensible cooling capacity	kW	16.1	19.7	22.3	32.5	40.4	32.2	39.9	48.7	70.9
SHR (sensible/total ratio)		0.90	0.90	0.99	0.93	0.91	0.92	0.92	0.85	0.88
compressor absorbed power	kW	4.07	5.46	5.48	7.55	9.59	7.87	10.3	12.74	18.78
EC fans absorbed power	kW	0.71	1.45	1.97	2x0.71	2x1.06	2x0.71	2x1.07	2x 1.91	2x 1.93
EER (Energy Efficiency Ratio — compr. and EC fan)		3.74	3.18	3.03	3.91	3.77	3.76	3.57	3.44	3.58
CHILLED WATER PERFORMANCE (1)										
total cooling capacity	kW	8.5	12.5	31.8	45.0	56.3	44.8	56.8	62.5	83.7
sensible cooling capacity	kW	8.5	12.5	27.2	37.8	46.1	37.6	46.6	51.9	72.3
SHR (sensible/total ratio)		1.00	1	0.86	0.84	0.82	0.84	0.82	0.83	0.86
water flow	l/s	0.40	0.60	1.52	2.14	2.69	2.14	2.71	2.98	3.99
unit total pressure drop	kPa	34	54	121	106	132	105	135	160	61
CHILLED WATER CONTENT										
Total chilled water internal volume	dm^3	8.5	11.2	19.2	33.6	41.0	33.6	41.0	41.0	85.0
DIMENSIONS										
length	mm	750	750	1000	1750	1750	1750	1750	1750	2550
depth	mm	750	750	850	850	850	850	850	850	890
height	mm	1950	1950	1950	1950	1950	1950	1950	1950	1950
footprint	m^2	0.56	0.56	0.85	1.49	1.49	1.49	1.49	1.49	2.27
WEIGHTS										
net	kg	290	320	510	720	715	725	745	755	1115
gross (std. packing see Fig. 12j)	kg	300	330	520	730	725	735	755	765	1125

***(1) ON THE FOLLOWING STANDARD CONDITIONS**: Room conditions 24°C bs; 50% R.H. (17°C wb) — Condensing temperature: 45°C (mid point) — CW mode water temperature inlet/outlet 7/12 °C — **EER** refers to the indoor unit only — Air flow of the units refers to the standard configuration with G4 class filter.*
***Note**: Cooling capacities are gross. To obtain the net cooling capacities the fan power input must be substracted.*
***(2)** Max. external static pressure for the indicated air flow*
***(3)** Measured in the front part at 1.5 m height, 2 m distance, referred to free field, with fan and compressor in operation. Ducted unit.*
***(4)** Measured in the front part at 1.5 m height, 2 m distance, referred to free field, with only fan in operation. Ducted unit.*

Technical Data

Tab. 4e — Dualfluid water—cooled, digital direct expansion unit
Dxx U/O H series

MODEL		D1GxH	D2ExH	D3AxH	D3GxH	D4ExH	D3FxH	D4HxH	D5DxH	D8FUH
power supply voltage (V ±10%)	V/Ph/Hz	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50
Refrigerant circuit		single	single	single	single	single	double	double	double	double
PERFORMANCE (1)										
airflow	m^3/h	4685	5460	7080	9540	11230	9490	11370	12910	19010
external static pressure (Under) ESP	Pa	20	20	20	20	20	20	20	20	20
max available external static pressure (Under) (2)	Pa	380	192	88	406	269	408	257	124	236
external static pressure (Over) ESP	Pa	50	50	50	50	50	50	50	50	—
max available external static pressure (Over) (2)	Pa	408	214	126	415	272	420	261	131	—
unit power input	kW	4.78	6.91	7.46	8.97	11.71	9.29	12.17	16.58	22.64
ethylene glycol	%	0	0	0	0	0	0	0	0	0
SPL sound pressure level (3) Under	dB(A)	49.5	52.0	53.1	57.2	57.7	57.3	55.9	59.1	65.0
SPL sound pressure level (4) Under	dB(A)	49.2	51.5	52.8	56.9	57.4	57.0	55.5	58.7	64.8
SPL sound pressure level (3) Over	dB(A)	51.0	51.8	52.8	54.9	57.3	54.5	57.9	60.8	—
SPL sound pressure level (4) Over	dB(A)	50.3	50.3	51.2	53.2	55.6	53.7	55.9	59.0	—
MECHANICAL COOLING PERFORMANCE										
Refrigerant						R410A				
total cooling capacity	kW	17.9	22.0	23.2	35.1	44.2	34.9	43.3	57.1	81.0
sensible cooling capacity	kW	16.1	19.7	21.9	32.5	40.3	32.2	39.9	48.7	70.8
SHR (sensible/total ratio)		0.90	0.90	0.94	0.93	0.91	0.92	0.92	0.85	0.87
compressor absorbed power	kW	4.07	5.46	5.49	7.55	9.59	7.87	10.03	12.74	18.78
EC fans absorbed power	kW	0.71	1.45	1.97	2x0.71	2x 1.06	2x 071	2x 1.07	2x 1.92	2x 1.93
EER (Energy Efficiency Ratio — compr. and EC fan)		3.74	3.18	3.11	3.91	3.77	3.76	3.56	3.44	3.58
water inlet temperature	°C	30	30	30	30	30	30	30	30	30
water flow	l/s	0.47	0.62	0.57	0.80	1.15	2x 0.43	2x 0.62	2x 0.80	2x 0.95
water condenser pressure drop	kPa	19	17	16	12	15	13	26	30	10
unit total pressure drop	kPa	26	22	20	20	15	19	38	38	10
CHILLED WATER PERFORMANCE										
total cooling capacity	kW	12.2	18.2	31.8	45.0	56.3	44.8	56.8	62.5	83.7
sensible cooling capacity	kW	12.2	17.7	27.2	37.8	46.1	37.6	46.6	51.9	72.3
SHR (sensible/total ratio)		1.00	0.97	0.86	0.84	0.82	0.84	0.82	0.83	0.86
water inlet temperature	°C	7	7	7	7	7	7	7	7	7
water flow	l/s	0.58	0.87	1.52	2.14	2.69	2.14	2.71	2.98	3.99
unit total pressure drop	kPa	65	98	121	106	132	105	135	160	61
CHILLED WATER CONTENT										
Total chilled water internal volume	dm^3	10.4	12.7	21.1	36.8	45.1	36.2	43.6	44.5	93.0
DIMENSIONS										
length	mm	750	750	1000	1750	1750	1750	1750	1750	2550
depth	mm	750	750	850	850	850	850	850	850	890
height	mm	1950	1950	1950	1950	1950	1950	1950	1950	1950
footprint	m^2	0.56	0.56	0.85	1.49	1.49	1.49	1.49	1.49	2.27
WEIGHTS										
net	kg	290	320	510	720	730	725	745	755	1115
Gross (std. packing see Fig. 12j)	kg	300	330	520	730	740	735	755	765	1125

***(1) ON THE FOLLOWING STANDARD CONDITIONS**: Room conditions 24°C bs; 50% R.H. (17°C wb) — Condensing temperature: 45°C (mid point) — **EER** refers to the indoor unit only — Air flow of the units refers to the standard configuration with G4 class filter.*
***Note**: Cooling capacities are gross. To obtain the net cooling capacities the fan power input must be substracted.*
***(2)** Max. external static pressure for the indicated air flow*
***(3)** Measured in the front part at 1.5 m height, 2 m distance, referred to free field, with fan and compressor in operation. Ducted Over unit.*
***(4)** Measured in the front part at 1.5 m height, 2 m distance, referred to free field, with only fan in operation. Ducted Over unit.*

Technical Data

Options (further information: Cap.8)

MODEL		D1G	D2E	D3A	D3G	D4E	D3F	D4H	D5D	D8F
power supply voltage (V ±10%)	V/Ph/Hz	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50
Electrical heating (opt.)										
FLA	A	8,6	8,6	11.0	22.0	22.0	22.0	22.0	22.0	26
total power / steps	kW/no.	5.85/3	5.85/3	7.5/1	15.0/2	15.0/2	15.0/2	15.0/2	15.0/2	18.0/3
Humidifier										
FLA	A	9.0	9.0	9.0	13.0	13.0	13.0	13.0	13.0	13.0
nominal power	kW	5.8	5.8	5.8	9.0	9.0	9.0	9.0	9.0	9.0
Re—heating mode										
Hot—gas coil — R410A										
heating capacity (@24°C, 50%R.H., 45°C condens.temp.)	kW	10.6	13.2	13.8	20.5	25.9	5.2	6.4	8.4	13.5
Hot—water coil — DX mode — R410A										
heating capacity — 45°C condens.temp. (@24°C, 50%R.H., 80/65°C water temp.)	kW	12,1	13,8	16.3	34.5	34.4	34.2	38.3	40.8	32.2
Heating mode										
Hot—water coil										
heating capacity (@24°C, 50%R.H., 80/65°C water temp.)	kW	9,1	10,0	12.4	27.4	30.2	27.3	30.5	31.8	25.6

5 Heat Rejections (A — D versions)

Coupling of room units with remote air—cooled condensers

The units should be connected to **Liebert HPA**, single circuit.

The following paragraphs describe the suggested coupling of **Liebert HPM** units. The data given below are approximate and must always be verified on the basis of the other specific operating conditions.

Tab. 5f — Coupling of Condensers with Liebert HPM A—D

MODEL	External temperature up to 35°C	External temperature up to 40°C	External temperature up to 46°C
D1ExA	1 x HCR24	1 x HCR24	1 x HCR33
D1GxA/D	1 x HCR24	1 x HCR24	1 x HCR33
D2ExA/D	1 x HCR33	1 x HCR43	1 x HCR51
D3AxA/D	1 x HCR33	1 x HCR43	1 x HCR59
D3FxA/D	2 x HCR24	2 x HCR24	2 x HCR33
D3GxA/D	1 x HCR33	1 x HCR43	1 x HCR76
D4ExA/D	1 x HCR43	1 x HCR59	1 x HCR76
D4HxA/D	2 x HCR24	2 x HCR33	2 x HCR43
D5DxA/D	2 x HCR33	2 x HCR43	2 x HCR59
D7LxA	2 x HCR33	2 x HCR43	2 x HCR76
D8FUA/D	2 x HCR43	2 x HCR51	2 x HCR76

Tab. 5g — Technical data and performance of Air condenser

Model	Power supply [V/Ph/Hz]	Total Heat Rejection (THR)* R410A [kW]	Air Volume [m³/h]	Noise Level ** [dB(A)] @ 5 m	Input Power [kW]	Current Absorption [A]	FLA [A]	Refrigerant connections [mm]		Unit with packing	
								Gas line [mm]	Liquid line [mm]	Dimensions [mm]	Weight [kg]
HCR 24	230/1/50	24,0	8.600	51,0	0,55	2,5	2,5	16	16	L 1112 W 1340 H 907	60
HCR 33	230/1/50	32,2	7.400	51,0	0,55	2,5	2,5	16	16	L 1112 W 1340 H 907	75
HCR 43	230/1/50	46,0	17.000	54,0	1,10	5,0	5,0	16	16	L 1112 W 2340 H 907	92
HCR 51	230/1/50	52,0	17.000	54,0	1,10	5,0	5,0	22	16	L 1112 W 2340 H 907	93
HCR 59	230/1/50	62,0	15.600	54,0	1,10	5,0	5,0	22	16	L 1112 W 2340 H 907	102
HCR 76	230/1/50	78,0	25.500	56,0	1,65	7,5	7,5	22	16	L=1112 W=3340 H=907	136
HCR 88	230/1/50	92,0	23.400	56,0	1,65	7,5	7,5	22	16	L=1112 W=3340 H=907	165
HCR 99	230/1/50	130,0	32.000	57,0	2,20	10,0	10,0	28	22	L=1112 W=4338 H=907	220

(*) The nominal capacities refer to the following operative conditions:

- refrigerant as indicated (R410A).
- temperature differences: 15 K (T condensation – Toutdoor).
- height of the installation = 0 m, above the sea level. For different altitudes, see Hirating program.
- clean exchange surfaces.

(**) The levels of sound pressure here included are measured in the same operative conditions, and are referred to 5 m far from the unit, at 1.5 m in height in free field conditions.

Coupling of water cooled units with remote Dry Coolers

The water—condensed units are provided with a water/refrigerant exchanger with braze—welded **plates** made of **stainless steel**; this advanced exchanger type gives the highest efficiency in heat exchange. In addition, a certain oversizing of the exchanger has been provided so as to reduce pressure drops (and energy consumption of the water pump) as much as possible and thus to allow the unit to operate with the external chiller in closed circuit, even at high outdoor temperatures.

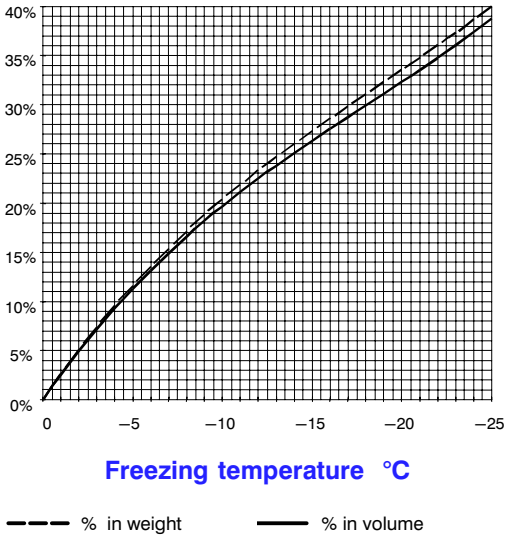
The Over/Under units type W/H are designed for operating with mains water or water in closed circuit with an external chiller. The Over/Under units type F are designed for operating with water in closed circuit with a remote Dry Cooler (or other suitable external device).
When operating in a closed circuit, the water is cooled by the outdoor air in a heat exchanger; in this case, to avoid unwanted ice formation during winter, it is advisable to use a water/glycol mixture.

The circulation of the water—glycol mixture is forced (the pump is not supplied). If mains water or tower water is used, when installing the unit fit a mechanical filter on the water line to protect the condenser against possible impurities contained in the water (for condenser cleaning see the service manual).

Dry Coolers

Our Dry Coolers are built with a copper/aluminium cooling coil and axial fan(s).
The main data on Dry Coolers is shown in the following table:

Percentage of ethylene glycol mixed with water



Note:
In the closed circuits to avoid water freezing in the cold seasons, it is strictly recommended to mix water with ethylene glycol. The suggested percentage is given in the Diagram.
For safety reason, **calculate the percentage** at least at 5°C below the minimum ambient temperature.

It is also recommended to check periodically the mixture: in case of leackage of the circuit, the sanitary water, used at compensation, reduces progressively the glycol percentage and increases the freezing point of the mixture!

Features and benefits

Liebert HPD Dry Coolers are the new range of liquid coolers, able to cover rated heat exchange capacities from 8 to 400 kW.

They excel above all for their efficiency, versatility and reliability, thanks to the following features:

- possibility of installation with horizontal or vertical air flow with simple operations on site, with the same model of Dry Cooler, without needing any wiring or re—wiring inside the unit.
- modulating fan speed regulator with phase (optional), for a continuous modulation of the fan speed, installed on the machine, wired and factory—set, thus making the connection steps on site and the unit start—up extremely easy; the fan speed regulator with phase cutoff can be selected to control up to two set—point values for the water delivery temperature of the Dry Cooler.
  Do not use fan speed regulator other than the approved one supplied by the manufacturer.
  When the Dry Cooler is ordered without temperature control, an outer on/off type control (to be arranged by the customer) is anyway allowed and must be connected on site with the suitable terminals available in the electric board Q of the unit (see wiring diagram enclosed to the unit).

Heat Rejections (W — F — H versions)

- The axial fans are equipped with protection grid and are statically and dynamically balanced; they can guarantee high efficiency and a low emitted noise level (above all in the low noise version); further, they are equipped with motors able to operate within a wide range of outdoor working temperatures. Protection degree IP 54. Single—phase fans feature an electric condenser incorporated in the terminal board.
- Heat exchanger with oval—geometry tubes ensuring the best air flow and thus an increase in the efficiency of the heat exchange, for a lower emitted noise level.
  Tubes are in copper and fins in aluminum, with wide heat exchange surface.
  Upon request (optional), the unit can be ordered with fins in epoxy—coated aluminum, with a better protection. The coil manifolds are in copper, with flanged connections in AISI 304 stainless steel for the models with three—phase power supply and male gas threaded connections for the single—phase models.
- the power supply is:

  230 V single phase 50 Hz in the ESM models (standard noise level) and ELM models (low noise level).

  400 V three—phase 50 Hz in the EST models (standard noise level) and ELT models (low noise level).
- Electrical boxes and accessories are water proof IP55.
- The frame is made up of a sturdy structure in galvanized steel, totally painted.
- The units are equipped with protection electric board Q, with main disconnector and safety device for fan motors.
- The most important technical data are gathered in Tab. 5i.
  Tests on thermal performance have been carried out at IMQ laboratories, according to the norm UNI EN 1048:2000, at the following special operating conditions:

  Air inlet T = 35°C

  Water inlet T = 45°C

  Water outlet T = 40°C
  Sound pressure levels have been evaluated according to the norm EN13487, at a 10—m distance, with free field.
- The working pressure depends on the circuit where the Dry Cooler is connected. Dry Cooler max working pressure = **16** bar.

All Dry Coolers are CE marking.

Dry Cooler units are conform to the following directives:

- 2006/42/EC;
- 2004/108/EC;
- 2006/95/EC;
- 97/23/EC.

Tab. 5h — Coupling of Dry Coolers

Model	External temperature up to 30ºC		External temperature up to 35ºC		External temperature up to 40ºC	
	Standard	Low noise	Standard	Low noise	Standard	Low noise
D1E W	1 x ESM009	1 x ELM011	1 x ESM013	1 x ELM011	1 x ESM022	1 x ELM018
D1G W/H/F	1 x ESM009	1 x ELM011	1 x ESM018	1 x ELM015	1 x ESM022	1 x ELM027
D2E W/H/F	1 x ESM018	1 x ELM018	1 x EST028	1 x ELM027	1 x EST050	1 x ELT040
D3A W/H/F	1 x ESM018	1 x ELM018	1 x EST028	1 x ELM027	1 x EST050	1 x ELT040
D3F W/H/F	1 x ESM022	1 x ELM018	1 x EST028	1 x ELM027	1 x EST050	1 x ELT047
D3G W/H/F	1 x ESM022	1 x ELM027	1 x EST028	1 x ELM027	1 x EST050	1 x ELT055
D4E W/H/F	1 x EST028	1 x ELM027	1 x EST040	1 x ELT040	1 x EST060	1 x ELT065
D4H W/H/F	1 x EST028	1 x ELM027	1 x EST040	1 x ELT040	1 x EST060	1 x ELT065
D5D W/H/F	1 x EST040	1 x ELT040	1 x EST050	1 x ELT047	1 x EST080	1 x ELT065
D7L W	1 x EST050	1 x ELT047	1 x EST060	1 x ELT055	1 x EST080	1 x ELT085
D8F W/H/F	1 x EST060	1 x ELT055	1 x EST080	1 x ELT065	1 x EST125	1 x ELT100

The table shows the recommended combinations of the Dry Coolers Liebert HPD with the air conditioners Liebert HPM, according to the external air temperature.
The combinations have been evaluated considering a mixture of water and ethylene glycol up to 30% as thermal exchange fluid.
The above indications are approximate and must be checked on the basis of other specific operating conditions.
For operating conditions other than those indicated in the table, refer to the New Hirating calculation software and to the Dry Coolers service manual.

Heat Rejections (W — F — H versions)

Tab. 5i — Technical data and performance of Dry Coolers

	Performances			Electric data			Overall dimensions		
Standard Model	**Duty** *(a)*	**Air flow**	**Noise level** *(c)*	**Supply**	**Number of fans**	**Total absorbed power**	**Width**	**Depth**	**Height** *(b)*
	kW	**m³/h**	**db(A)**	**V/ph/Hz**	**nº**	**kW**	**mm**	**mm**	**mm**
ESM009	10.8	7100	46	230/1/50	1	0.78	1336	820	1030
ESM013	12.8	6700	46	230/1/50	1	0.78	1336	820	1030
ESM018	16.1	15000	49	230/1/50	2	1.56	2236	820	1030
ESM022	22.0	14200	49	230/1/50	2	1.56	2236	820	1030
EST028	28.0	20000	49	400/3/50	2	1.38	2866	1250	1070
EST040	36.4	19400	49	400/3/50	2	1.38	2866	1250	1070
EST050	46.1	18400	49	400/3/50	2	1.38	2866	1250	1070
EST060	62.8	28200	51	400/3/50	3	2.07	4066	1250	1070
EST070	69.5	27600	51	400/3/50	3	2.07	4066	1250	1070
EST080	84.8	37600	52	400/3/50	4	2.76	5266	1250	1070
EST125	128.9	63000	50	400/3/50	3	6.00	5276	1620	1650
EST175	168.1	84000	51	400/3/50	4	8.00	6826	1620	1650
EST220	217.6	118800	53	400/3/50	6	12.00	5576	2340	1650
EST270	265.4	109200	53	400/3/50	6	12.00	5576	2340	1650
EST330	327.2	151600	54	400/3/50	8	16.00	7226	2340	1650
EST400	414.1	189500	54	400/3/50	10	20.00	8876	2340	1650

	Performances			Electric data			Overall dimensions		
Low Noise Model	**Duty** *(a)*	**Air flow**	**Noise level** *(c)*	**Supply**	**Number of fans**	**Total absorbed power**	**Width**	**Depth**	**Height** *(b)*
	kW	**m³/h**	**db(A)**	**V/ph/Hz**	**nº**	**kW**	**mm**	**mm**	**mm**
ELM008	6.8	5200	40	230/1/50	1	0.29	1336	820	1030
ELM011	10.3	4700	40	230/1/50	1	0.29	1336	820	1030
ELM015	13.9	10400	43	230/1/50	2	0.58	2236	820	1030
ELM018	17.9	9800	43	230/1/50	2	0.58	2236	820	1030
ELM027	27.0	14700	44	230/1/50	3	0.87	3136	820	1030
ELT040	36.9	15400	43	400/3/50	2	0.96	2866	1250	1070
ELT047	44.5	21000	44	400/3/50	3	0.99	4066	1250	1070
ELT055	55.7	23100	45	400/3/50	3	1.44	4066	1250	1070
ELT065	65.6	32000	46	400/3/50	4	1.92	5266	1250	1070
ELT085	80.8	28800	46	400/3/50	4	1.92	5266	1250	1070
ELT100	96.7	40800	41	400/3/50	3	2.49	5276	1620	1650
ELT130	128.7	62800	44	400/3/50	4	4.92	3926	2340	1650
ELT160	158.2	65200	44	400/3/50	4	4.92	6826	1620	1650
ELT210	212.3	89100	46	400/3/50	6	7.38	5576	2340	1650
ELT270	277.5	118800	47	400/3/50	8	9.84	7226	2340	1650
ELT350	351.0	148500	47	400/3/50	10	12.30	8876	2340	1650

(a): *at the following operative conditions:*
outdoor temperature = 35°C,
inlet/outlet water temperature = 45°C/40°C,
fluid is pure water, slm zero meters.
For different conditions refer to NewHirating program.
(b): *vertical flow installation.*
(c): *sound pressure level, free field, at 10 m distance, according to EN13487.*

6 Airflow characteristics

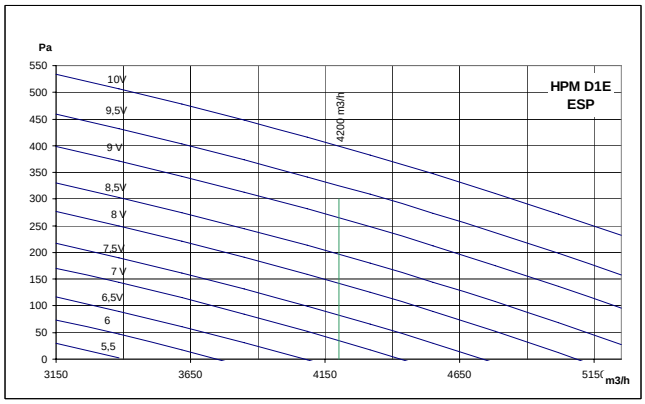
The graphs give the available and allowed external static pressure against airflow at different motor supply voltages for all units, with G4 air filter, standard configuration.

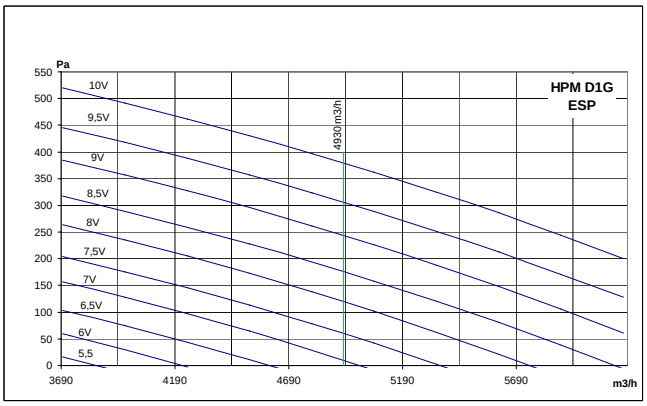
Useful available heads with standard fan

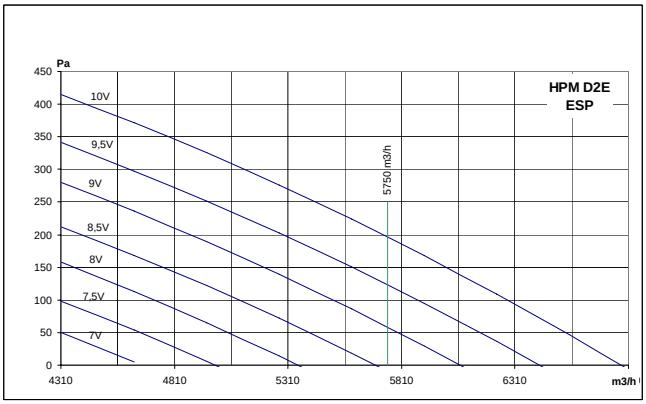
The air conditioners of the Liebert HPM series are supplied with electric fans sized for 20 Pa Available External Static Pressure (ESP) for the models Under, 50 Pa for the models Over.

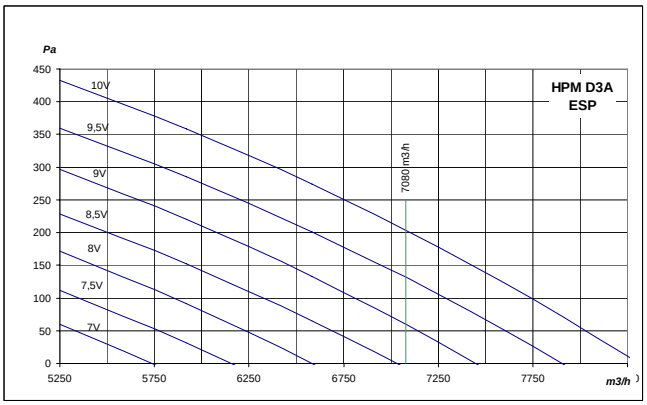
ESP: Available External Static Pressure

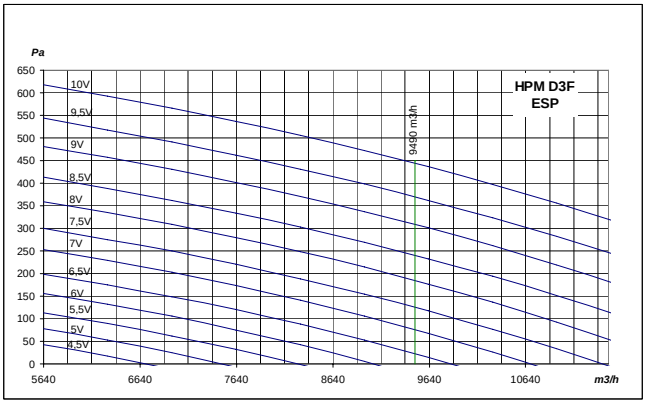
Liebert HPM – A/W versions and U/O configurations

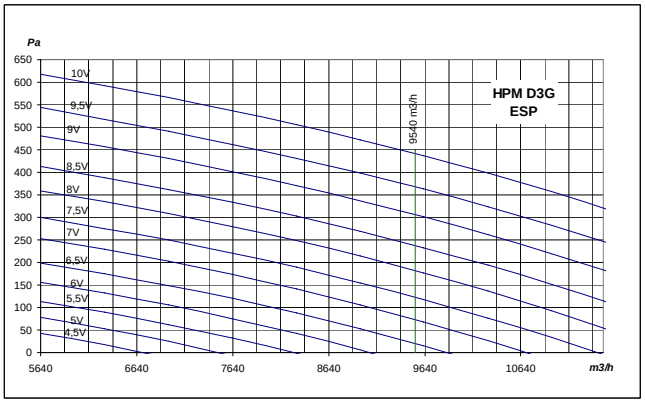




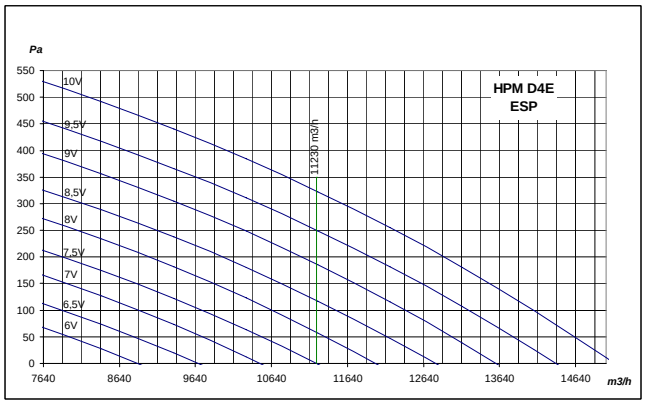


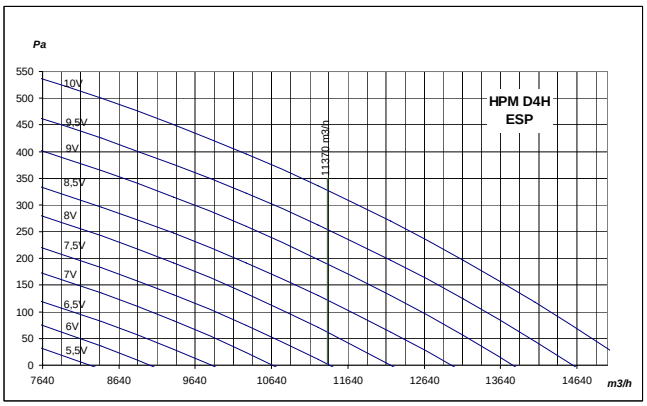


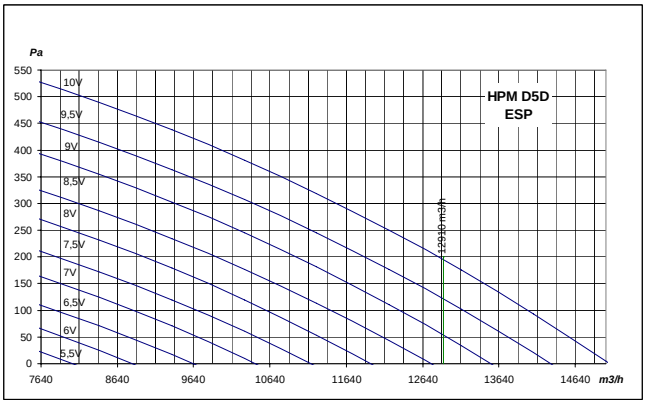


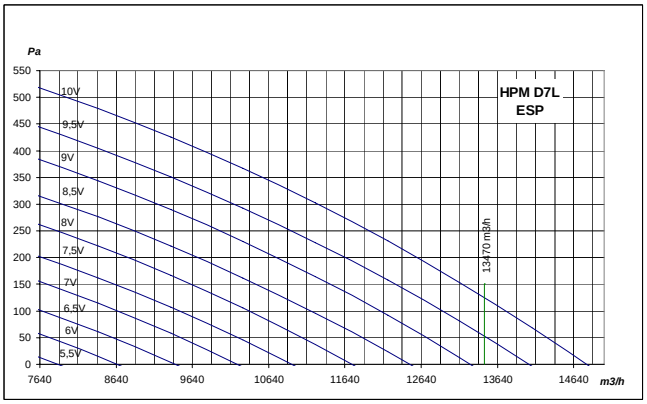


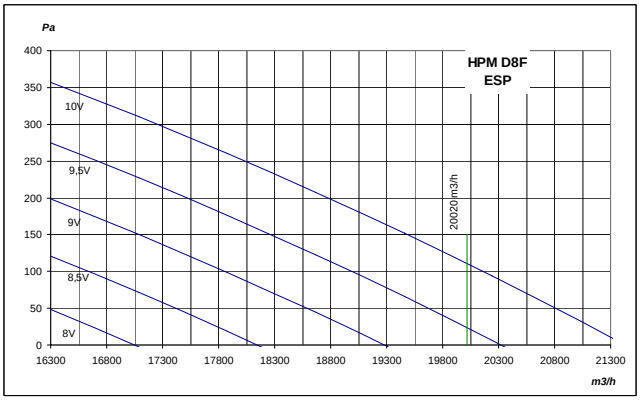
Airflow characteristics



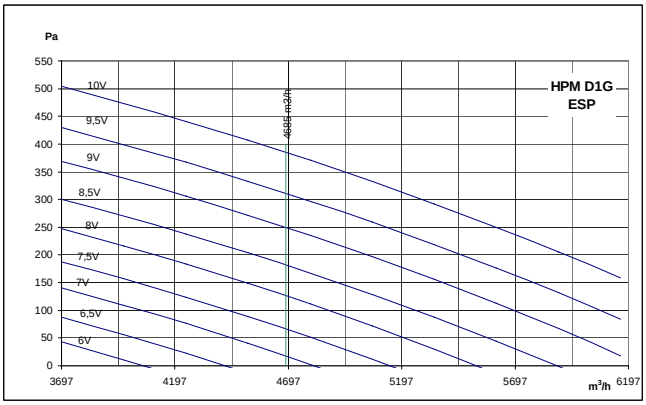


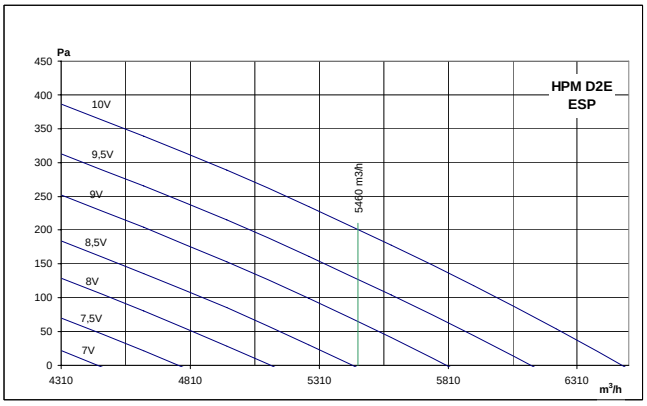




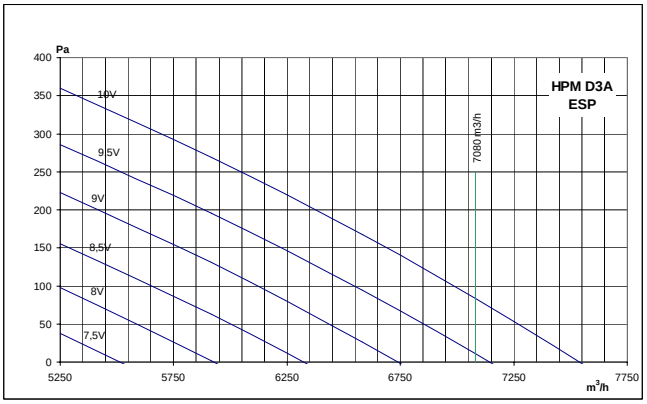


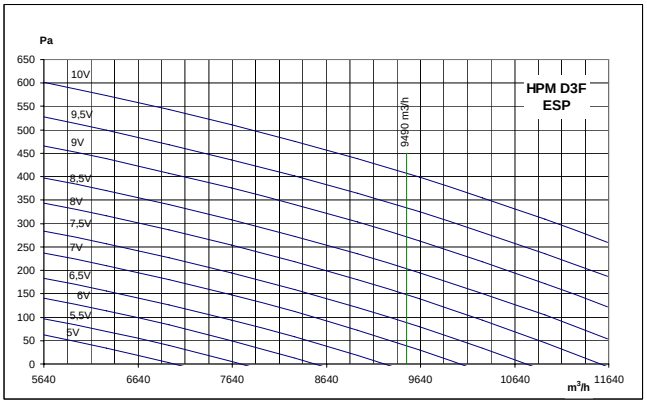
Liebert HPM – F/D/H versions and U/O configurations

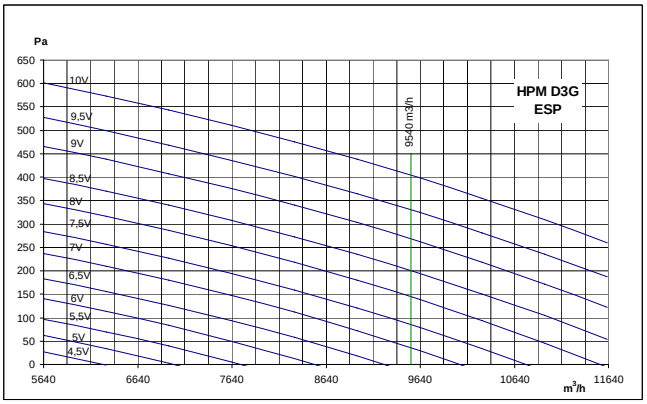


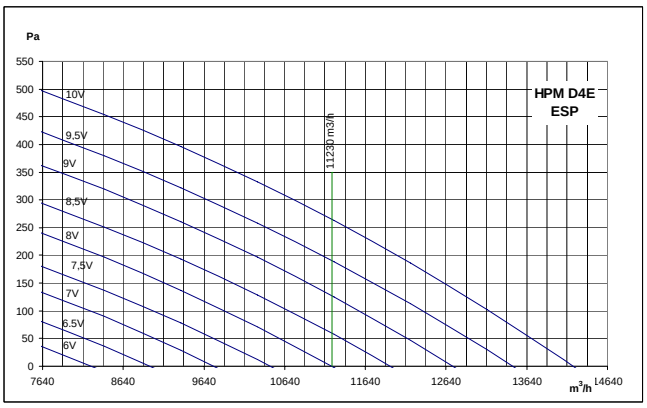


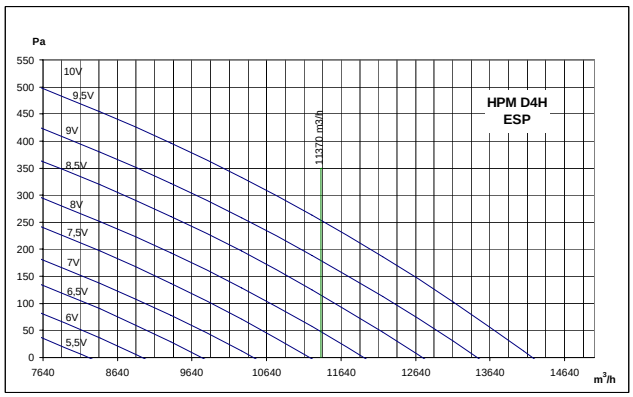
Airflow characteristics

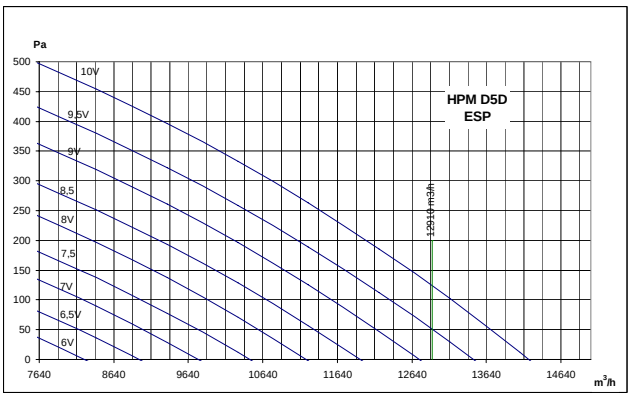


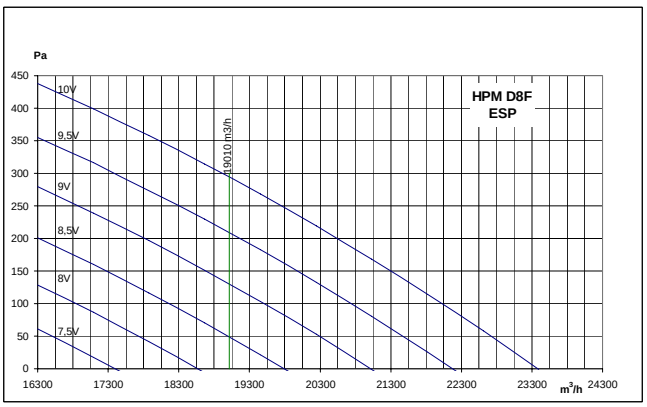










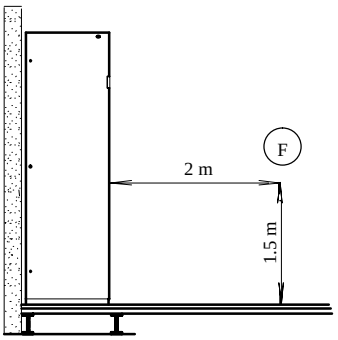


7 Sound Pressure Level

Liebert HPM units have been designed with particular care for sound and vibration problems. The complete mechanical insulation of the ventilating section, combined with the special study of the aeraulic circuit as a consequence of accurate researches made in our thermodynamical laboratories and the oversizing of the components crossed by air offer the highest ventilation efficiency with the lowest sound emission.

Sound emission spectra

All tests are performed in our laboratories under the described conditions. The instrument is placed in (F) point, at 1.5 m from the ground in front of the machine at 2 m distance. Test conditions: Under unit with underflow air discharge and 20 Pa available external static pressure; Over unit with ducted air discharge and 50 Pa available external static pressure. Standard air flow with clean G4 filters. Ambient temperature 24°C and relative humidity 50%. Condensing temperature 45°C. **The noise levels refer to free field conditions.**



Sound Pressure Level

Sound emission spectra

The following tables show sound levels for every octave band frequency.

Tab. 7a — A/W versions and Under configuration

MODEL	Mode	Level	Octave band frequency (Hz)									Sound Level [dB(A)]
			31.5	63	125	250	500	1000	2000	4000	8000	
D1EUA/W	(1)	SPL	42.0	42.0	49	54.5	44.8	39.3	36.9	30.1	23.4	48.6
	(2)	SPL	42.7	42.7	49.6	54.6	45.4	39.4	37	32.3	24.7	48.8
	(3)	PWL	68.2	68.2	74.4	74.3	71.6	66.8	64	62	55.6	73.4
D1GUA/W	(1)	SPL	42.2	42.2	48.2	55.3	44.9	39.2	36.6	30.1	23.5	49.0
	(2)	SPL	42.9	42.9	49.0	55.4	45.5	39.3	36.7	32.3	24.8	49.2
	(3)	PWL	66.3	66.3	72.7	72.4	69.7	64.9	62.1	60.1	53.7	71.5
D2EUA/W	(1)	SPL	45.2	45.2	54.7	52.5	45.3	43.2	40.9	34.1	31.0	49.5
	(2)	SPL	46.1	46.1	55.2	52.7	46.6	43.3	41.0	36.3	31.6	50.0
	(3)	PWL	66.8	66.8	74.3	77.4	70.8	67.8	65.7	63.1	57.8	74.5
D3AUA/W	(1)	SPL	53.6	53.6	52.2	56.1	52.2	49.2	48.2	40.9	38.6	55.2
	(2)	SPL	59.2	59.2	52.6	57.1	52.2	49.2	48.2	40.9	39.2	55.4
	(3)	PWL	74.3	74.3	77.2	81.0	72.9	71.1	69.0	64.3	60.6	77.5
D3FUA/W	(1)	SPL	51.0	51.0	53.9	59.8	51.7	49.8	46.9	41.6	34.1	55.9
	(2)	SPL	56.7	56.7	54.0	60.1	51.7	49.8	46.9	41.6	34.4	56.0
	(3)	PWL	51.5	52.3	66.4	71.3	65.3	69.2	68.2	63.3	58.0	73.8
D3GUA/W	(1)	SPL	50.7	50.7	53.6	59.5	51.4	49.5	46.6	41.3	33.8	55.6
	(2)	SPL	56.5	56.5	53.8	59.9	51.5	49.5	46.6	41.4	34.2	55.8
	(3)	PWL	51.6	52.4	66.5	71.4	65.4	69.2	68.2	63.4	58.1	73.8
D4EUA/W	(1)	SPL	52.3	52.3	55.2	61.1	53.0	51.1	48.2	42.9	35.4	57.2
	(2)	SPL	58.1	58.1	55.4	61.5	53.1	51.1	48.2	43.0	35.8	57.4
	(3)	PWL	53.2	54.0	68.1	73.0	67.0	70.8	69.8	65.0	59.7	75.4
D4HUA/W	(1)	SPL	53.8	53.8	56.8	57.2	55.2	54.1	49.3	42.7	36.0	58.1
	(2)	SPL	65.3	65.3	58.0	57.5	55.3	54.2	49.4	42.8	36.1	58.3
	(3)	PWL	82.3	82.3	79.9	82.4	74.5	72.7	70.6	65.9	62.2	79.0
D5DUA/W	(1)	SPL	58.7	57.7	57.6	61.2	53.3	53.2	50.9	43.1	38.6	58.5
	(2)	SPL	58.7	57.7	58.5	61.4	54.1	53.3	51.0	43.1	38.6	58.7
	(3)	PWL	72.4	72.4	81.1	83.8	76.7	74.2	72.1	67.4	63.7	80.6
D7LUA/W	(1)	SPL	60.0	59.0	58.9	62.5	54.6	54.5	52.2	44.4	39.9	59.8
	(2)	SPL	60.0	59.0	59.8	62.7	55.4	54.6	52.3	44.4	39.9	60.0
	(3)	PWL	73.7	73.7	82.4	85.1	78.0	75.5	73.4	68.7	65.0	81.9
D8FUA/W	(1)	SPL	66.6	66.6	73.7	70.9	63.0	61.1	57.0	49.3	39.5	67.2
	(2)	SPL	66.8	66.8	73.8	71.0	63.3	61.3	57.3	49.8	41.3	67.4
	(3)	PWL	83.8	83.8	93.7	91.6	83.8	79.2	78.4	69.4	61.6	87.5

Sound Pressure Level

Tab. 7b — F/D/H versions and Under configuration

MODEL	Mode	Level	Octave band frequency (Hz)									Sound Level [dB(A)]
			31.5	63	125	250	500	1000	2000	4000	8000	
D1GUF/D/H	(1)	SPL	42.5	42.5	48.5	55.6	45.2	39.5	36.9	30.4	23.8	49.3
	(2)	SPL	43.2	43.2	49.3	55.7	45.8	39.6	37.0	32.5	25.1	49.5
	(3)	PWL	66.5	66.5	72.9	72.6	69.9	65.1	62.3	60.2	53.9	71.7
D2EUF/D/H	(1)	SPL	47.2	47.2	56.7	54.5	47.3	45.2	42.9	36.1	33	51.5
	(2)	SPL	48.0	48.0	57.1	54.7	48.5	45.3	43.0	38.2	33.6	52.0
	(3)	PWL	68.7	68.7	76.2	79.4	72.7	69.8	67.7	65	59.8	76.4
D3AUF/D/H	(1)	SPL	51.2	51.2	49.8	53.7	49.8	46.8	45.8	38.5	36.2	52.8
	(2)	SPL	57.0	57.0	50.4	54.9	50	46.8	45.8	38.5	37.0	53.1
	(3)	PWL	72.3	72.3	75.0	79.0	70.5	68.7	66.6	61.9	58.6	75.2
D3FUF/D/H	(1)	SPL	52.1	52.1	55.0	60.9	52.8	50.9	48.0	42.7	35.2	57.0
	(2)	SPL	58.0	58.0	55.3	61.4	53.0	50.9	48.1	42.9	35.7	57.3
	(3)	PWL	53.0	53.8	67.9	72.8	66.8	70.5	69.6	64.8	59.5	75.2
D3GUF/D/H	(1)	SPL	52.0	52.0	54.9	60.8	52.7	50.8	47.9	42.6	35.1	56.9
	(2)	SPL	57.9	57.9	55.2	61.3	52.9	50.8	48.0	42.8	35.6	57.2
	(3)	PWL	53.1	53.9	68.0	72.9	66.9	70.6	69.7	64.9	59.6	75.3
D4EUF/D/H	(1)	SPL	52.5	52.5	55.4	61.3	53.2	51.3	48.4	43.1	35.6	57.4
	(2)	SPL	58.4	58.4	55.7	61.8	53.4	51.3	48.5	43.3	36.1	57.7
	(3)	PWL	53.6	54.4	68.5	73.4	67.4	71.1	70.2	65.4	60.1	75.8
D4HUF/D/H	(1)	SPL	50.0	50.0	53.0	53.4	51.4	50.3	45.5	38.9	32.2	54.3
	(2)	SPL	61.7	61.7	54.4	53.9	51.7	50.6	45.8	39.2	32.5	54.7
	(3)	PWL	78.9	78.9	76.5	79.0	71.1	69.3	67.2	62.5	58.8	75.6
D5DUF/D/H	(1)	SPL	54.4	54.4	57.4	57.8	55.8	54.7	49.9	43.3	36.6	58.7
	(2)	SPL	66.1	66.1	58.8	58.3	56.1	55.0	50.2	43.6	36.9	59.1
	(3)	PWL	84.1	84.1	81.7	84.2	76.3	74.5	72.4	67.7	64.0	80.8
D8FUF/D/H	(1)	SPL	64.2	64.2	71.3	68.5	60.6	58.7	54.6	46.9	37.1	64.8
	(2)	SPL	64.4	64.4	71.4	68.6	60.9	58.9	54.9	47.4	38.9	65.0
	(3)	PWL	81.4	81.4	91.3	89.2	81.4	76.8	76.0	67.0	59.2	85.1

LEGENDA

The sound levels global and for each octave band are expressed in dB with a tolerance of (−0/+2) dB.

(1) *Only ventilation (20 Pa available external static pressure), 2 m in front of the unit and 1.5 m height, in free field conditions.*

(2) *Working compressor (20 Pa available external static pressure), 2 m in front of the unit and 1.5 m height, in free field conditions.*

(3) *Working compressor, on discharge side.*

Level

SPL *sound pressure level*

PWL*sound power level*

Sound Pressure Level

Tab. 7c — A/W versions, Over configurations

MODEL	Mode	Level	Octave band frequency (Hz)									Sound Level [dB(A)]
			31.5	63	125	250	500	1000	2000	4000	8000	
D1EOA/W	(1)	SPL	50.6	50.6	54.8	50.2	49.1	44.1	40.3	33.7	24.0	50.2
	(2)	SPL	59.1	54.8	55.7	51.4	49.8	45.5	41.2	34.9	25.5	51.2
	(3)	PWL	76.9	72.6	76.6	77.3	73.6	71	67.7	63.9	59.7	76.4
D1GOA/W	(1)	SPL	50.2	50.2	54.4	49.8	48.7	43.7	39.9	33.3	23.6	49.8
	(2)	SPL	56.3	53.6	55	50.7	49.2	44.8	40.6	34.2	24.7	50.5
	(3)	PWL	73.9	71.2	75.7	76.4	72.8	70.1	66.9	63.0	58.7	75.5
D2EOA/W	(1)	SPL	51.7	51.7	55.9	51.9	49.2	45.8	42.4	36.3	26.5	51.4
	(2)	SPL	56.5	57.4	57.2	53.5	50.5	47.6	43.5	37.7	28.2	52.9
	(3)	PWL	74.5	75.4	79.9	83.6	75.6	75.3	72.5	68.1	65.7	80.8
D3AOA/W	(1)	SPL	58.4	58.4	57.9	57.7	56.1	49.9	45.7	38.1	28.9	56.5
	(2)	SPL	60.6	59.8	57.9	57.7	56.1	51.1	47	42	35.6	57.1
	(3)	PWL	68.8	68.4	77.3	80.7	73.0	72.2	70.1	67.5	67.6	78.4
D3FOA/W	(1)	SPL	47.3	47.0	50.6	52.1	53.6	51.0	45.0	36.1	29.9	54.9
	(2)	SPL	58.8	58.0	54.6	53.9	53.6	51.0	45.2	40.2	33.8	55.3
	(3)	PWL	80.7	80.2	83.1	78.8	70.8	66.2	65.4	58.9	50.9	75.0
D3GOA/W	(1)	SPL	46.8	46.5	50.1	51.6	53.1	50.5	44.5	35.6	29.4	54.4
	(2)	SPL	59.2	58.4	55.0	54.3	53.5	50.5	45.6	40.6	34.2	55.2
	(3)	PWL	80.1	79.6	82.5	78.2	69.9	65.3	64.5	58.3	50.3	74.2
D4EOA/W	(1)	SPL	50.3	50.0	53.6	55.1	56.6	54.0	48.0	39.1	32.9	57.9
	(2)	SPL	62.7	61.9	58.5	57.8	57.0	54.0	49.1	44.1	37.7	58.7
	(3)	PWL	83.6	83.1	86	81.7	73.4	68.8	68	61.8	53.8	77.7
D4HOA/W	(1)	SPL	63.5	58.4	62.4	58.0	56.8	55.5	50.0	43.5	39.4	59.5
	(2)	SPL	63.5	59.1	62.4	58.0	60.3	56.8	50.5	43.5	39.4	61.2
	(3)	PWL	71.6	71.6	80.5	83.9	78.5	75.5	73.3	68.6	65.9	81.7
D5DOA/W	(1)	SPL	61.5	56.4	60.4	56.0	54.8	53.5	48.0	41.5	37.4	57.5
	(2)	SPL	61.5	57.9	60.4	56.0	59.1	55.6	49.3	41.5	37.4	59.9
	(3)	PWL	70.1	70.1	79	82.4	76.8	73.9	71.8	67.1	64.4	80.1
D7LOA/W	(1)	SPL	62.2	57.1	61.1	56.7	55.5	54.2	48.7	42.2	38.1	58.2
	(2)	SPL	62.2	57.7	61.1	56.7	58.9	55.4	49.1	42.2	38.1	59.8
	(3)	PWL	71.1	71.1	80.0	83.4	77.5	74.9	72.8	68.1	65.4	81.0

Sound Pressure Level

Tab. 7d — F/D/H versions, Over configuration

MODEL	Mode	Level	Octave band frequency (Hz)									Sound Level [dB(A)]
			31.5	63	125	250	500	1000	2000	4000	8000	
D1GOF/D/H	(1)	SPL	50.7	50.7	54.9	50.3	49.2	44.2	40.4	33.8	24.1	50.3
	(2)	SPL	56.5	53.9	55.5	51.1	49.7	45.2	41.0	34.7	25.2	51.0
	(3)	PWL	73.9	71.3	76.0	76.6	73.1	70.3	67.1	63.3	59.0	75.8
D2EOF/D/H	(1)	SPL	52.5	52.5	56.7	52.7	50.0	46.6	43.2	37.1	27.3	52.2
	(2)	SPL	57.0	58.0	58.0	54.2	51.3	48.4	44.3	38.4	28.9	53.7
	(3)	PWL	74.4	75.4	80.1	83.7	75.8	75.5	72.7	68.2	65.8	81.0
D3AOF/D/H	(1)	SPL	54.6	54.6	54.1	53.9	52.3	46.1	41.9	34.3	25.1	52.7
	(2)	SPL	58.5	57.7	54.3	53.9	52.8	49.0	44.9	39.9	33.5	54.3
	(3)	PWL	68.1	67.3	73.5	76.9	69.3	70.9	68.9	66.8	66.9	76.4
D3FOF/D/H	(1)	SPL	48.1	47.8	51.4	52.9	54.4	51.8	45.8	36.9	30.7	55.7
	(2)	SPL	60.5	59.7	56.3	55.6	54.8	51.8	46.9	41.9	35.5	56.5
	(3)	PWL	83.1	82.6	85.5	81.2	71.6	67.0	66.4	61.3	53.3	76.7
D3GOF/D/H	(1)	SPL	47.5	47.2	50.8	52.3	53.8	51.2	45.2	36.3	30.1	55.1
	(2)	SPL	61.1	60.3	56.9	56.2	55.4	51.6	47.5	42.5	36.1	56.8
	(3)	PWL	83.0	82.5	85.4	81.1	71.0	66.0	66.3	61.2	53.2	76.5
D4EOF/D/H	(1)	SPL	49.1	48.8	52.4	53.9	55.4	52.8	46.8	37.9	31.7	56.7
	(2)	SPL	62.7	61.9	58.5	57.8	57.0	53.2	49.1	44.1	37.7	58.4
	(3)	PWL	84.6	84.1	87.0	82.7	72.6	67.6	67.9	62.8	54.8	78.1
D4HOF/D/H	(1)	SPL	59.9	54.8	58.8	54.4	53.2	51.9	46.4	39.9	35.8	55.9
	(2)	SPL	59.9	55.9	58.8	54.4	57.1	53.6	47.3	39.9	35.8	57.9
	(3)	PWL	68.0	68.3	76.9	80.3	75.7	72.7	69.8	65.0	62.3	78.5
D5DOF/D/H	(1)	SPL	63.0	57.9	61.9	57.5	56.3	55.0	49.5	43.0	38.9	59.0
	(2)	SPL	63.0	58.8	61.9	57.5	60.0	56.5	50.2	43.0	38.9	60.8
	(3)	PWL	71.7	71.7	80.6	84.0	76.3	75.5	73.4	68.7	66.0	81.3

LEGENDA

The sound levels global and for each octave band are expressed in dB with a tolerance of (−0/+2) dB.

(1) *Only ventilation (50 Pa available external static pressure), 2 m in front of the unit and 1.5 m height, in free field conditions.*

(2) *Working compressor (50 Pa available external static pressure), 2 m in front of the unit and 1.5 m height, in free field conditions.*

(3) *Working compressor, on discharge side.*

Level

SPL *sound pressure level*

PWL*sound power level*

Tab. 7e — A/W versions and Displacement configuration

MODEL	Mode	Level	Octave band frequency (Hz)									Sound Level [dB(A)]
			31.5	63	125	250	500	1000	2000	4000	8000	
D1EDA/W	(1)	SPL	59.1	59.1	61.8	55.2	52.5	53.2	47.4	37.4	30.6	56.6
	(2)	SPL	59.3	66	62.2	55.4	53.2	54.7	50.1	46.9	38.5	58.4
	(3)	PWL	66.7	73.4	73.2	73.4	70.7	67.2	65.6	68.3	61.2	74.6
D1GDA/W	(1)	SPL	57.4	57.4	60.1	53.5	50.8	51.5	45.7	35.7	28.9	54.9
	(2)	SPL	57.4	64.2	60.5	53.7	51.5	53.0	48.3	45.0	36.7	56.7
	(3)	PWL	65.1	71.9	71.8	72.0	69.3	65.8	64.1	66.7	59.7	73.1
D2EDA/W	(1)	SPL	60.9	60.9	63.6	57.0	54.3	55	49.2	39.2	32.4	58.4
	(2)	SPL	60.9	67	63.9	57.1	54.9	56.3	51.5	47.8	39.5	59.9
	(3)	PWL	67.4	73.5	75.6	78.8	71.6	70.5	69.4	71	65.8	77.8
D3ADA/W	(1)	SPL	64.3	64.3	63.8	63.6	62.0	55.8	51.6	44.0	34.8	62.4
	(2)	SPL	66.6	65.8	63.8	63.6	62.0	57.1	53.0	48.0	41.6	63.0
	(3)	PWL	75.6	74.8	83.2	86.6	78.9	78.4	76.4	74.3	74.4	84.6

LEGENDA

The sound levels global and for each octave band are expressed in dB with a tolerance of (−0/+2) dB.

(1) *Only ventilation (0 Pa available external static pressure), 2 m in front of the unit and 1.5 m height, in free field conditions.*

(2) *Working compressor (0 Pa available external static pressure), 2 m in front of the unit and 1.5 m height, in free field conditions.*

(3) *Working compressor, on discharge side.*

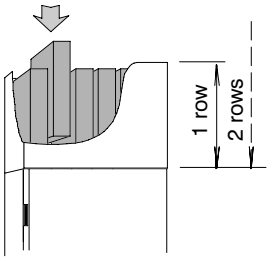
Level

SPL *sound pressure level*

PWL*sound power level*

Sound Pressure Level

Silencing cartridges (option)— for supply (Over) and suction (Under)



These are special cartridges made of self−extinguishing material with a high noise attenuation capacity. They are guaranteed against disintegration and release of particles do to friction of the air.

It is possible to install **one** or **two** rows of cartridges in the supply hood by inserting them through the top: one single row for ≥ 600 mm height hood, two rows for a hood height 1200 mm.
Despite a small additional pressure drop, these cartridges provide a remarkable sound power level reduction (see tab. 7d).

Tab. 7f — Features of silencing cartridges

Models	Dimensions	Free Section	Cartridge Number	
	[mm]	[mm]	1 row	2 rows
D1E … D2E	500 x 195 x 500	400 x 100	4	8
D3A	500 x 195 x 500	400 x 100	5	10
D3F.. D7L	500 x 195 x 500	400 x 100	11	22
D8F	500 x 195 x 500	400 x 100	16	32

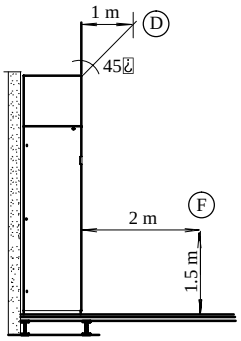
Tab. 7g — Attenuation in dB

row no.	Attenuation in dB at different frequency values (Hz)							
	63	125	250	500	1000	2000	4000	8000
1	1	4	7	15	26	28	27	14
2	1	6	12	27	49	53	49	23

Tab. 7h — Pressure drops

row no.	Pressure drops (Pa) for each module at different air flows (m^3/s)				
	0.2	0.3	0.4	0.5	0.6
1	1	2	4	7	9
2	3	6	11	18	26

Tab. 7i — Approximate variations of Sound Pressure Level



Variations compared to values measured without noise reduction duct: free discharge (for Over units) or free suction (Under units).

Position **F**: 2 meters from the front, 1.5 meter from the ground

Position **D**: 1 meter from the front, 45° from the top

Unit Configuration	Plenum Height	Cartridge Rows Number	Position	
			F	D
Under	600 mm	1	−4.0 dB	−7.0 dB
	1200 mm	2	−5.0 dB	−8.0 dB
Over	600 mm	1	−7.5 dB	−12.0 dB
	1200 mm	2	−9.5 dB	−14.0 dB

8 Technical Specifications

Fan (room unit)

Innovative application of single inlet centrifugal fans incorporating an impeller with curved blades corrosion resistant made of aluminium with new design to get increased performances and sound radiation free of tonal noise.
High efficiency.
The motor is three–phase with IP54 protection; provided with internal thermal protection.
The fan wheel is statically and dynamically balanced; the bearings are self–lubricating.
The fan is mounted on anti–vibration rubber supports to reduce the mechanical contact with the frame and hence minimize vibration.
Available head up to 350 Pa.
Modularity.
Variable speed: several different settings; possibility to optimize air flow, available head, dehumidification operation.
Other information: see **Chap. 1**.

Air filters (see Chap. 9)

Compressor

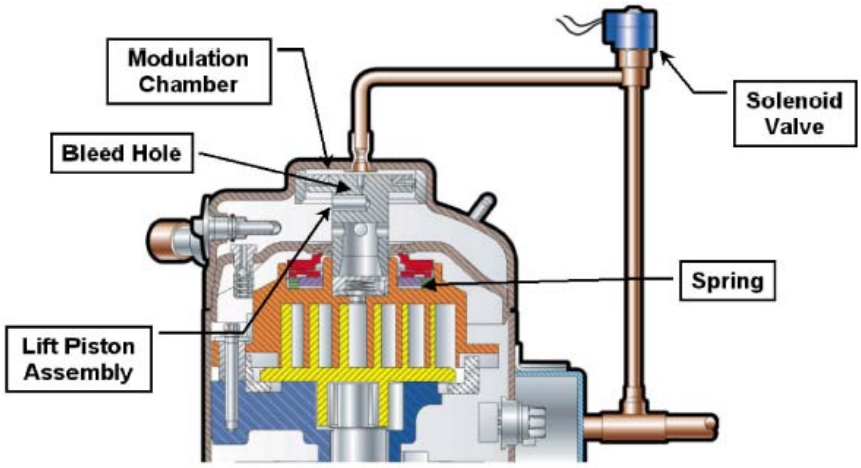
Digital Scroll compressor [Digital range]

When it is mandatory to have a precise and continuous equivalence between the load and the cooling capacity. We get this through the innovative compressor: the Copeland Digital Scroll. It uses a simple and effective method to modulate the capacity, giving unparalleled performance in the modulation field.

The controlled separation of the scrolls is achieved using a solenoid valve and a bypass connection between the discharge chamber and the intake gas (See Fig.8.a). The scrolls are designed so that the upper scroll can separate from the bottom scroll by 1mm vertically. A piston is attached on top of the upper scroll and will lift up the upper scroll when it moves up. When the solenoid valve is closed, the Digital Scroll operates as a normal scroll compressor and the compressed gas is discharged at high pressure through the normal piping. When the solenoid valve is opened, the discharge chamber and intake gas pressure becomes connected, thereby releasing some of the discharge pressure. This leads to less pressure holding the piston down thereby causing the piston to shift upwards, which in turn lifts the upper scroll. Once the scrolls separate, any gas passing through is no longer compressed.

The Digital Scroll operates in two stages – the ”loaded state”, when the solenoid valve is normally closed and ”unloaded state”, when the solenoid valve is open. During the loaded state the compressor operates like a standard scroll and delivers full capacity and mass flow. However, during the unloaded state, there is no capacity and no mass flow through the compressor.

Fig. 8.a



At this stage, let us introduce the concept of a cycle time. A cycle time consists of a ”Loaded State” time and ”Unloaded State” time. The duration of these 2—time segments determine the capacity modulation of the compressor. Example: In a 20 seconds cycle time, if the loaded state time is 10 seconds and the unloaded state time is 10 seconds, the compressor modulation is 50%. If for the same cycle time, the loaded state time is 15 seconds and the unloaded state time is 5 seconds, the compressor modulation is 75%. The capacity is a time averaged summation of the loaded state and unloaded state. By varying the loaded state time and unloaded state time, any capacity between 10% and 100% can be delivered by the compressor. Hence, the Copeland Digital Scroll can achieve a continuous modulation of AC capacity to suit the system’s needs precisely.
We could vary the cycle time and still achieve the same effective capacity, but Copeland and Liebert they have done extensive testing to optimize the cycle time in this application.

Electric expansion valve device [optional]

The valve is designed for modulating control of refrigerant circuits with high speed and high precision. It is suitable for use as expansion device in refrigerant circuits with Copeland Digital Scroll compressor, with organic safety refrigerants (i.e. R410A). For variable capacity systems, an EXV provides superior performance as compared to a thermostatic expansion valve (TXV), due to:

- Precise flow control
- Positioning time

Electronic expansion valve ensure a better control on super heating at the end of the evaporator, ensuring at same that compressor will never be filled by liquid from the 10% to 110% of its nominal capacity, instead a mechanical one can’t ensure it. It has to be calibrate and then it will work properly but only around the calibration point.
This means that a TXV works better (i.e. better control, longer life) with a condensing pressure as much as possible constant. For such reason with TXV the condensing temperature is kept around 45°C as set point. But during the coldest period the condensing temperature can be lowered and the electronic expansion valve adapts to this new situation. This permits an increase of the cooling capacity of the unit, decrease the power input of the unit and so increase the energy efficiency of the entire Liebert HPM Digital unit. Basically this on a standard unit with standard Scroll compressor has the negative effect of decreasing the SHR of the unit (common competitors’ application), while on Liebert HPM Digital thanks to Digital Scroll modulation this negative effect disappears. So for such reason to have the biggest advantage from the electronic expansion valve use a different set point for the fan speed controller of the condenser coupled with Liebert HPM Digital (33°C — P1)

Digital range — Major Benefits

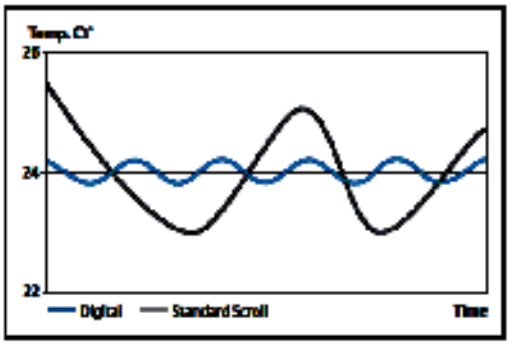
Emerson Network Power is proud to offer a new possibility to have the best technologic evolutions in your cooling unit, adding to an already optimum product a wide range of benefits:
Modulation (as explained in Digital Scroll Chapter):

- Perfect match between Cooling Capacity and Heat Load.
- Lower power input partial load.
- Quick adaptation to changing heat load.
- Possibility to size cooling system to overcome to future heat load growth.

Precision Control:

- More precise room temperature control.
  Once you make a direct comparisons between standard units using standard scroll compressors and Liebert HPM Digital, is necessary to notice that Liebert HPM Digital has a very high precision in control room temperature; so all the advantages exponentially increase comparing Liebert HPM Digital to a standard unit with the same tolerances on controlling the temperature.

Fig. 8.b



In fact to guarantee the same precision, standard scroll technology has to use additional technologies, like hot gas by pass or hot gas injection, and others, to avoid the compressor shut off, and to avoid loosing temperature control. All these techniques are very energy expensive, and for this reason we can say that Liebert HPM Digital offers more requiring less.

Availability & Reliability:

- Less number of start/stop cycling means longer unit life.
  As described previously at partial load, a Digital scroll doesn't work with ON – OFF configuration. This avoids peaks in adsorbed power, and reduces stress on components. This increases the life of the unit, greatly reducing failure due to fatigue.
- Wide operational limits for higher availability.
  To maximise the possible advantages coming from the thermodynamic functioning of Liebert HPM Digital Emerson Network Power has developed special software; with an additional pressure transducer the control, when external air temperature increases over standard functioning limits, commands the compressor to modulate his capacity. Forcing the condensing temperature to decrease under the limit, even when at partial load, the unit guarantees refrigeration; standard units in the same condition would fail. So when you size your requested unit you consider the worst external conditions; it can happen that occasionally during the year it will be hotter than your design ambient temperature. In this case a standard unit will shut down due to high condensing temperatures, leaving your Data Center without cooling when the requirement is at its highest, however your Liebert HPM Digital will guarantee a partial cooling capacity. So System availability is guaranteed even during extreme operating conditions.

Increased Efficiency thanks to:

- COP and SHR Effect.
  At partial load alternation between loaded and unloaded states involves a reduction on nominal mass flow both on the evaporator and on the condenser. This gives digital technology two important thermodynamic advantages: higher evaporating temperatures, and lower condensing temperatures. These are both important characteristics, the evaporating temperature is directly related to cooling capacity, and a higher evaporating temperature means a higher cooling capacity. Condensing temperature is directly related to power input, and lower it is the lower the power consumption of the compressor. Consequently the Digital scroll increases its COP at partial load (higher then 75%) in fact the higher evaporating temperature and lower condensing temperature gives higher cooling capacity and lower power input.
- Electronic Expansion Valve Effect (as explained in the proper Chapter).
- EC Fan Effect (as explained in the proper Chapter).

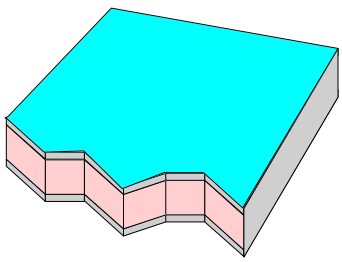
Thanks to all these effects we can have a reduction up to 50% on the yearly energy consumption and a return of investment lower then half a year (considering a comparison versus a standard Room Cooling Unit with standard Scroll, standard AC Fan and standard Thermostatic Expansion Valve, placed in a city in the centre of Europe).

Coils

DX Refrigerant/room air

In such a way we can increase the global efficiency to the biggest value.
High front surface.
Made of copper pipes and aluminium fins.
Fins treated with hydrofile styrol acrylic paints to withstand corrosive atmospheres.
Low pressure drop.
High SHR (Sensible Heat Ratio).

Frame and panels



The sheet steel structure, painted with epoxy–polyester powders, is assembled by stainless steel rivets; the paneling system ensures higher stiffness; there will also be some pluggings (compressor space and fan) for guaranteeing both safety and high acoustic absorption.
The frontal panel is assembled on hinges to make the access easier; this can be opened by the fast closing lock.
The rear and side panels are screwed to the supports. The rear panel is screwed directly to the frame.

The air returns from the machine top in machines with underfloor air delivery, whereas in machines with upward air delivery it returns through the metal grid on the front panel.

The compressor section can be reached even during the unit operation by removing the front panel and the protection plugging.
The panels are lined with thermoacoustic insulating material — class 0 (ISO 11822).

Refrigerant

The units are designed for being used with refrigerant R410A.

Humidifier (option) see Chap. 11

Electrical Heaters (option) for Heating Mode

The heaters are made of:

— aluminium with high efficiency fins for **D1E,D1G,D2E and D8F models**

— finned armored stainless steel AISI 304 for **D3A,D3F,D3G,D4E,D4H,D5D and D7L models**:

to maintain a low surfaces power density. Ionization effects are eliminated owing to the low heater surface temperature. Each stage of electric heating is distributed across the three phases so to avoid balancing problems.

There an ON—OFF type electronic temperature controller, a safety thermostat with manual reset, a miniature circuit breaker for short—circuit protection and harness protection from possible accidental contact.

When electrical heating is installed, the dehumidification system can be also activated and humidity sensor and indicator provided, if especially ordered (see "humidification and dehumidification system" for the dehumidification function). Electric heating can be installed combined with hot gas or hot water heating.

Hot Gas Coil (option)

DX units for Reheating Mode only (versions A/W/F/D/H)

Liebert HPM can be supplied with a reheating system that uses the heat which is normally transferred to the condenser, thus saving energy.

This system is activated during the dehumidification phase, when the temperature is below its setpoint. A control valve prevents the refrigerant from flowing into the reheat coil when not required. Hot gas reheat is available as an alternative to hot water reheat.

Tab. 8a — Features of hot gas reheat system at nominal airflow

MODELS U/O A/W/F/D/H		D1E	D1G	D2E	D3A	D3F	D3G	D4E	D4H	D5D	D7L	D8F
rows	no.	1	1	1	1	1	1	1	1	1	1	1
surface	m^2	0.37	0.37	0.37	0.47	1.07	1.07	1.07	1.07	1.07	1.07	1.29
reheating capacity (at 24°C, 50%, condensing temperature 45°C)	kW	8.9	10.6	14.2	17.3	21.3	26.7	10.8	13.6	17.5	20.4	28.2

Tab. 8b — Reheating mode during the dehumidifications

Hot gas reheat (HG) + Heaters (H1, H2) during Dehumidification mode			
	ON	**OFF**	**Functions**
first step	HG + H1	=	Reheating + Heater
second step	HG + H2	HG + H1	Reheating + Heater

Hot Water Coil (for heating and reheating mode and dehumidification system)

The hot water heating coil is made of copper pipes and aluminium fins, with one row, test pressure 30 bar and includes an exhaust valve. A three−way on−off valve directly driven by the microprocessorcontroller is supplied as standard.
A hot water thermostat (provided by the customer) is installed to indicate the presence of hot water at the correct temperature. When hot water heating is installed, the dehumidification system can also activated and a humidity sensor and indicator provided, if especially ordered (see ”humidification and dehumidification system” for the dehumidification function).
The hot water heating/reheat system can be installed as an alternative to the hot gas reheat system.

Tab. 8c − Features of hot water reheat system at nominal airflow

MODELS U/O A/W/F/D/H		D1E	D1G	D2E
rows	no.	1	1	1
surface	m^2	0.37	0.37	0.37
indoor temp. 24°C, 50% R.H.; water inlet/outlet temperature 80/65°C; condensing temperature 45°C				
power (re−heating)	kW	10.4	11.5	12.9
water flow	l/s	0.17	0.19	0.21
coil side pressure drops	kPa	1	1	1
total pressure drops	kPa	4	5	3
indoor temp. 20°C, 50% R.H.; water inlet/outlet temperature 80/65°C; condensing temperature 45°C				
power (re−heating)	kW	11.3	12.4	13.9
water flow	l/s	0.18	0.20	0.23
coil side pressure drops	kPa	1	1	1
total pressure drops	kPa	4	5	3

MODELS U/O A/W/F/D/H		D3A	D3F	D3G	D4E	D4H	D5D	D7L
rows	no.	1	1	1	1	1	1	1
surface	m^2	0.47	1.07	1.07	1.07	1.07	1.07	1.07
indoor temp. 24°C, 50% R.H.; water inlet/outlet temperature 80/65°C; condensing temperature 45°C								
power (re−heating)	kW	17.2	34.4	34.5	38.4	38.6	42.1	43.8
water flow	l/s	0.28	0.56	0.563	0.627	0.63	0.686	0.714
coil side pressure drops	kPa	1	2	2	3	3	3	4
total pressure drops	kPa	4	15	15	19	20	23	25
indoor temp. 20°C, 50% R.H.; water inlet/outlet temperature 80/65°C; condensing temperature 45°C								
power (re−heating)	kW	18.4	36.6	36.7	40.8	41	44.7	46.5
water flow	l/s	0.3	0.596	0.598	0.665	0.668	0.729	0.758
coil side pressure drops	kPa	1	3	3	3	3	4	4
total pressure drops	kPa	5	18	18	22	22	26	28

MODELS U A/W/F/D/H		D8F
rows	no.	1
surface	m^2	1.29
indoor temp. 24°C, 50% R.H.; water inlet/outlet temperature 80/65°C; condensing temperature 45°C		
power (re−heating)	kW	32.0
water flow	l/s	0.522
coil side pressure drops	kPa	5
total pressure drops	kPa	10
indoor temp. 20°C, 50% R.H.; water inlet/outlet temperature 80/65°C; condensing temperature 45°C		
power (re−heating)	kW	33.9
water flow	l/s	0.553
coil side pressure drops	kPa	6
total pressure drops	kPa	11

Technical Specifications

Tab. 8d — Reheating mode during the dehumidifications

	Hot water reheat (HW) + Heaters (H1, H2) during Dehumidification mode		
	ON	**OFF**	**Functions**
first step	HW + H1	=	Reheating + Heater
second step	HW + H2	HW + H1	Reheating + Heater

Tab. 8e — Features of hot water heating system at nominal airflow

MODELS U/O A/W/F/D/H		**D1E**	**D1G**	**D2E**
rows	no.	1	1	1
surface	m^2	0.37	0.37	0.37
indoor temp. 24°C, 50% R.H.; water inlet/outlet temperature 80/65°C.				
power (heating)	kW	7.7	8.6	9.5
water flow	l/s	0.125	0.14	0.15
coil side pressure drops	kPa	1	1	1
total pressure drops	kPa	3	3	2
indoor temp. 20°C, 50% R.H.; water inlet/outlet temperature 80/65°C.				
power (heating)	kW	8.8	9.7	10.7
water flow	l/s	0.14	0.159	0.174
coil side pressure drops	kPa	1	1	1
total pressure drops	kPa	3	4	2

MODELS U/O A/W/F/D/H		**D3A**	**D3F**	**D3G**	**D4E**	**D4H**	**D5D**	**D7L**
rows	no.	1	1	1	1	1	1	1
surface	m^2	0.47	1.07	1.07	1.07	1.07	1.07	1.07
indoor temp. 24°C, 50% R.H.; water inlet/outlet temperature 80/65°C.								
power (heating)	kW	13.1	27.2	27.3	30.4	30.5	32.7	33.6
water flow	l/s	0.213	0.444	0.446	0.495	0.497	0.534	0.547
coil side pressure drops	kPa	1	2	2	2	2	2	2
total pressure drops	kPa	3	10	10	12	12	14	15
indoor temp. 20°C, 50% R.H.; water inlet/outlet temperature 80/65°C.								
power (heating)	kW	14.5	29.8	29.9	33.2	33.2	35.8	36.7
water flow	l/s	0.237	0.486	0.487	0.542	0.542	0.584	0.598
coil side pressure drops	kPa	1	2	2	2	2	2	3
total pressure drops	kPa	3	12	12	14	14	16	18

MODELS U A/W/F/D/H		**D8F**
rows	no.	1
surface	m^2	1.29
indoor temp. 24°C, 50% R.H.; water inlet/outlet temperature 80/65°C.		
power (heating)	kW	25.4
water flow	l/s	0.415
coil side pressure drops	kPa	3
total pressure drops	kPa	6
indoor temp. 20°C, 50% R.H.; water inlet/outlet temperature 80/65°C.		
power (heating)	kW	27.7
water flow	l/s	0.451
coil side pressure drops	kPa	4
total pressure drops	kPa	7

Water—cooled Condenser

DX — W/F/H units (see Chap. 5)

Electric board

The electric board is housed in the front part in a space insulated against the air flow and protected by a cover, so as to avoid tampering by non—authorized personnel and to protect the electric board parts supplied with a voltage higher than 24 V.

The electric board complies with the norm 204—1 IEC.
The air conditioners have been provided for operating at 400 V~/3/50 Hz+N+G.

Magnetothermal switches are supplied as protection of every electric component. A single—phase transformer has been provided for supplying power to the secondary circuit at 24 V.

A main switch with door—locking handle is installed to prevent it from being removed when the switch is in the operating position.

There will be an automatic start—up after a possible stop due to power supply lack.
Additional terminals for remote start—up and carry of some operating conditions (fans and compressors) or connection of additional devices (Liquistat, Firestat, Smokestat, clogged filters) are available on the terminal block of the electric board. On the terminal block there is also a clean contact for the remote signalling of the general alarm.

Control system

Very simple user interface.

Immediately intelligible utilization of the control unit system with LCD.

Net connectivity of several units.

Possible utilization of the iCom CDL with graphic display.

Fig. 8.c iCom Medium (single circuit units)

Fig. 8.d iCom Large (double circuit units)

Outdoor Components

Air—cooled Condenser

DX — A/D units (see Product Documentation of HCR condenser)
For pipe layout and unit connection, see Chap. 12 and Service Manual in the unit (or surfed on the web).

Dry—Cooler

DX — W/F/H units

9 Filter section

Standard filters

Removable filters installed inside the unit before of fan and heat exchanger.

Filtration from G4 to F5 (CN EN779 – respectively corresponding to EU4 and EU5 accoding to Eurovent EU4/5).

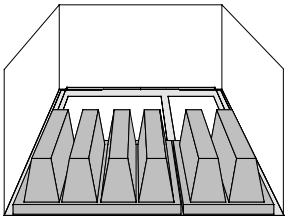
The folded structure of the filters gives high filtration efficiency and low pressure drop.

The filter media used consists of synthetic fibre cells. The frame is made of cardboard.
The additional pressure drop in comparison with G4 sdt filters are indicated in Tab. 9c.

High efficiency filters

Optional high efficiency filters, filtration class F6, F7 and F9 in accordance with the CEN EN 779 standard, are made of fibreglass filter media. The filters are placed in "V" sections with a solid external frame in polypropylene, and can withstand remarkable pressure and flow variations. These filters will be installed within an additional duct on the unit top.

Filter holding duct



If 290 mm high filters are needed, a metal hood must be supplied to support them, installed on the top of the unit and with the same colour. For dimensions see Fig. 12.d.

Clogged filter alarm

A differential static pressure gauge after anf before the filter gives a signal when the filter is dirty.

Fresh air kit

The fresh air kit, optional, has a G3 class filter installed on the intake side of the fan and is connected to the Liebert HPM unit with a 100 mm diameter plastic duct.
As the fresh air intake is positioned close to the fan suction, it will easily mix with the recirculation air.

Air Filters general information

Recently new test methods and configuration systems have been developed for all type of filters. In Europe, CEN is working to establish common standards, in the United States ASHRAE Standards has been in use since 1968, and replaced by ANSI/ASHRAE 52.1–1992. So, in order to have a reference about different standards, see Tab. 9a and Tab 9b. There is no perfect correspondence between different standards, due to the different test methods, but the tables can be used as general guide.

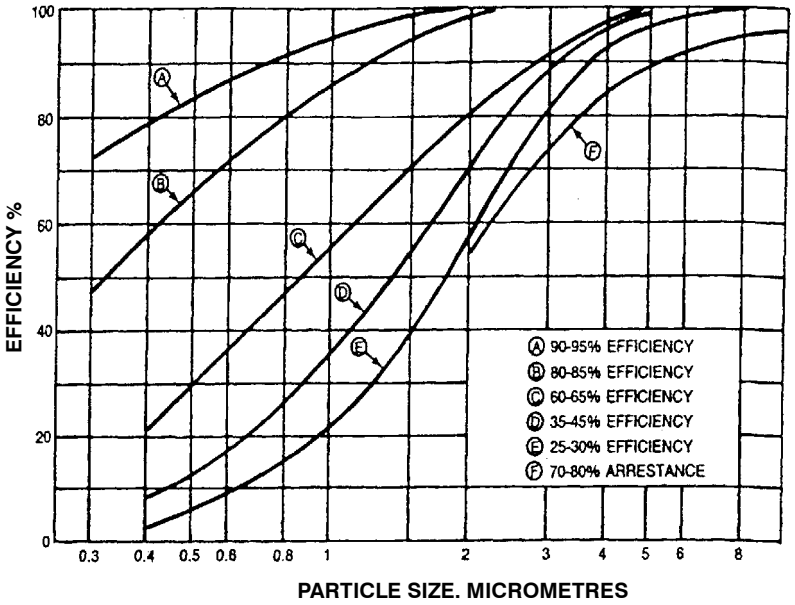
Tab. 9a – Comparison between air filter tests

Eurovent 4/9	EN 779 EN 1882	Average Arrestance * [ASHRAE Standard 52.1–1992]		Average Dust Spot Efficiency ** [ASHRAE Standard 52.1–1992]		Minimum Efficiency Reporting Value [ASHRAE 52.2–1999]
		[greater then or equal to]	[less than]	[greater than or equal to]	[less than]	
EU1	G1	60%	65%		20%	1–4
EU2	G2	65%	80%	20%		4
EU3	G3	80%	90%	20%		5
EU4	G4	90%	95%	20%	30%	6–7–8
EU5	F5	95%	98%	40%	60%	8–9–10
EU6	F6	99%		60%	80%	10–11–12–13
EU7	F7	99%		80%	90%	13–14
EU8	F8	99%		90%	95%	14–15
EU9	F9	99%		95%		15

* *Achieved filtering performance in accordance to gravimetric test method on a specific sample of dust.*
** *Achieved filtering performance in accordance to a light transmission test methods, with natural atmospheric dust.*

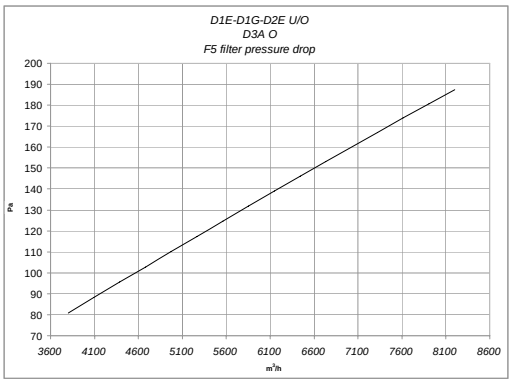
Filter section

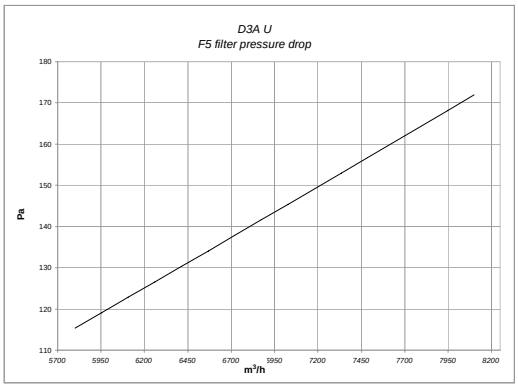
Tab. 9b – Approximate efficiency versus particle size for typical air filters

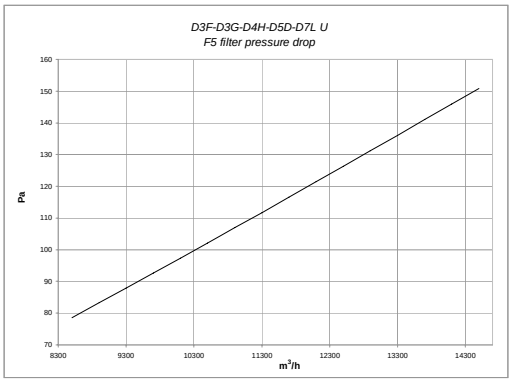


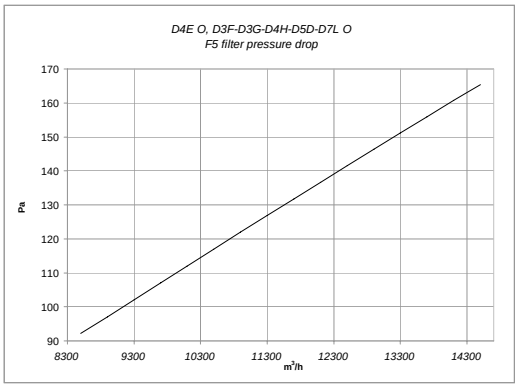
Curves are approximation for general guidance only. Efficiency and arrestance per ASHRAE Std 52.1 test method [From ASHRAE Handbook, HVAC Systems and Equipment].

Tab. 9c – Additional pressure drop Filters F5

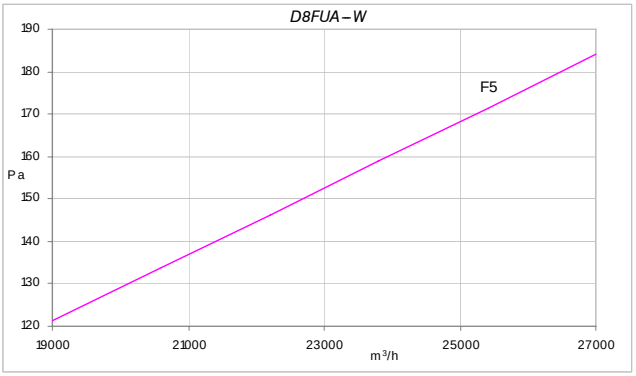




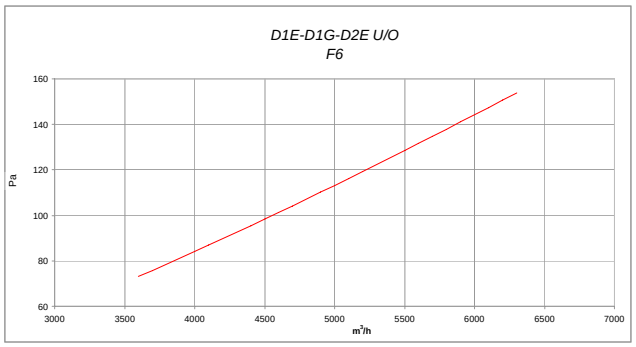




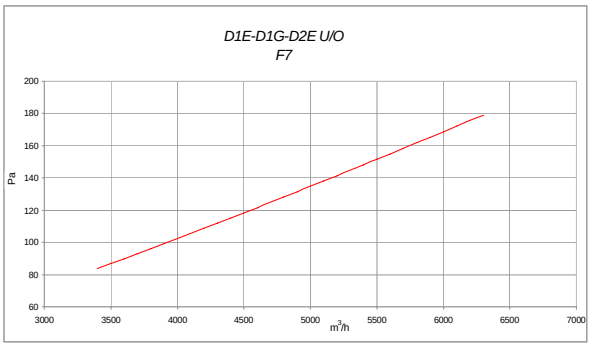
Filter section



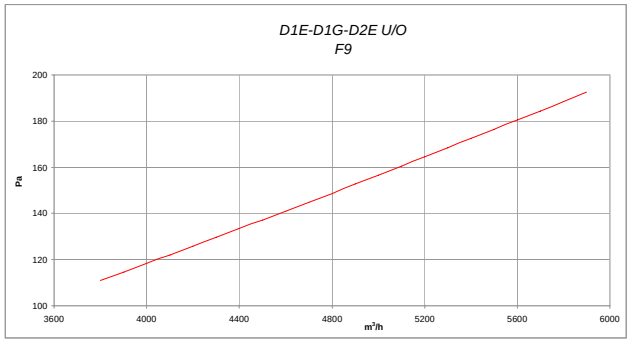
Tab. 9d – Additional pressure drop Filters F6



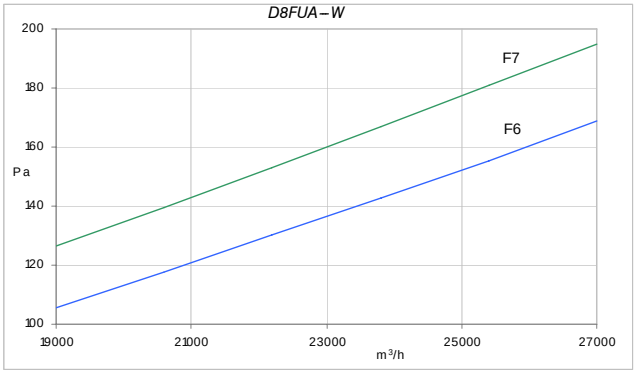
Tab. 9e – Additional pressure drop Filters F7



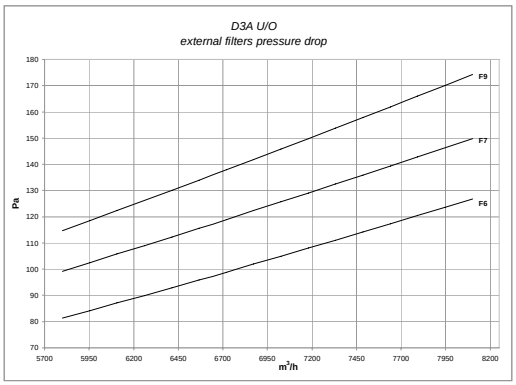
Tab. 9f – Additional pressure drop Filters F9

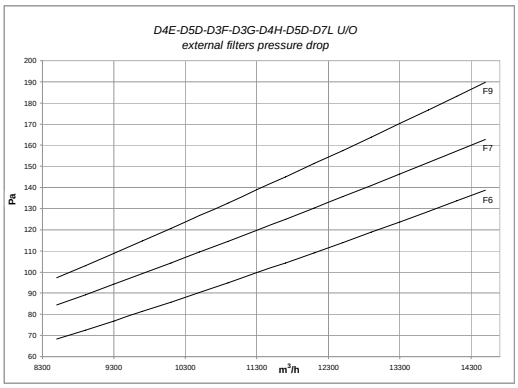


Tab. 9g – Additional pressure drop Filters F6–F7



Tab. 9h – Additional pressure drop Filters F6–F7–F9





10 Microprocessor Controls

iCom Control

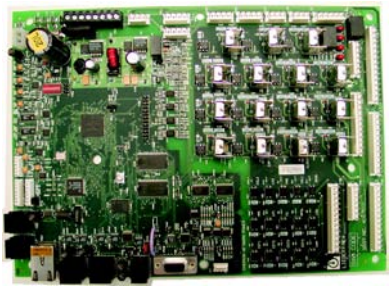
Fig. 10.a

Liebert HPM models are controlled by iCom:

- iCom Medium, for single circuit units (Fig. 10.a).
- iCom Large, for double circuit units (Fig. 10.b).

In both versions the Main Board is housed in the electrical panel and it is connected to the remote display, to be installed in the container/room .(connection cable is included)

Fig. 10.b



- The user interface is the 3−digit back−lit display showing parameter values and relevant symbols/codes in a tree menu. It features navigation push−buttons and status leds.
- Both high and low priority alarms activate a visual indicator and buzzer.
- Input for Remote On−Off and volt−free contacts for simple remote monitoring of low and high priority alarms: high/low room temperature, high/low refrigerant pressure, fan/control failure are available.

- LAN management: functions provided as standard include stand−by (in case of failure or overload of the unit in operation, the second one starts automatically), automatic rotation, and cascade (division of the load among several units, through split of the proportional band).
- All service settings are protected through a 3−Level password system.
- Automatic restart is provided after a power failure.

Tab. 10a − Technical Data iCom

Technical Data	iCom Medium	iCom Large
E2prom	4Mbit + 512kbit	
Flash memory	32Mbit	
RAM memory space	128Mbit	
Microcontroller	Coldfire 32Mbit	
Analogue Input	3 x 0−10V,0−5V,4..20mA (selectable) + 2 PTC/NTC + 3 NTC	4 x 0−10V,0−5V,4..20mA (selectable) + 2 PTC/NTC + 2 NTC
Digital Input	9 x opto−coupled	15 x opto−coupled
Analogue Output	2 x 0−10V	4 x 0−10V
Digital Output	7 triacs output and 2 relay output	15 triacs output and 2 relay output
Time and date function buffered by LI−battery		
Hirobus Lan connectors	2 RJ45 sockets (for unit in LAN, remote display)	
Ethernet network connectors	1 RJ45 socket	
CAN bus connectors	2 RJ12 sockets	
Hironet connectors	1 RJ9 socket for RS485 (direct connection to proprietary supervision)	
RS232 service port	−	1 db9 socket

Microprocessor Controls

CDL Graphic Display (option)

Featuring a 24h graphic record of controlled parameters as well as the last 200 events occurred. A back−up battery keeps the data stored in the memory (graphic data record, alarms).

- Large graphic display (320 x 240 pixel)
- System Window: system operation status at a glance
- Self−explanatory Icons: they are used for the Menu−Layout of the CDL iCom
- Online Help: Every single parameter has its own multi−page explanation (Evolution)
- Status Report of the latest 200 event−messages of the unit/system
- Four different Graphic Data Records (Evolution)
- Timer Mode (electronic timer included in the Software)
- Semi or Full Manual Mode software management including all safety devices
- 4−Level Passwords system to protect all the settings
- Ergonomic design for use also as portable device (start−up and ”flying connections” by service personnel)
- Multi−language menu with on−the−fly language selection

Technical Data CDL Graphic Display

- Microcontroller: . . . . . Coldfire 32Mbit
- Time and date function buffered by LI−battery
- Ethernet network connectors . . . . . 2 RJ45 sockets (for unit in LAN, remote display)
- CAN bus connectors . . . . . 2 RJ12 sockets
- Power supply: . . . . . via CAN bus or external 12Vdc supply

Alarm Board (accessory)

The Alarm Board converts Alarms (high priority) or Warnings (lower priority) from iCom into Volt−free contacts (up to five, either normally closed or normally open). In this way, following Warnings/Alarms are separated: High or Low refrigerant pressure; High room Temperature; Low room Temperature; Fan Failure, Clogged Filter alarm (if installed).

SMM, Wireless SMS Communication (accessory)

The unit is able to send short text messages (SMS) of the its status/alarms to the display of GSM900−1800MHz mobile phones, allowing real time, cost effective maintenance.

11 Humidair humidifier (optional)

Humidification

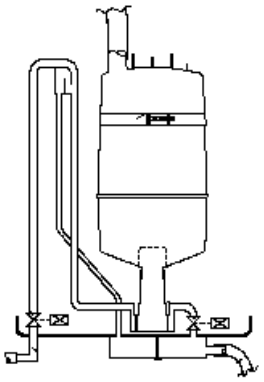
The **humidification system** is provided by a HUMIDAIR electronic humidifier. The **dehumidification function**, which is supplied as standard when the humidifier option is installed, acts by reducing the fan speed with consequent reduction of the air flow and at the same time switching on the compressor.

Electronic humidity control

The software of the iCom microprocessor control includes an algorithm which manages the HUMIDAIR electronic modulating humidifier and also provides the dehumidification function. There is also a special function which automatically prevents dehumidification if the return air temperature is below the required value. When the temperature reaches the correct value, the dehumidification function is automatically reactivated. Dehumidification control may be either of the proportional or of the on−off type, depending on the installation requirements: on−off is set as standard at the factory.

HUMIDAIR electric steam humidifier

HUMIDAIR is a replaceable plastic water cylinder with immersed electrodes. When an electronic current passes between the electrodes, the water is converted into the required quantity of steam. It is suitable for a large range of water qualities (with varying degrees of hardness) with the exception of demineralized water. It almost instantaneously produces clean, particle−free steam and avoids energy losses which are typical of other systems. HUMIDAIR is provided with the steam cylinder, water inlet and outlet valves and a maximum level sensor. The steam output can be adjusted within a range of values which can be chosen manually and is factory−set at 70% of the maximum capacity (see the relevant data).



Humidifier features

The steam is mixed with the delivery air of the evaporating coil by means of a suitable distributor. The iCom controller can determine when the cylinder has to be changed. Replacing the cylinder is extremely easy and quick. A self−adaptive flow control system is fitted as standard and controls the current passing through the cylinder water.

Tab. 11a − Humidair specifications

HPM MODEL	HUMIDAIR MODEL	MAIN POWER SUPPLIES (V ± 10%)	SETTING	ABSORBED CURRENT	POWER	MAX. CYLINDER WATER VOLUME	MAX. SUPPLY WATER QUANTITY	MAX. DRAIN WATER QUANTITY
			[kg/h] *	[A]	[kW]	[l]	[l/min.]	[l/min.]
D1E...D3A	**KUECLD**	400V / 3ph / 50Hz	2.7...9.0	9.0	5.8	5.5	0.6	4.0
D3F...D7L	**KUECLD**	400V / 3ph / 50Hz	3.9...13.0	13.0	9.0	5.5	0.6	4.0
D8F	**KUECLD**	400V / 3ph / 50Hz	3.9...13.0	13.0	9.0	5.5	0.6	4.0

Tab. 11b − Humidair specifications for Displacement unit

HPM MODEL	HUMIDAIR MODEL	MAIN POWER SUPPLIES (V ± 10%)	SETTING	ABSORBED CURRENT	POWER	MAX. CYLIN-DER WATER VOLUME	MAX. SUPPLY WATER QUANTITY	MAX. DRAIN WATER QUANTITY
			[kg/h] *	[A]	[kW]	[l]	[l/min.]	[l/min.]
D1E...D3A	**KUECLD**	400V / 3ph / 50Hz	2.7...4.5	4.6	3.0	5.5	0.6	4.0

For humidifier current (FLA) and rated power refer to electrical features in air conditioner manual.
(*) Unit is factory−set to produce about 70% of the maximum value (see iCom manual).

12 Dimensional Data / Connections

Fig. 12.a Overall dimensions Service Area D1E–D1G–D2E

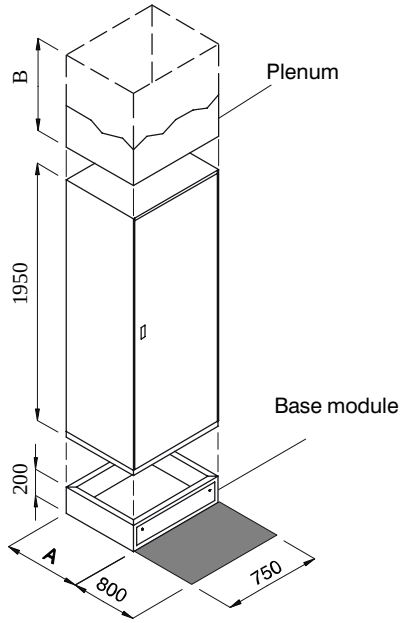


Fig. 12.b Overall dimensions Service Area D3A

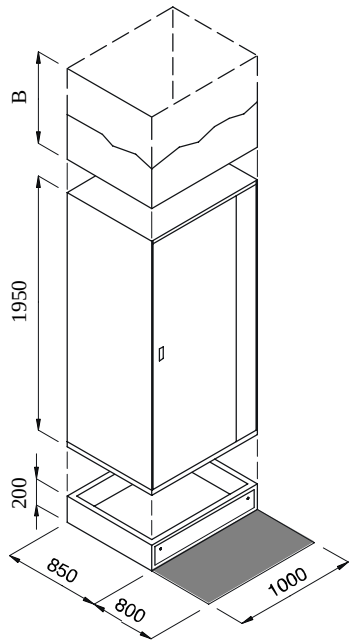


Fig. 12.c Overall dimensions Service Area D3F–D3G–D4E D4H–D5D–D7L

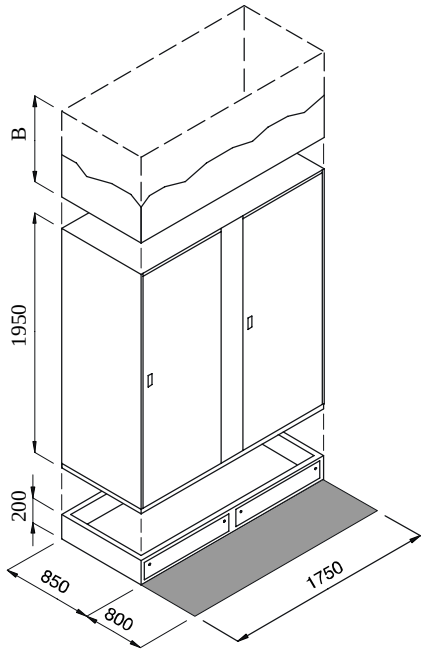
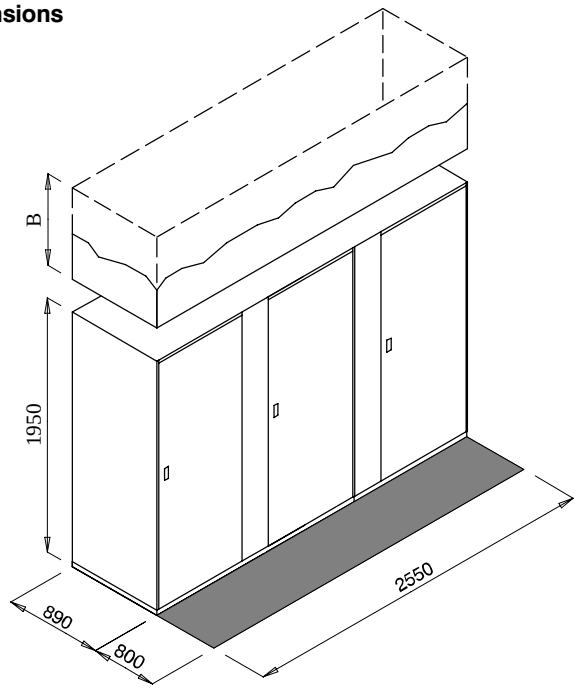


Fig. 12.d Overall dimensions Service Area D8F

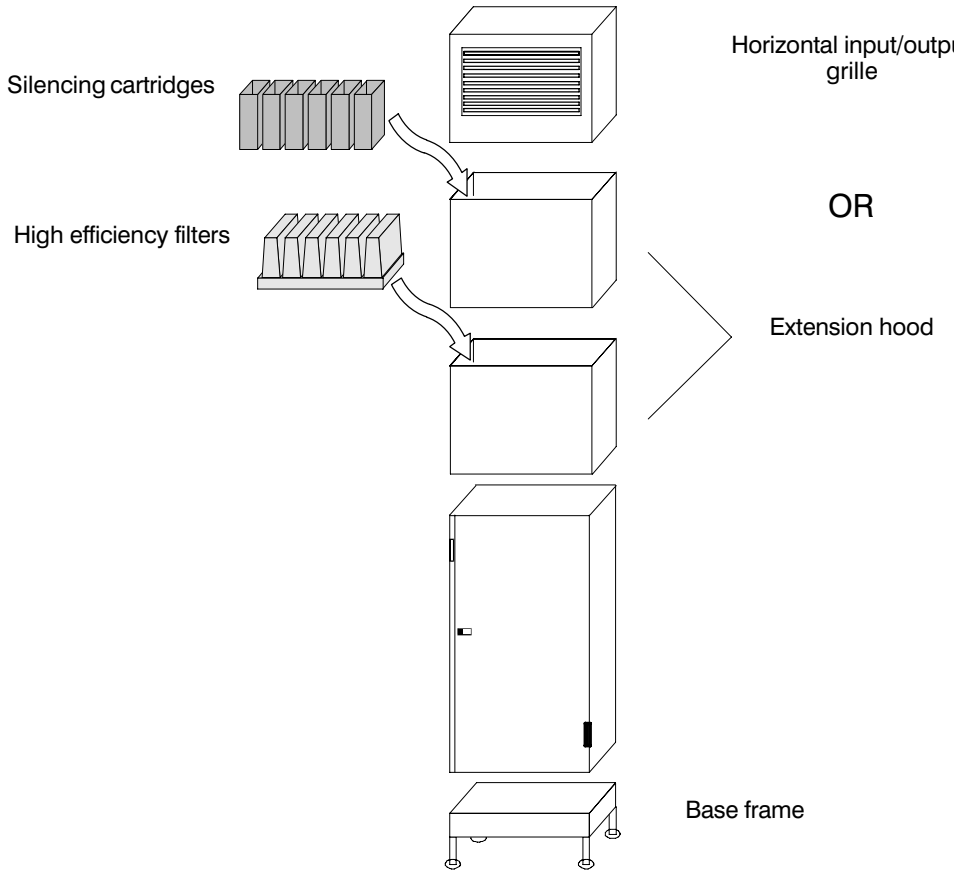


Models	A (mm)	B: AVAILABLE PLENUM HEIGHTS (mm)			
		Plenum simple	Plenum for silencing cartridges	Plenum for high efficiency filters	Plenum with frontal airflow (OVER only)
D1E D1G D2E	750	500–600–700– 800 – 900–1000–100–1200	600–900–1200	500–600–700– 800–900	600
D3A	850				
D3F D3G D4E D4H D5D D7L	850				
D8F	890	600–700– 800 – 900–1000–100–1200	600–900–1200	600–700–800–900	–

Dimensional Data / Connections

MODELS	WEIGHTS (kg)						
	Versions						
	A	W	F	D	H	K / A	K / W
D1E	240	247				247	254
D1G	250	260	290	280	290	260	270
D2E	270	280	320	310	320	280	290
D3A	415	425	510	500	510	425	435
D3F	580	590	725	715	725		
D3G	570	580	720	710	720		
D4E	585	600	730	715	730		
D4H	585	600	745	730	745		
D5D	625	650	770	745	770		
D7L	645	670					
D8F	925	950	1140	1115	1140		

Fig. 12.e Accessories and options diagram



Plenum with frontal airflow (Over)

A supply plenum with horizontal air flow can be installed on top of the unit. The 600 mm high plenum has the same design as the unit; it consists of sandwich panels lined with non–flammable insulation material of class 0 (ISO 1182.2), density 30 (see Fig. 12.b). kg/m^3. It is equipped with a double deflection grille.
A single deflection double fin grille can be supplied.

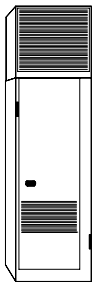
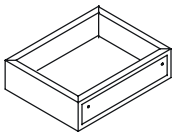


Fig. 12.f

Base modules (Over)

A 200 mm high basemodule can be supplied on request to support Liebert HPM Over units and at the same time allow pipework to enter the base of the unit when a raised floor is not installed. Some 300 or 500 mm base modules with air filter G4 or F5 efficiency, can be supplied on request to support Liebert HPM Over units with bottom or rear air intake. Note that in this case the air conditioning unit must be ordered with a blind front panel.

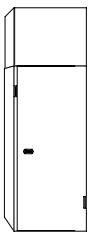
Fig. 12.g



Intake and delivery hoods

Liebert HPM can be equipped with intake and supply ducts on the top for connection of the unit to a false ceiling. The air duct is manufactured to complement the design of the unit; it consists of sandwich panels lined with non−flammable insulation material of Class 0 (ISO 1182.2), density 30 kg/m^3; its height ranges between 500 mm and 1200 mm (see Fig. 12.a).

Fig. 12.h



Base frames (option)

When required, a base frame adjustable in height by ±25 mm can be supplied. Three sizes are available: height

$\leq$ 300 mm;
$\leq$ 500 mm;
$\leq$ 800mm.

Note: This frame allows the installation of more units side by side

Fig. 12.i

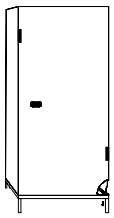
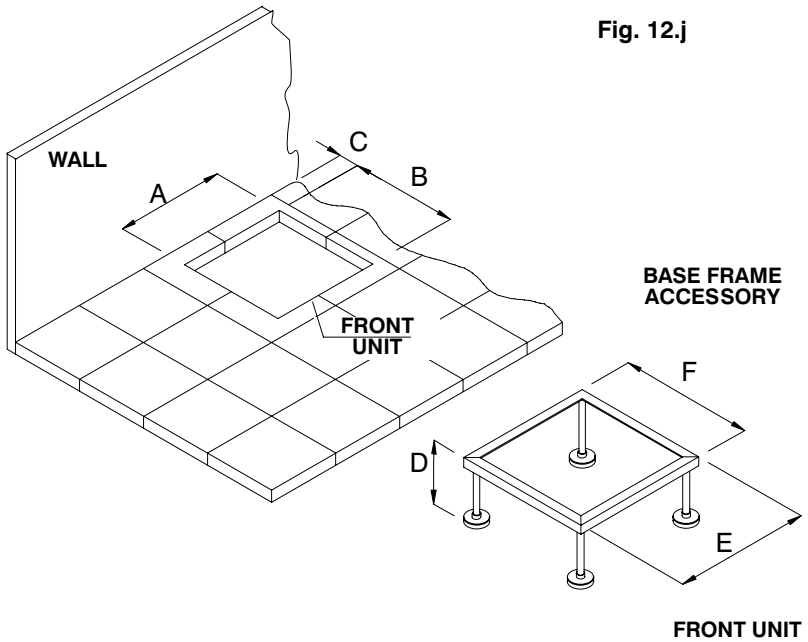


Fig. 12.j

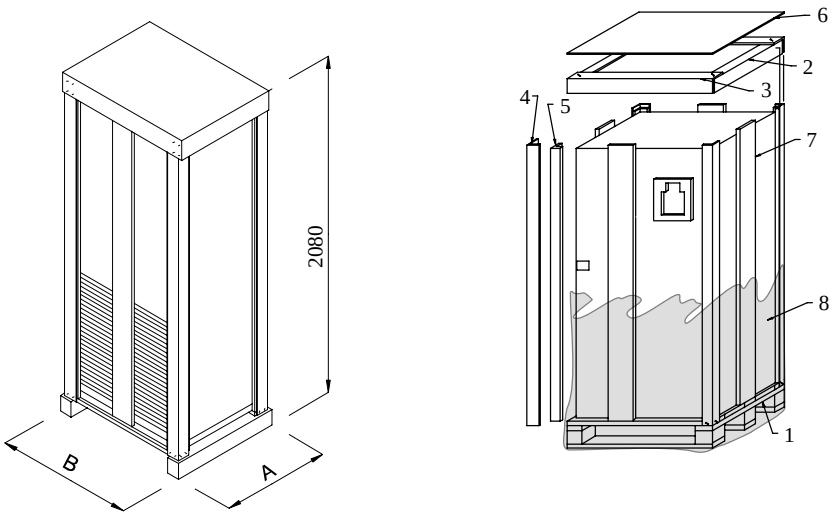


Tab. 12a − Hole in the floor and base frame dimensions

MODELS	Dimensions (mm)								
	A		B		C		D	E	F
	without base frame	with base frame	without base frame	with base frame	without base frame	with base frame			
D1E D1G D2E	690	750	670	740	50	10	$\leq$ 300 $\leq$ 500 $\leq$ 800	740	730
D3A	930	1000	770	840				990	830
D3F D3G D4E D4H D5D D7L	1680	1750						1740	
D8F	2460	2550	805	895				2550	885

Packing

Fig. 12.k Packing standard



The air conditioners are usually packed on a wooden pallet (1), with shockproof angle pieces in pressed cardboard (2, 3, 4)/polystyrene (5), panels in cardboard (6)/polystyrene (7) and flexible polythene film (8).

Tab. 12b — Packing depth (A)

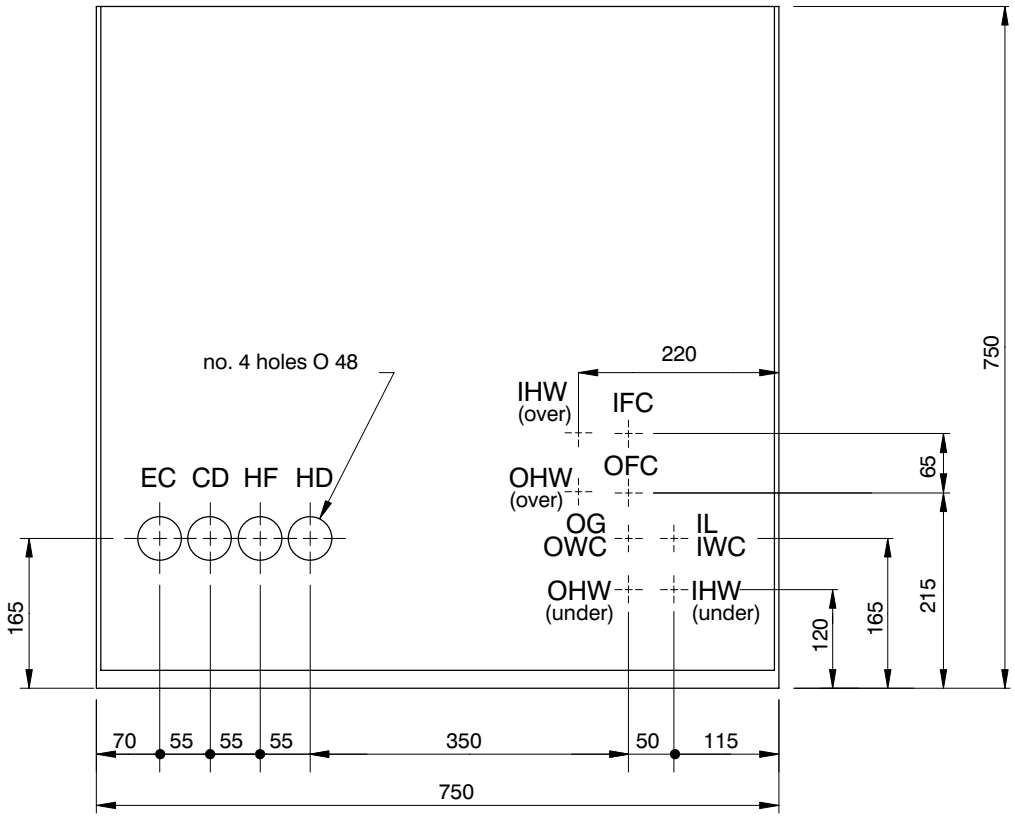
MODELS	Dimensions (mm)	
	A	B
D1E D1G D2E	830	830
D3A	930	1080
D3F D3G D4E D4H D5D D7L	930	1830
D8F	970	2630

Special packing (options)

Special packing for sea transport, consisting of a wooden box or crate, can be supplied on request.

Dimensional Data / Connections

Fig. 12.I Refrigerant, water and electrical connections Liebert HPM D1E..D2E, plan view



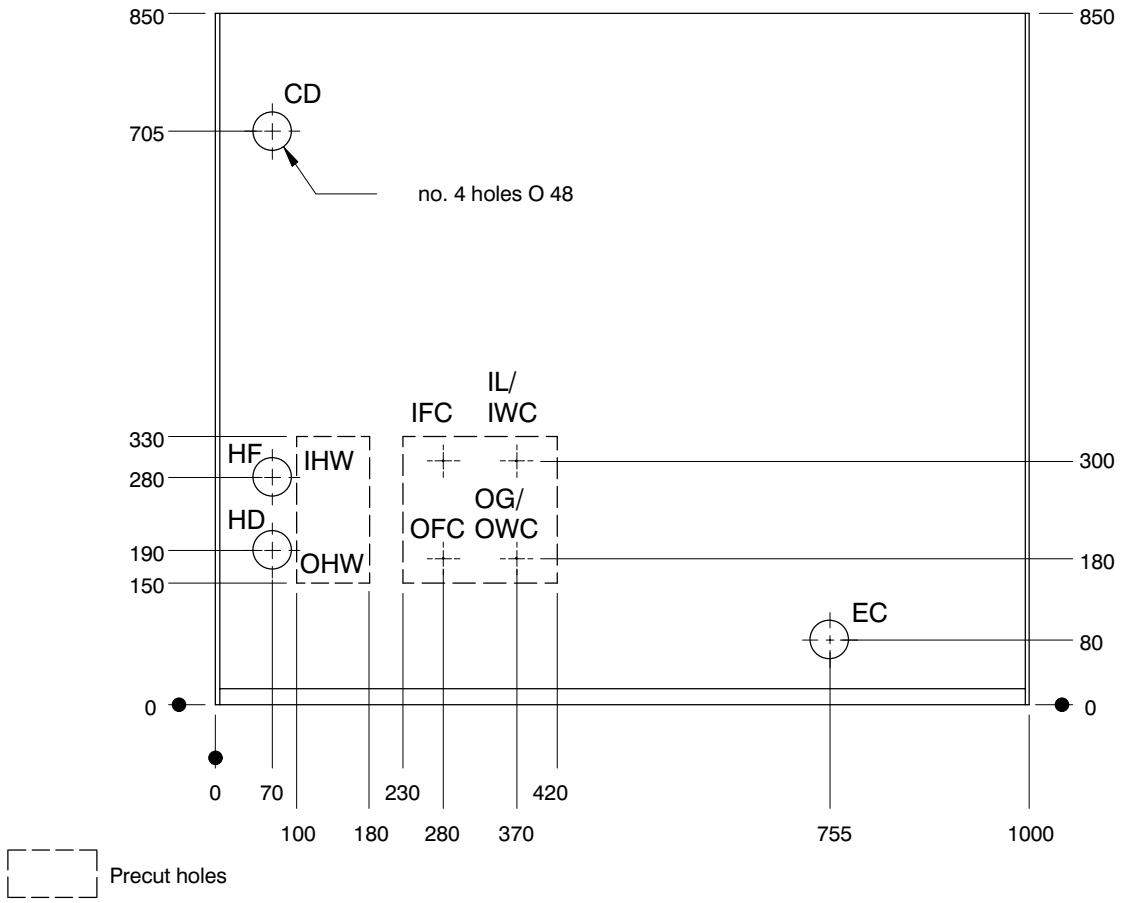
UNIT FRONT

Unit Connection		Version				
		A	W	D	H	F
IL	Refrigerant liquid line inlet *	OD 16 mm		OD 16 mm		
OG	Refrigerant gas line outlet *	OD 18 mm		OD 18 mm		
IWC	Water to condenser inlet		3/4" GAS–F		3/4" GAS–F	
OWC	Water from condenser outlet		3/4" GAS–F		3/4" GAS–F	
IHW	Hot water inlet (opt.)	OD 18 mm				
OHW	Hot water outlet (opt.)	OD 18 mm				
IFC	Water inlet to Freecooling/Dualfluid coil			1" GAS–F	1" GAS–F	1" GAS–F
OFC	Water outlet from Freecooling/Dualfluid coil			1" GAS–F	1" GAS–F	1" GAS–F
CD	Condensate drain	ID 20 mm				
HF	Humidifier feed (opt.)	1/2" GAS–M				
HD	Humidifier drain (opt.)	ID 22 mm				
EC	Electrical power supply	Hole ⌀ 48 mm				

* ***Connection size only. The dimension of the connecting pipe depends on unit model and refrigerant, see Tab. 12c on page 12 – 10.***

Dimensional Data / Connections

Fig. 12.m Refrigerant, water and electrical connections Liebert HPM D3A



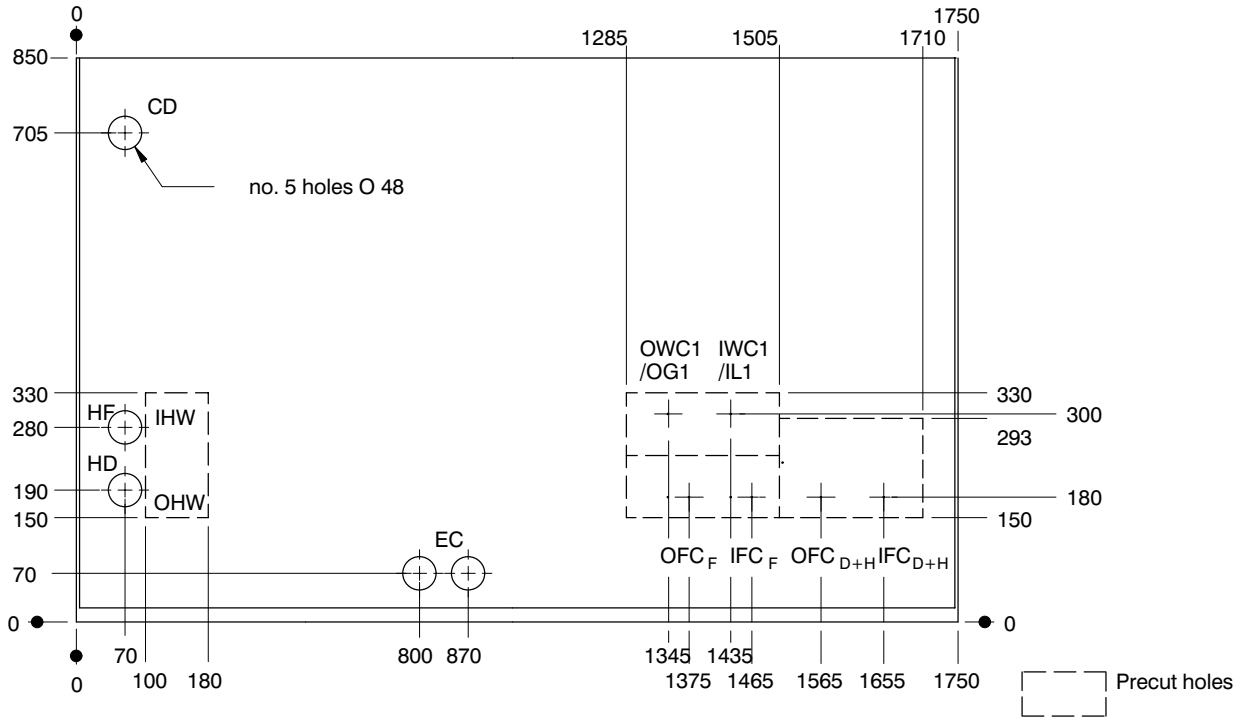
UNIT FRONT

Unit Connection		Version				
		A	W	D	H	F
IL	Refrigerant liquid line inlet *	OD 16 mm		OD 16 mm		
OG	Refrigerant gas line outlet *	OD 18 mm		OD 18 mm		
IWC	Water to condenser inlet		1" GAS–F		1" GAS–F	
OWC	Water from condenser outlet		1" GAS–F		1" GAS–F	
IHW	Hot water inlet (opt.)	OD 18 mm				
OHW	Hot water outlet (opt.)	OD 18 mm				
IFC	Water inlet to Freecooling and Dualfluid coil			1" GAS–F	1" GAS–F	1.1/4" GAS–F
OFC	Water outlet from Freecoolingn and Dualfluid coil			1" GAS–F	1" GAS–F	1.1/4" GAS–F
CD	Condensate drain	ID 20 mm				
HF	Humidifier feed (opt.)	1/2" GAS–M				
HD	Humidifier drain (opt.)	ID 22 mm				
EC	Electrical power supply	Hole ⌀ 48 mm				

* ***Connection size only. The dimension of the connecting pipe depends on unit model and refrigerant, see Tab. 12c on page 12 – 10.***

Dimensional Data / Connections

Fig. 12.n Refrigerant, water and electrical connections Liebert HPM D3G–D4E, singlecircuit – plan view



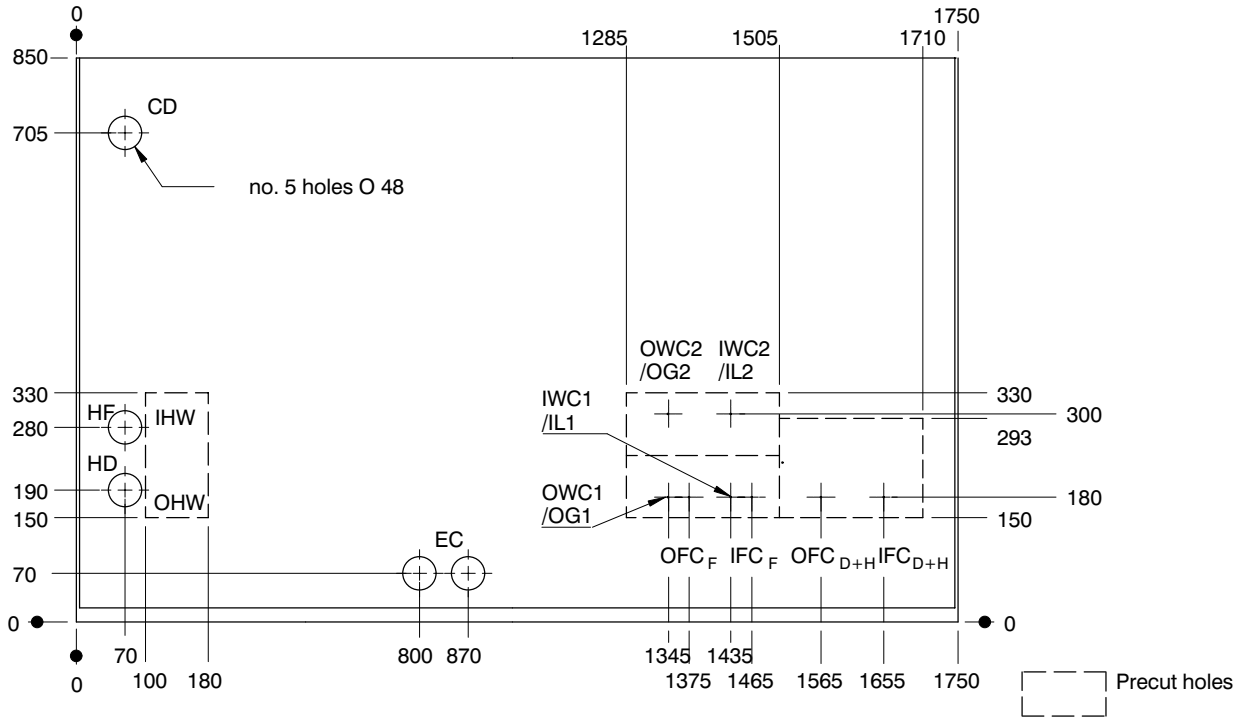
UNIT FRONT

Models	Unit Connection		Version				
			A	W	D	H	F
D3G	IL1	Refrigerant liquid line inlet 1*	OD 16 mm		OD 16 mm		
D4E			OD 18 mm		OD 18 mm		
D3G	OG1	Refrigerant gas line outtlet 1*	OD 18 mm		OD 18 mm		
D4E			OD 22 mm		OD 22 mm		
D3G	IWC1	Water to condenser 1 inlet		1.1/4" GAS–F		1.1/4" GAS–F	
D3G	OWC1	Water from condenser 1 outlet		1.1/4" GAS–F		1.1/4" GAS–F	
Dxx	IHW	Hot water inlet (opt.)	OD 22 mm				
Dxx	OHW	Hot water outlet (opt.)	OD 22 mm				
D3G	IFC (F)	Water inlet to Freecooling					1.1/4" GAS–F
D4E	IFC (F)						1.1/2" GAS–F
D3G	OFC (F)	Water outlet from Freecooling					1.1/4" GAS–F
D4E	OFC (F)						1.1/2" GAS–F
D3G	IFC (D+H)	Water inlet to Dualfluid			1.1/4" GAS–F	1.1/4" GAS–F	
D4E	IFC (D+H)				1.1/2" GAS–F	1.1/2" GAS–F	
D3E	OFC (D+H)	Water outlet from Dualfluid			1.1/4" GAS–F	1.1/4" GAS–F	
D4E	OFC (D+H)				1.1/2" GAS–F	1.1/2" GAS–F	
Dxx	CD	Condensate drain	ID 20 mm				
Dxx	HF	Humidifier feed (opt.)	1/2" GAS–M				
Dxx	HD	Humidifier drain (opt.)	ID 22 mm				
Dxx	EC	Electrical power supply	Hole ⌀ 48 mm				

* ***Connection size only. The dimension of the connecting pipe depends on unit model and refrigerant, see Tab. 12c on page 12 – 10.***

Dimensional Data / Connections

Fig. 12.o Refrigerant, water and electrical connections Liebert HPM D3F D4H…D7L doublecircuit — plan view



UNIT FRONT

Models	Unit Connection		Version				
			A	W	D	H	F
D34—42—50—66	IL1	Refrigerant liquid line inlet 1*	OD 16 mm		OD 16 mm		
D3F—4H—5D—7L	IL2	Refrigerant liquid line inlet 2*	OD 16 mm		OD 16 mm		
D3F—4H—5D—7L	OG1	Refrigerant gas line outtlet 1*	OD 18 mm		OD 18 mm		
D3F—4H—5D—7L	OG2	Refrigerant gas line outlet 2 *	OD 18 mm		OD 18 mm		
D5D—7L	IWC1	Water to condenser 1 inlet		1.1/4" GAS—F		1.1/4" GAS—F	
D3F—4H	IWC1			3/4" GAS—F		3/4" GAS—F	
D3F—4H	IWC2	Water to condenser 2 inlet		3/4" GAS—F		3/4" GAS—F	
D5D—7L	IWC2			1.1/4" GAS—F		1.1/4" GAS—F	
D5D	OWC1	Water from condenser 1 outlet		1.1/4" GAS—F		1.1/4" GAS—F	
D3F—4H	OWC1			3/4" GAS—F		3/4" GAS—F	
D3F—4H	OWC2	Water from condenser 2 outlet		3/4" GAS—F		3/4" GAS—F	
D5D—7L	OWC2			1.1/4" GAS—F		1.1/4" GAS—F	
Dxx	IHW	Hot water inlet (opt.)	OD 22 mm				
Dxx	OHW	Hot water outlet (opt.)	OD 22 mm				
D3F	IFC (F)	Water inlet to Freecooling					1.1/4" GAS—F
D4H—5D	IFC (F)						1.1/2" GAS—F
D3F	OFC (F)	Water outlet from Freecooling					1.1/4" GAS—F
D4H—5D	OFC (F)						1.1/2" GAS—F
D3F	IFC (D+H)	Water inlet to Dualfluid			1.1/4" GAS—F	1.1/4" GAS—F	
D4H—5D	IFC (D+H)				1.1/2" GAS—F	1.1/2" GAS—F	
D3F—3G	OFC (D+H)	Water outlet from Dualfluid			1.1/4" GAS—F	1.1/4" GAS—F	
D4E—5D D4E	OFC (D+H)				1.1/2" GAS—F	1.1/2" GAS—F	
Dxx	CD	Condensate drain	ID 20 mm				
Dxx	HF	Humidifier feed (opt.)	1/2" GAS—M				
Dxx	HD	Humidifier drain (opt.)	ID 22 mm				
Dxx	EC	Electrical power supply	Hole ∅ 48 mm				

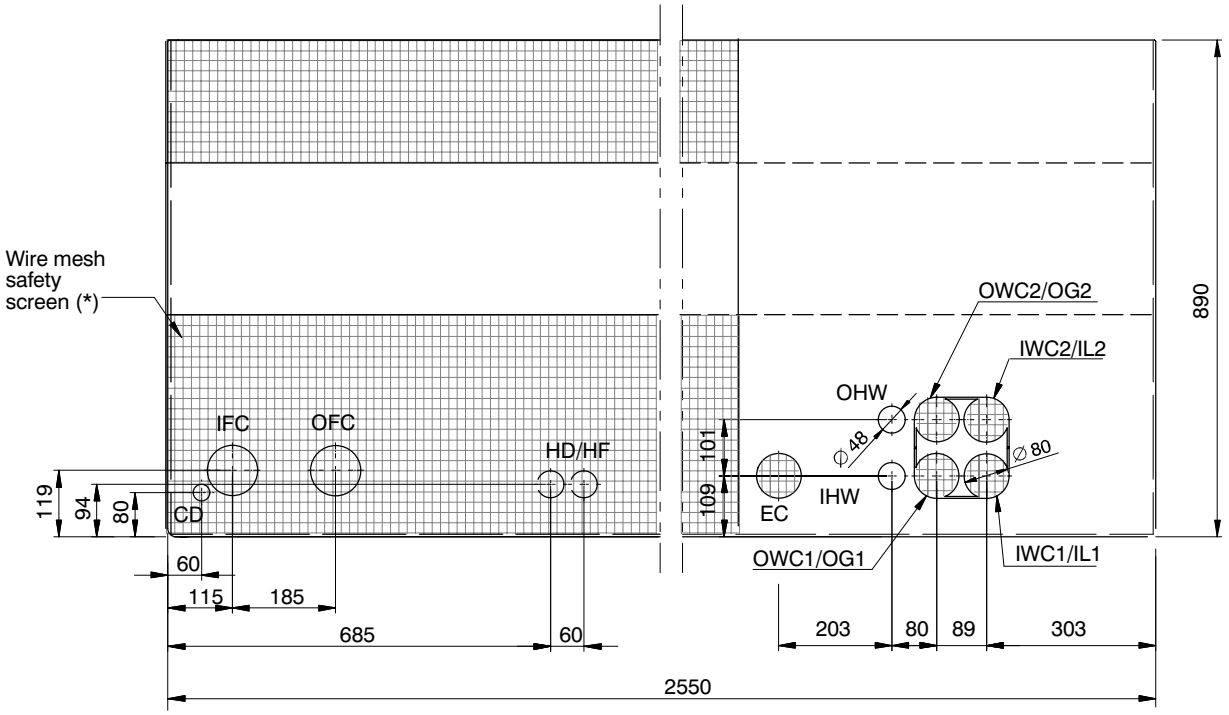
* ***Connection size only. The dimension of the connecting pipe depends on unit model and refrigerant, see Tab. 12c on page 12 — 10.***

* ***Inlet, outlet 1 referred to standard scroll compressor circuit.***

* ***Inlet, outlet 2 referred to digital scroll compressor circuit.***

Dimensional Data / Connections

Fig. 12.p Refrigerant, water and electrical connections Liebert HPM D8F



UNIT FRONT

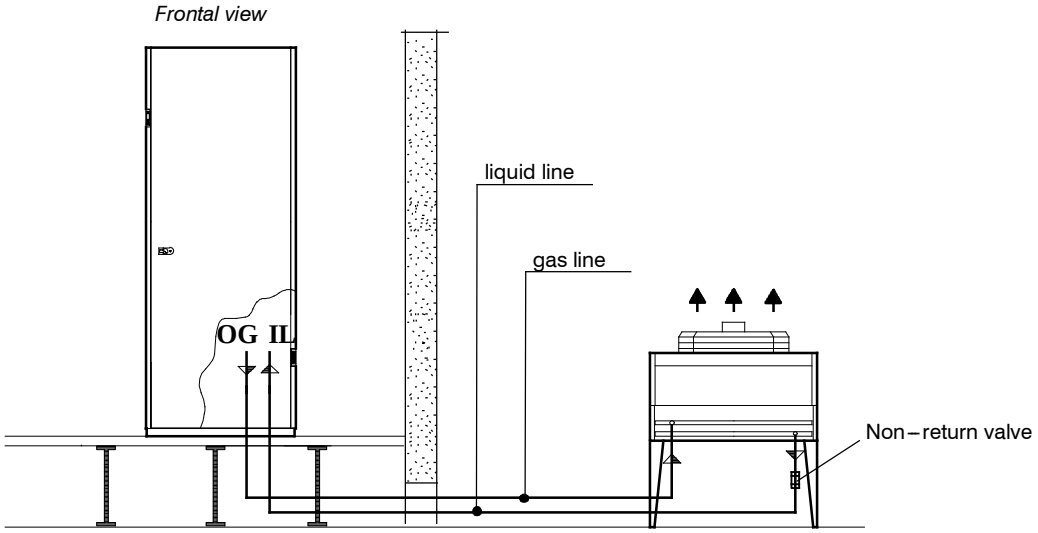
(*) This must be cut in order to allow access for the pipes and cables

Unit Connection		Version				
		A	W	D	H	F
IL1	Refrigerant liquid line inlet 1 *	OD 18 mm		OD 18 mm		
IL2	Refrigerant liquid line inlet 2 *	OD 18 mm		OD 18 mm		
OG1	Refrigerant gas line outlet 1 *	OD 22 mm		OD 22 mm		
OG2	Refrigerant gas line outlet 2 *	OD 22 mm		OD 22 mm		
IWC1	Water to condenser 1 inlet		1.1/4"GAS–F		1.1/4"GAS–F	
IWC2	Water to condenser 2 inlet		1.1/4"GAS–F		1.1/4"GAS–F	
OWC1	Water from condenser 1 outlet		1.1/4"GAS–F		1.1/4"GAS–F	
OWC2	Water from condenser 2 outlet		1.1/4"GAS–F		1.1/4"GAS–F	
IHW	Hot water inlet (opt.)	OD 22 mm				
OHW	Hot water outlet (opt.)	OD 22 mm				
IFC (F)	Water inlet to Freecooling					2.1/2"GAS–M
OFC (F)	Water outlet from Freecooling					2.1/2"GAS–M
IFC (D+H)	Water inlet to Dualfluid			2.1/2"GAS–M	2.1/2"GAS–M	
OFC (D+H)	Water outlet from Dualfluid			2.1/2"GAS–M	2.1/2"GAS–M	
CD	Condensate drain	ID 20 mm				
HF	Humidifier feed (opt.)	1/2" GAS–M				
HD	Humidifier drain (opt.)	ID 22 mm				
EC	Electrical power supply	Hole ∅ 80 mm				

* ***Connection size only. The dimension of the connecting pipe depends on unit model and refrigerant, see Tab. 12c on page 12 – 10.***

Fig. 12.q Refrigeration connections

Liebert HPM – A



OG	Refrigerant pipe outlet
IL	Refrigerant pipe inlet

Notes: *recommended diameters see Table in Chap. 4.*

Tab. 12c – Pipe diameters (room unit – remote condenser)

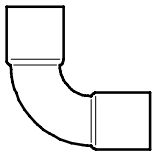
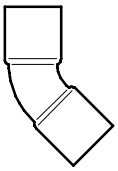
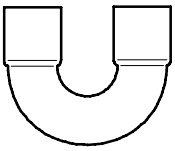
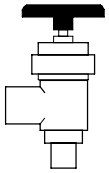
MOD.	**STANDARD PIPE DIAMETERS** (Valid for equivalent lengths up to 30 m) **copper tube external diametre X thickness (mm) R410A**	
	Gas	**Liquid**
D1E	14 X 1	14 X 1
D1G	16 X 1	16 X 1
D2E	18 X 1	16 X 1
D3A	22 X 1.5	18 X 1
D3F	16 X 1	16 X 1
D3G	22 X 1.5	18 X 1
D4E	28 X 1.5	22 X 1.5
D4H	18 X 1	16 X 1
D5D	22 X 1.5	18 X 1
D7L	22 X 1.5	18 X 1
D8F	28 X 1,5	22 X 1.5

For equivalent lengths up to 50 m:

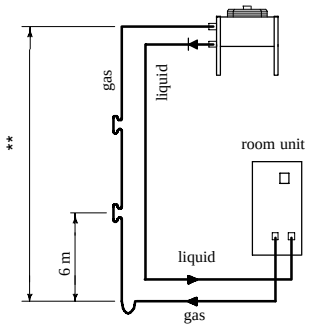
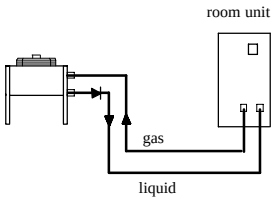
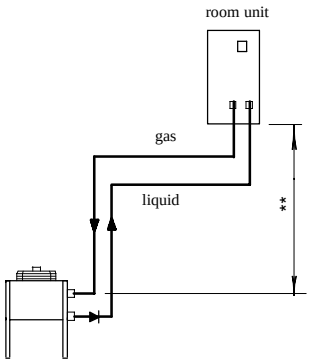
- Equal diameters
- Max. geodetic height difference between condenser and room unit: from +30 to –8 m (when the condenser is placed underneath the room unit):
- Variex at the condenser
- Oversizing of the condenser at least of 15% more than standard capacity
- Hot gas reheat not allowed.
- Syphon on the vertical gas lines every 6 metres
- Relevant extra oil charge.
- Non return valve in the refrigerant discharge pipe 2m far from the compressor.

Dimensional Data / Connections

Tab. 12d — Equivalent lengths in meters of: curves, shut—off and non—return valves

Nominal diameter (mm)	 90°	 45°	 180°	 90°	
12	0.50	0.25	0.75	2.10	1.90
14	0.53	0.26	0.80	2.20	2.00
16	0.55	0.27	0.85	2.40	2.10
18	0.60	0.30	0.95	2.70	2.40
22	0.70	0.35	1.10	3.20	2.80
28	0.80	0.45	1.30	4.00	3.30

Tab. 12e — Condenser positioning

CONDENSER POSITION			CONDENSER ABOVE CONDITIONER	CONDENSER AND CONDITIONER AT SAME LEVEL	CONDENSER BELOW CONDITIONER (not recommended)
INSULATION	gas	int.	necessary	necessary	necessary
		ext.	only for aesthetic reasons	only for aesthetic reasons	only for aesthetic reasons
	liq.	int.	absolutely not	not necessary	no (expose to cold underfloor air)
		ext.	only for aesthetic reasons	only if exposed to sun	only if exposed to sun
LAYOUT			 (**) see Chap. 3		 (**) see Chap. 3

13 All Options / Accessories

Silencing cartridges for supply hoods
See Chap. 7

Special Cartridges
See Chap. 8

Heating—Reheat and humidity control
See Chap. 8

High efficiency filters
See Chap. 9

Filter holding duct
See Chap. 9

Clogged filter alarm
See Chap. 9

Fresh air kit
See Chap. 9

Humidifier
See Chap. 11

Delivery plenum with frontal airflow for Over models
See Chap. 12

Base modules
See Chap. 12

Intake and delivery hoods
See Chap. 12

Base frames
See Chap. 12

Special packing
See Chap. 12

Flooding alarm (Liquistat)

The flooding alarm detects the presence of water or of any other conductive liquid and, opening a circuit, activates an alarm.
There are no moving parts and it is not subject to dirt or vibration. Up to 5 sensors can be connected to the same flooding alarm device to control many points in the room. The alarm device is supplied with a sensor. Additional sensors can be ordered separately.

Smoke alarm (Smokestat)

A smoke alarm can be installed to stop the conditioning system when the presence of smoke in the intake air is perceived.
This is an optical smoke detector (it uses the Tyndall effect), which absorbs very low current (100mA) and is absolutely insensitive to light or wind.

Fire alarm (Firestat)

In some applications the fire regulations require the installation of an alarm device (Firestat) which deactivates the air conditioner when the intake air temperature is too high.

All Options / Accessories

Automatic condensate pump

The Liebert HPM's condensate drain piping can be connected to a pump complete with a flow cutout that permits the pump to stop and reset automatically.

Tab. 13f — Features of the automatic pump for condensate discharge

water flow	[l/s]	0.083	0.167	0.250	0.333
available head	[kPa]	20	19	18	14

Non—return valves (Versions A and D)

For air—cooled units, a non—return valve is supplied on request in a separate kit. It should be installed on the liquid line near the condenser, in a vertical position with downward flow.

Additional temperature and humidity sensor (EEAP)

EEAP (Environmental Alarm Package) is an additional temperature and relative humidity sensor similar to the humitemp sensor.The sensor can be installed in a suitable place up to 20 m from the air conditioner. It generates an alarm if the temperature or the relative humidity exceeds one of the four thresholds that can be selected by the user:

High temperature: (from 10°C to 50°C)
low temperature: (from 0°C to 30°C)
high relative humidity: (from 30% to 99%)
low relative humidity: (from 10% to 70%).

Bottom air intake (Over models)

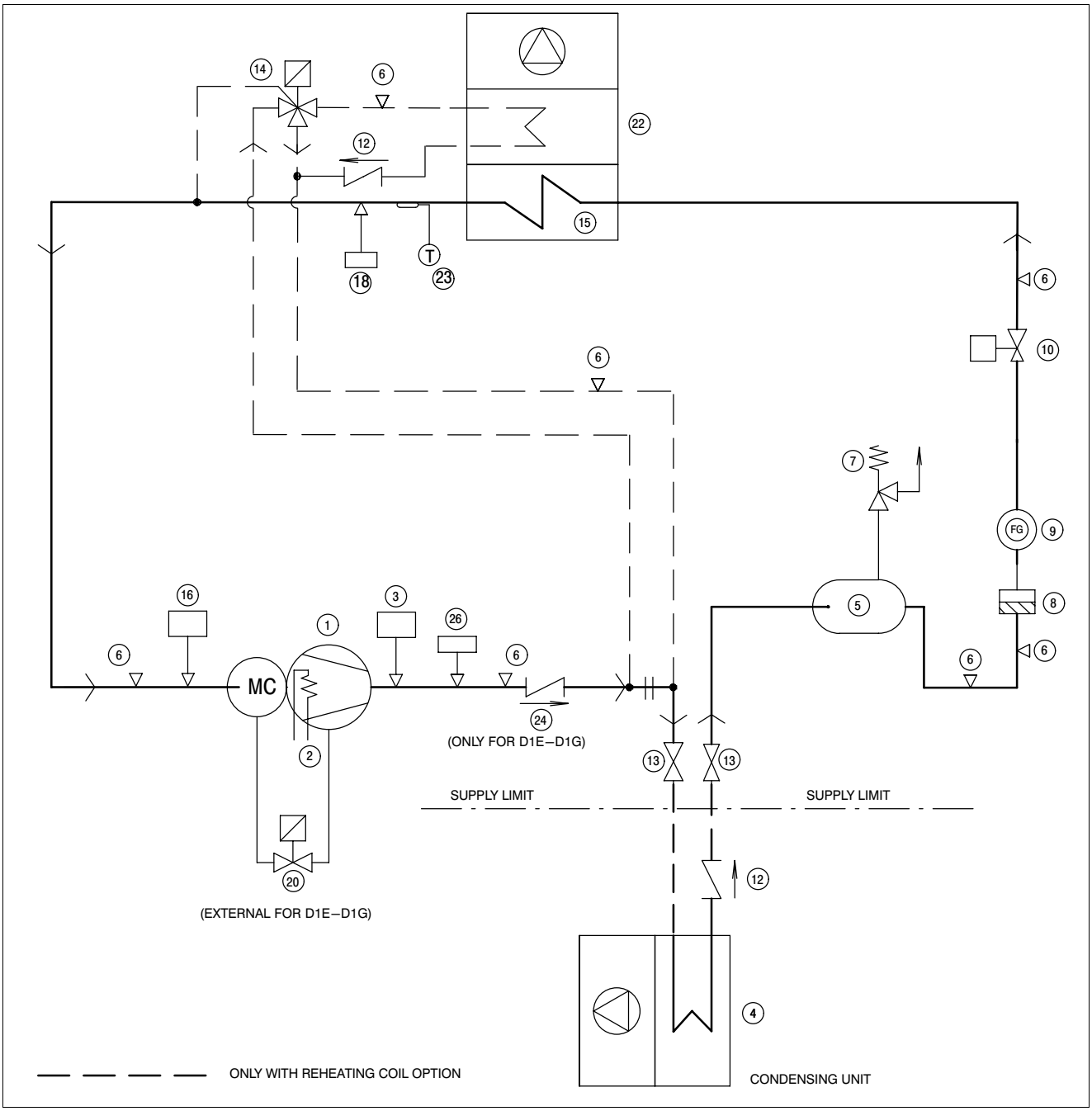
Liebert HPM units can be supplied to permit air intake from below. In this case, the front panel with intake grille is replaced by a special blind panel, which further reduces noise levels.

Epoxy Coated Coils

Remote condensers are available with aluminium fins coated by an epoxy film, for aggressive environments.

14 Refrigerant (EEV ALCO) and Hydraulic Circuits

Fig. 14.1 – Liebert HPM D1E–D1G–D2E–D3A–D3G–D4E U/O A

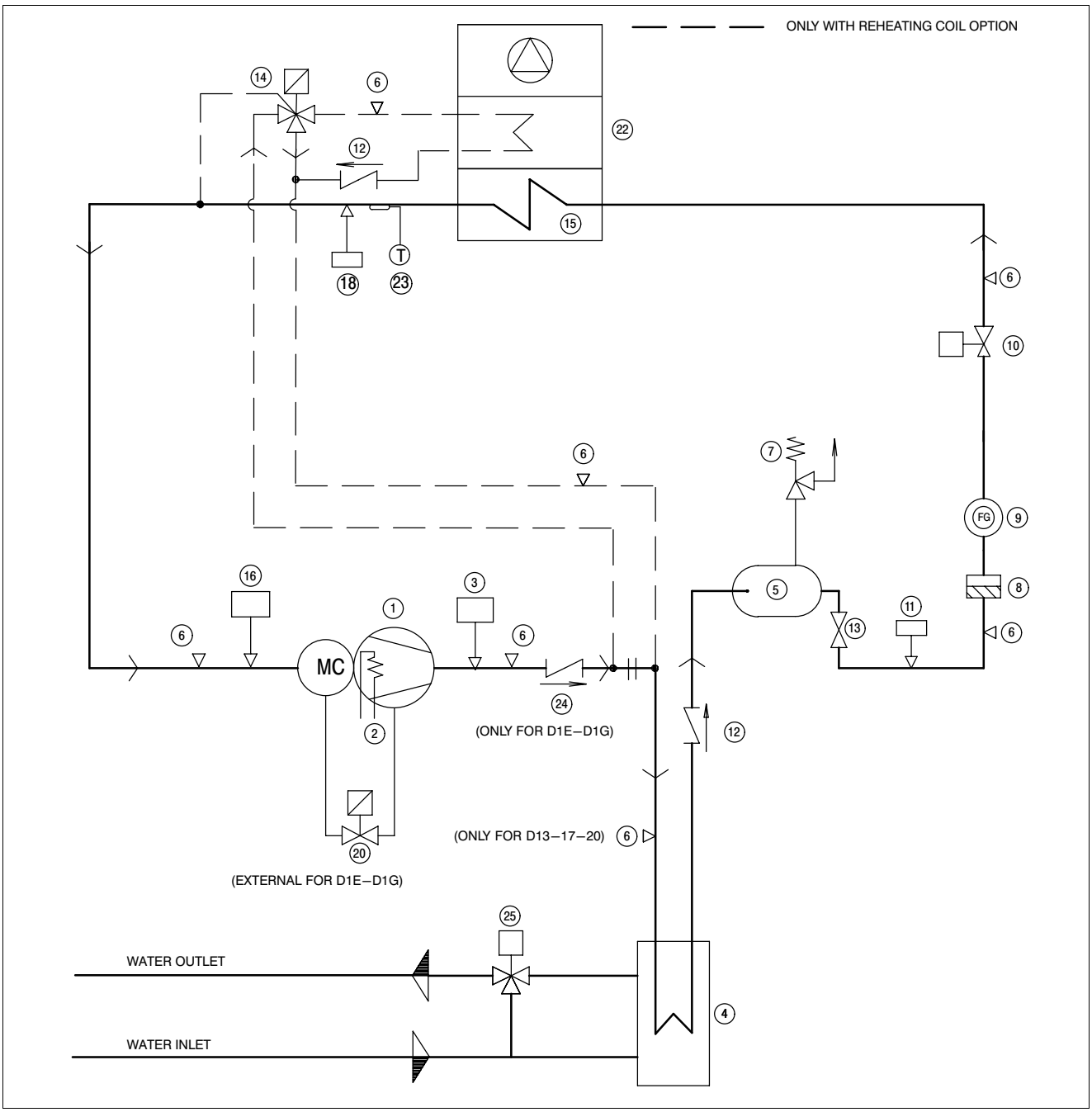


POS.	DESCRIPTION
1	Compressor
2	Crankcase heater
3	High pressure switch (HP)
4	Air cooled condenser
5	Liquid receiver
6	Access valve
7	Safety valve
8	Filter dryer
9	Sight glass
10	Electronic expansion valve (EEV)
12	Check valve

POS.	DESCRIPTION
13	Shut–off valve
14	Reheating solenoid valve (optional)
15	Evaporator
16	Low pressure switch (LP)
18	Pressure transducer for electronic expansion valve
20	Capacity mod. solenoid valve (ext. for D1E–D1G)
22	Reheating coil (optional)
23	Temperature sensor for EEV
24	Check valve
26	Pressure transducer for HP

Refrigerant (EEV ALCO) and Hydraulic Circuits

Fig. 14.2 – Liebert HPM D1E–D1G–D2E–D3A–D3G–D4E U/O W

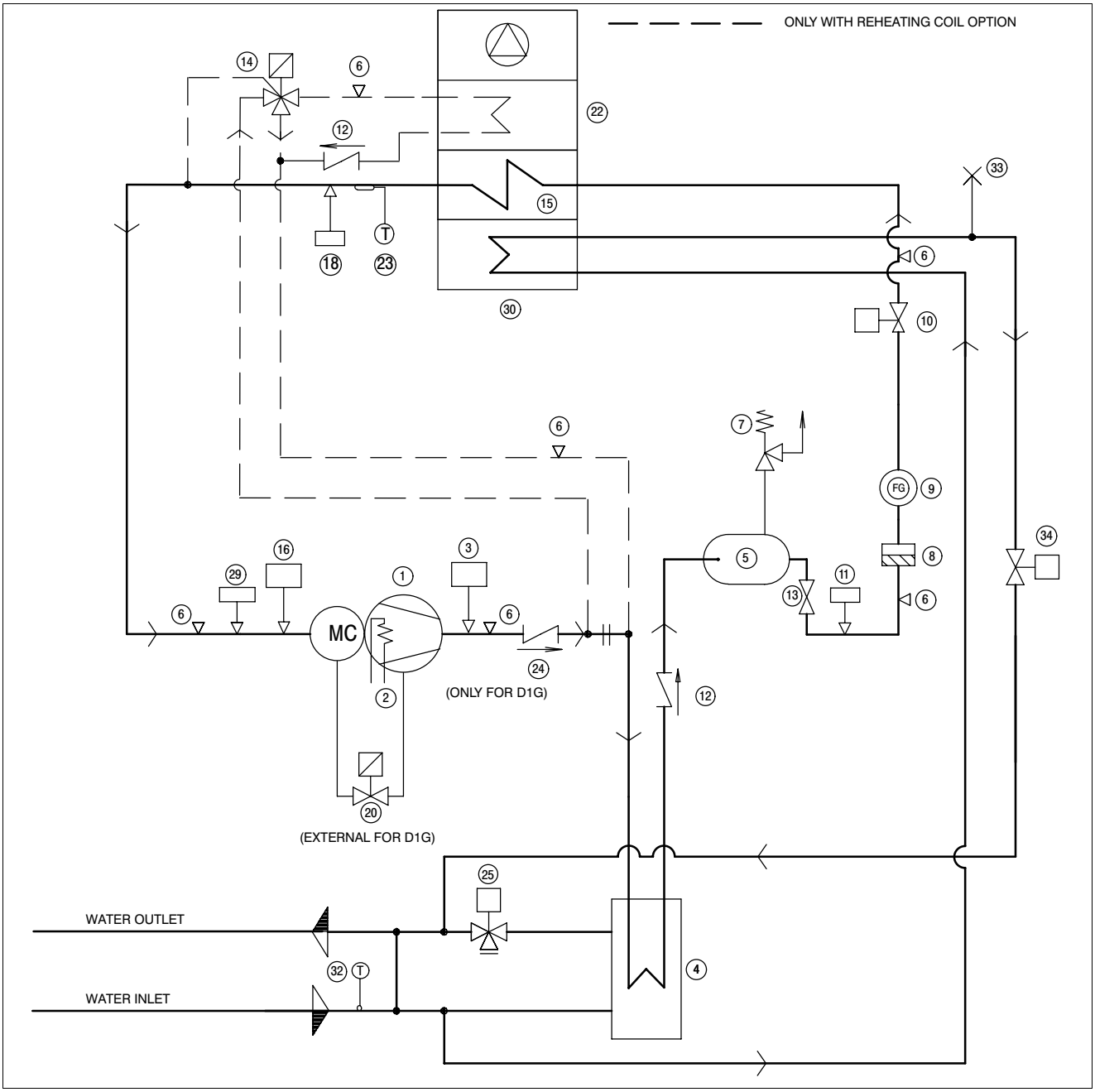


POS.	DESCRIPTION
1	Compressor
2	Crankcase heater
3	High pressure switch (HP)
4	Water cooled condenser
5	Liquid receiver
6	Access valve
7	Safety valve
8	Filter dryer
9	Sight glass
10	Electronic expansion valve (EEV)
11	Pressure transducer condensing regulation

POS.	DESCRIPTION
12	Check valve
13	Shut–off valve
14	Reheating solenoid valve (optional)
15	Evaporator
16	Low pressure switch (LP)
18	Pressure transducer for electronic expansion valve
20	Capacity mod. solenoid valve
22	Reheating coil (optional)
23	Temperature sensor for EEV
24	Check valve
25	Condensing regulation water valve

Refrigerant (EEV ALCO) and Hydraulic Circuits

Fig. 14.3 – Liebert HPM D1G–D2E–D3A–D3G–D4E U/O F

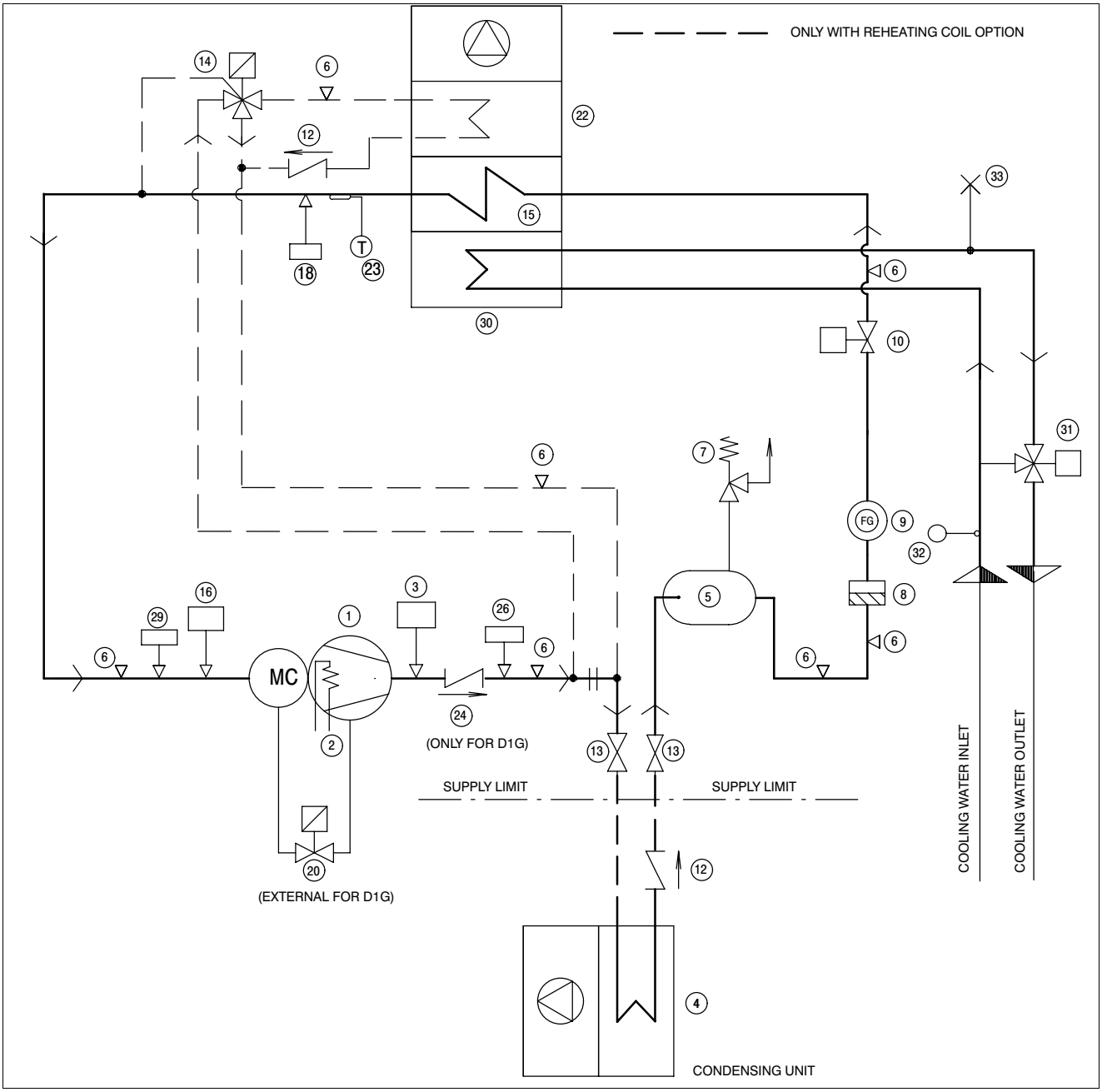


POS.	DESCRIPTION
1	Compressor
2	Crankcase heater
3	High pressure switch (HP)
4	Water cooled condenser
5	Liquid receiver
6	Access valve
7	Safety valve
8	Filter dryer
9	Sight glass
10	Electronic expansion valve (EEV)
11	Pressure transducer condensing regulation
12	Check valve
13	Shut–off valve
14	Reheating solenoid valve (optional)

POS.	DESCRIPTION
15	Evaporator
16	Low pressure switch (LP)
18	Pressure transducer for electronic expansion valve
20	Capacity mod. solenoid valve
22	Reheating coil (optional)
23	Temperature sensor for EEV
24	Check valve
25	Condensing regulation water valve
29	Minimum pressure switch
30	Chilled water coil
32	Inlet water thermostat
33	Manual bleed valve
34	Chilled water 2–way valve

Refrigerant (EEV ALCO) and Hydraulic Circuits

Fig. 14.4 – Liebert HPM D1G–D2E–D3A–D3G–D4E U/O D

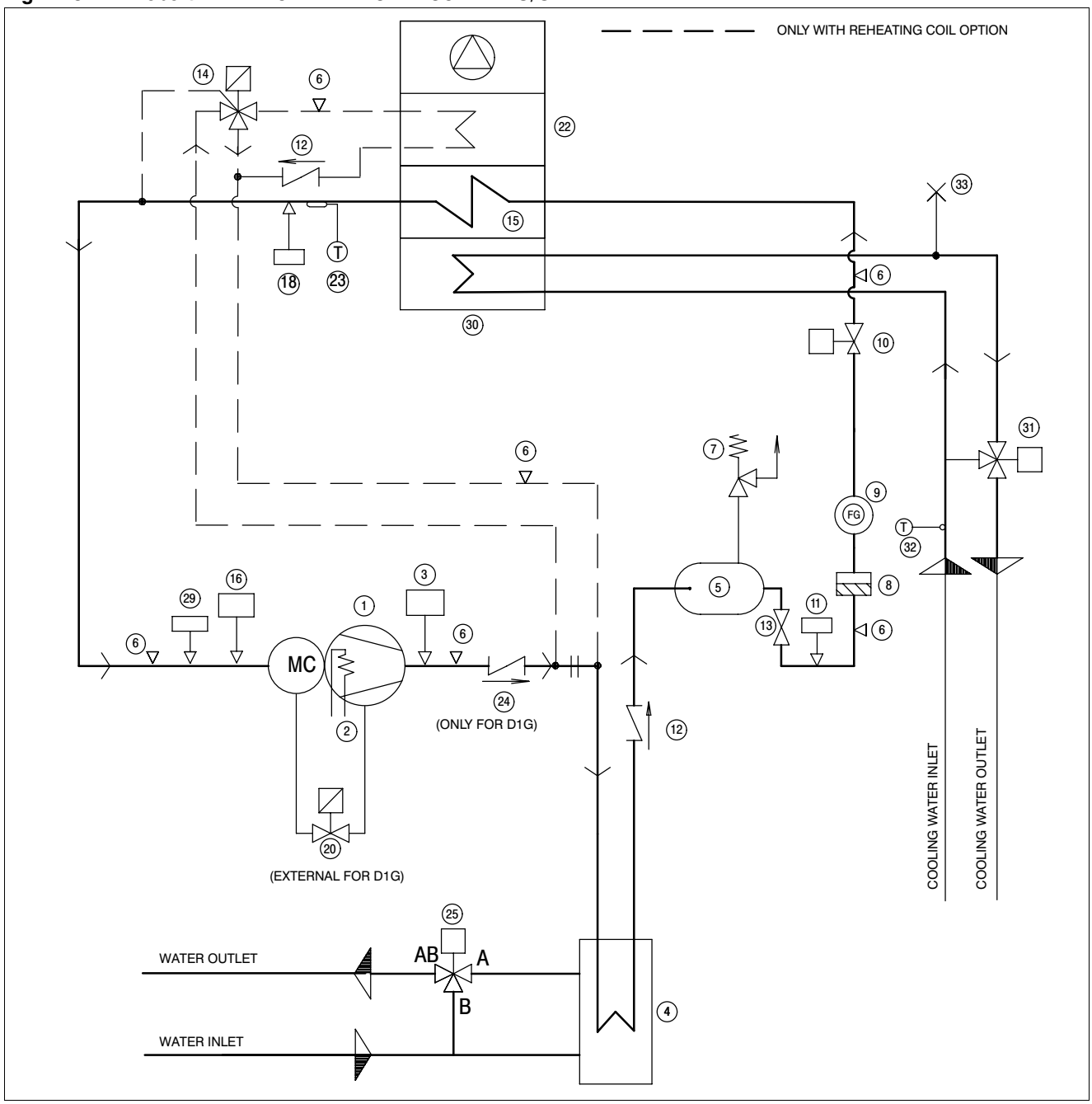


POS.	DESCRIPTION
1	Compressor
2	Crankcase heater
3	High pressure switch (HP)
4	Air cooled condenser
5	Liquid receiver
6	Access valve
7	Safety valve
8	Filter dryer
9	Sight glass
10	Electronic expansion valve (EEV)
12	Check valve
13	Shut–off valve
14	Reheating solenoid valve (optional)

POS.	DESCRIPTION
15	Evaporator
16	Low pressure switch (LP)
18	Pressure transducer for electronic expansion valve
20	Capacity mod. solenoid valve
22	Reheating coil (optional)
23	Temperature sensor for EEV
24	Check valve
26	High pressure transducer (HP)
29	Minimum pressure switch
30	Chilled water coil
31	Chilled water 3–way valve
32	Inlet water sensor
33	Manual bleed valve

Refrigerant (EEV ALCO) and Hydraulic Circuits

Fig. 14.5 – Liebert HPM D1G–D2E–D3A–D3G–D4E U/O H

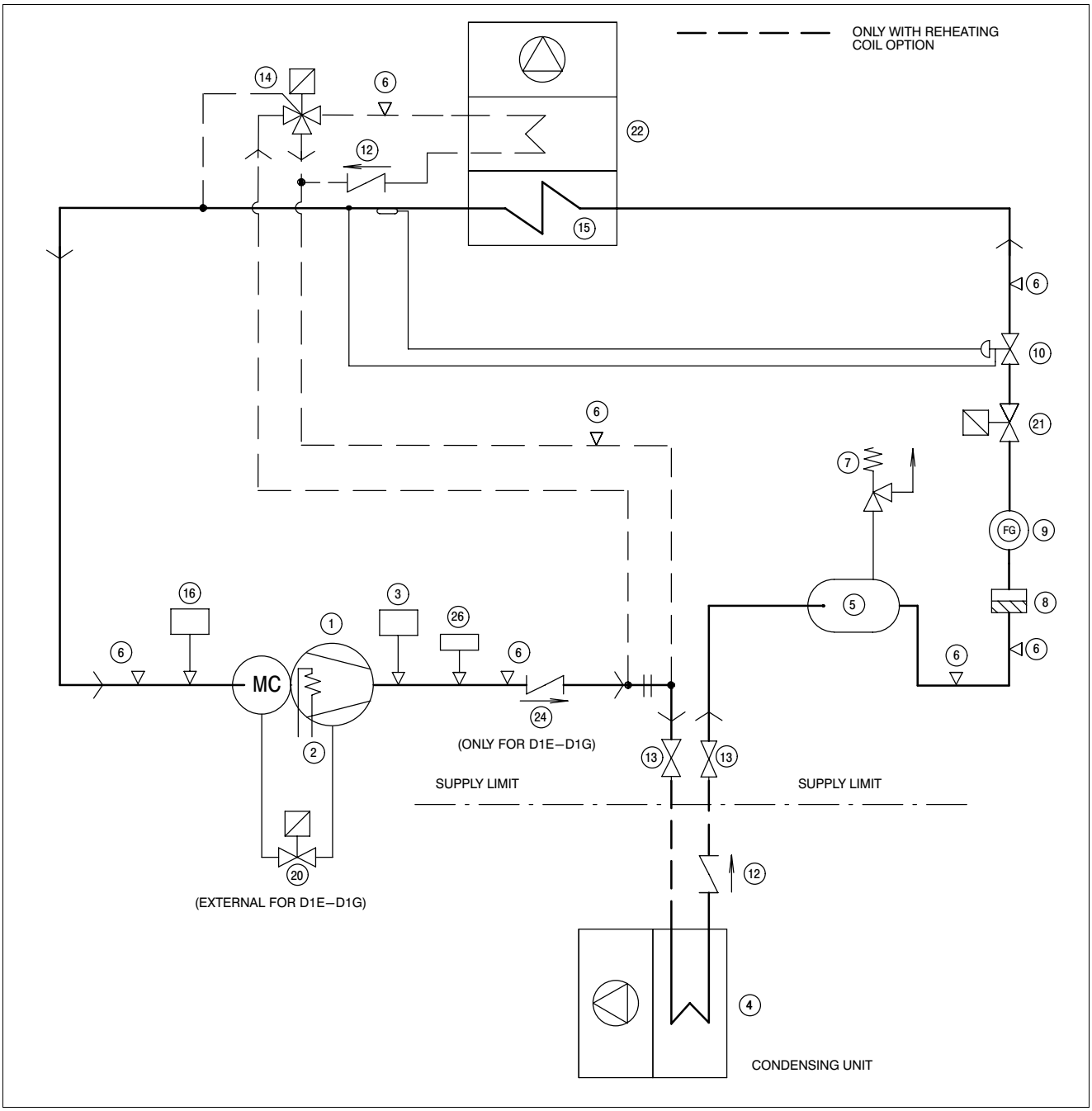


POS.	DESCRIPTION
1	Compressor
2	Crankcase heater
3	High pressure switch (HP)
4	Water cooled condenser
5	Liquid receiver
6	Access valve
7	Safety valve
8	Filter dryer
9	Sight glass
10	Electronic expansion valve (EEV)
11	Pressure transducer condensing regulation
12	Check valve
13	Shut–off valve
14	Reheating solenoid valve (optional)

POS.	DESCRIPTION
15	Evaporator
16	Low pressure switch (LP)
18	Pressure transducer for electronic expansion valve
20	Capacity mod. solenoid valve
22	Reheating coil (optional)
23	Temperature sensor for EEV
24	Check valve
25	Condensing regulation water valve
29	Minimum pressure switch
30	Chilled water coil
31	Chilled water 3–way valve
32	Inlet water thermostat
33	Manual bleed valve

Refrigerant (TXV) and Hydraulic Circuits

Fig. 14.6 – Liebert HPM D1E–D1G–D2E–D3A–D3G–D4E U/O A

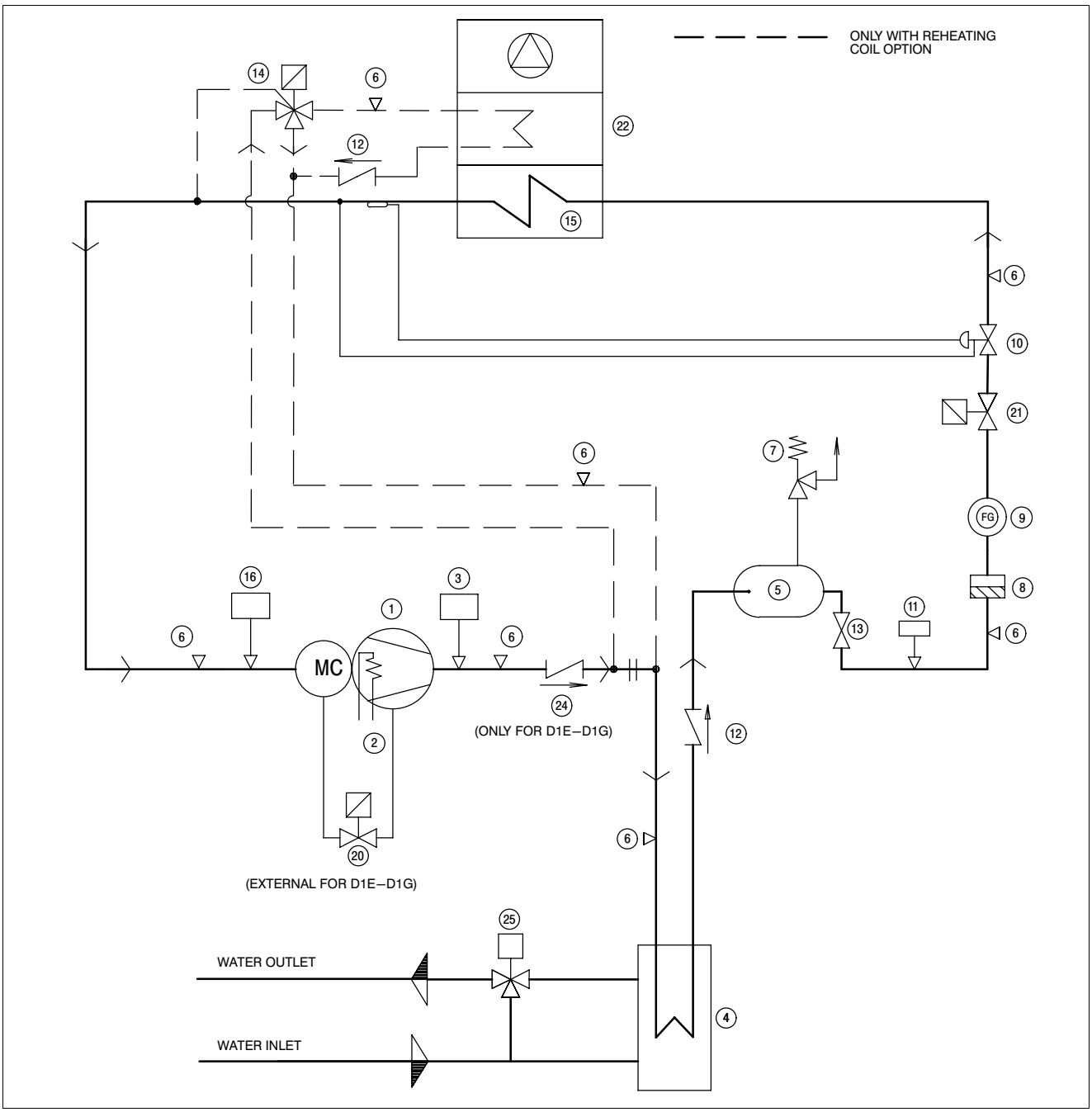


POS.	DESCRIPTION
1	Compressor
2	Crankcase heater
3	High pressure switch (HP)
4	Air cooled condenser
5	Liquid receiver
6	Access valve
7	Safety valve
8	Filter dryer
9	Sight glass
10	Thermostatic expansion valve (TXV)

POS.	DESCRIPTION
12	Check valve
13	Shut–off valve
14	Reheating solenoid valve (optional)
15	Evaporator
16	Low pressure switch (LP)
20	Capacity mod. solenoid valve
21	Shut–off solenoid valve
22	Reheating coil (optional)
24	Check valve
26	Pressure transducer for HP

Refrigerant (TXV) and Hydraulic Circuits

Fig. 14.7 – Liebert HPM D1E–D1G–D2E–D3A–D3G–D4E U/O W

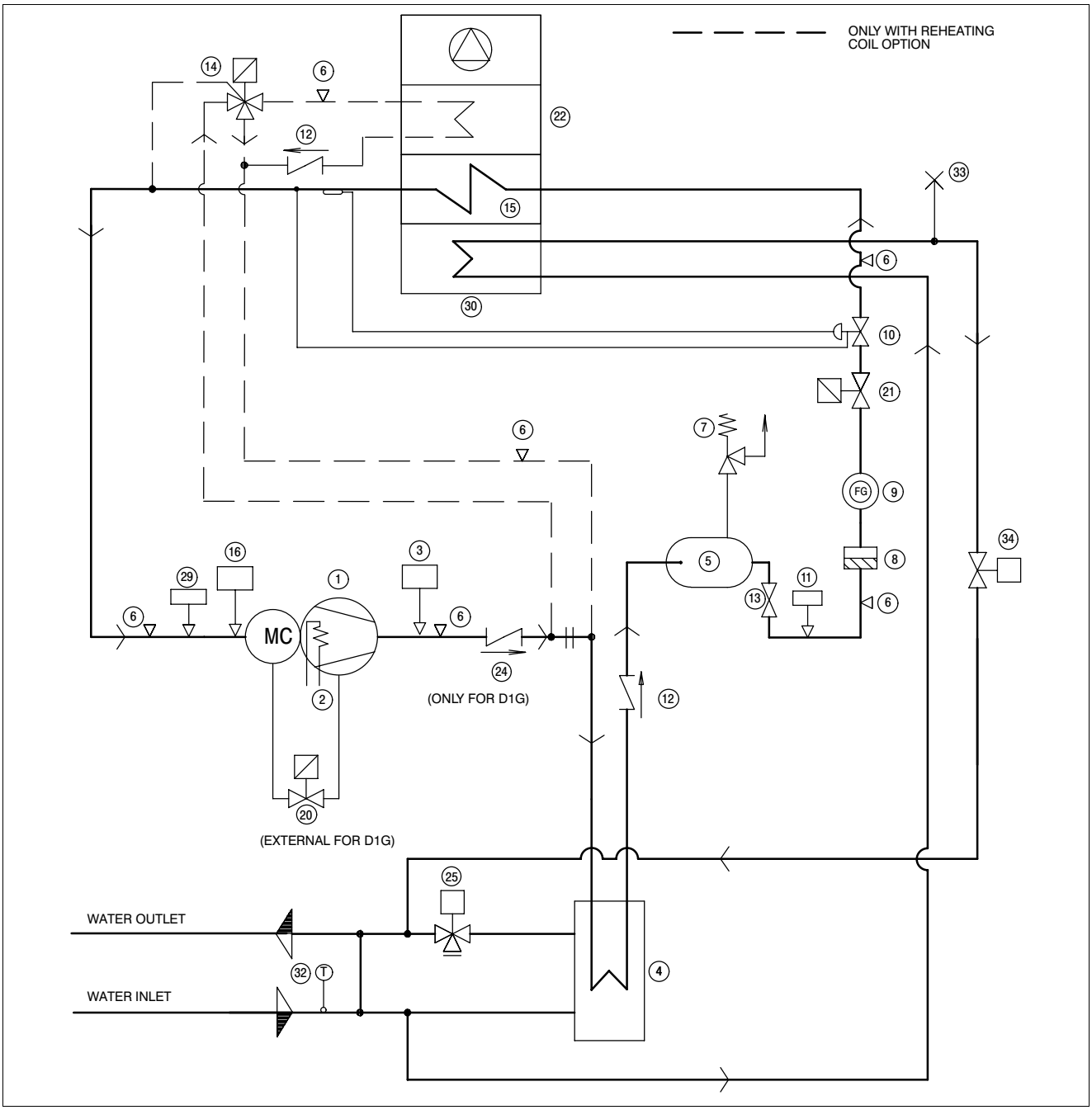


POS.	DESCRIPTION
1	Compressor
2	Crankcase heater
3	High pressure switch (HP)
4	Water cooled condenser
5	Liquid receiver
6	Access valve (for D13–17–20 only)
7	Safety valve
8	Filter dryer
9	Sight glass
10	Thermostatic expansion valve (TXV)
11	Pressure transducer condensing regulation

POS.	DESCRIPTION
12	Check valve
13	Shut–off valve
14	Reheating solenoid valve (optional)
15	Evaporator
16	Low pressure switch (LP)
20	Capacity mod. solenoid valve
21	Shut–off solenoid valve
22	Reheating coil (optional)
24	Check valve
25	Condensing regulation water valve

Refrigerant (TXV) and Hydraulic Circuits

Fig. 14.8 – Liebert HPM D1G–D2E–D3A–D3G–D4E U/O F

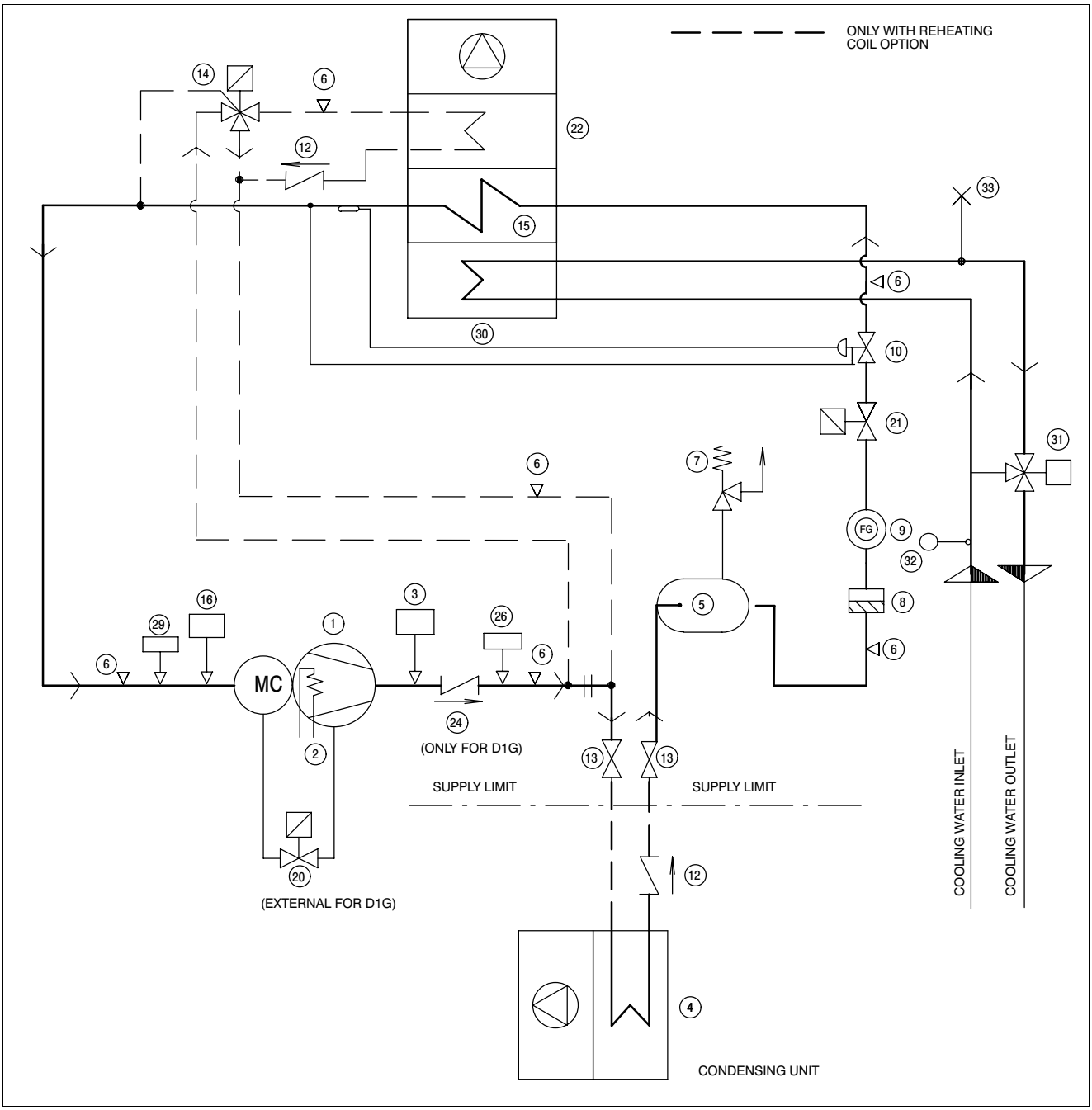


POS.	DESCRIPTION
1	Compressor
2	Crankcase heater
3	High pressure switch (HP)
4	Water cooled condenser
5	Liquid receiver
6	Access valve
7	Safety valve
8	Filter dryer
9	Sight glass
10	Thermostatic expansion valve (TXV)
11	Pressure transducer condensing regulation
12	Check valve
13	Shut–off valve

POS.	DESCRIPTION
14	Reheating solenoid valve (optional)
15	Evaporator
16	Low pressure switch (LP)
20	Capacity mod. solenoid valve
21	Shut–off solenoid valve
22	Reheating coil (optional)
24	Check valve
25	Condensing regulation water valve
29	Minimum pressure switch
30	Chilled water coil
32	Inlet water thermostat
33	Manual bleed valve
34	Chilled water 2–way valve

Refrigerant (TXV) and Hydraulic Circuits

Fig. 14.9 – Liebert HPM D1G–D2E–D3A–D3G–D4E U/O D

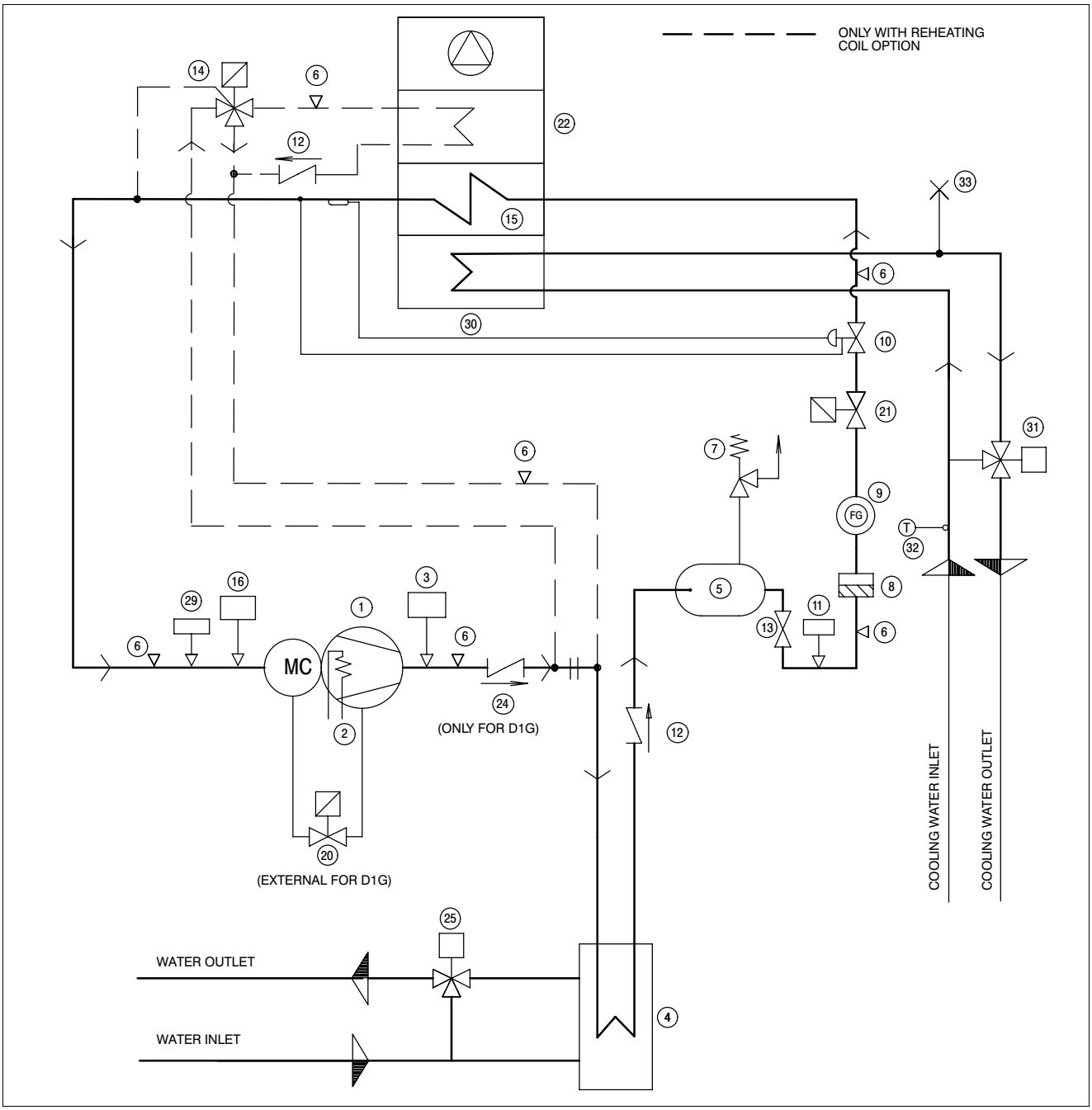


POS.	DESCRIPTION
1	Compressor
2	Crankcase heater
3	High pressure switch (HP)
4	Air cooled condenser
5	Liquid receiver
6	Access valve
7	Safety valve
8	Filter dryer
9	Sight glass
10	Thermostatic expansion valve (TXV)
11	–
12	Check valve
13	Shut–off valve

POS.	DESCRIPTION
14	Reheating solenoid valve (optional)
15	Evaporator
16	Low pressure switch (LP)
20	Capacity mod. solenoid valve
21	Shut–off solenoid valve
22	Reheating coil (optional)
24	Check valve
26	High pressure transducer (HP)
29	Minimum pressure switch
30	Chilled water coil
31	Chilled water 3–way valve
32	Inlet water sensor
33	Manual bleed valve

Refrigerant (TXV) and Hydraulic Circuits

Fig. 14.10 – Liebert HPM D1G–D2E–D3A–D3G–D4E U/O H

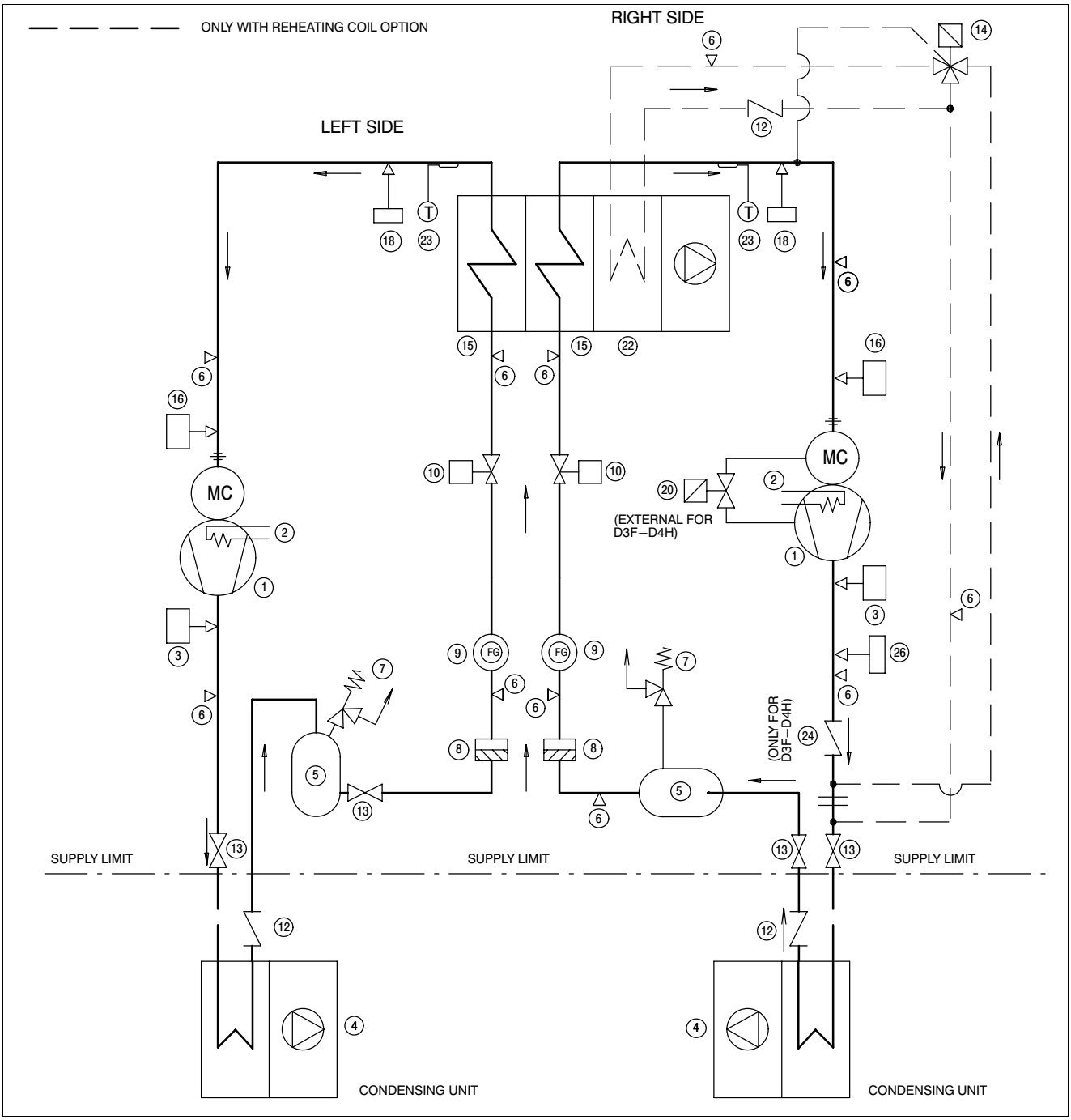


POS.	DESCRIPTION
1	Compressor
2	Crankcase heater
3	High pressure switch (HP)
4	Water cooled condenser
5	Liquid receiver
6	Access valve
7	Safety valve
8	Filter dryer
9	Sight glass
10	Thermostatic expansion valve (TXV)
11	Pressure transducer condensing regulation
12	Check valve
13	Shut–off valve

POS.	DESCRIPTION
14	Reheating solenoid valve (optional)
15	Evaporator
16	Low pressure switch (LP)
20	Capacity mod. solenoid valve
21	Shut–off solenoid valve
22	Reheating coil (optional)
24	Check valve
25	Condensing regulation water valve
29	Minimum pressure switch
30	Chilled water coil
31	Chilled water 3–way valve
32	Inlet water thermostat
33	Manual bleed valve

Refrigerant (2 EEV ALCO) and Hydraulic Circuits

Fig. 14.11 – Liebert HPM D3F–D4H–D5D–D7L U/O A (2xEEV)

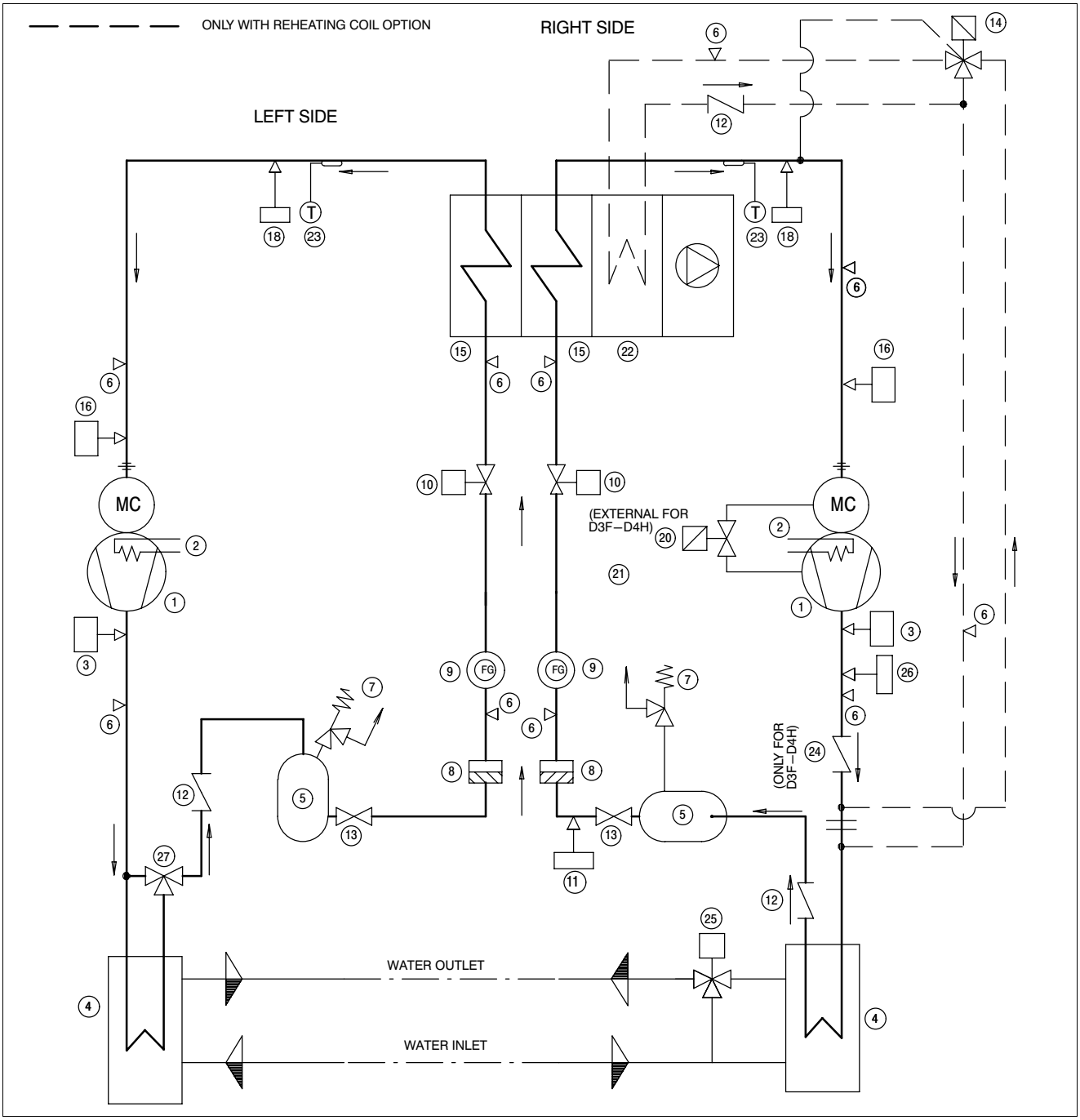


POS.	DESCRIPTION
1	Compressor
2	Crankcase heater
3	High pressure switch (HP)
4	Air cooled condenser
5	Liquid receiver
6	Access valve
7	Safety valve
8	Filter dryer
9	Sight glass
10	Electronic expansion valve (EEV)
12	Check valve

POS.	DESCRIPTION
13	Shut–off valve
14	Hot gas solenoid valve (optional)
15	Evaporator
16	Low pressure switch (LP)
18	Pressure transducer for electronic expansion valve
20	Capacity mod. solenoid valve
22	Reheating coil (optional)
23	Thermostat for electronic expansion valve
24	Check valve
26	High pressure transducer (HP)

Refrigerant (2 EEV ALCO) and Hydraulic Circuits

Fig. 14.12 – Liebert HPM D3F–D4H–D5D–D7L U/O W (2 x EEV)

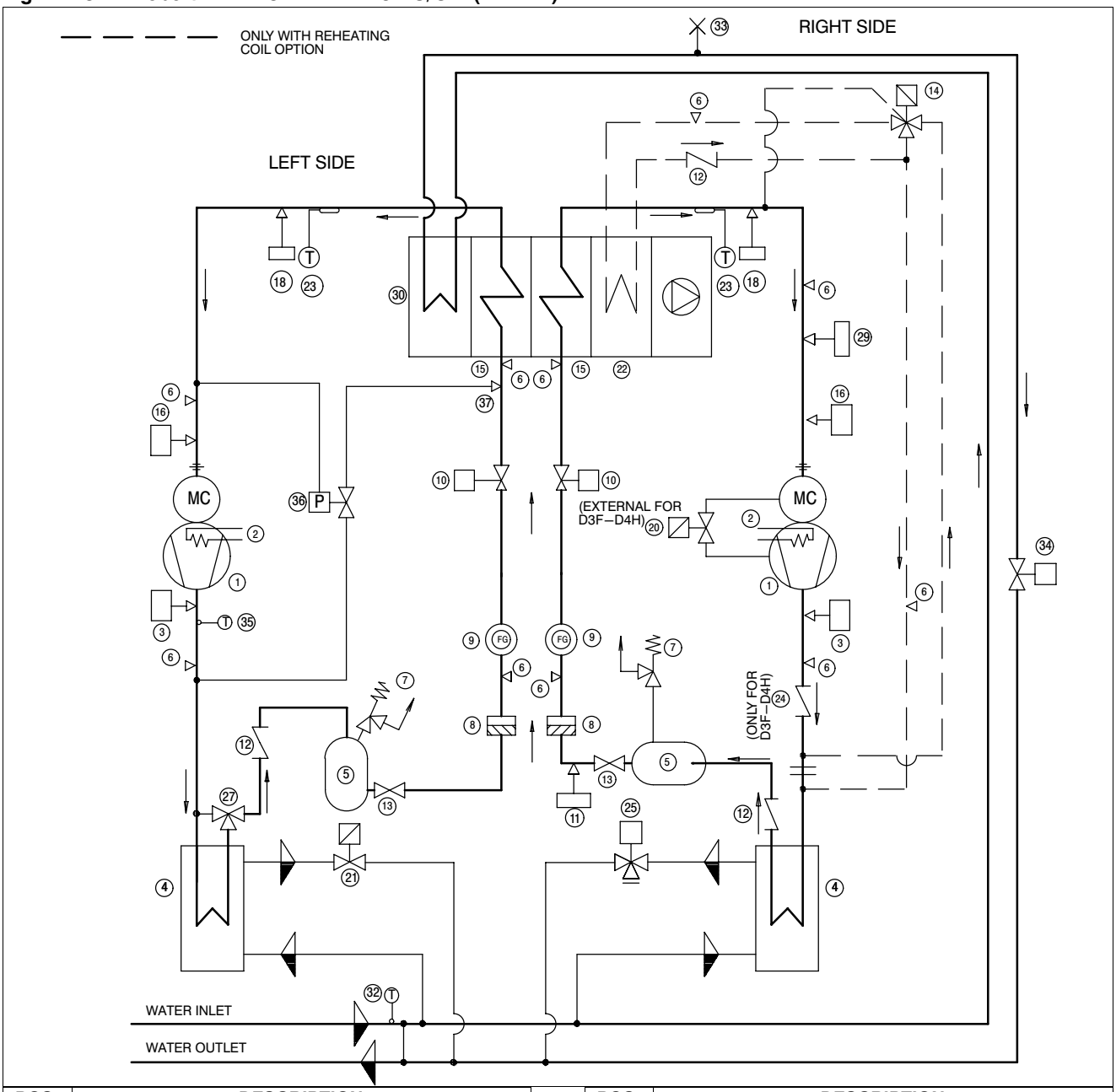


POS.	DESCRIPTION
1	Compressor
2	Crankcase heater
3	High pressure switch (HP)
4	Water cooled condenser
5	Liquid receiver
6	Access valve
7	Safety valve
8	Filter dryer
9	Sight glass
10	Electronic expansion valve (EEV)
11	Pressure transducer condensing regulation
12	Check valve

POS.	DESCRIPTION
13	Shut–off valve
14	Reheating solenoid valve (optional)
15	Evaporator
16	Low pressure switch (LP)
18	Pressure transducer for electronic expansion valve
20	Capacity mod. solenoid valve
22	Reheating coil (optional)
23	Temperature sensor for EEV
24	Check valve (for D3F–D4H only)
25	Condensing regulation water valve
27	Head pressure control valve

Refrigerant (2 EEV ALCO) and Hydraulic Circuits

Fig. 14.13 – Liebert HPM D3F–D4H–D5D U/O F (2 x EEV)

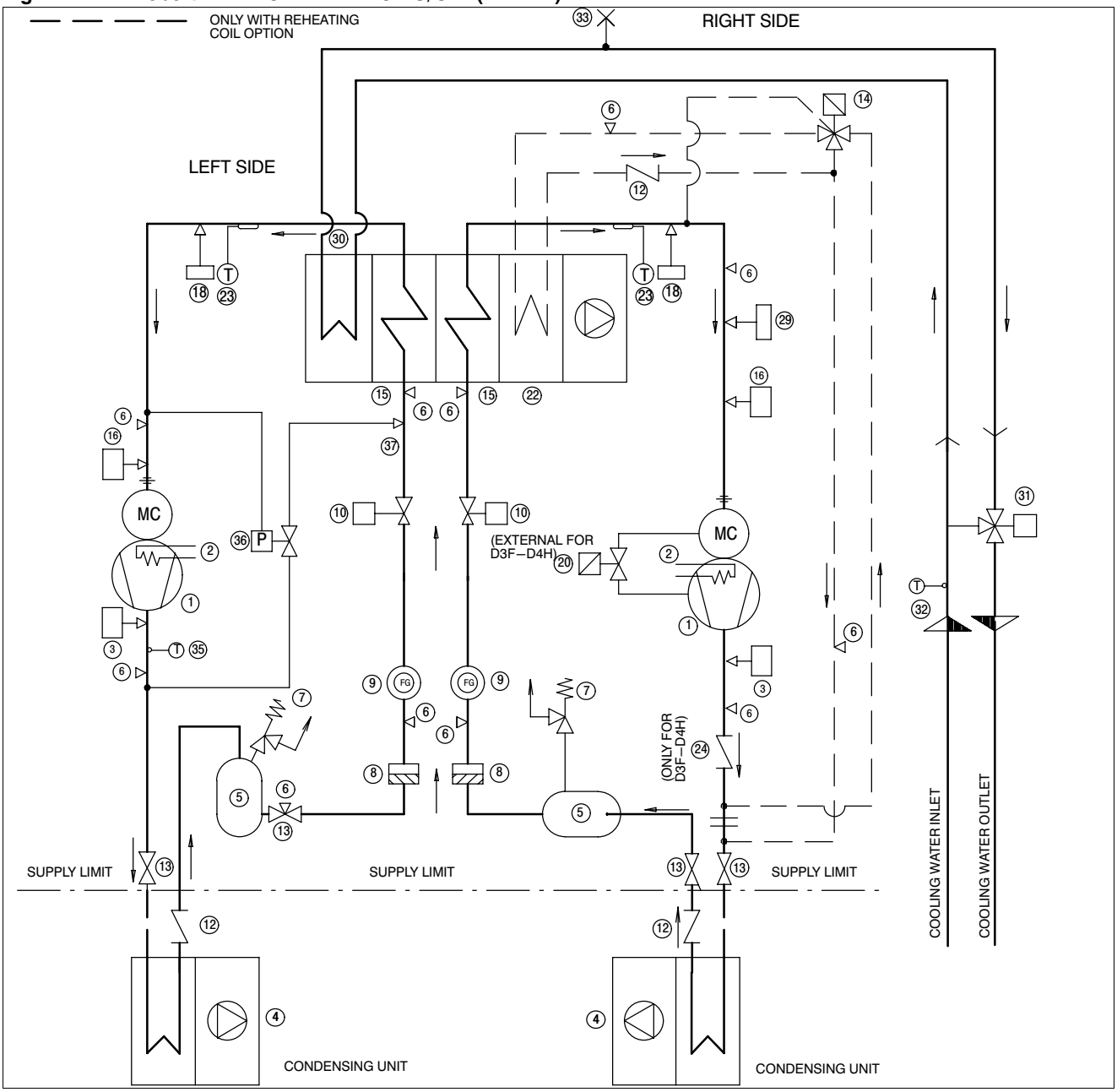


POS.	DESCRIPTION
1	Compressor
2	Crankcase heater
3	High pressure switch (HP)
4	Water cooled condenser
5	Liquid receiver
6	Access valve
7	Safety valve
8	Filter dryer
9	Sight glass
10	Electronic expansion valve (EEV)
11	Pressure transducer condensing regulation
12	Check valve
13	Shut–off valve
14	Reheating solenoid valve (optional)
15	Evaporator
16	Low pressure switch (LP)

POS.	DESCRIPTION
18	Pressure transducer for electronic expansion valve
20	Capacity mod. solenoid valve
21	Shut–off solenoid valve
22	Reheating coil (optional)
23	Temperature sensor for EEV
24	Check valve (for D3F–D4H only)
25	Condensing regulation water valve
27	Head pressure control valve
29	Minimum pressure switch
30	Chilled water coil
32	Inlet water thermostat
33	Manual bleed valve
34	Chilled water 2–way valve
35	Safety thermostat
36	Hot gas injection valve (antifreeze)
37	Hot gas injector

Refrigerant (2 EEV ALCO) and Hydraulic Circuits

Fig. 14.14 – Liebert HPM D3F–D4H–D5D U/O D (2 x EEV)

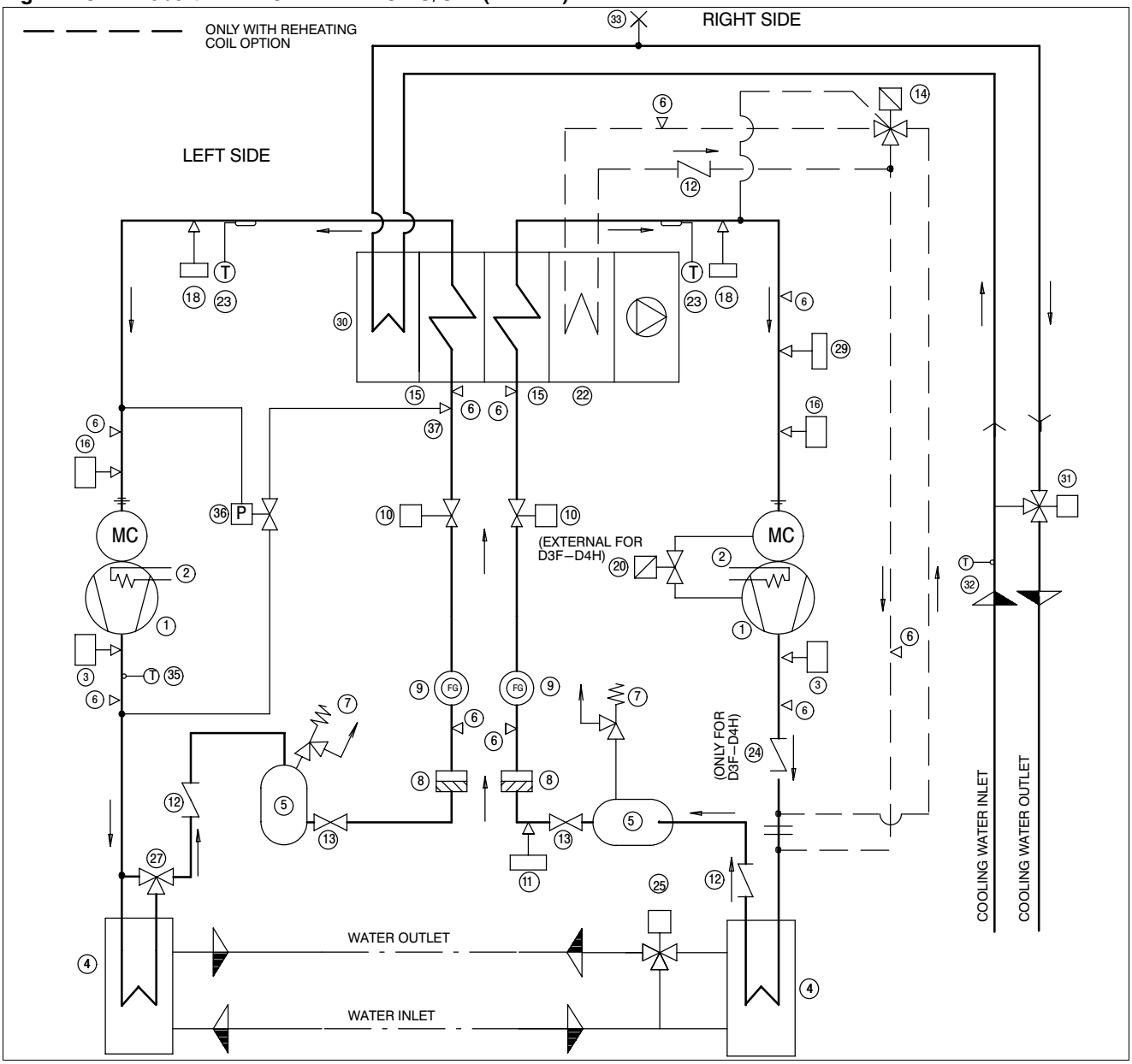


POS.	DESCRIPTION
1	Compressor
2	Crankcase heater
3	High pressure switch (HP)
4	Air cooled condenser
5	Liquid receiver
6	Access valve
7	Safety valve
8	Filter dryer
9	Sight glass
10	Electronic expansion valve (EEV)
12	Check valve
13	Shut–off valve
14	Reheating solenoid valve (optional)
15	Evaporator

POS.	DESCRIPTION
16	Low pressure switch (LP)
18	Pressure transducer for electronic expansion valve
20	Capacity mod. solenoid valve
22	Reheating coil (optional)
23	Temperature sensor for EEV
24	Check valve (for D3F–D4H only)
29	Minimum pressure switch
30	Chilled water coil
31	Chilled water 3–way valve
32	Inlet water thermostat
33	Manual bleed valve
35	Safety thermostat
36	Hot gas injection valve (antifreeze)
37	Hot gas injector

Refrigerant (2 EEV ALCO) and Hydraulic Circuits

Fig. 14.15 – Liebert HPM D3F–D4H–D5D U/O H (2 x EEV)

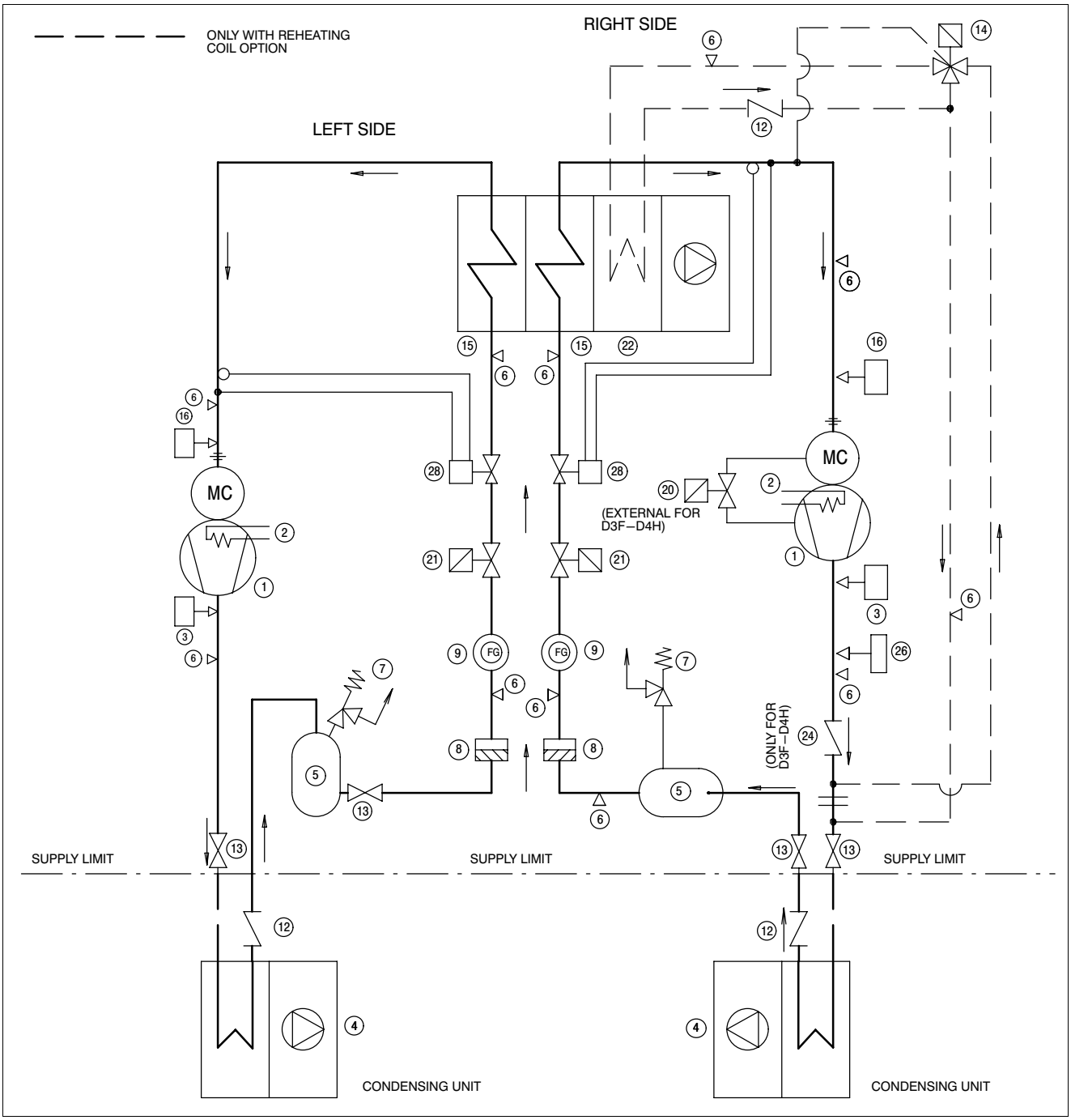


POS.	DESCRIPTION
1	Compressor
2	Crankcase heater
3	High pressure switch (HP)
4	Water cooled condenser
5	Liquid receiver
6	Access valve
7	Safety valve
8	Filter dryer
9	Sight glass
10	Electronic expansion valve (EEV)
11	Pressure transducer condensing regulation
12	Check valve
13	Shut–off valve
14	Reheating solenoid valve (optional)
15	Evaporator
16	Low pressure switch (LP)

POS.	DESCRIPTION
18	Pressure transducer for electronic expansion valve
20	Capacity mod. solenoid valve
22	Reheating coil (optional)
23	Temperature sensor for EEV
24	Check valve (for D3F–D4H only)
25	Condensing regulation water valve
26	High pressure transducer (HP)
27	Head pressure control valve
29	Minimum pressure switch
30	Chilled water coil
31	Chilled water 3–way valve
32	Inlet water thermostat
33	Manual bleed valve
35	Safety thermostat
36	Hot gas injection valve (antifreeze)
37	Hot gas injector

Refrigerant (2 TXV) and Hydraulic Circuits

Fig. 14.16 – Liebert HPM D3F–D4H–D5D–D7L U/O A (2 x TXV)

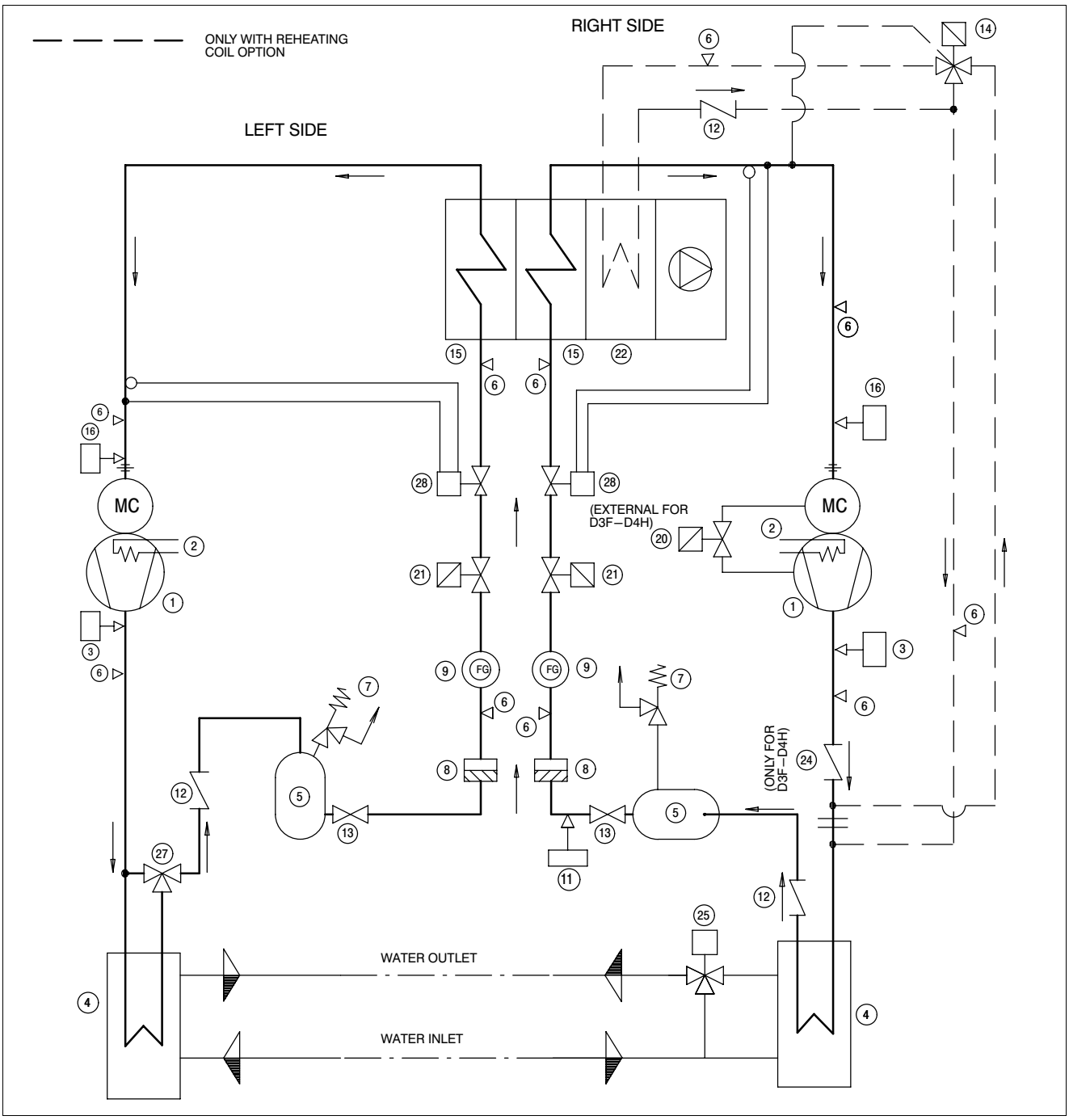


POS.	DESCRIPTION
1	Compressor
2	Crankcase heater
3	High pressure switch (HP)
4	Air cooled condenser
5	Liquid receiver
6	Access valve
7	Safety valve
8	Filter dryer
9	Sight glass
12	Check valve

POS.	DESCRIPTION
13	Shut–off valve
14	Reheating solenoid valve (optional)
15	Evaporator
16	Low pressure switch (LP)
20	Capacity mod. solenoid valve
21	Shut–off solenoid valve
22	Reheating coil (optional)
24	Check valve (for D3F–D4H only)
26	High pressure transducer (HP)
28	Thermostatic expansion valve (TXV)

Refrigerant (2 TXV) and Hydraulic Circuits

Fig. 14.17 – Liebert HPM D3F–D4H–D5D–D7L U/O W (2 x TXV)

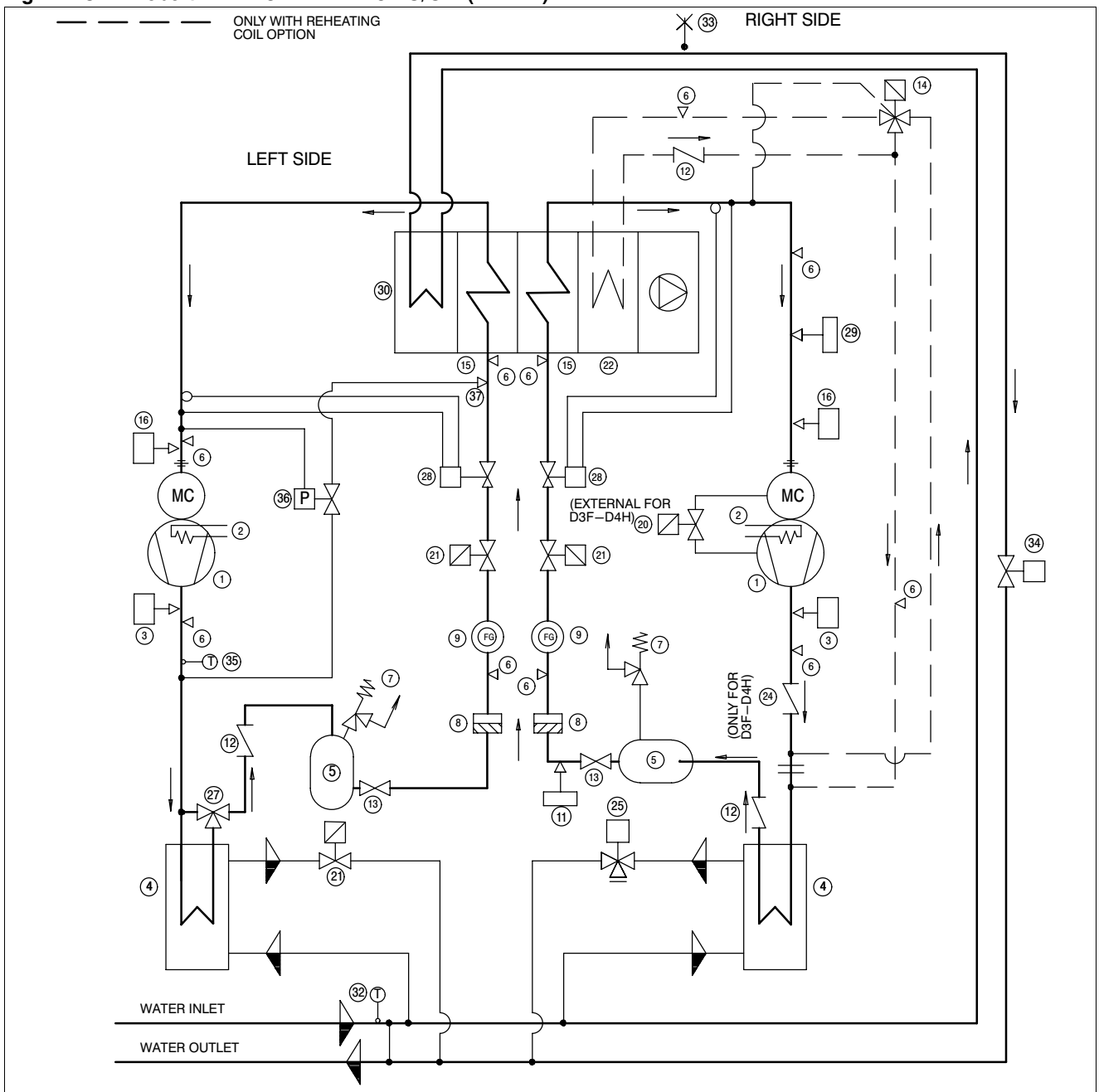


POS.	DESCRIPTION
1	Compressor
2	Crankcase heater
3	High pressure switch (HP)
4	Water cooled condenser
5	Liquid receiver
6	Access valve
7	Safety valve
8	Filter dryer
9	Sight glass
11	Pressure transducer condensing regulation
12	Check valve

POS.	DESCRIPTION
13	Shut–off valve
14	Reheating solenoid valve (optional)
15	Evaporator
16	Low pressure switch (LP)
20	Capacity mod. solenoid valve
21	Shut–off solenoid valve
22	Reheating coil (optional)
24	Check valve (for D3F–D4H only)
25	Condensing regulation water valve
27	Head pressure control valve
28	Thermostatic expansion valve (TXV)

Refrigerant (2 TXV) and Hydraulic Circuits

Fig. 14.18 – Liebert HPM D3F–D4H–D5D U/O F (2 x TXV)

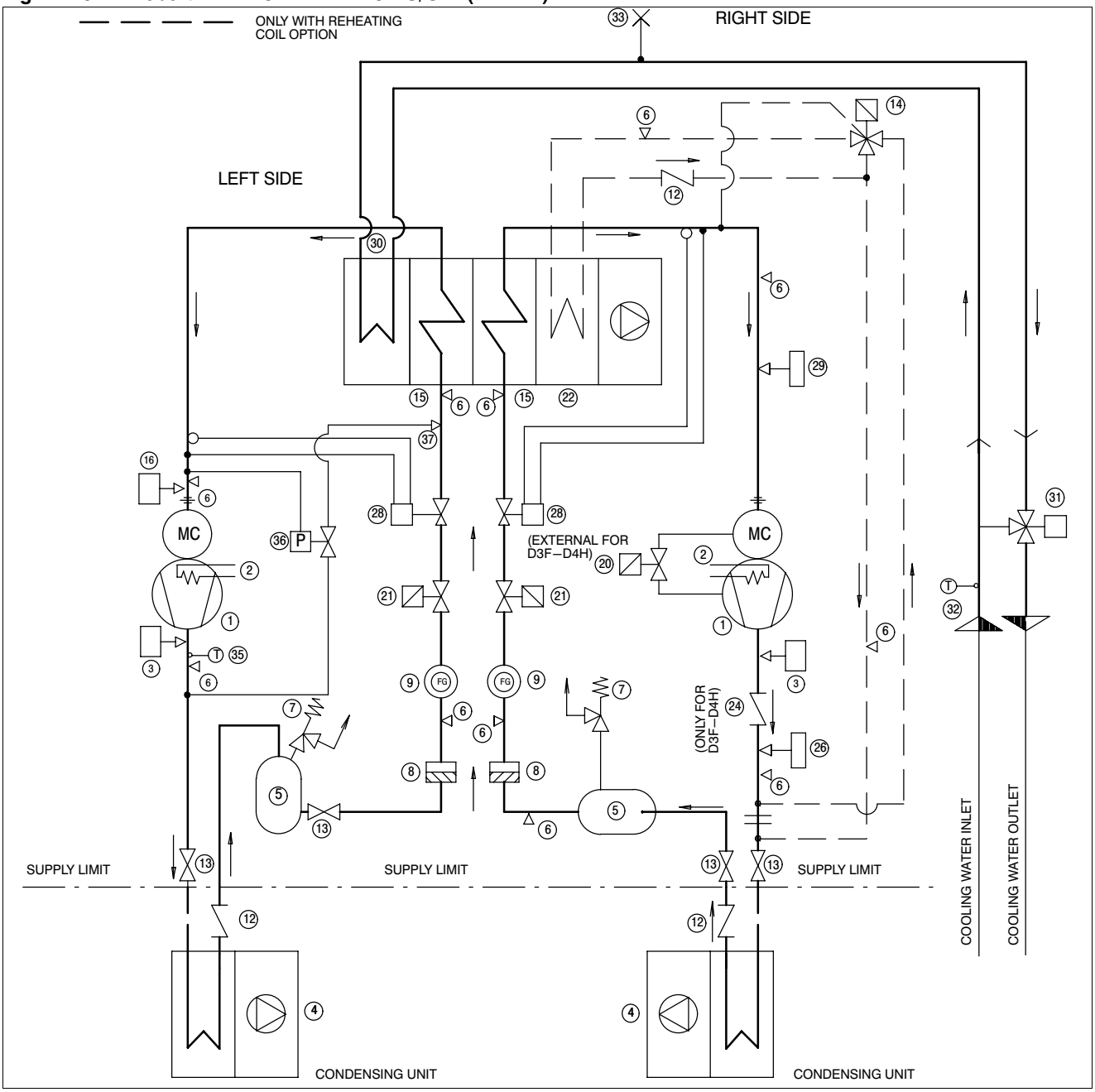


POS.	DESCRIPTION
1	Compressor
2	Crankcase heater
3	High pressure switch (HP)
4	Water cooled condenser
5	Liquid receiver
6	Access valve
7	Safety valve
8	Filter dryer
9	Sight glass
11	Pressure transducer condensing regulation
12	Check valve
13	Shut–off valve
14	Reheating solenoid valve (optional)
15	Evaporator
16	Low pressure switch (LP)

POS.	DESCRIPTION
20	Capacity mod. solenoid valve
21	Shut–off solenoid valve
22	Reheating coil (optional)
24	Check valve (for D3F–D4H only)
25	Condensing regulation water valve
27	Head pressure control valve
28	Thermostatic expansion valve (TXV)
29	Minimum pressure switch
30	Chilled water coil
32	Inlet water thermostat
33	Manual bleed valve
34	Chilled water 2–way valve
35	Safety thermostat
36	Hot gas injection valve (antifreeze)
37	Hot gas injector

Refrigerant (2 TXV) and Hydraulic Circuits

Fig. 14.19 – Liebert HPM D3F–D4H–D5D U/O D (2 x TXV)

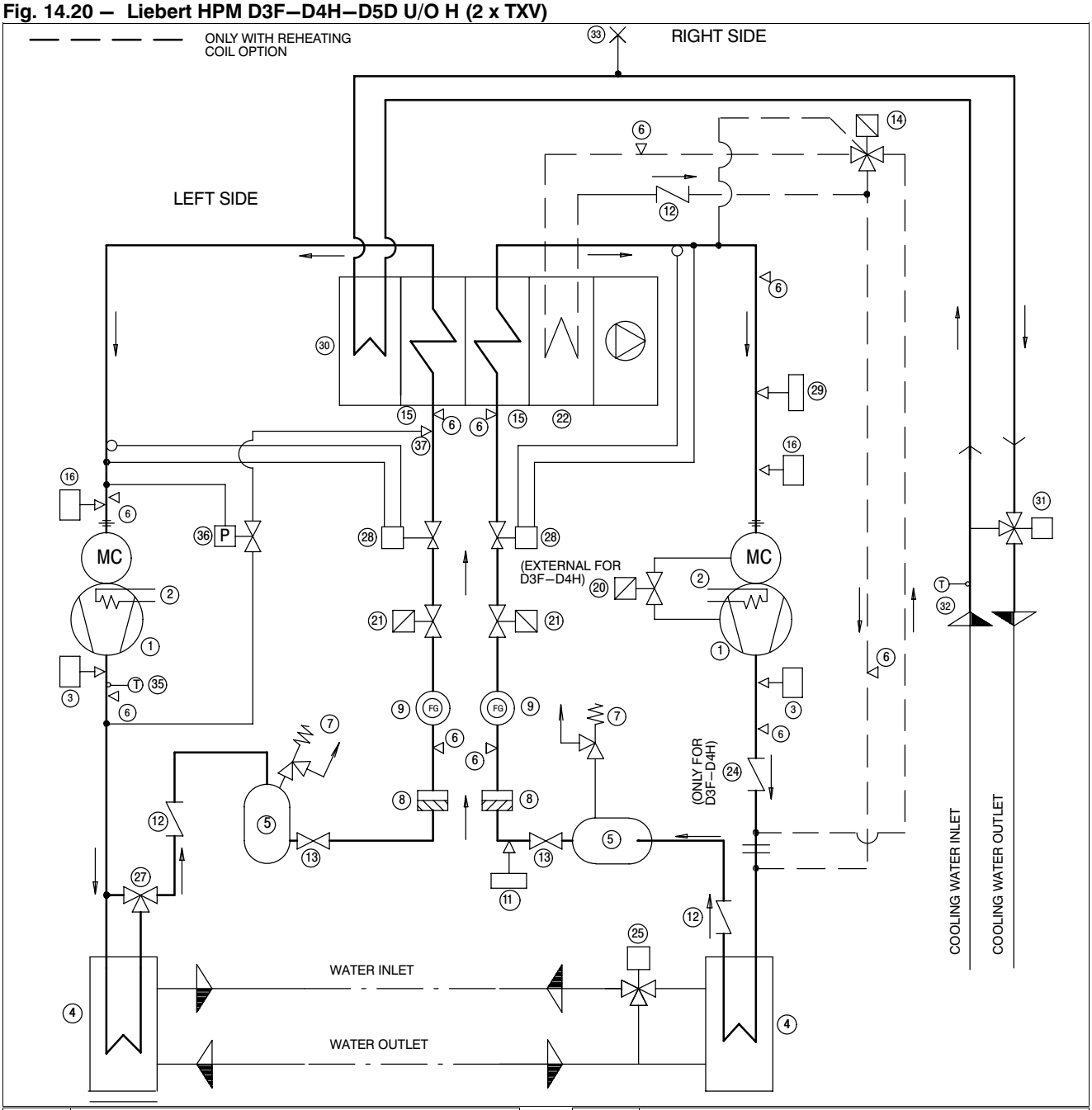


POS.	DESCRIPTION
1	Compressor
2	Crankcase heater
3	High pressure switch (HP)
4	Air cooled condenser
5	Liquid receiver
6	Access valve
7	Safety valve
8	Filter dryer
9	Sight glass
12	Check valve
13	Shut–off valve
14	Reheating solenoid valve (optional)
15	Evaporator
16	Low pressure switch (LP)

POS.	DESCRIPTION
20	Capacity mod. solenoid valve (external for D3F–D4H)
21	Shut–off solenoid valve
22	Reheating coil (optional)
24	Check valve (for D3F–D4H only)
26	High pressure transducer (HP)
28	Thermostatic expansion valve (TXV)
29	Minimum pressure switch
30	Chilled water coil
31	Chilled water 3–way valve
32	Inlet water thermostat
33	Manual bleed valve
35	Safety thermostat
36	Hot gas injection valve (antifreeze)
37	Hot gas injector

Refrigerant (2 TXV) and Hydraulic Circuits

Fig. 14.20 – Liebert HPM D3F–D4H–D5D U/O H (2 x TXV)

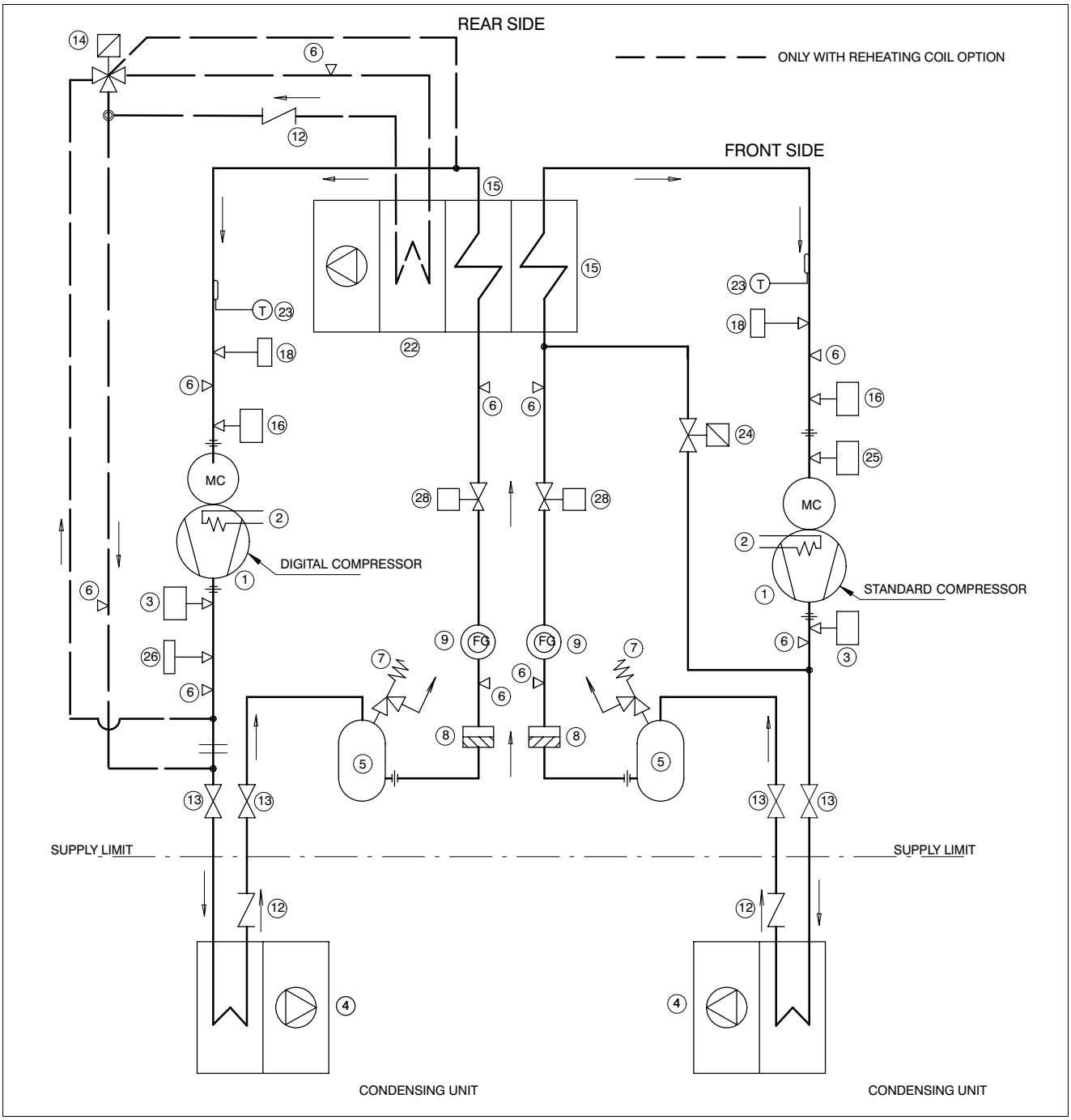


POS.	DESCRIPTION
1	Compressor
2	Crankcase heater
3	High pressure switch (HP)
4	Water cooled condenser
5	Liquid receiver
6	Access valve
7	Safety valve
8	Filter dryer
9	Sight glass
11	Pressure transducer condensing regulation
12	Check valve
13	Shut–off valve
14	Reheating solenoid valve (optional)
15	Evaporator
16	Low pressure switch (LP)

POS.	DESCRIPTION
20	Capacity mod. solenoid valve
21	Shut–off solenoid valve
22	Reheating coil (optional)
24	Check valve (for D3F–D4H only)
25	Condensing regulation water valve
27	Head pressure control valve
28	Thermostatic expansion valve (TXV)
29	Minimum pressure switch
30	Chilled water coil
31	Chilled water 3–way valve
32	Inlet water thermostat
33	Manual bleed valve
35	Safety thermostat
36	Hot gas injection valve (antifreeze)
37	Hot gas injector

Refrigerant (2 EEV ALCO) and Hydraulic Circuits

Fig. 14.21 – Liebert HPM D8F U/O A (2xEEV)

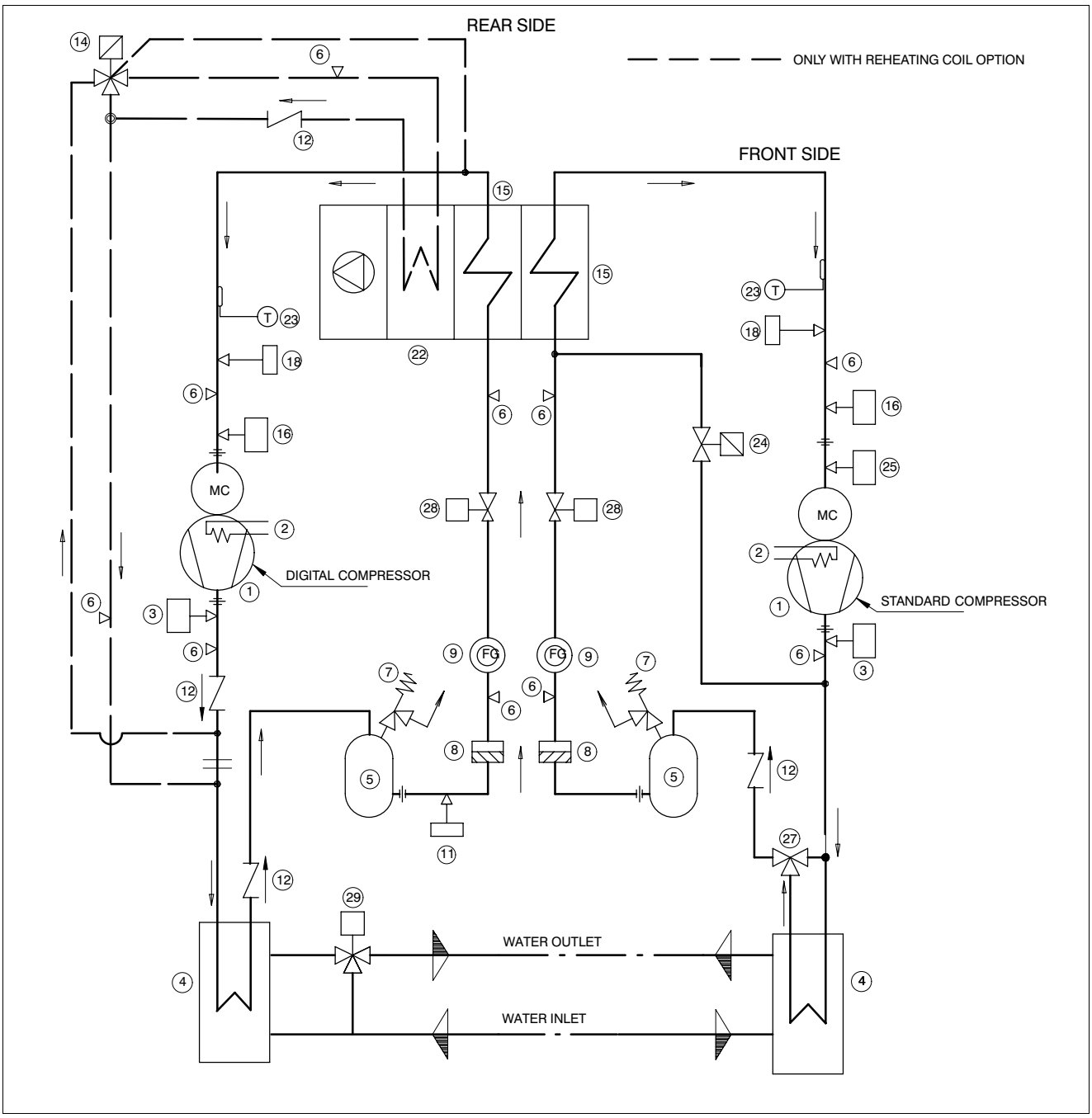


POS.	DESCRIPTION
1	Compressor
2	Crankcase heater
3	High pressure switch (HP)
4	Air cooled condenser
5	Liquid receiver
6	Access valve
7	Safety valve
8	Filter dryer
9	Sight glass
12	Check valve
13	Shut–off valve

POS.	DESCRIPTION
14	Hot gas solenoid valve (optional)
15	Evaporator
16	Low pressure switch (LP)
18	Pressure transducer for electronic expansion valve
22	Reheating coil (optional)
23	Temperature sensor for EEV
24	Hot gas injection valve
25	On/off pressure switch hot gas injection valve
26	High pressure transducer (HP)
28	Thermostatic expansion valve (EEV)

Refrigerant (2 EEV ALCO) and Hydraulic Circuits

Fig. 14.22 – Liebert HPM D8F U/O W (2xEEV)

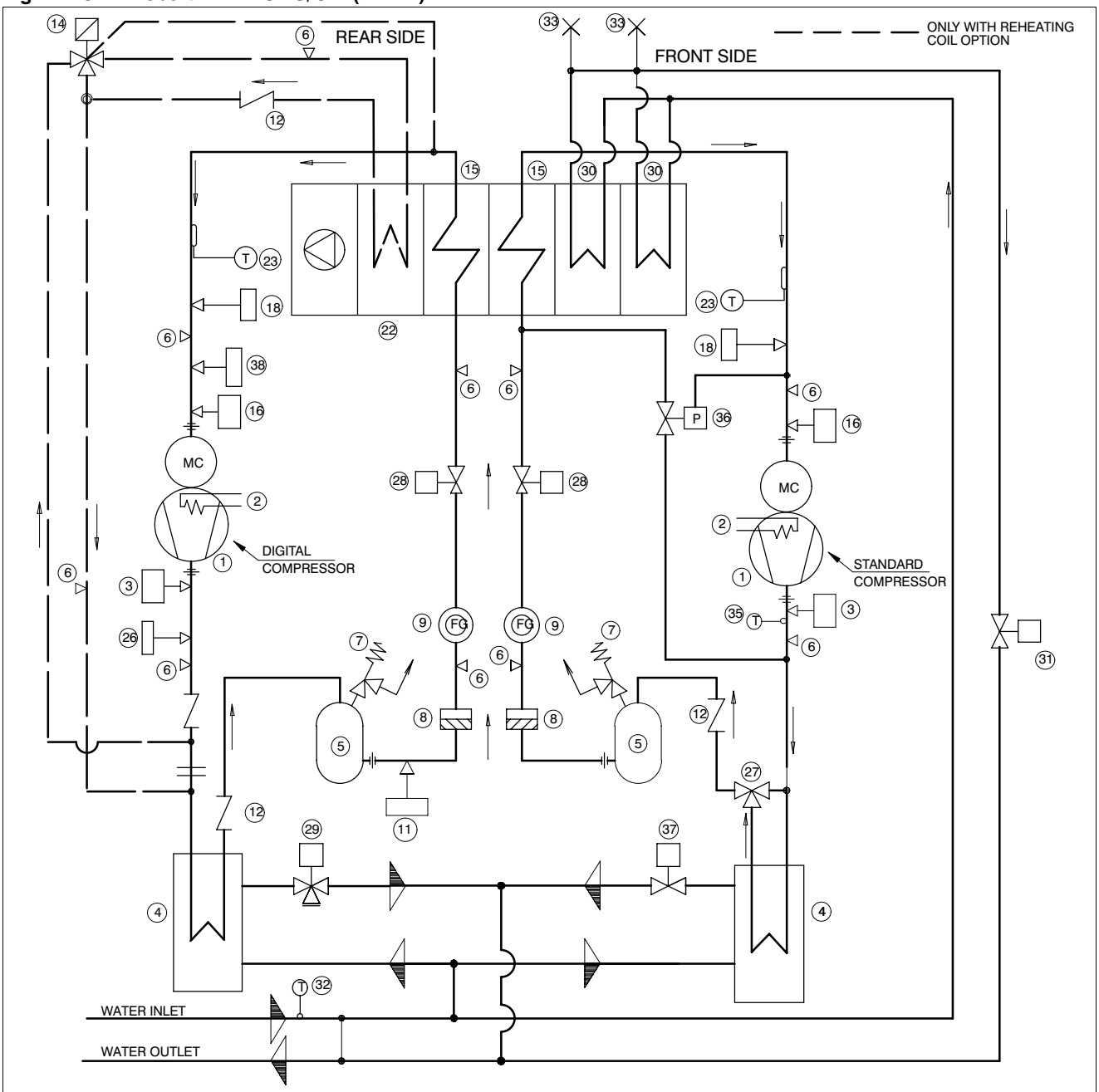


POS.	DESCRIPTION
1	Compressor
2	Crankcase heater
3	High pressure switch (HP)
4	Water cooled condenser
5	Liquid receiver
6	Access valve
7	Safety valve
8	Filter dryer
9	Sight glass
11	Pressure transducer condensing regulation
12	Check valve
13	Shut–off valve

POS.	DESCRIPTION
14	Hot gas solenoid valve (optional)
15	Evaporator
16	Low pressure switch (LP)
18	Pressure transducer for electronic expansion valve
22	Reheating coil (optional)
23	Temperature sensor for EEV
24	Hot gas injection valve
25	On/off pressure switch hot gas injection valve
26	High pressure transducer (HP)
28	Thermostatic expansion valve (EEV)
29	Condensing regulation water valve

Refrigerant (2 EEV ALCO) and Hydraulic Circuits

Fig. 14.23 – Liebert HPM D8F U/O F (2xEEV)

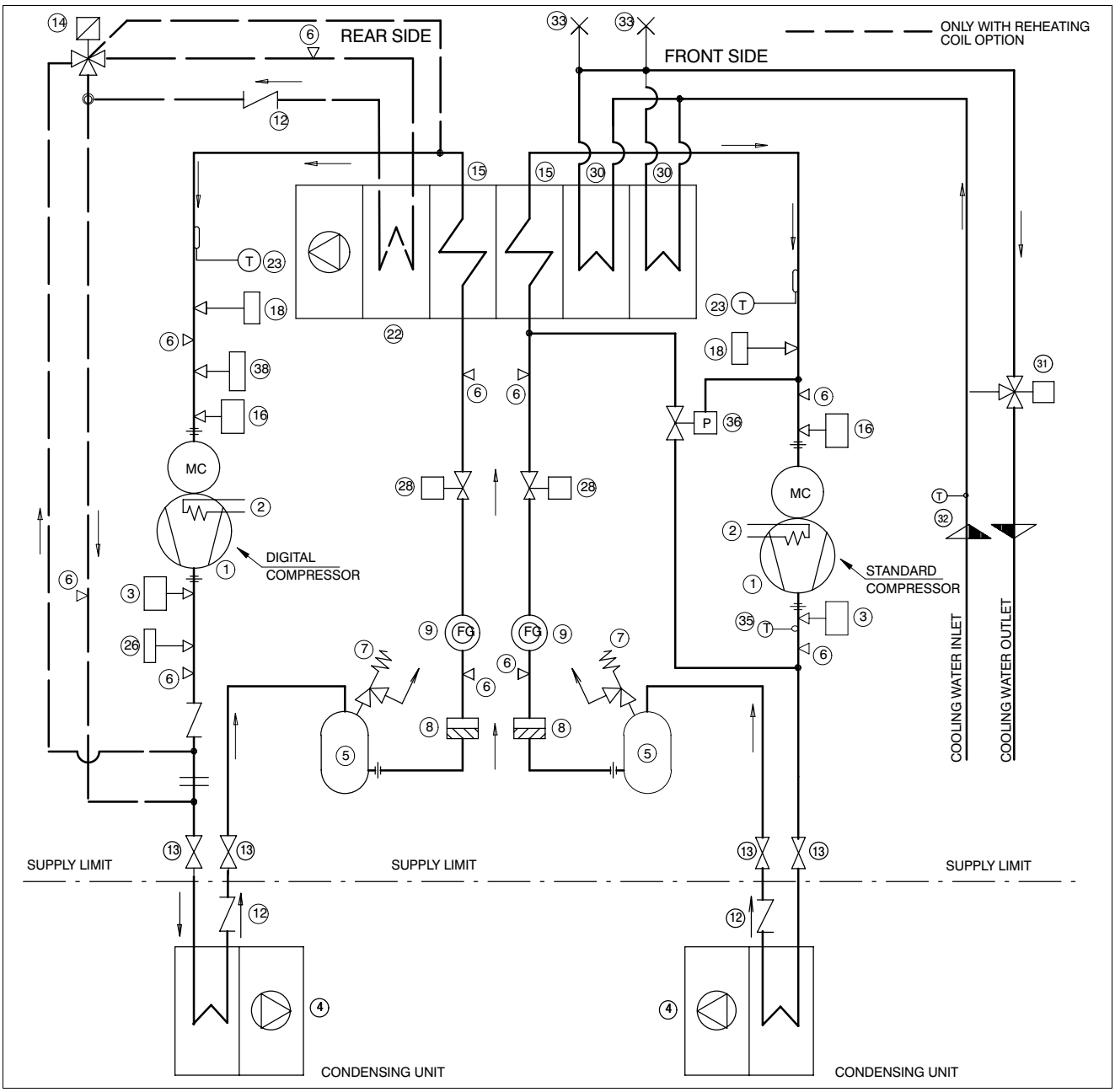


POS.	DESCRIPTION
1	Compressor
2	Crankcase heater
3	High pressure switch (HP)
4	Water cooled condenser
5	Liquid receiver
6	Access valve
7	Safety valve
8	Filter dryer
9	Sight glass
11	Pressure transducer condensing regulation
12	Check valve
13	Shut–off valve
14	Hot gas solenoid valve (optional)
15	Evaporator
16	Low pressure switch (LP)

POS.	DESCRIPTION
18	Pressure transducer for electronic expansion valve
22	Reheating coil (optional)
23	Temperature sensor for EEV
26	High pressure transducer (HP)
27	Head pressure control valve
28	Thermostatic expansion valve (EEV)
29	Condensing regulation water valve
30	Chilled water coil
31	Chilled water 2–way valve
32	Inlet water thermostat
33	Manual bleed valve
35	Safety thermostat
36	Hot gas injection valve
37	Shut–off solenoid valve
38	Minimun pressure switch (LP)

Refrigerant (2 EEV ALCO) and Hydraulic Circuits

Fig. 14.24 – Liebert HPM D8F U/O D (2xEEV)

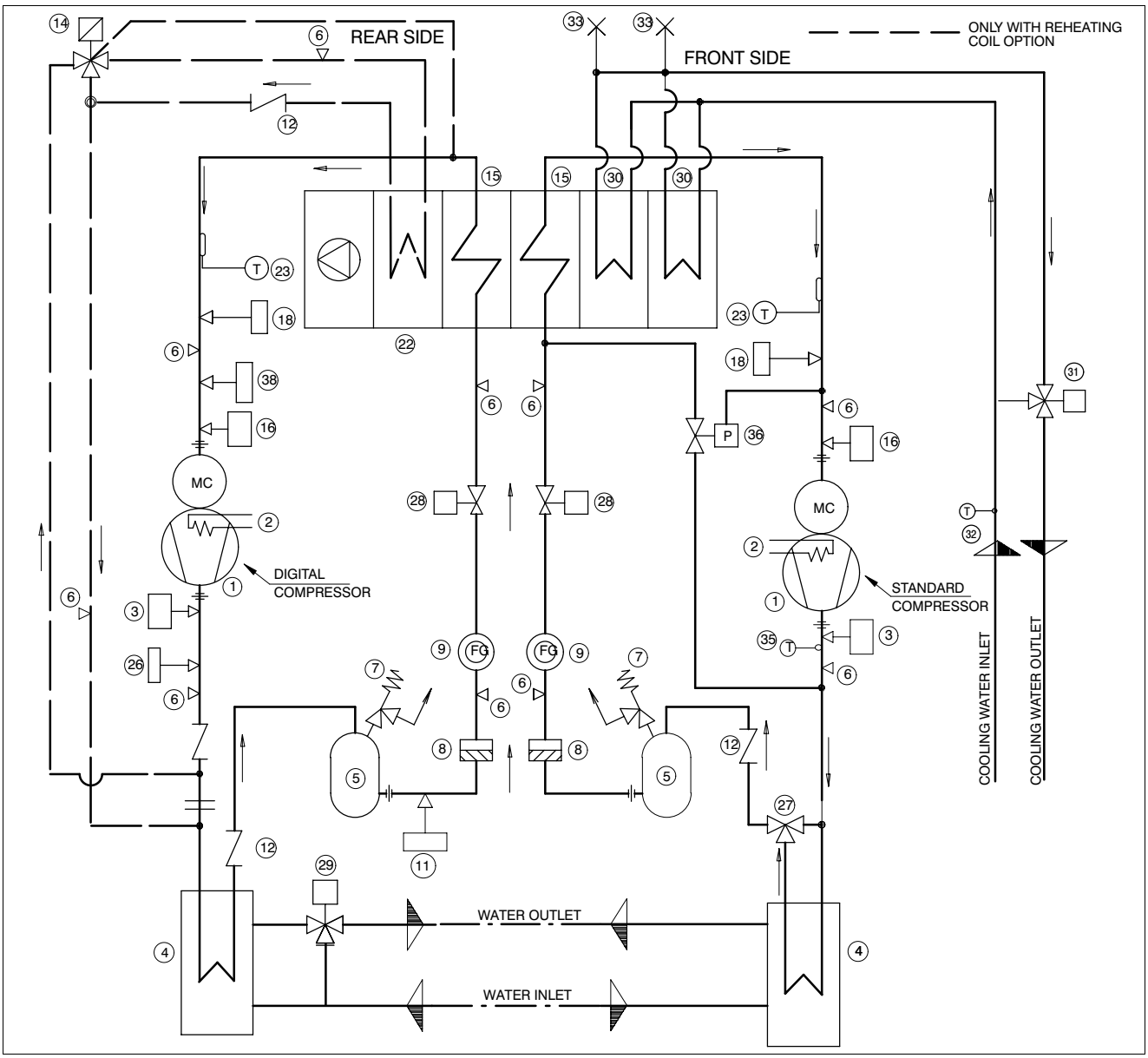


POS.	DESCRIPTION
1	Compressor
2	Crankcase heater
3	High pressure switch (HP)
4	Air cooled condenser
5	Liquid receiver
6	Access valve
7	Safety valve
8	Filter dryer
9	Sight glass
12	Check valve
13	Shut–off valve
14	Hot gas solenoid valve (optional)
15	Evaporator
16	Low pressure switch (LP)

POS.	DESCRIPTION
18	Pressure transducer for electronic expansion valve
22	Reheating coil (optional)
23	Temperature sensor for EEV
26	High pressure transducer (HP)
27	Head pressure control valve
28	Thermostatic expansion valve (EEV)
30	Chilled water coil
31	Chilled water 3–way valve
32	Inlet water thermostat
33	Manual bleed valve
35	Safety thermostat
36	Hot gas injection valve
38	Minimun pressure switch (LP)

Refrigerant (2 EEV ALCO) and Hydraulic Circuits

Fig. 14.25 – Liebert HPM D8F U/O H (2xEEV)

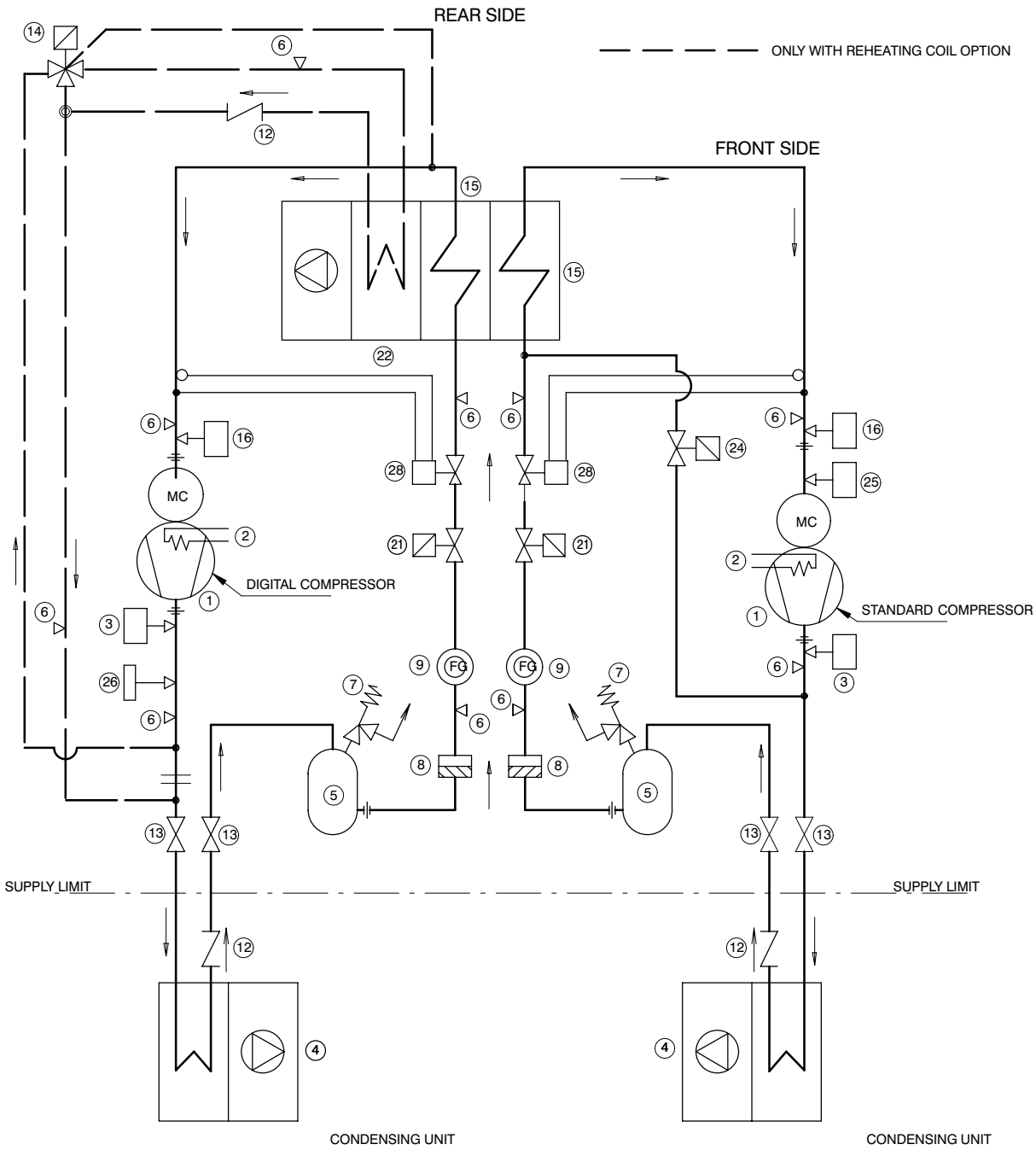


POS.	DESCRIPTION
1	Compressor
2	Crankcase heater
3	High pressure switch (HP)
4	Water cooled condenser
5	Liquid receiver
6	Access valve
7	Safety valve
8	Filter dryer
9	Sight glass
11	Pressure transducer condensing regulation
12	Check valve
13	Shut–off valve
14	Hot gas solenoid valve (optional)
15	Evaporator
16	Low pressure switch (LP)

POS.	DESCRIPTION
18	Pressure transducer for electronic expansion valve
22	Reheating coil (optional)
23	Temperature sensor for EEV
26	High pressure transducer (HP)
27	Head pressure control valve
28	Thermostatic expansion valve (EEV)
29	Condensing regulation water valve
30	Chilled water coil
31	Chilled water 3–way valve
32	Inlet water thermostat
33	Manual bleed valve
35	Safety thermostat
36	Hot gas injection valve
38	Minimun pressure switch (LP)

Refrigerant (2 TXV) and Hydraulic Circuits

Fig. 14.26 – Liebert HPM D8F U/O A (2xTXV)

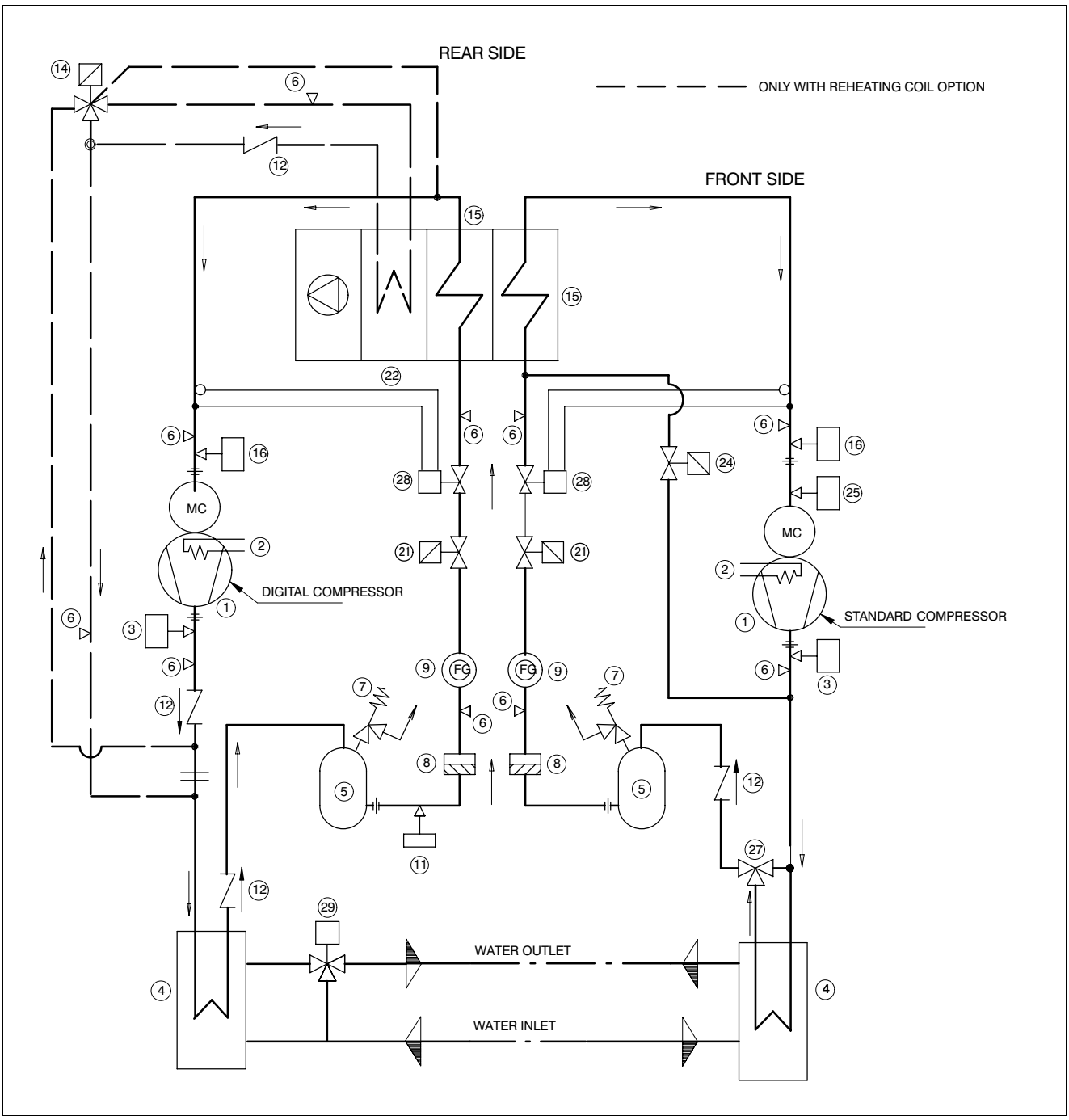


POS.	DESCRIPTION
1	Compressor
2	Crankcase heater
3	High pressure switch (HP)
4	Air cooled condenser
5	Liquid receiver
6	Access valve
7	Safety valve
8	Filter dryer
9	Sight glass
12	Check valve

POS.	DESCRIPTION
13	Shut–off valve
14	Hot gas solenoid valve (optional)
15	Evaporator
16	Low pressure switch (LP)
21	Shut–off solenoid valve
22	Reheating coil (optional)
24	Hot gas injection valve
25	On/off pressure switch hot gas injection valve
26	High pressure transducer (HP)
28	Thermostatic expansion valve (TXV)

Refrigerant (2 TXV) and Hydraulic Circuits

Fig. 14.27 – Liebert HPM D8F U/O W (2xTXV)

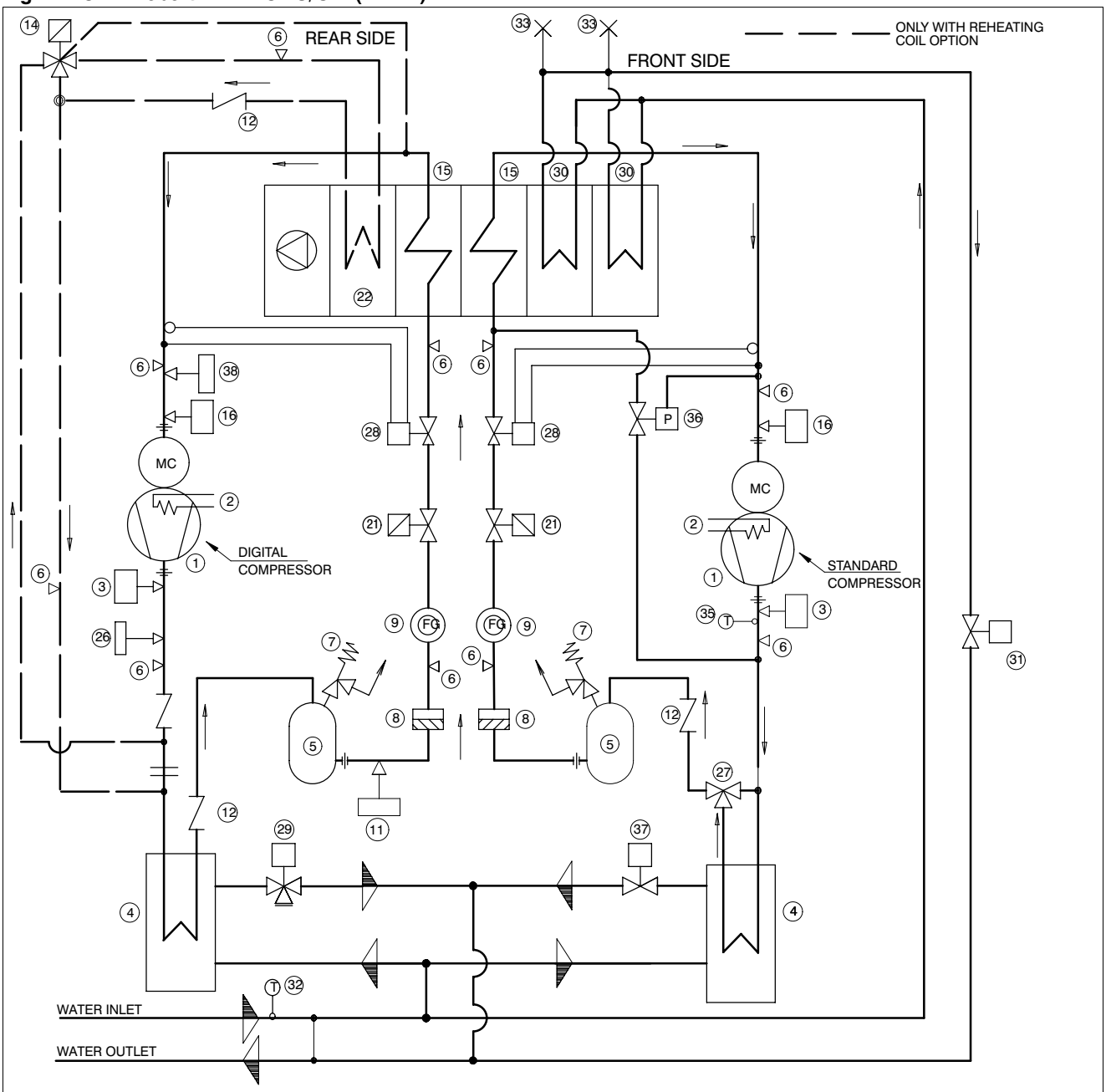


POS.	DESCRIPTION
1	Compressor
2	Crankcase heater
3	High pressure switch (HP)
4	Water cooled condenser
5	Liquid receiver
6	Access valve
7	Safety valve
8	Filter dryer
9	Sight glass
11	Pressure transducer condensing regulation
12	Check valve

POS.	DESCRIPTION
14	Hot gas solenoid valve (optional)
15	Evaporator
16	Low pressure switch (LP)
21	Shut–off solenoid valve
22	Reheating coil (optional)
24	Hot gas injection valve
25	On/off pressure switch hot gas injection valve
27	Head pressure control valve
28	Thermostatic expansion valve (TXV)
29	Condensing regulation water valve

Refrigerant (2 TXV) and Hydraulic Circuits

Fig. 14.28 – Liebert HPM D8F U/O F (2xTXV)

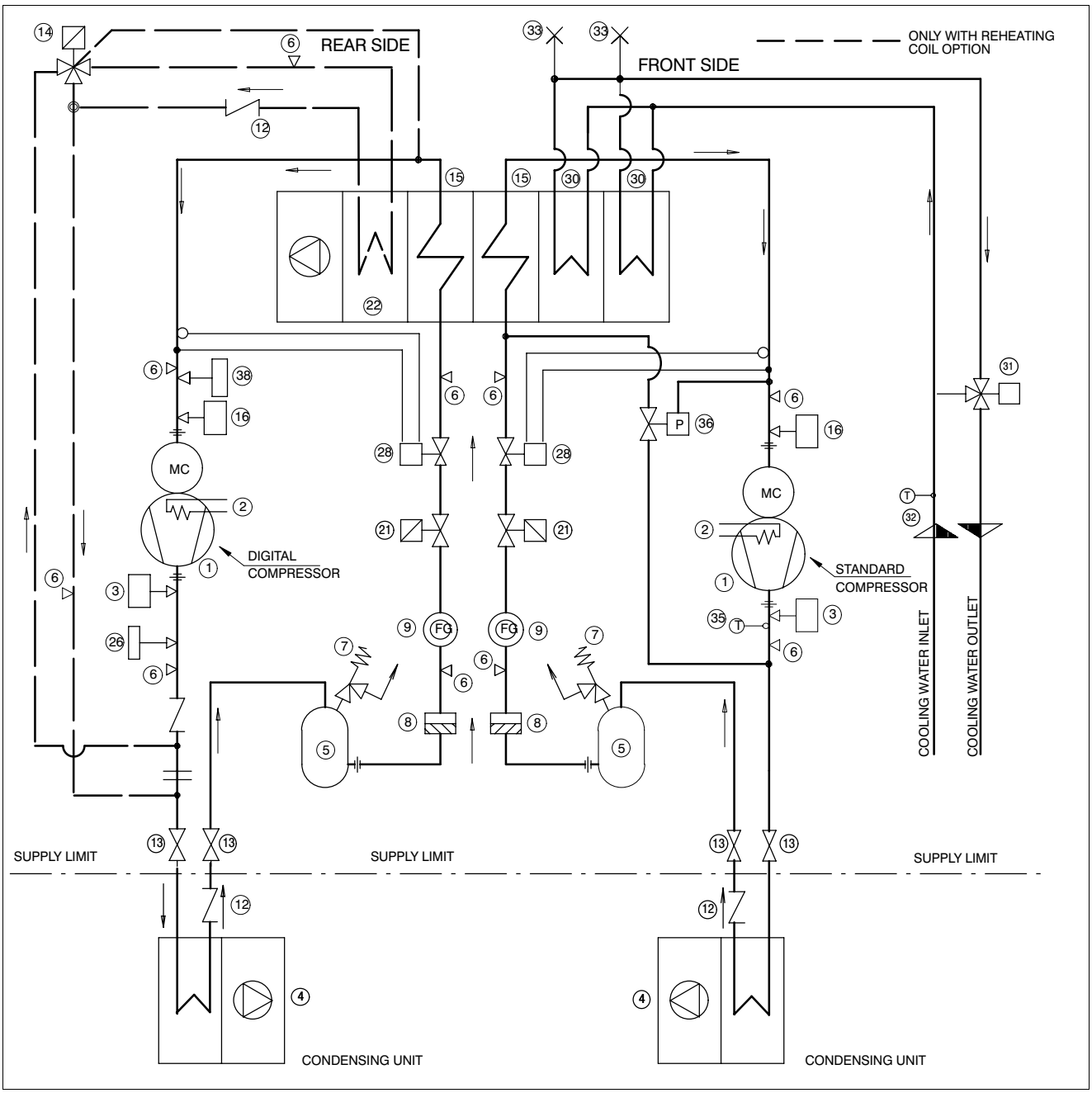


POS.	DESCRIPTION
1	Compressor
2	Crankcase heater
3	High pressure switch (HP)
4	Water cooled condenser
5	Liquid receiver
6	Access valve
7	Safety valve
8	Filter dryer
9	Sight glass
11	Pressure transducer condensing regulation
12	Check valve
13	Shut–off valve
14	Hot gas solenoid valve (optional)
15	Evaporator
16	Low pressure switch (LP)

POS.	DESCRIPTION
21	Shut–off solenoid valve
22	Reheating coil (optional)
26	High pressure transducer (HP)
27	Head pressure control valve
28	Thermostatic expansion valve (TXV)
29	Condensing regulation water valve
30	Chilled water coil
31	Chilled water 2–way valve
32	Inlet water thermostat
33	Manual bleed valve
35	Safety thermostat
36	Hot gas injection valve
37	Shut–off solenoid valve
38	Minimun pressure switch (LP)

Refrigerant (2 TXV) and Hydraulic Circuits

Fig. 14.29 – Liebert HPM D8F U/O D (2xTXV)

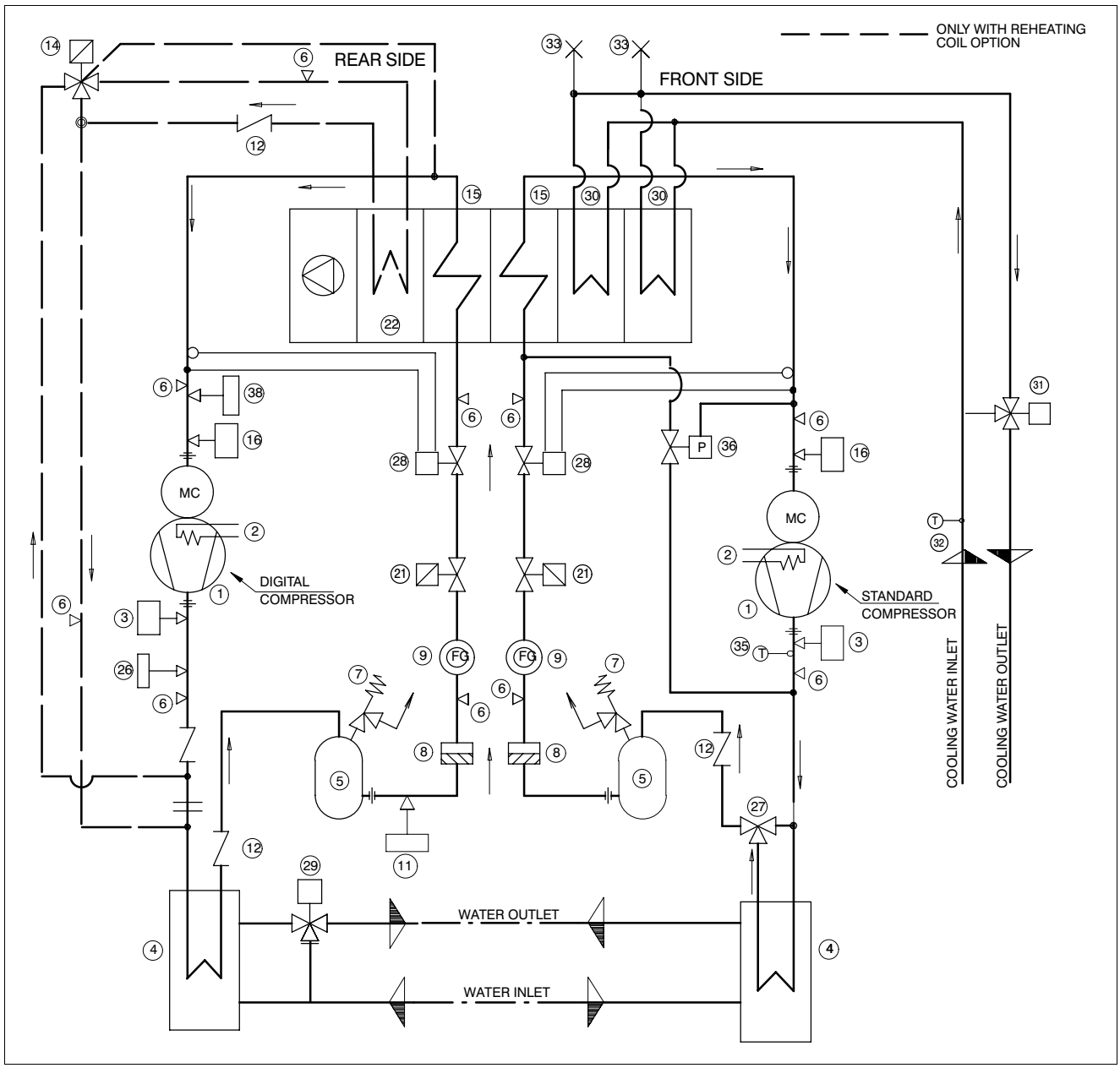


POS.	DESCRIPTION
1	Compressor
2	Crankcase heater
3	High pressure switch (HP)
4	Air cooled condenser
5	Liquid receiver
6	Access valve
7	Safety valve
8	Filter dryer
9	Sight glass
12	Check valve
13	Shut–off valve
14	Hot gas solenoid valve (optional)
15	Evaporator

POS.	DESCRIPTION
16	Low pressure switch (LP)
21	Shut–off solenoid valve
22	Reheating coil (optional)
26	High pressure transducer (HP)
28	Thermostatic expansion valve (TXV)
30	Chilled water coil
31	Chilled water 3–way valve
32	Inlet water thermostat
33	Manual bleed valve
35	Safety thermostat
36	Hot gas injection valve
38	Minimun pressure switch (LP)

Refrigerant (2 TXV) and Hydraulic Circuits

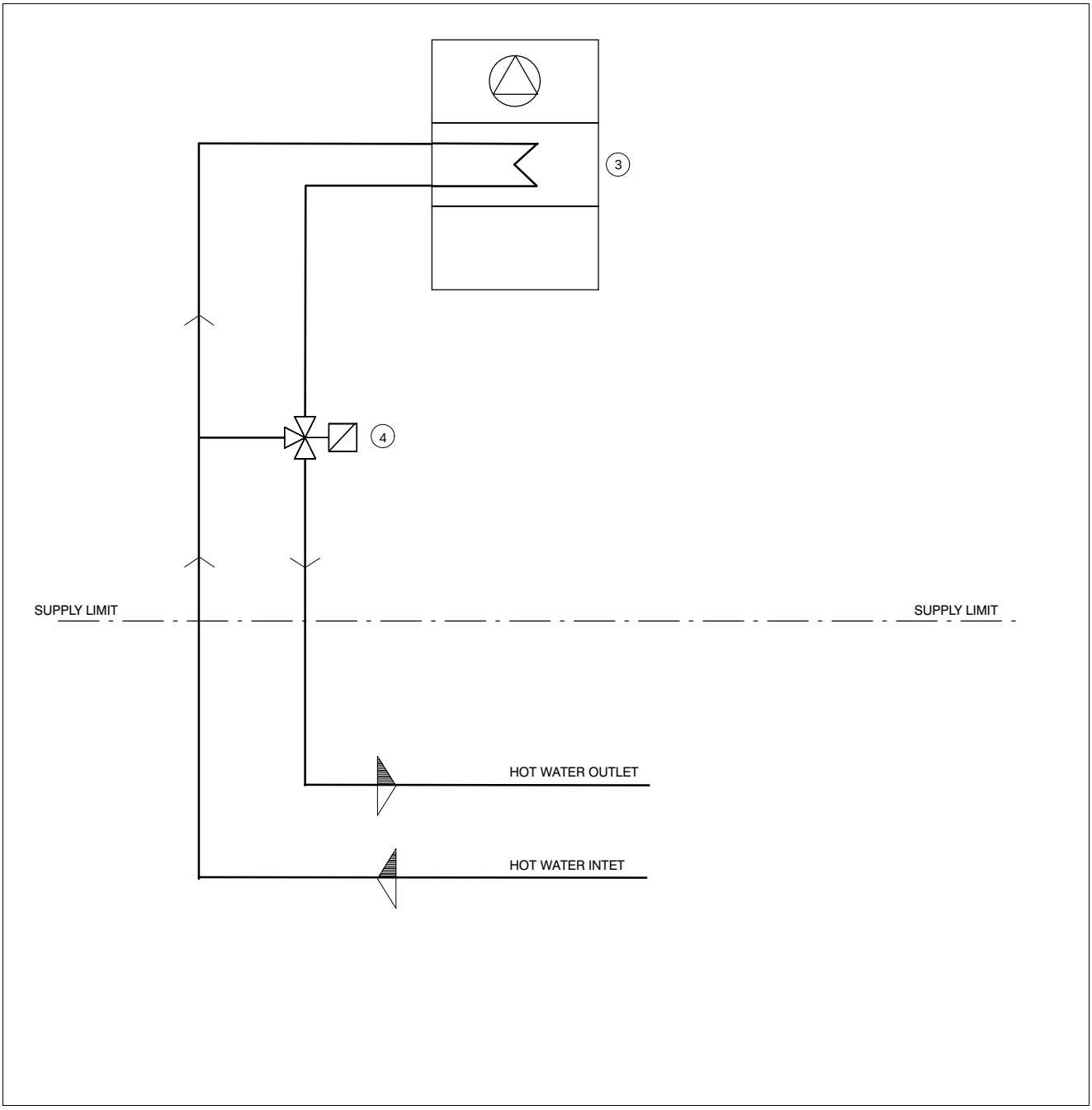
Fig. 14.30 – Liebert HPM D8F U/O H (2xTXV)



POS.	DESCRIPTION
1	Compressor
2	Crankcase heater
3	High pressure switch (HP)
4	Water cooled condenser
5	Liquid receiver
6	Access valve
7	Safety valve
8	Filter dryer
9	Sight glass
11	Pressure transducer condensing regulation
12	Check valve
13	Shut–off valve
14	Hot gas solenoid valve (optional)
15	Evaporator

POS.	DESCRIPTION
16	Low pressure switch (LP)
21	Shut–off solenoid valve
22	Reheating coil (optional)
26	High pressure transducer (HP)
27	Head pressure control valve
28	Thermostatic expansion valve (TXV)
29	Condensing regulation water valve
30	Chilled water coil
31	Chilled water 3–way valve
32	Inlet water thermostat
33	Manual bleed valve
35	Safety thermostat
36	Hot gas injection valve
38	Minimun pressure switch (LP)

Fig. 14.31 — Hot water reheating coil — optional



POS.	Optional components
3	Hot water coil
4	Hot water 3—way valve

Fabbricante – Manufacturer – Hersteller – Fabricant – Fabricante
Fabricante – Tillverkare – Fabrikant – Valmistaja – Produsent
Fabrikant – Κατασκεναστηζ – Producent

Emerson Network Power S.r.l. – Zona Industriale Tognana
Via Leonardo da Vinci, 16/18 – 35028 Piove di Sacco – Padova (Italy)

Il Fabbricante dichiara che questo prodotto è conforme alle direttive Europee:
The Manufacturer hereby declares that this product conforms to the European Union directives:
Der Hersteller erklärt hiermit, dass dieses Produkt den Anforderungen der Europäischen Richtlinien gerecht wird:
Le Fabricant déclare que ce produit est conforme aux directives Européennes:
El Fabricante declara que este producto es conforme a las directivas Europeas:
O Fabricante declara que este produto está em conformidade com as directivas Europeias:
Tillverkare försäkrar härmed att denna produkt överensstämmer med Europeiska Uniones direktiv:
De Fabrikant verklaart dat dit produkt conform de Europese richtlijnen is:
Vaimistaja vakuuttaa täten, että tämä tuote täyättää seuraavien EU–direktiivien vaatimukset:
Produsent erklærer herved at dette produktet er i samsvar med EU–direktiver:
Fabrikant erklærer herved, at dette produkt opfylder kravene i EU direktiverne:
Ο Κατασκευαστής δηλώνει ότι το παρόν προΪόν είναι κατασκευασμένο αύμφωνα με τις οδηγίες της Ε.Ε.:

2006/42/EC; 2004/108/EC; 2006/95/EC; 97/23/EC

Ensuring the High Availability Of Mission-Critical Data and Applications

Emerson Network Power, a business of Emerson (NYSE:EMR), is the global leader in enabling Business-Critical Continuity™ from grid to chip for telecommunication networks, data centers, health care and industrial facilities. Emerson Network Power provides innovative solutions and expertise in areas including AC and DC power and precision cooling systems, embedded computing and power, integrated racks and enclosures, power switching and controls, monitoring, and connectivity. All solutions are supported globally by local Emerson Network Power service technicians. Liebert power, precision cooling and monitoring products and services from Emerson Network Power improve the utilization and management of data center and network technologies by increasing IT system availability, flexibility and efficiency. For more information, visit www .liebert .com, www .emersonnetworkpower .com or www .eu .emersonnetworkpower .com

Locations

Emerson Network Power - Headquarters EMEA
Via Leonardo Da Vinci 16/18
Zona Industriale Tognana
35028 Piove di Sacco (PD) Italy
Tel: +39 049 9719 111
Fax: +39 049 5841 257
marketing.emea @ emersonnetworkpower .com

Emerson Network Power - Service EMEA
Via Leonardo Da Vinci 16/18
Zona Industriale Tognana
35028 Piove di Sacco (PD) Italy
Tel: +39 049 9719 111
Fax: +39 049 9719 045
service.emea @ emersonnetworkpower .com

United States
1050 Dearborn Drive
P.O. Box 29186
Columbus, OH 43229
Tel: +1 6148880246

Asia
29/F The Orient Square Building
F. Ortigas Jr. Road, Ortigas Centre
Pasig City 1605 Philippines
Tel: +63 2 620 3600
Fax: +63 2 730 9572

Emerson Network Power

The global leader in Business-Critical Continuity™

- AC Power
- Connectivity
- DC Power
- Embedded Computing
- Embedded Power
- Monitoring
- Outside Plant
- Power Switching & Control
- Precision Cooling
- Rack & Integrated Cabinets
- Services
- Surge Protection