



30GH 040-245

30GZ 040-245

Air-cooled liquid chillers

50 Hz

REGULATION PRO-DIALOG ^{72/15}



Carrier is participating in the Eurovent Certification Programme. Products are as listed in the Eurovent Directory of Certified Products.



Installation, operation and maintenance instructions



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The photo on the front cover is only for illustration purposes and not contractually binding (photo shows unit with optional compressor sound enclosure).

The manufacturer reserves the right to make modifications at any time without prior notice.

START-UP CHECK LIST

Start-up date: _____

Equipment sold by: _____ Contract No.: _____

Installed by: _____ Contract No.: _____

Site address: _____

Equipment type and serial numbers: 30GH/GZ _____

Electrical data:

Supply voltage: Ph. 1 _____ V Ph. 2 _____ V Ph. 3 _____ V

Nominal voltage: V _____ % network voltage: _____

Current draw: Ph. 1 _____ A Ph. 2 _____ A Ph. 3 _____ A

Control circuit voltage _____ V Circuit breaker calibration _____ A

Main circuit breaker rating: _____ A

Physical data:

Condenser:

Entering air temperature: _____ °C

Leaving air temperature: _____ °C

Pressure drop (air): _____ kPa

Discharge air pressure: _____ Pa

Fan speed: _____ r/s or rpm

Fan motor input: Ph. 1 _____ V Ph. 2 _____ V Ph. 3 _____ V

Ph. 1 _____ V Ph. 2 _____ V Ph. 3 _____ V

Ph. 1 _____ V Ph. 2 _____ V Ph. 3 _____ V

Ph. 1 _____ V Ph. 2 _____ V Ph. 3 _____ V

Safety device setting:

High pressure switch: cut-out _____ kPa cut-in _____ kPa

Low-pressure protection: cut-out _____ kPa cut-in _____ kPa

Defrost protection: cut-out _____ °C cut-in _____ °C

Control thermostat: cut-out first step _____ °C cut-in first step _____ °C

cut-out second step _____ °C cut-in second step _____ °C

Oil level: _____

Oil visible in sight glass: _____

Colour of moisture indicator: _____

Air bubbles visible in sight glass: _____

Accessories:

-

-

Commissioning engineer (name): _____

Name _____ Date _____





Remarks:

NOTE: Please fill in this sheet during the installation

Dimensions/clearances (mm)

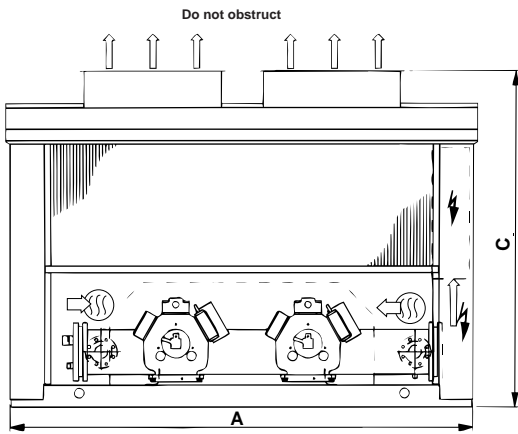
30GH/GZ	A	B	C	D	E	F	G
040-045	2450	1870	1912	2500	1200	500	1200
050-060	2900	2156	2060	2500	1200	500	1200
085-100	3404	2328	2471	1600	1800	1600	1800
120-145	4322	2328	2471	1600	1800	1600	1800
150-170	6229	2328	2471	1600	1800	1600	1800
190-220	7147	2328	2471	1600	1800	1600	1800
245	8983	2328	2471	1600	1800	1600	1800

Legend:

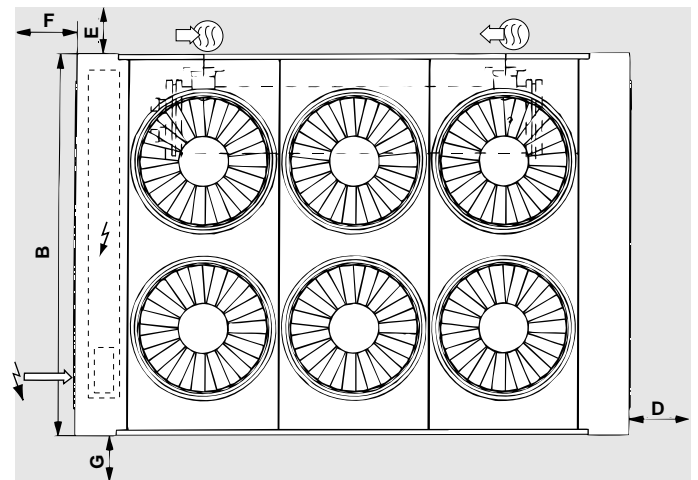
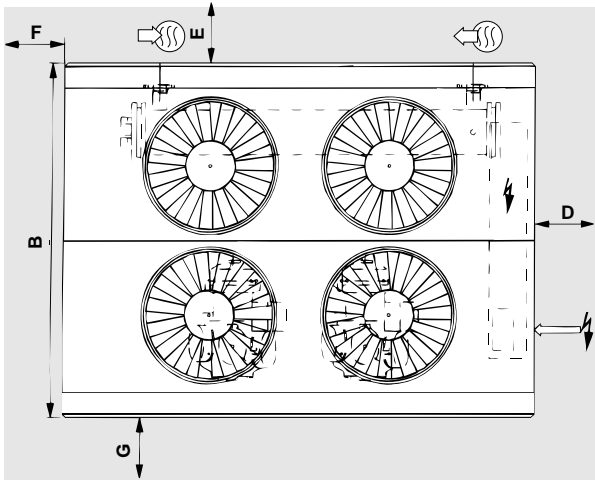
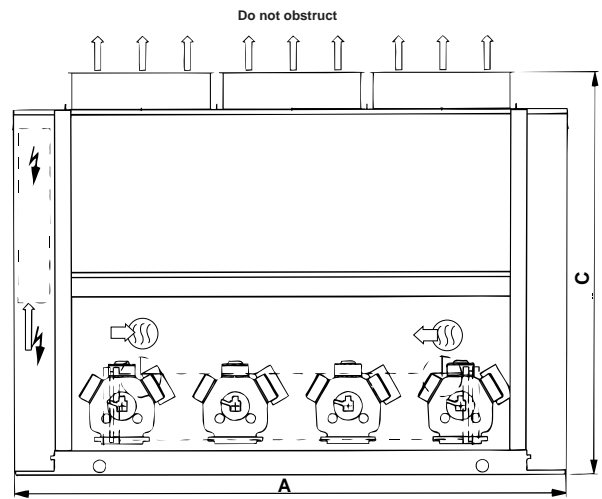
-  Space required for clearance
-  Power supply
-  Water inlet
-  Water outlet

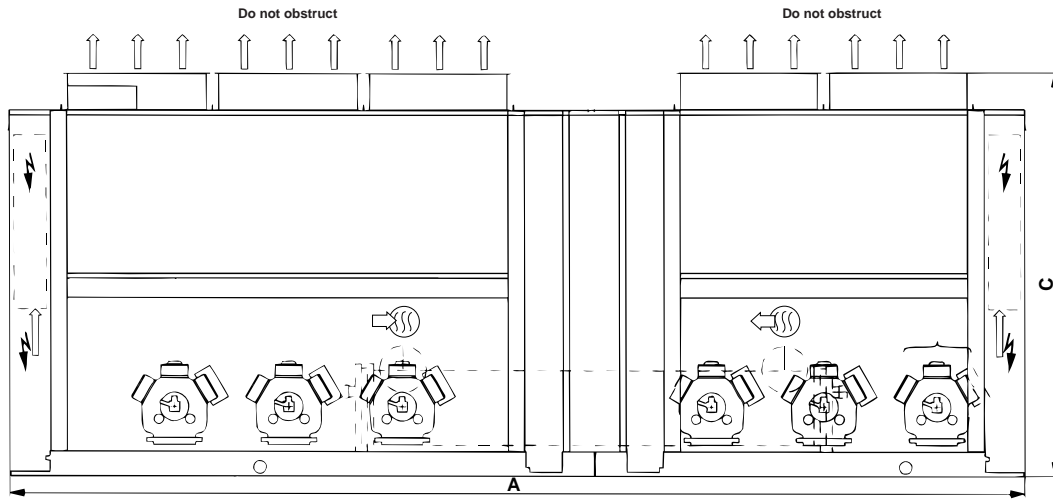
NOTE :
Dimensional drawings are available on request.

30GH/GZ 040-060

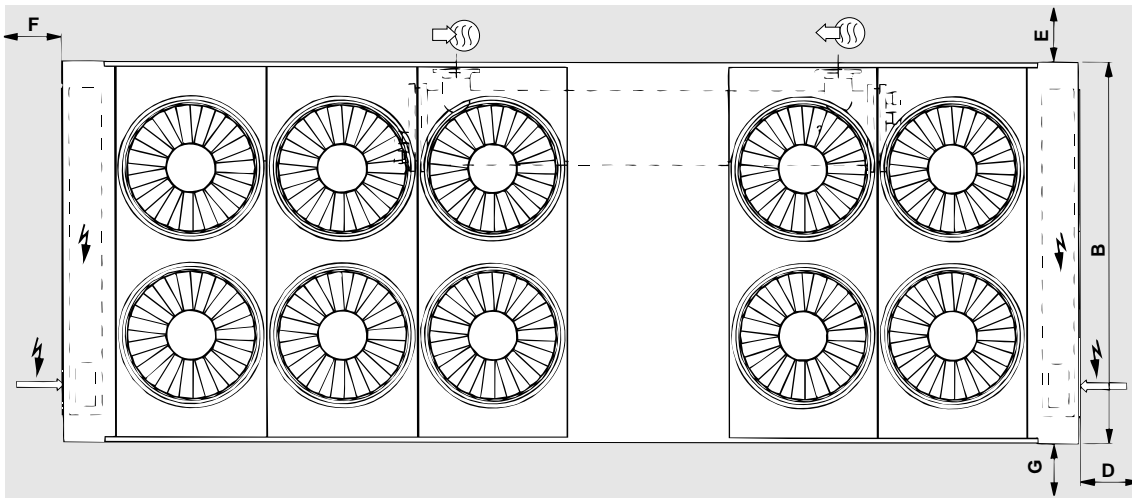


30GH/GZ 085-145





ATTENTION:
30GH/GZ 170- 245
have two power
connection points.



Floor mounting

- For unit mounting holes, weight distribution and centre of gravity coordinates, refer to the dimensional drawings.
- These units are designed for outdoor installation.

CAUTION:

- Ensure the air flow around the unit is not obstructed.
- At least two sides of the units must be free from obstructions, to ensure proper air flow.
- If several units are installed, next to each other, ensure that the space in between the units is the same as the unit depth.
- There must not be any roof or cover above the unit.

Physical data



30GH/GZ		040	045	050	060	085	095	100	120	130	145	150	160	170	190	220	245	
Net nominal cooling capacity*																		
30GH (R-22)	kW	107	124	156	190	255	300	344	396	442	457	498	516	562	631	729	808	
30GZ (R-407C)	kW	102	118	150	181	244	287	329	379	417	437	476	499	538	603	697	773	
Operating weight																		
	kg	1380	1445	1710	1780	3012	3067	3439	3884	4330	4452	5010	5172	5592	6442	6742	7992	
Refrigerant charge R-22																		
Circuit A	kg	15	15	17.2	19.5	33.2	34.2	29.4	37	48.4	46.5	53.1	59.8	59.8	60	60	67.4	
Circuit B	kg	15	15	17.2	19.5	19	23.7	29.4	37	32.3	35.1	38.9	47.4	49.3	57	60	67.4	
Refrigerant charge R-407C																		
Circuit A	kg	16.5	16.5	19	21.5	24	34	28	36	47	46	53	59	59	59	59	66	
Circuit B	kg	16.5	16.5	19	21.5	15	24	28	36	32	35	38.5	46	48	56	59	66	
Compressors																		
		Semihhermetic, 4 or 6 cylinders 24.2 r/s (1450 rpm)																
Circuit A		1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	4	
Circuit B		1	1	1	1	1	1	2	2	2	2	2	2	3	3	4	4	
Control type																		
		PRO-DIALOG control																
No. of capacity stages																		
		4	4	4	4	6	6	4	4	5	5	5	5	6	7	8	8	
Minimum capacity																		
	%	25	33	33	33	20	22	22	25	17	17	20	20	14	12	10	12.5	
Evaporator																		
		Direct-expansion, multi-tube shell, two circuits																
Net water volume	l	55	55	63	63	92	92	154	154	199	242	199	242	242	242	242	242	
Water connections																		
		Flat flanges PN 16, in accordance with NFE 29 203																
Inlet/outlet		DN80	DN80	DN80	DN80	DN100	DN100	DN125	DN125	DN150	DN150	DN150	DN150	DN150	DN150	DN150	DN150	
Drain (NPT)	in	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	
Max. water side operating pressure	kPa	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	
Condenser																		
		Copper tubes and aluminium fins																
Fans																		
		Shrouded axial FLYING-BIRD fan																
Quantity		2	2	4	4	6	6	6	8	8	8	10	10	10	12	12	16	
Total air flow	l/s	9944	9944	19890	19890	29830	29830	29830	39780	39780	39780	49720	49720	49720	59670	59670	79560	
Speed	r/s	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	

* Standard Eurovent conditions: Evaporator entering/leaving water temperature 12°C and 7°C. Condenser entering air temperature 35°C.
 Net cooling capacity = gross cooling capacity minus the water pump heat against the internal evaporator pressure drop.

Electrical data



30GH/GZ		040	045	050	060	085	095	100	120	130	145	150	160	170	190	220	245	
Power wiring																		
Nominal power supply		V-ph-Hz 400-3-50																
Voltage range		V 360-440																
Auxiliary circuit (heaters)																		
		V-ph-Hz 230-1-50																
Power input	W	570	570	570	570	980	980	1160	1160	1460	1460	1460	1460	1640	1820	2000	2000	
Max. unit power input (comp. + fans)**																		
30GH	kW	45	59	70	95	117	142	162	189	209	209	237	237	257	304	349	379	
30GZ	kW	41	55	64	87	110	134	152	174	192	202	228	225	241	282	328	358	
Max. unit power input with separate supply (possible on 30G 170-245)																		
30GH circuit A	kW	-	-	-	-	-	-	-	-	-	-	-	-	142	175	175	190	
30GH circuit B	kW	-	-	-	-	-	-	-	-	-	-	-	-	115	129	175	190	
30GZ circuit A	kW	-	-	-	-	-	-	-	-	-	-	-	-	141	165	164	179	
30GZ circuit B	kW	-	-	-	-	-	-	-	-	-	-	-	-	100	117	164	179	
Fan power supply																		
		V-ph-Hz 400-3-50																
Fan power input	kW	2.3	2.3	4.6	4.6	7	7	7	9	9	9	12	12	12	14	14	19	
Max. starting current (comp. + fans)																		
30GH/GZ standard unit	A	144	186	219	296	476	518	553	601	636	636	684	684	719	802	879	934	
30GH/GZ with part-winding start	A	std	std	std	std	338	380	415	463	498	546	546	546	581	664	741	796	
30GH/GZ with separate power supply circuit A**	A	-	-	-	-	-	-	-	-	-	-	-	-	517	574	574	601	
30GH/GZ with separate power supply circuit B**	A	-	-	-	-	-	-	-	-	-	-	-	-	469	497	574	601	
Max. unit current drawn (comp. + fans)*																		
30GH	A	78	102	120	166	204	250	280	333	364	364	416	416	447	530	608	666	
30GZ	A	72	97	113	153	194	236	268	306	338	356	401	396	424	496	577	630	
30GH with separate power supply circuit A**	A	-	-	-	-	-	-	-	-	-	-	-	-	250	304	304	333	
30GH with separate power supply circuit B**	A	-	-	-	-	-	-	-	-	-	-	-	-	197	229	304	333	
30GZ with separate power supply circuit A**	A	-	-	-	-	-	-	-	-	-	-	-	-	248	290	289	315	
30GZ with separate power supply circuit B**	A	-	-	-	-	-	-	-	-	-	-	-	-	176	206	289	315	

* Compressor and fan, at maximum unit operating values

** Unit sizes 30GZ 170-245 have a separate power supply per circuit. All currents are given at nominal voltage

Electrical data notes (cont.)

- 30GZ units have a single power connection point (except 30GZ 170-245 which have two connection points).
- A separate power source (230 V, 1 ph, 50 Hz) that does not exceed the main switch capacity is required to power the compressor crankcase heater circuit. This source must be supplied from a transformer. It must not be supplied from a phase + neutral supply (for ground + neutral systems).
- The control box includes the following standard features:
 - Starter and motor protection devices for each compressor and the fan(s)
 - Control devices
- Field connections:
 - All connections to the system and the electrical installations must be in full accordance with all applicable local codes.
- The Carrier 30GZ chillers are designed and built to ensure conformance with these codes. The recommendations of European standard EN 60 204-1 (machine safety - electrical machine components - part 1: general regulations) are specifically taken into account, when designing the electrical equipment.

NOTES:

- Generally the recommendations of IEC 364 are accepted as compliance with the requirements of the installation directives. Conformance with EN 60 204 is the best means of ensuring compliance with the Machines Directive § 1.5.1.

- Annex B of EN 60204-1 describes the electrical characteristics used for the operation of the machines.

- The operating environment for the 30GZ chillers is specified below:
- Environment* - Environment as classified in EN 60 721:
 - outdoor installation*
 - ambient temperature range: -18°C to +46°C, class 4K4H*
 - altitude: ≤ 2000 m
 - presence of hard solids, class 4S2 (no significant dust present)
 - presence of corrosive and polluting substances, class 4C2 (negligible)
 - vibration and shock, class 4M2
- Competence of personnel, class BA4* (trained personnel - IEC 364)
- Power supply frequency variation: ± 2 Hz.
- The neutral (N) line must not be connected directly to the unit (if necessary use a transformer).
- Overcurrent protection of the power supply conductors is not provided with the unit.
- The optional factory-installed circuit breaker is of type "a" (EN 60 204-1 § 5.3.2).

NOTE: If particular aspects of an actual installation do not conform to the conditions described above, or if there are other conditions which should be considered, always contact your local Carrier representative.

* The required protection level for this class is IP43BW (according to reference document IEC 529). All 30GZ units are protected to IP44CW and fulfill this protection condition.

APPLICATION DATA

Minimum cooler water flow rates

30GH/GZ	Min flow rate, l/s
040-045	3.6
050-060	4.0
085-095	6.0
100-120	8.5
130	9.8
145	12.1
150	9.8
160-245	12.1

Maximum chilled water flow rate

The maximum chilled water flow is limited by the maximum permitted pressure drop in the evaporator. It must have a minimum temperature difference at the evaporator of 2.8 K, corresponding to a flow rate of 0,9 l/s per kW.

Water loop volume

Whatever the size of the system, the water loop minimum volume is given by the following formula:

$$\text{Volume} = \text{CAP (kW)} \times \text{N}^* = \text{litres}$$

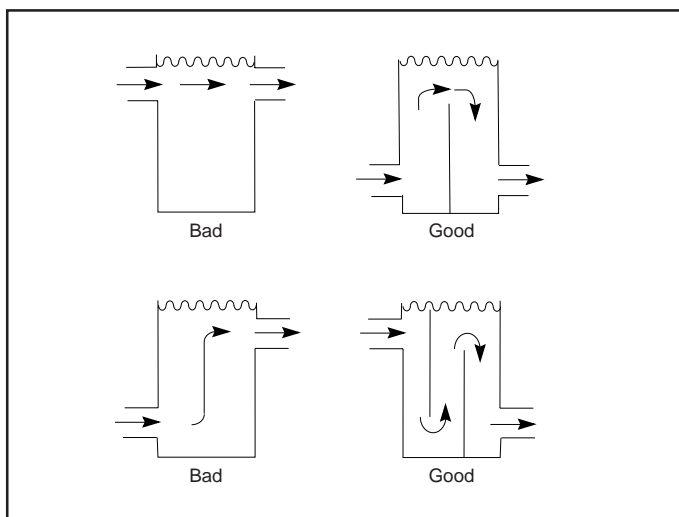
where CAP is the nominal system capacity (kW) at the nominal operating conditions of the installation.

Application	N
Air conditioning	3.25
Industrial process cooling	6.5
Low temperature operation	6.5

This volume is necessary for stable operation and accurate temperature control.

It is often necessary to add a buffer water reservoir to the circuit in order to achieve the required volume. The reservoir must itself be internally baffled in order to ensure proper mixing of the liquid (water or brine). Refer to the examples below.

NOTE: The compressor must not restart more than 6 times in an hour.



INSTALLATION

SAFETY CONSIDERATIONS

Installation, start-up and servicing this equipment can be hazardous due to system pressures, electrical components and equipment location (roofs, elevated structures, etc.).

Only trained, qualified installers and service mechanics should install, start-up and service this equipment.

Untrained personnel can perform basic functions, such as cleaning coils. All other operations should be performed by trained service personnel.

When working on the equipment, observe precautions in the literature, and on tags, stickers, and labels attached to the equipment.

- Follow all safety codes.
- Wear safety glasses and work gloves.
- Use care in handling, rigging and setting down bulky equipment.

WARNING: Before doing any work ensure that the power supply (400 V and 230 V) is disconnected, and switches and isolators are opened and tagged.

During operation some parts of the unit reach or exceed temperatures of 70°C (e.g. compressor discharge side, discharge line). Only trained and qualified engineers, aware of these hot surfaces, are allowed to perform maintenance operations.

Preliminary checks

Check equipment received

- Inspect the unit for damage or missing parts. If damage is detected, or if shipment is incomplete, immediately file a claim with the shipping company.
- Confirm that the unit received is the one ordered. Compare the nameplate data with the order.
- Confirm that all accessories ordered for on-site installation have been delivered, and are complete and undamaged.

Moving and siting the unit

Moving

Do not remove skids, pallets or protective packaging until the unit is in its final position. Move the chiller using tubes or rollers, or lift it, using slings of the correct capacity.

CAUTION: Only use slings at the designated lifting points which are marked on the unit.

Siting

Before siting the unit check that :

- the permitted loading at the site is adequate or that appropriate strengthening measures have been taken.
- the surface is horizontal, flat and intact.
- there is adequate space around the unit to make power and water connections for service and air flow.
- there are adequate support points and that they are in the right places.
- the location is not subject to flooding.
- where heavy snowfall is likely and long periods of sub-zero temperatures are normal, provision has been made to prevent snow accumulating by raising the unit above the height of drifts normally experienced. Baffles may be necessary to deflect strong winds and to prevent snow from blowing directly into the unit. They must not restrict air flow into the unit.

CAUTION: Before lifting the unit, check that all casing panels are securely fixed in place. Lift and set down the unit with great care. Tilting and jarring can damage the unit and impair unit operation.

The 30GH/GZ units can be hoisted with rigging. Coils should always be protected against crushing while a unit is being moved. Use struts or spreader bars to spread the slings above the unit. Do not tilt a unit more than 15°.

WARNING: Never push or lever on any of the enclosure panels of the unit. Only the base of the unit frame is designed to withstand such stresses.

Check compressor mountings

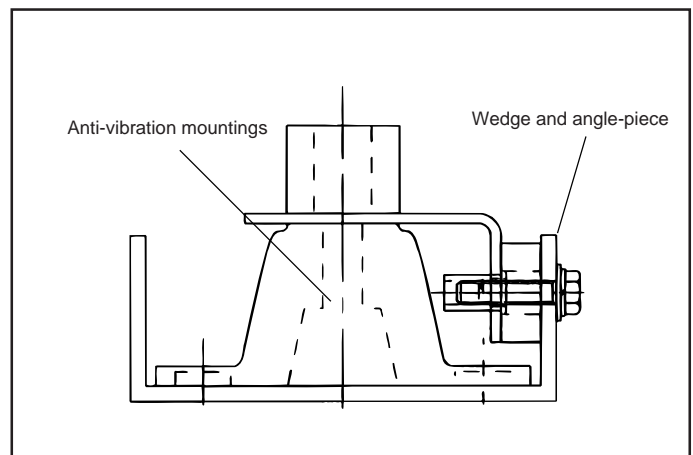
Before the first start-up of the unit proceed as follows:

All compressors are mounted on anti-vibration mountings. For the 30GH/GZ 040-060 units, please do not loosen the bolts or fixing screws.

For 30GH/GZ 085-245 units

The compressors are mounted on anti-vibration mountings. For shipping purposes these are packed solid with wedges, angle pieces and retaining bolts. These must be removed, when the installation is completed to allow the vibration absorbing mountings to do their job (see figure below).

Cross section of anti-vibration mounting (30GH/GZ 085-100)



Water connections

Refer to the certified dimensional drawings for the sizes and positions of all water inlet and outlet connections. The water pipes must not transmit any radial or axial force to the heat exchangers or any vibration to the pipework or building.

The water supply must be analysed and appropriate filtering, treatment, control devices, isolation and bleed valves and circuits built in, as necessary. Consult either a water treatment specialist or appropriate literature on the subject.

Operating precautions

The water circuit should be designed to have the least number of elbows and horizontal pipe runs at different levels. Below the basic checks to be done (see also the illustration of a typical hydraulic circuit below).

- Note the water inlets and outlets of the heat exchangers.
- Install manual or automatic air purge valves at all high points in the water circuit.
- Use an expansion chamber or an expansion/relief valve to maintain pressure in the system.
- Install water thermometers in both the entering and leaving water connections close to the evaporator.
- Install drain valves at all low points to allow the whole circuit to be drained.
- Install stop valves, close to the evaporator, in the entering and leaving water lines.
- Use flexible connections to reduce the transmission of vibration to the pipework.
- Insulate all pipework, after testing for leaks, both to reduce thermal leaks and to prevent condensation.
- Cover the insulation with a vapour barrier.

Water-loop connections

Make the water-side heat exchanger connections, using appropriate hardware capable of ensuring water-tightness of threaded unions.

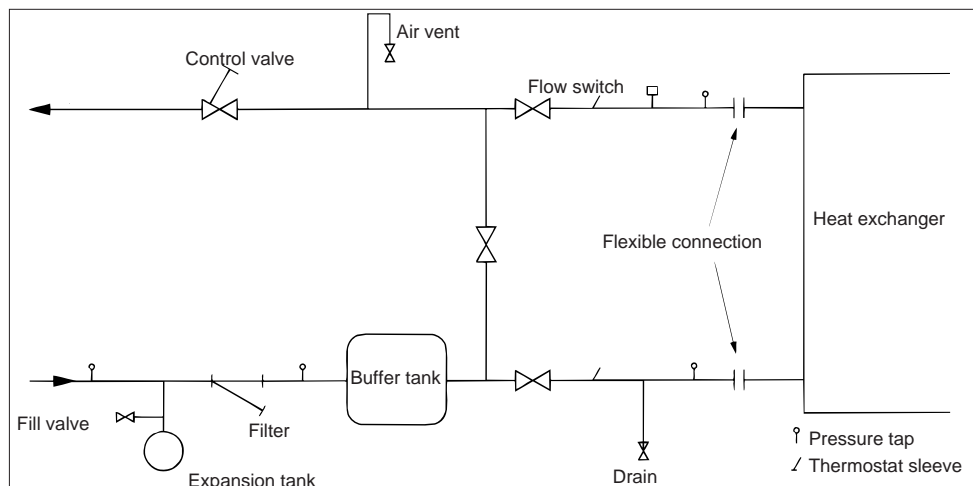
The illustration below shows a typical hydraulic circuit.

IMPORTANT: In winter frost can cause cooler damage. Use appropriate methods of protection, according to the climatic conditions:

- Add ethylene glycol.
- Increase the insulation thickness.
- Do not de-energize the cooler heaters.
- For a prolonged shutdown period, drain the water from the cooler and replace it with ethylene glycol. At the beginning of the next cooling season, refill the cooler and add the recommended inhibitor.

Auxiliary equipment should be installed according to basic refrigeration and piping practices, especially with respect to minimum and maximum cooler water flow rates, which must be between the values given in the tables in the 'Application data' section.

Typical hydraulic circuit diagram



Power supply

The power supply must conform to the specification on the chiller nameplate. The supply voltage must be within the range specified in the electrical data table.

ATTENTION: Units 30GH/GZ 040-160 have only one power connection point.

Units 30GH/GZ 170-245 have two power connection points.

For connections refer to the wiring diagrams.

WARNING: Operation of the chiller with an improper supply voltage or with excessive phase imbalance constitutes abuse which will invalidate the Carrier warranty. If the phase imbalance exceeds 2% for voltage, contact your local electricity supply company at once and ensure that the chiller is not switched on until corrective measures have been taken.

Voltage phase imbalance (%) :

$$= \frac{100 \times \text{max.deviation from average voltage deviation}}{\text{Average voltage}}$$

Electrical checks

WARNING: Never switch off the power supply to the crankcase heaters unless the chiller is out of service for a seasonal shutdown or lengthy repair. The heaters must be re-energised for at least 24 hours before the chiller is restarted.

- Switch the unit off.
- Open the control circuit disconnect switch.
- Check the transformer connections.
- Ensure that the control circuit corresponds to the wiring diagram for the unit.
- Check that all electrical connections are secure at the terminals, contactors, bus bars and compressor terminal blocks.

Start-up

Preliminary checks

Never be tempted to start the chiller without reading fully, and understanding, the operating instructions and without having carried out the following pre-start checks:

Confirm that all crankcase heaters are firmly in place, and check the secure positioning of all control sensors.

Confirm that all crankcase heaters are working by feeling all compressor crankcases. Every compressor has a 180 W cartridge heater (see the wiring diagram). The heater remains energised even when the chiller is shut down to stop the lubricating oil from absorbing refrigerant.

Check the operation of all accessories - chilled water circulating pumps, air handlers and other equipment connected to the evaporator. Follow the individual manufacturer's instructions for this equipment.

It is recommended to connect the auxiliary contact of the water pump contactor to ensure maximum unit safety (see wiring diagram delivered with the unit).

Fill the chilled water circuit with clean water, and an inhibitor formulated specifically for this purpose, or fill it with another non-corrosive fluid to be chilled.

Purge air at all high points in the system. If water temperatures below 5°C for R-407C and 4°C for R-22 are likely, add the appropriate volume of ethylene glycol to prevent freezing.

Confirm that the suction and discharge line stop valves are fully opened.

Open the refrigerant line valves. Check again that the water circuit valves are open.

Check that oil is visible in each compressor sight glass to between 1/8 and 3/8 of the total glass depth (check for all compressors).

Confirm that there are no refrigerant leaks.

Confirm that discharge muffler securing bands and discharge line connections are tight.

Check that all electrical connections are secure.

Actual start-up

IMPORTANT:

- Commissioning and start-up of the chiller must be supervised by a qualified refrigeration engineer.*
 - Start-up and operating tests must be carried out with a thermal load applied and water circulating in the evaporator.*
 - All set point adjustments and control tests must be carried out before the unit is started up.*
 - Please refer to the controls manual for the unit.*
- Ensure that the crankcase heaters have been energized for 24 hours before starting up the unit for the first time.
 - Start up the unit.
 - Check that all safety devices are satisfied, particularly the high pressure switches.

For this purpose:

- Stop the condenser fans.
- Operate the machine until the high pressure switch trips and verify that the pressure does not exceed the cut-out value of 2900 kPa.
- Using the control point as a reference, verify the correct operation of the unit.

SERVICING REFRIGERATION COMPONENTS

Any technician attending the machine for any purpose must be a fully qualified refrigeration engineer.

WARNING: Before doing any work on the machine ensure that the power is switched and locked off and that all isolators are tagged. If a refrigerant circuit is opened, it must be evacuated, and recharged, after ensuring that the refrigerant is clean and free from impurities, the filter-drier has been changed and the unit has been tested for leaks. Before any operation on a refrigerant circuit, it is necessary to remove the complete charge of refrigerant from the unit with a refrigerant charge recovery group.

General maintenance

Keep the unit itself and the space around it clean and free of obstructions. Remove all rubbish such as packing materials, as soon as the installation is completed.

Regularly clean the exposed pipework to remove all dust and dirt. This makes detection of water leaks easier, and they can be repaired before more serious faults develop.

Confirm that all screwed and bolted connections and joints are secure. Secure connections prevent leaks and vibration from developing.

Check that all insulation joints are securely closed and that all insulation is firmly in place. Check all heat exchangers and all pipework.

Confirm regularly that any phase imbalance in the three-phase power supply is within acceptable limits.

Lubricate the hinges, locks and latches on the electrical control box doors sparingly.

Liquid refrigerant charging

Checking the charge

WARNING: When adjusting the refrigerant charge always ensure that water is circulating in the evaporator in order to prevent any possibility of freezing up. Damage caused by freezing is not covered by the product warranty.

30GH/GZ units are shipped with a full normal charge of refrigerant. Refer to the Physical Data table. Ensure that there are bubbles visible in the sight glass are not due to an excessive pressure drop in the liquid line piping. If it is necessary to add more refrigerant, run the unit at full capacity for some time and then add refrigerant until there are no bubbles in the sight glass. This will generally mean adding more refrigerant than would be needed to prevent bubbles from being seen in the sight glass. Ensure that the humidity is maintained at the correct level.

WARNING: To ensure proper operation of 30GH/GZ units there must be at least 7 K (30GH) or 12 K (30GZ) of subcooling as the liquid refrigerant enters the expansion valve.

The units 30GH/GZ 040-245 use refrigerant. For your information, we are reproducing here some extracts from the official publication dealing with the design, installation, operation and maintenance of air conditioning and refrigeration systems and the training of people involved in these activities, agreed by the air conditioning and refrigeration industry.

Refrigerant guidelines

Refrigeration installations must be inspected and maintained regularly and rigorously by specialists. Their activities must be overseen and checked by properly trained people.

To minimise discharge to the atmosphere, refrigerants and lubricating oil must be transferred using methods which reduce leaks and losses to a minimum.

- Leaks must be repaired immediately
- A valve on the condenser liquid refrigerant outlet line enables the refrigerant charge to be transferred to the receiver provided specifically for this purpose.
- If the residual pressure is too low to make the transfer alone, a purpose-built refrigerant recovery unit must be used.
- Compressor lubricating oil contains refrigerant. Any oil drained from a system during maintenance must therefore be handled and stored accordingly.
- Refrigerant under pressure must never be discharged to the atmosphere.

Recharging liquid refrigerant

CAUTION: 30GZ 040-245 units are charged with liquid HFC-407C refrigerant.

This non-azeotropic refrigerant blend consists of 23% R-32, 25% of R-125 and 52% R-134a, and is characterised by the fact that at the time of the change in state the temperature of the liquid/vapour mixture is not constant, as with azeotropic refrigerants. All checks must be pressure tests, and the appropriate pressure/temperature ratio table must be used for the interpretation of the values.

Leak detection is especially important for units charged with refrigerant R-407C. Depending on whether the leak occurs in the liquid or in the vapour phase, the proportion of the different components in the remaining liquid is not the same.

NOTE: Regularly carry out leak checks and immediately repair any leak found.

Undercharge

If there is not enough refrigerant in the system, this is indicated by gas bubbles in the moisture sight glass. There are two possibilities:

- Small undercharge (bubbles in the sight glass, no significant change in suction pressure).
 - After detection and repair the unit can be recharged.
 - The replenishment of the charge must always be done in the liquid phase at the liquid line. The refrigerant cylinder must contain a minimum of 10% of its initial charge.

- Significant undercharge (large bubbles in the sight glass, drop in suction pressure).
 - **Small units** (charge below 20 kg per circuit).
After detection and repair completely drain the refrigerant charge, using a refrigerant recovery unit, then recharge completely, following the precautions given above.
 - **Large units** (charge above 20 kg per circuit).
After detection and repair completely recharge the unit as described above, operate it for a few minutes and then **let a specialist carry out a chromatographic analysis to verify the composition of the blend** (range: R-32: 22-24%, R-125: 23-27%, R-134a: 50-54%).

Compressors

Checking the oil charge

Check the oil level and add or remove oil as necessary so that the level is 1/8 to 3/8 up each sight glass with the compressor running normally.

WARNING: Use only oils which have been approved for use in refrigeration compressors. Never use oil which has been exposed to air.

CAUTION: R-22 oils are NOT compatible with R-407C.

Recommended oil:

R-22 compressors:

- Mineral oil, Carrier specification No. PP 33-2
- Suniso 3 GS (Sun Oil Co)
- Capella WF 32-150
- Clavus G 32 (Shell Oil Co)
- Gargoyle Artic (Mobil Oil) - original charge

R-407C compressors:

- Oil, Carrier specification No. PP 47-26
- Mobiloil EAL 68 - Carrier reference 470EE as original charge, in 5 liter containers

WARNING: All fixing devices and fittings which may have been removed during servicing must always be replaced upon completion of the work and before restarting the unit.

Tightening torques to be applied

Description	Diameter, mm	Torque, Nm
Discharge valve	M16	135-140
Cylinder head	M12	75-87
Suction and liquid line flange	M12	75-87
Suction valve	M16	135-140

Compressor motor protection

Circuit breaker

Calibrated, thermo-magnetic, manually reset circuit breaker to protect the motor against locked rotors and excessive current draw. It also protects against overcurrents up to the trip capacity indicated on the wiring diagram.

WARNING: Never bypass a circuit breaker or increase its setting. If a circuit breaker trips, find out why it has done so and correct the problem before resetting the breaker.

Discharge gas thermostat DGT

(only for units with low temperature option)

A sensor in each compressor discharge line opens to shut down the compressor if the discharge gas temperature exceeds the preset level.

Cut out 146°C Cut in 113°C

Crankcase heater

Each compressor is fitted with an electric resistance crankcase heater which prevents any absorption of refrigerant by the compressor lubricating oil when the compressor is shut down. Each heater is held in place by a screw clip which must be secure. Prolonged exposure of the heater to air will result in its destruction. The heater is energized when the compressor is switched off. Regularly check that the heater operates correctly when the unit is shut down.

WARNING: Never open or disconnect any switch or circuit breaker which will cut the supply to the heaters, unless the unit is to be shut down for lengthy service or repair or for a seasonal shut down. In all cases the heater must be energised for at least 24 hours before a compressor is restarted.

Compressor protection circuit board (STARTERGUARD)

The purpose of this card is to monitor the compressor operating environment, in particular:

- the crankcase heaters
- the contactors
- the part winding start timer
- the control wiring between these components

The status of the controlled components is displayed via three different-coloured LEDs:

- Green LED: correct operation
- Orange LED: signals that the magnetic loop of the card has detected the presence of a current, either in the compressor crankcase heater or in the compressor motor.

If the green and orange LEDs are illuminated together, this indicates that there is no fault.

- Red LED - fault related to:
 - the heater, if the orange LED is not lit
 - the contactor or the power line of the compressor motor, if the orange LED is lit

If a fault is detected, the compressor is shut down.

Power supply and resetting:

The STARTERGUARD card uses 24 V AC \pm 10%, 50 Hz or 60 Hz. When a fault occurs, the 24 V supply must be interrupted and then restored, in order to reset the card. The green LED lights up.

Heat exchangers

Evaporator

Protection devices

Freeze-up prevention thermostat

The evaporator is protected against freeze-up. The protection is provided by two sensors installed in the unit.

Evaporator maintenance

Check that:

- the insulating foam is intact and securely in place.
- the cooler heaters are operating, secure and correctly positioned.
- the water-side connections are clean and show no sign of leakage.

Multitube evaporators

The evaporator can be removed using the following procedure:

- Close the chilled water supply and return valves (if installed), and disconnect the chilled water supply and return pipe connections.
- Drain the water from the cooler.
- Remove all temperature sensors from the cooler.
- Fold back the insulation at the refrigerant line connections.

When the evaporator heads and manifolds are removed, the outer tube end plates will be visible.

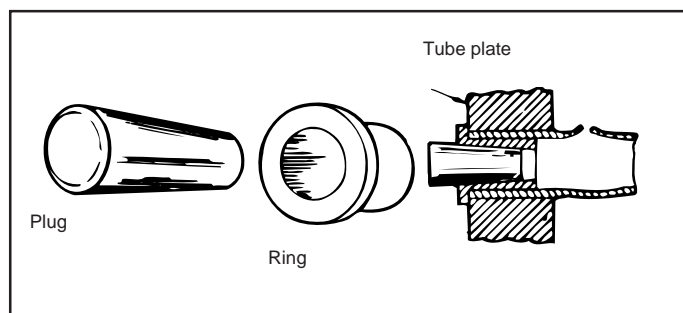
Four evaporator tubes on 30GH/GZ 040-060 units and six tubes on 30GH/GZ 085-245 units are swaged into the end plate and cannot be removed. A dot punch mark in the end plate opposite each one identifies each of them. If any of them develop a leak, the tube must be plugged, as described below.

Plugging evaporator tubes

A leaking tube can be plugged pending replacement. The number of tubes plugged will determine when they should be replaced. Check with Carrier the effect upon chiller performance of plugging a number of tubes. Carrier will need to know the number of tubes to be plugged and their positions. The figure below shows the Elliott method of plugging tubes.

WARNING: Take care when inserting plugs not to damage the plate material between the tubes. Avoid excessive force. Clean all components with Locquic N and then coat all surfaces with several drops of Loctite 75 to ensure a good seal without applying excessive force.

Elliott tube plug



Components	Part number
Tube brass plug	---T-853--103500S-*
Tube brass ring	---T-853--002570S-*
Brass plug (holes without tubes)	---T-853--1031—S-*
Brass ring (holes without tubes)	---T-853--002631S-*
Loctite	No. 75*
Locquic	"N"*

* Order directly from your Carrier distributor

Replacing cooler tubes

Retubing must be done only by a properly trained service engineer. Most standard practices can be applied, but for cooler tubes a 5% crush allowance is made for tube expansion and twisting (15.87 mm diameter tubes are used in these coolers).

The table below gives the specification of the materials used.

Example:

Tube sheet hole diameter	16.00 mm
Tube outside diameter	15.87 mm
Clearance	0.13 mm
Tube inside diameter before rolling	14.27 mm
Tube inside diameter after rolling	14.48 mm

NOTE: Tubes next to the gasket webs must be flush with the tube sheets at either end of the cooler.

Preparation of gaskets

When rebuilding the cooler, new gaskets must always be used. They must conform to the Carrier specification for compressed gaskets.

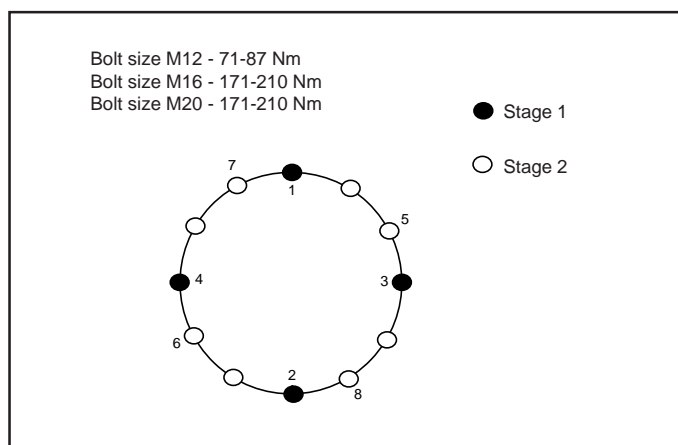
- Clean the gasket and its place on the tube sheet.
- Cover the two matching surfaces (gasket and tube sheet) with adhesive, and stick them together.
- Let the joint dry for 5 minutes.
- Moisten the joint with a small amount of compressor oil.
- Reinstall the evaporator head within 30 minutes.

Tightening cooler head bolts

Cooler head bolts must be tightened in the specified sequence and to the correct torque.

Use this tightening sequence:

- Hand tighten the first four bolts as shown below in stage 1.
- Hand tighten the next bolts as shown below in stage 2.
- Starting at the 12 o'clock position, and working clockwise, insert and hand tighten the remaining outer bolts.
- Insert and tighten the six screws in the center of the head.



- Starting again at 12 o'clock and working clockwise tighten the outer bolts to the correct torque.
- Not less than one hour later insert and tighten the six bolts in the centre of the head, using the torque values given.
- After the cooler has been refilled with clean refrigerant, use a soap and water solution or an electronic detector to confirm that there are no leaks.
- Replace the evaporator insulation and temperature sensors.

Condenser coil

We recommend, that finned coils are inspected regularly to check the degree of fouling. This depends on the environment where the unit is installed, and will be worse in urban and industrial installations and near trees that shed their leaves.

For coil cleaning proceed as follows:

- Remove fibres and dust collected on the condenser face with a soft brush (or vacuum cleaner).
- Clean the coil with the appropriate cleaning agents.

We recommend TOTALINE products for coil cleaning:

Part No. P902 DT 05EE: traditional cleaning method

Part No. P902 CL 05EE: cleaning and degreasing.

These products have a neutral pH value, do not contain phosphates, are not harmful to the human body, and can be disposed of through the public drainage system.

Depending on the degree of fouling both products can be used diluted or undiluted.

For normal maintenance routines we recommend using 1 kg of the concentrated product, diluted to 10%, to treat a coil surface of 2 m². This process can either be carried out with a TOTALINE applicator gun (part No. TE01 WA 4000EE) or using a high-pressure spray gun in the low-pressure position. With pressurised cleaning methods care should be taken not to damage the coil fins. The spraying of the coil must be done:

- in the direction of the fins
- in the opposite direction of the air flow direction
- with a large diffuser (25-30°)
- at a distance of 300 mm.

The two cleaning products can be used for any of the following coil finishes: Cu/Cu, Cu/Al, Cu/Al with Polual, Blygold and/or Heresite protection.

It is not necessary to rinse the coil, as the products used are pH neutral. To ensure that the coil is perfectly clean, we recommend rinsing with a low water flow rate. The pH value of the water used should be between 7 and 8.

WARNING: Never use pressurized water without a large diffuser. Concentrated and/or rotating water jets are strictly forbidden.

Correct and frequent cleaning (approximately every three months) will prevent 2/3 of the corrosion problems.

Fan motor replacement

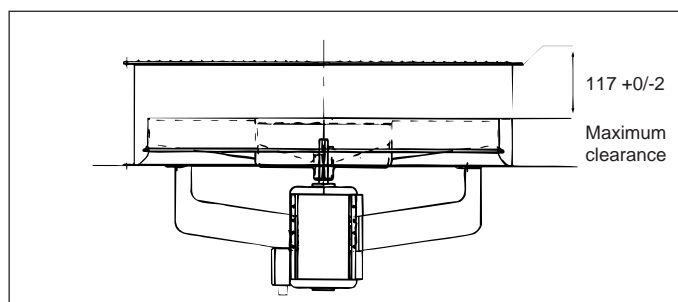
This presents no special problems. The work is done from above the unit.

- Remove the grille with its support air duct assembly.
- Remove the fan shaft protection cap.
- Pull the fan from the shaft using a FACOM U35, or similar, hub puller.
- Unscrew the fan motor fixing bolts.
Remove only the lower bolts to prevent the motor from falling.
- Withdraw the fan motor.

Installation is in the reverse order. Take care not to damage the plastic components when installing the fan and position the fan to maintain a clearance of $117 + 0/-2$ mm between the upper edge of the fan and the upper edge of the volute.

CAUTION: On unit sizes 30GH/GZ 040-245 the fan rotation is counter clockwise, viewed from above.

30GH/GZ 040-245 fan



Fan motor protection

All units are equipped with a fan protection circuit breaker.

Refrigerant circuit

Thermal expansion valve (TXV)

The function of the thermal expansion valve is to control the flow of liquid refrigerant. The valve is controlled by a sensor bulb in the compressor suction line. It is factory set to maintain refrigerant superheat of 4 K.

This setting should not be changed unless absolutely necessary.

Filter-drier

The filter-drier keeps the circuit clean and free of moisture. The sight glass indicates when it is necessary to change the cartridge in the filter-drier. A temperature difference between the inlet and the outlet of the filter-drier indicates fouling of the drier.

NOTE: The unit must run for at least 12 hours before it can give an accurate indication, because only with the unit running is the indicator in continuous contact with the refrigerant.

Liquid line service valve

This valve provides, in each circuit, a liquid refrigerant charging port and, in conjunction with the compressor discharge line valves, enables liquid refrigerant to be pumped to the high pressure side of the system.

TROUBLESHOOTING CHART

Below we list a series of possible faults, along with the probable causes and suggested solutions. In the event of a unit malfunction, it is advisable to disconnect the power supply and ascertain the cause.

SYMPTOMS	CAUSE	REMEDY
Unit does not start	Lack of power supply	Connect power supply
	Main switch open	Close switch
	Low line voltage	Check voltage and remedy the deficiency
	A protection device has tripped	Reset
	Contactors stuck open	Replace contactor
	Seized compressor or short circuit	Check windings (grounded or short circuit), replace compressor
	Loose electrical connections	Check connections
Unit operates continually or starts and stops frequently	Defective compressor contactor	Replace contactor
	Defective compressor	Check valves, replace compressor
	Refrigerant losses	Check and add the necessary charge
Compressor continually cuts out at low pressure or via the DGT	Refrigerant losses	Add the necessary refrigerant charge
	Low water flow in the evaporator	Check water pump
	Blocked expansion valve	Clean or replace
	Blocked filter drier	Replace filter
Compressor continually cuts out at high pressure	Defective high pressure switch	Replace pressure switch
	Defective fan(s)	Check the fan(s) and the contactor(s)
	Low water flow in the condenser	Clean the condenser
Noises in the system	Piping vibrations	Support piping, check supports and tightness
	Noisy compressor	Check valve plate, change if necessary
	Badly fitting panels	Install correctly
Compressor loses oil	Leak in the system	Repair leak
Water losses	Defective inlet or outlet connections	Check and tighten if necessary



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