

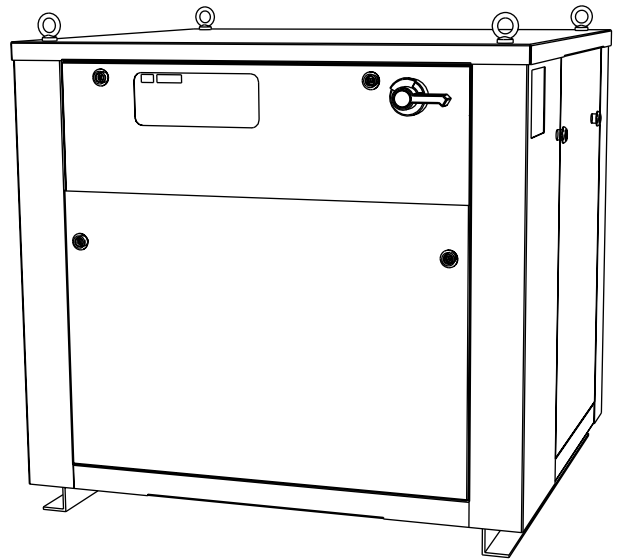
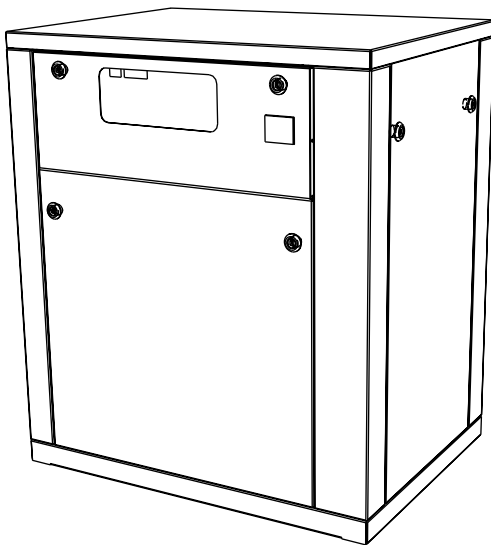
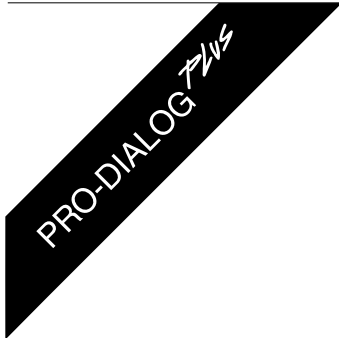


30SZ/SZV

Water-Cooled/Condenserless Liquid Chillers

Nominal cooling capacity 14-112 kW

50 Hz



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

For the operation of the control please refer to the Pro-Dialog *PLUS* Control manual for the 30SZ/SZV series



Installation, operation and maintenance instructions



Quality Management System Approval

The cover graphics are for illustrative purposes only, and are not contractually binding.

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START-UP CHECK LIST

Start up date:

Equipment sold by:

Contract No:

Installed by:

Contract No:

Site address:

Equipment type and serial No: 30SZ

30SZV

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 Control circuit fuse: A

Main circuit breaker rating:

PHYSICAL DATA:

Condenser:

Evaporator:

Entering water temp.: °C

Entering water temp.:°C

Leaving water temp.: °C

Leaving water temp.: °C

Pressure drop (water): kPa

Pressure drop (water): kPa

SAFETY DEVICE SETTING:

High pressure switch: cut-out: kPa

cut-in: kPa

Low pressure switch: cut-out: kPa

cut-in: kPa

Step controller: cut-out 1st step: °C

cut-in 1st step: °C

cut-out 2nd step: °C

cut-in 2 nd step: °C

Oil level:

Oil visible in sight glass?

ACCESSORIES

Commissioning engineer (name):

Customer agreement

Name:

Date:

Remarks:

Note: Complete this start-up list at the time of installation

1 - SAFETY CONSIDERATIONS

1.1 - General

Installation and servicing of air conditioning equipment can be hazardous due to system pressure and electrical components. Only trained and qualified service personnel should install, start-up or service air conditioning equipment.

Only authorised, trained and qualified technicians should be allowed to carry out work on the electrical or refrigerant components.

Untrained personnel can perform the basic maintenance functions such as cleaning the outside of the unit (without pressing on the control). All other functions, such as cleaning of the outside of the remote control, cleaning of the unit interior, checking the cut-out devices of the installation etc. must be done by qualified service personnel.

When working on air conditioning equipment, observe precautions in the literature, tags and labels attached to the unit and other safety precautions that may apply.

Follow all safety codes. Wear safety glasses and work gloves. Use a quenching cloth for unbrazing operations.

WARNING: Before performing service or maintenance operations on the unit, turn off the main power switch to the unit. Electrical shock could cause personal injury.

Only for use when repairing "Original Spare Parts". For repairs, special attention must be paid to the correct installation of the spare parts. The parts must always be installed in their original position.

During unit operation, some of the refrigerant circuit elements could reach a temperature in excess of 70°C so only trained or qualified personnel should access areas protected by access panels.

This unit should not be installed in an explosive atmosphere.

The unit can operate in normal radioelectric atmospheres in residential, commercial and light industrial installations. For other applications, please consult Carrier.

ATTENTION: Even if the compressor motors have been switched off, the power circuit remains energized, unless the unit or circuit disconnect switch is open. Refer to the wiring diagram for further details.

Attach appropriate safety labels.

1.2 - Equipment and components under pressure

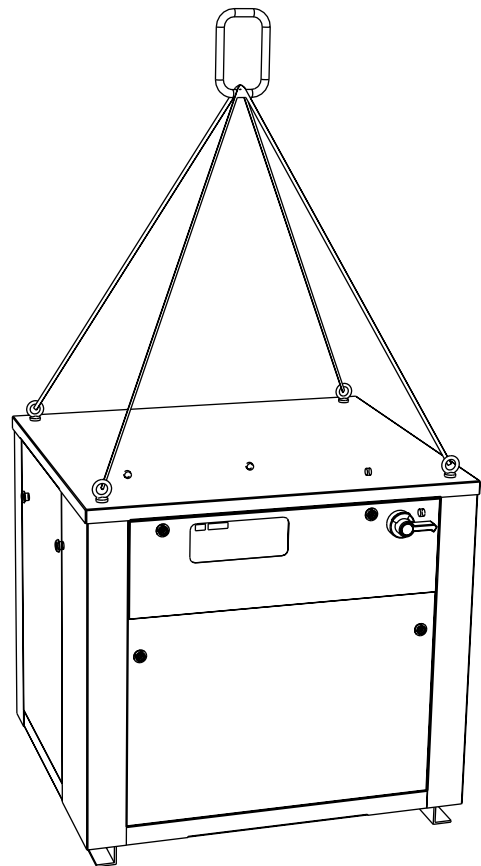
These products incorporate equipment or components under pressure, manufactured by Carrier or other manufacturers. We recommend that you consult your appropriate national trade association or the owner of the equipment or components under pressure (declaration, re-qualification, retesting, etc.). The characteristics of this equipment/these components are given on the nameplate or in the required documentation, supplied with the products.

1.3 - Transport

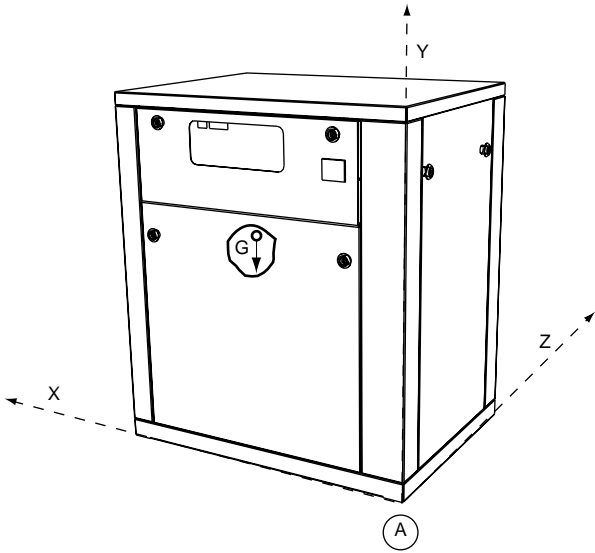
1. To prevent damage whilst in transit, do not remove the unit from the skid, until it is at its final location.
2. Ensure that the chains or ropes do not rub against the unit.
3. Avoid swinging the unit in a way that might cause it to fall.
4. Never roll or swing the unit more than 15°.

IMPORTANT: Ensure that all unit panels are fixed in place before moving the unit. Raise and set down the unit carefully. Do not stack more than three units during transport.

Rigging (30SZ/SZV 018-036)



Centre of gravity (approx.)

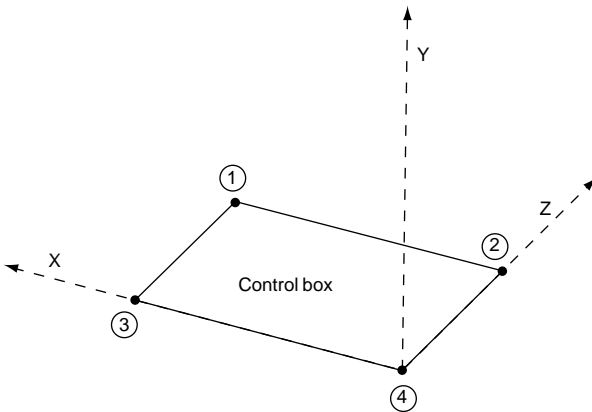


30SZ	004	005	006	007	009	011	018	024	027	036
XG* mm	340	340	340	340	340	340	483	493	493	490
YG* mm	280	280	275	285	280	278	342	333	333	324
ZG* mm	359	364	369	373	377	380	442	467	467	473

30SZV	004	005	006	007	009	011	018	024	027	036
XG* mm	335	335	335	335	335	335	478	488	488	485
YG* mm	287	287	282	292	287	285	349	340	340	331
ZG* mm	349	354	359	363	367	370	432	457	457	463

* Measured from point A
All dimensions are in mm

Weight distribution (approx.)



30SZ	004	005	006	007	009	011	018	024	027	036
1	30	32	34	42	48	52	94	116	120	130
2	36	37	40	50	56	61	98	119	122	132
3	18	18	19	24	30	32	112	122	124	133
4	21	23	23	28	34	37	120	123	126	135

30SZV	004	005	006	007	009	011	018	024	027	036
1	24	25	26	33	39	43	76	94	94	96
2	33	34	36	47	52	56	92	112	115	124
3	17	17	18	22	26	28	106	115	117	125
4	20	22	22	27	33	35	116	120	122	130

The weights are given in kg

2 - INSTALLATION

1. Inspect shipment. Inspect the unit. If it is damaged, or if the shipment is incomplete, immediately file a claim with the shipping company.
2. Check that the local power supply agrees with the specification on the unit nameplate.

2.1 - Siting the unit (all sizes)

Check that:

- The location is able to support unit operating weight (see Physical Data table).
- There is sufficient space for servicing around the unit (see chapter 'Dimensions/clearances').
- When installing on the ground, the selected site is not subject to flooding.
- The installation is in accordance with local rules and standards which govern the installation of air conditioning equipment.
- Vibration absorbers have been provided throughout the installation to prevent noise from being transmitted.

2.2 - Moving and handling

30SZ/30SZV 004-011

Do not remove the skids until the unit has been moved to its final location. The units may be moved by means of rollers under the skids, or with slings.

When lifting with hoist and slings, use spreaders to avoid damaging the unit panels.

Always place slings under the skids, never attach them to piping or to any other components on the unit.

2.3 - Location

These units must be located indoors and where the temperature is maintained between 5°C and 40°C.

The strength of the supporting surface must be adequate to support the weight of the unit with refrigerant and water charge. Install reinforcement if necessary.

2.4 - Mounting

Mount the unit on the floor or on a solid platform.

Use an isolation pad under the unit to reduce sound transmission.

Use flexible joints in the water piping to reduce sound transmission from the units.

2.5 - Vertical and horizontal installation

These units can be modularly installed, either vertically or horizontally.

Do not stack more than three units for sizes 004-011 or more than 2 units for sizes 018-036.

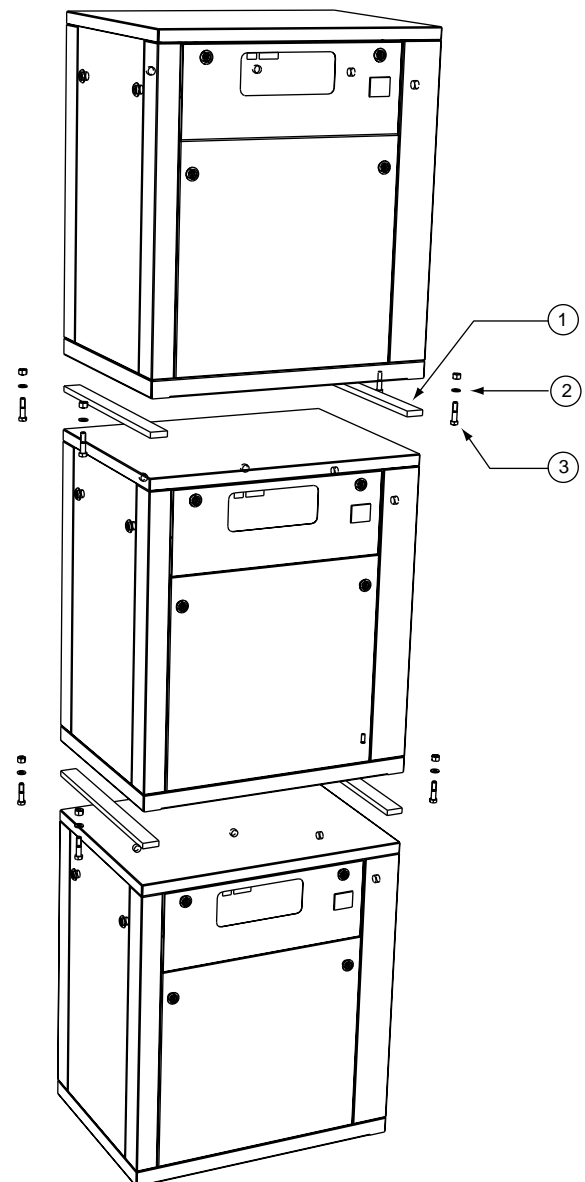
2.5.1 - Modular vertical installation (sizes 004-011)

1. Place the lower unit in the desired location.
2. Make 4 holes of 8.5 mm diameter in the top panel of the lower unit (see Fig. "Holes in the unit top panel"). These holes are already marked.

3. On the right- and the left-hand side of the top panel of the lower unit, position two insulation strips of 15 mm thickness and 10 mm height, so that the holes made previously are centred under the insulation strip. The insulation strip absorbs the transmission of vibrations from the higher to the lower unit. When selecting the insulation strip the unit weight must be considered. Punch holes into the insulation strips to align with the holes in the unit top panel (Fig. "Vertical installation, sizes 004-011"). The insulation strips and fixings should be determined by the installer.
4. Place the other unit above the lower unit so that the nuts that secure the base panel of the upper unit are aligned with the holes in the panel.
5. Fix one unit to the other with the four bolts (M8).
6. The power supply must be separate for each unit. Please consult the wiring diagrams.

VERY IMPORTANT: Do not stack more than 3 units.

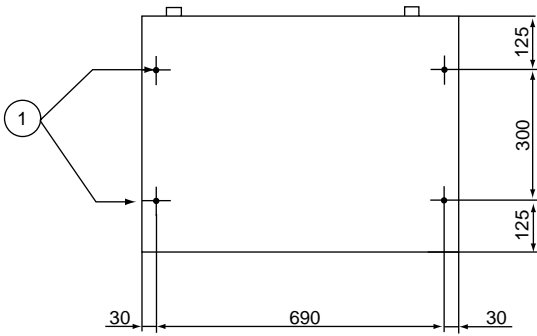
Vertical installation, sizes 004-011



Legend

- 1 Insulation strip
- 2 Washers
- 3 Bolts

Holes in the unit top panel



Legend

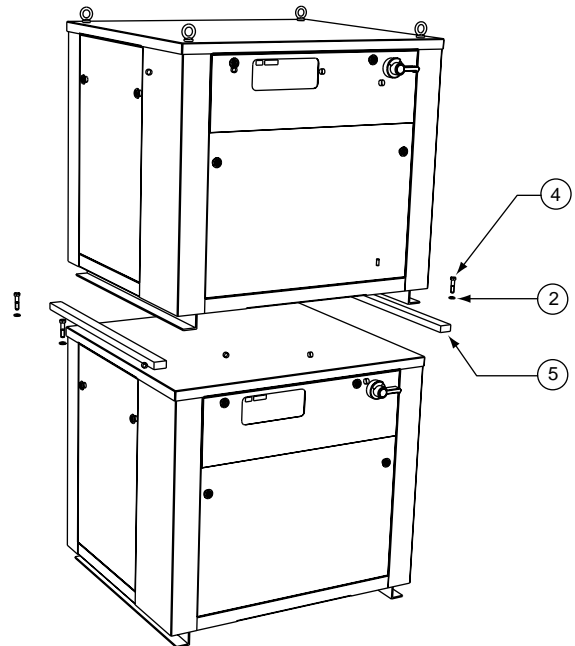
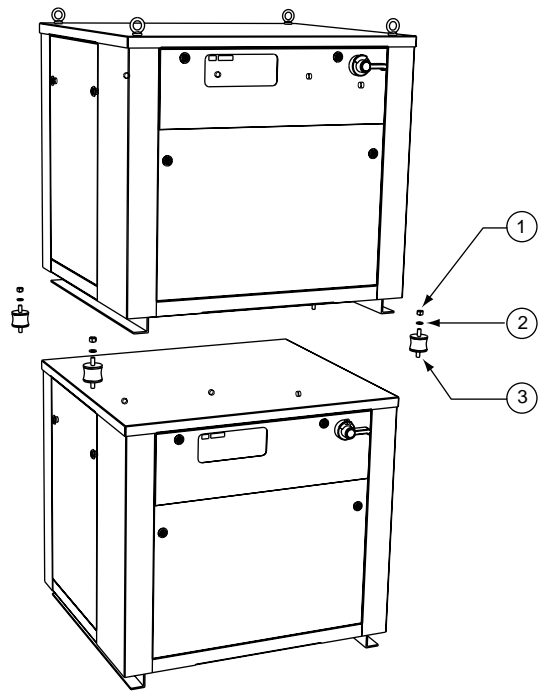
4 holes for vertical assembly (ref. ①)

2.5.2 - Modular vertical installation (sizes 018-036)

1. Place the lower unit in the desired location.
2. Remove the lifting hooks in the top panel of the lower unit. In order to do this it is necessary to turn them counter-clockwise.
3. On the right- and the left-hand side of the top panel of the lower unit, position two insulation strips of 15 mm thickness and 10 mm height, so that the holes provided for the lifting hooks are centred under the insulation strip. The insulation strip absorbs the transmission of vibrations from the higher to the lower unit. When selecting the insulation strip the unit weight must be considered. Punch holes into the insulation strips to align with the lifting hooks (Fig. "Vertical installation, sizes 018-036"). Vibration absorbers can also be installed as shown in Fig. "Vertical installation, sizes 018-036".
4. Place the other unit above the lower unit so that the holes through which the U-frame of the bottom panel of each unit is secured are aligned with the holes provided for the lifting hooks (Fig. "Vertical installation, sizes 018-036").
5. Fix one unit to the other with the four bolts (M12).
6. The power supply must be separate for each unit. Please consult the wiring diagrams.

VERY IMPORTANT: Do not stack more than 2 units.

Vertical installation, sizes 018-036



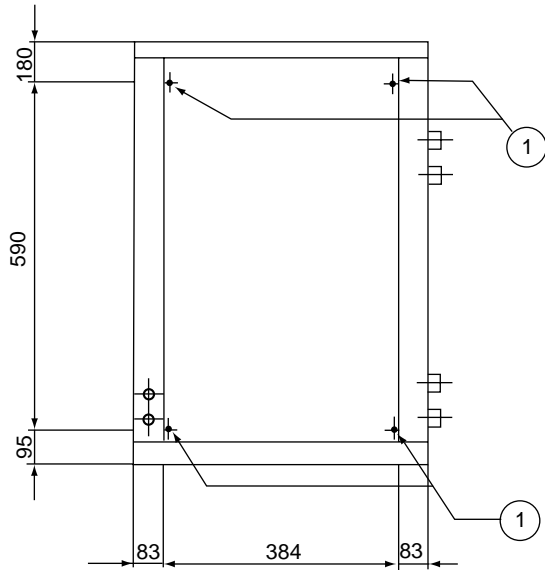
Legend

- 1 Nut
- 2 Washers
- 3 Vibration absorber
- 4 Screw
- 5 Insulation strip

2.5.3 - Horizontal modular installation (sizes 004-011)

Place the units side by side so that the holes are aligned. Fix the units in position with nuts (M6) and screws (Figures “Side grooves” and “Horizontal assembly”).

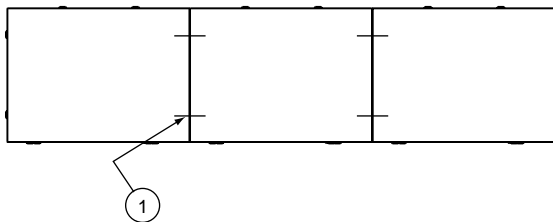
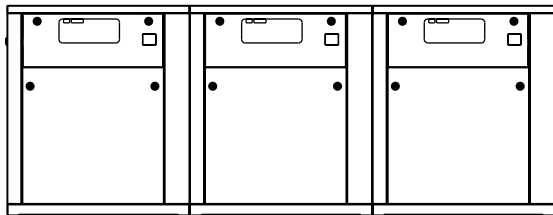
Side grooves



Legend

4 grooves for horizontal assembly (ref. ①)

Horizontal assembly



Legend

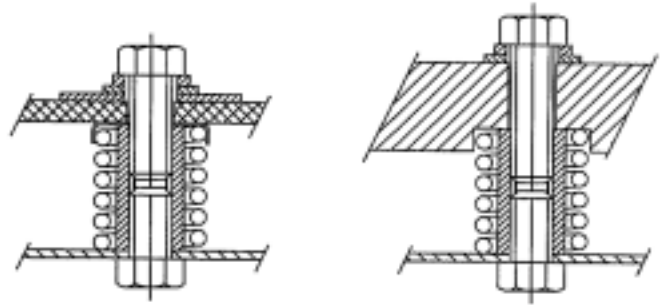
Joining screw M6 x 65 (ref. ①)

2.5.4 - Check compressor mountings (sizes 018-036)

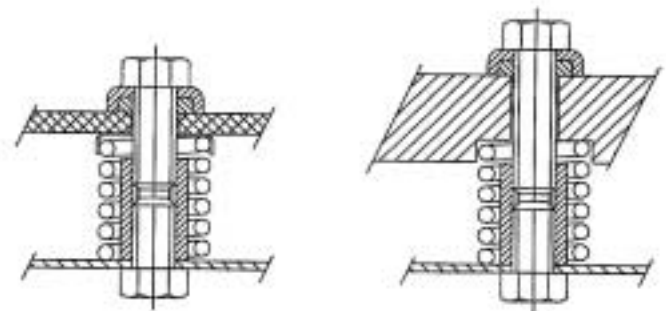
IMPORTANT: For unit transport, the compressor is held down by bolts and plain lock washers (see Fig. “Assembly for transportation”). After the unit is installed remove these bolts one at a time and reassemble with flanged washers and neoprene snubbers, as shown, using new self-locking bolts supplied with the unit.

Tighten the new bolts until the head bolt comes into contact with the flanged washer, then loosen each bolt until the flanged washer can be moved from side to side using finger pressure (see Fig. “Assembly for unit start-up”).

Assembly for transportation



Assembly for unit start-up



3 - PHYSICAL DATA



30SZ/SZV		004	005	006	007	009	011	018	024	027	036
Nominal cooling capacity											
30SZ*	kW	14.60	16.10	19.50	22.90	27.90	33.50	56.00	78.00	85.00	112.00
30SZV**	kW	13.70	15.40	18.50	22.10	26.40	32.30	52.00	72.00	77.00	106.00
Operating weight											
30SZ	kg	105	110	116	144	168	182	424	480	492	530
30SZV	kg	94	98	102	129	150	162	390	441	448	475
Refrigerant charge***											
		R-407C									
30SZ	kg	1.5	1.6	2.20	2.16	2.30	2.97	8.10	9.00	10.20	11.60
Compressor type											
		Scroll						Semi-hermetic			
No. of control steps		1	1	1	1	1	1	2	2	2	2
Capacity control		-	-	-	-	-	-	50-100	66-100	66-100	66-100
Evaporator type (30SZ/SZV)											
		Plate heat exchanger									
Net water volume		1.23	1.42	1.71	1.90	2.37	2.85	4.70	5.60	6.60	8.40
Water connections											
		MPT gas									
Inlet-outlet		1-1/4	1-1/4	1-1/4	1-1/4	1-1/4	1-1/4	1-1/2	1-1/2	1-1/2	1-1/2
Max. water pressure		1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Condenser type (30SZ)											
		Plate heat exchanger									
Net water volume		1.23	1.42	1.71	1.90	2.37	2.85	4.70	5.60	6.60	8.40
Water connections											
		MPT gas									
Inlet-outlet		1-1/4	1-1/4	1-1/4	1-1/4	1-1/4	1-1/4	1-1/2	1-1/2	1-1/2	1-1/2
Max. water pressure		1000	1000	1000	1000	1000	1000	1000	1000	1000	1000

* Evaporator entering water temperature 12°C, evaporator leaving water temperature 7°C, condenser entering water temperature 30°C, condenser leaving water temperature 35°C.

** Evaporator entering water temperature 12°C, evaporator leaving water temperature 7°C; condensing temperature dewpoint 50°C.

*** The 30SZV units have a nitrogen holding charge only.

4 - ELECTRICAL DATA



30SZ		004	005	006	007	009	011	018	024	027	036
Nominal power supply											
		V-ph-Hz 400-3-50									
Voltage range		V 360-440									
Nominal unit power input*		3.88	4.06	6.03	7.03	7.33	9.89	15.70	23.70	25.80	36.30
Nominal unit current drawn*		6.85	6.95	10.75	12.45	13.70	15.70	25.50	34.00	38.45	54.95
Maximum unit power input**		5.34	6.19	8.51	10.00	10.87	13.31	19.58	26.50	29.83	42.66
Maximum unit current drawn**		9.05	9.70	14.10	16.50	18.00	21.16	33.30	42.55	53.10	70.10
Starting current		59.5	70.5	94.0	116.0	127.0	159.0	104.0	134.0	152.0	207.0
30SZV		004	005	006	007	009	011	018	024	027	036
Nominal power supply											
		V-ph-Hz 400-3-50									
Voltage range		V 360-440									
Nominal unit power input†		4.14	4.43	6.36	7.32	8.02	10.70	16.40	23.80	26.10	36.70
Nominal unit current drawn†		7.65	7.75	11.70	13.50	15.45	17.50	27.90	36.35	41.40	58.80
Maximum unit power input‡		4.44	5.10	6.77	7.53	9.29	11.34	18.18	24.23	26.58	37.77
Maximum unit current drawn‡		9.05	9.70	14.10	16.50	18.00	21.16	33.30	42.55	53.10	70.10
Starting current		59.5	70.5	94.0	116.0	127	159.0	104.0	134.0	152.0	207.0

* Evaporator entering water temperature 12°C, evaporator leaving water temperature 7°C, condenser entering water temperature 30°C, condenser leaving water temperature 35°C.

** Evaporator leaving water temperature 10°C, condenser entering water temperature 50°C, condenser leaving water temperature 55°C.

† Evaporator entering water temperature 12°C, evaporator leaving water temperature 7°C, condensing temperature dewpoint 50°C.

‡ Evaporator leaving water temperature 10°C, condensing temperature dewpoint 60°C.

Electrical data notes

- 30SZ/SZV* units have a single power connection point.
- The control box includes the following standard features:
 - the start-up and motor protection devices for each compressor.
 - the 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 30SZ/SZV units are designed and built to ensure conformance with these codes. The recommendations of European standard EN 60204-1 (corresponding to IEC 60204-1)-(machine safety - electrical machine components - part 1: general regulations) are specifically taken into account, when designing the electrical equipment.
- altitude: ≤ 2000 m
- indoor installation*
- presence of water, class AD2* (possibility of water drops)
- presence of hard solids, class AE2* (no significant dust present)
- presence of corrosive and polluting substances, class AF1 (negligible)
- vibration and shock, class AG2, AH2
- Competence of personnel, class BA4* (personnel trained in accordance with IEC 60364)
- 2. Power supply frequency variation: ± 2 Hz.
- 3. The neutral (N) line must not be connected directly to the unit (if necessary use a transformer).
- 4. Overcurrent protection of the power supply conductors is not provided with the unit.
- 5. The factory-installed disconnect switch(es) is (are) of a type suitable for power interruption in accordance with EN 60947-3 (corresponding to IEC 60947-3).
- 6. The units are designed for connection to TN networks (IEC 60364). For IT networks the earth connection must not be at the network earth. Provide a local earth, consult competent local organisations to complete the electrical installation.

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.

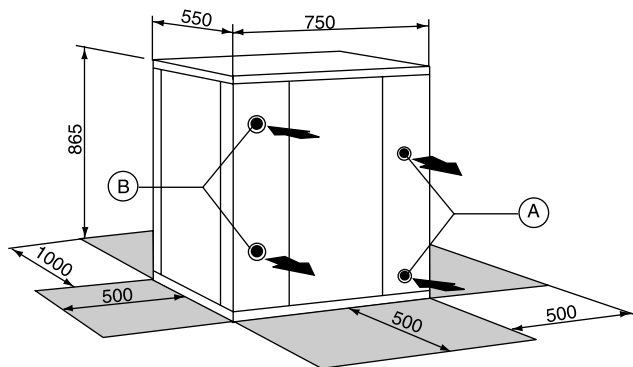
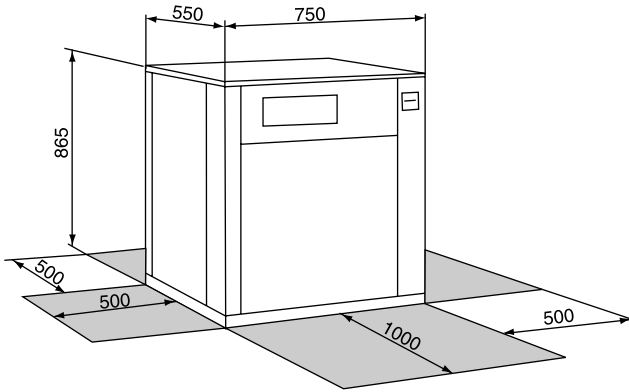
* The required protection level for this class is IP21B (according to reference document IEC 60529). All 30SZ/SZV units are protected to IP23C and fulfil this protection condition.

Notes:

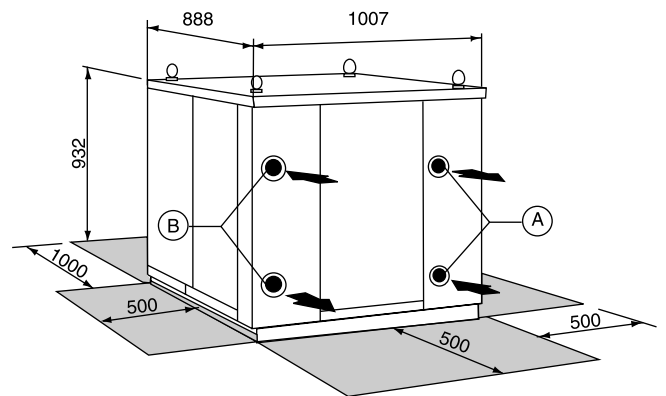
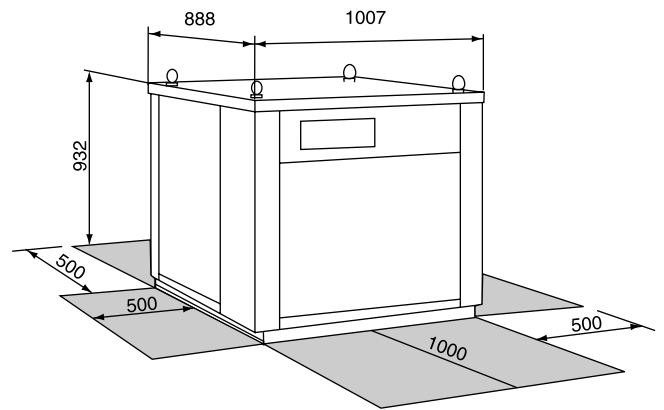
- Conformance with EN 60204-1 is the best means of ensuring compliance with the Machines Directive § 1.5.1. Generally the recommendations of IEC 60364 are accepted as compliance with the requirements of the installation directives.
- Annex B of EN 60204-1 describes the electrical characteristics used for the operation of the machines.
- 1. The operating environment for 30SZ/SZV units is specified below:
 - Environment* - Environment as classified in EN 60634 § 3:
 - ambient temperature range: +5°C to +40°C, class AA4*
 - humidity range (non condensable)*:
 - 50% rh at 40°C
 - 90% rh at 20°C

5 - DIMENSIONS/CLEARANCES

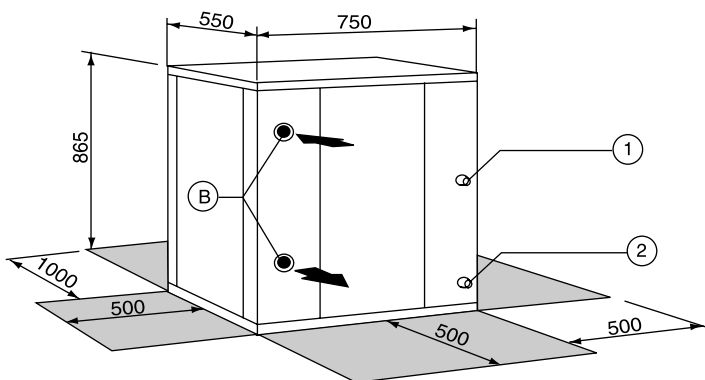
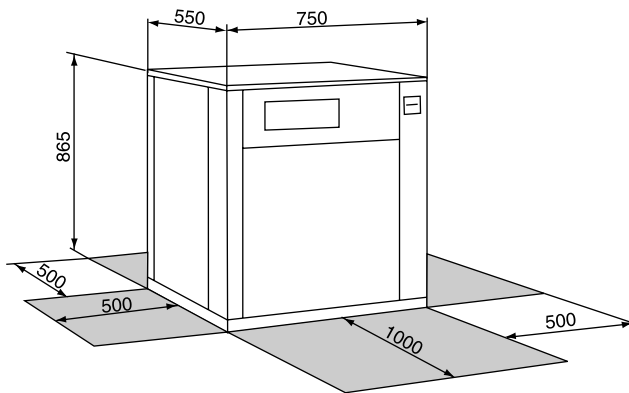
30SZ 004-011



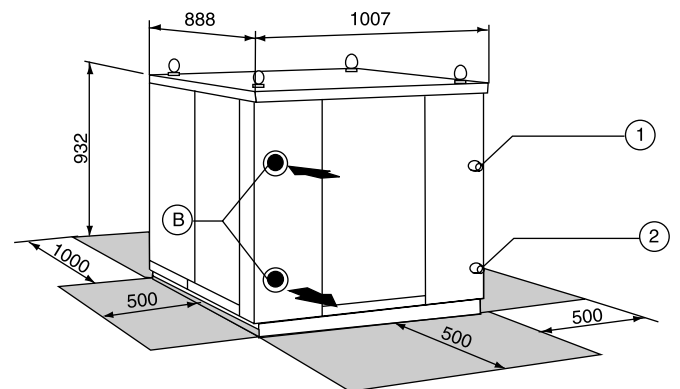
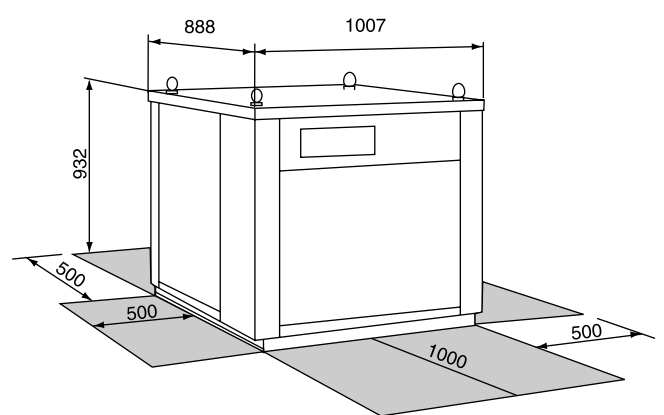
30SZ 018-036



30SZV 004-011



30SZV 018-036



All dimensions are in mm.

Nominal power supply 400-3-50

NOTE: When designing an installation, refer to the certified drawings, available on request.

Legend

- 1 Discharge line
- 2 Liquid line
- A Condenser
- B Evaporator

6 - HYDRAULIC CONNECTIONS

Make the heat exchanger water connections with the necessary components, using material which will guarantee that the screwed joints are leakproof.

The figures "Typical hydraulic installation" show a typical hydraulic circuit installation in an air conditioning system.

For an application with a hydraulic circuit, the following recommendations must be taken into account:

1. The water pump should discharge into the evaporator.
2. It is advisable to install shut-off valves to allow isolation of the most important circuit components, as well as the unit itself. These valves (ball, globe and butterfly valves) should produce a minimum loss of charge when they are open.
3. Provide circuit drains at the lowest point as well as the necessary clearances around the unit.
4. Install purges in the higher sections of the installation.
5. Pressure ports and pressure gauges should be installed upstream and downstream of the water pump.
6. Thermometers should be installed in the unit water inlet and outlet.
7. All piping must be adequately insulated.

Installation of the following components is OBLIGATORY:

1. A flow switch should be installed in a straight horizontal stretch with a length of at least five times the line diameter on either side. It must be positioned in the evaporator inlet pipe and must be electrically connected in accordance with the wiring diagram. The installation should incorporate a protection device which is activated when there is no water circulating in the heat exchanger.
2. The presence of particles in the water can lead to obstructions in the plate heat exchanger. In these installations a mesh filter should be installed at the heat exchanger inlet, with a mesh size of less than 1.2 mm (see Fig. "Mesh filter").
3. After assembling the system, or repairing the circuit, the whole system must be thoroughly cleaned with special attention paid to the state of the filters.
4. When low temperatures are expected, or if the unit is installed in a low temperature atmosphere, an adequate amount of ethylene glycol should be added.

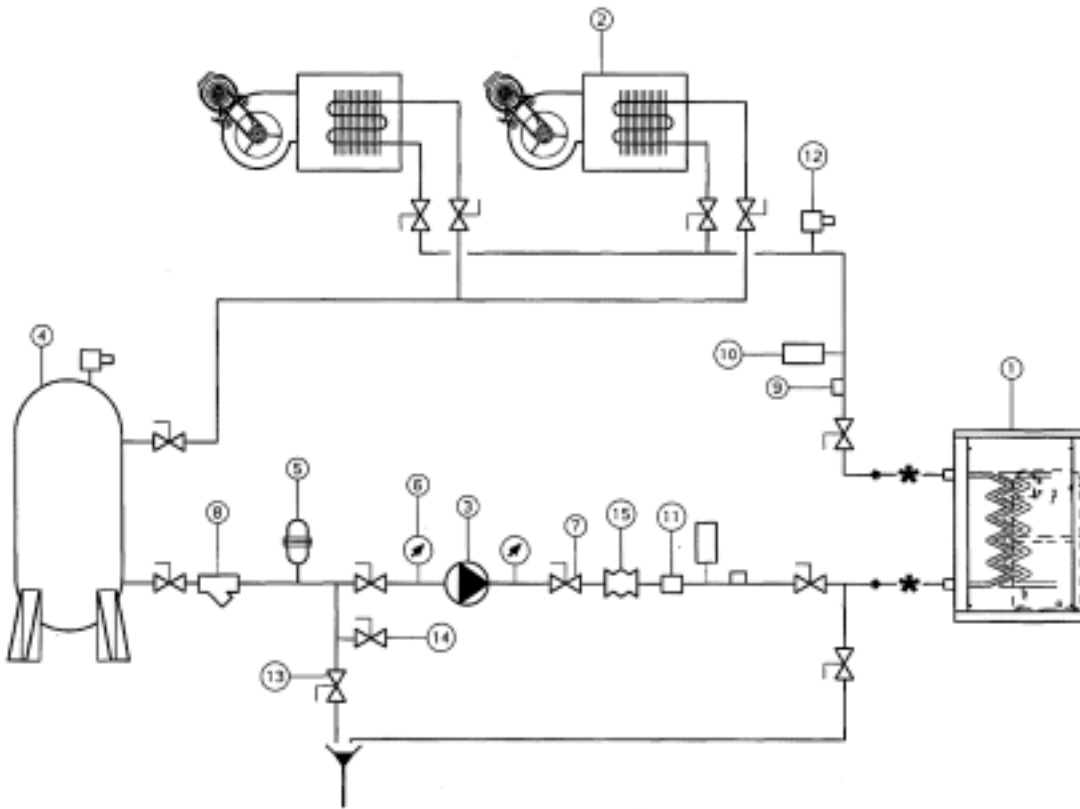
Use the curve (see Fig. "Ethylene glycol") to determine the correct ethylene glycol concentration for the temperature.

Mesh filter



NOTE: The use of these filters is strongly recommended.

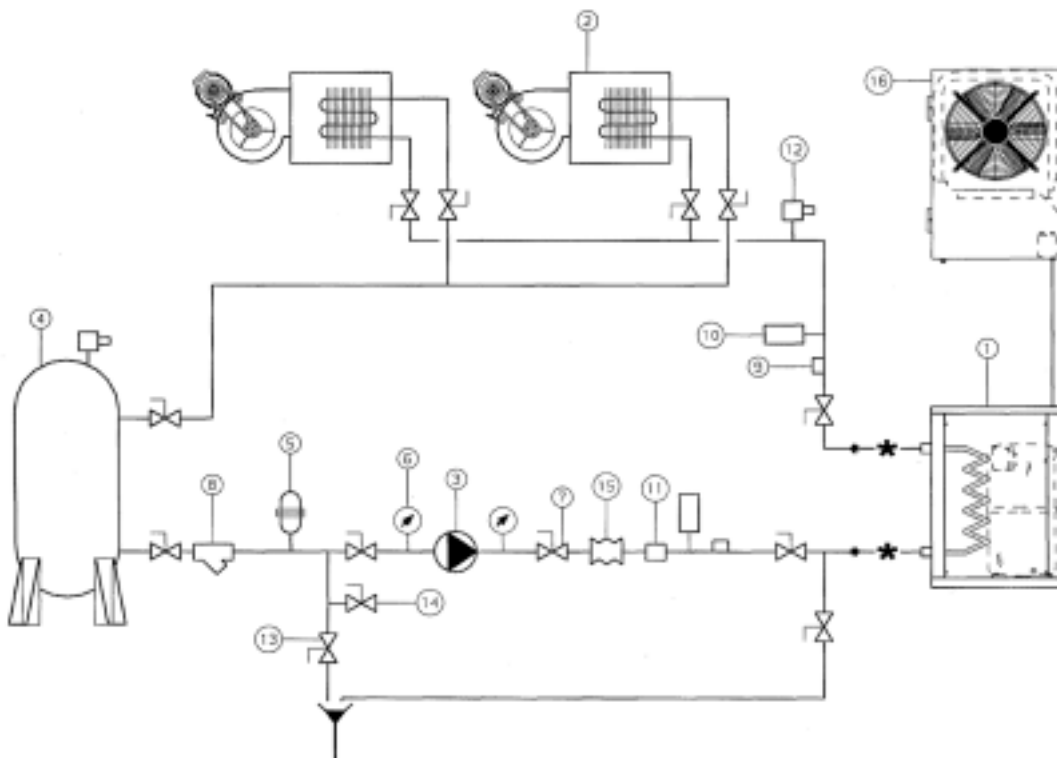
Typical hydraulic installation (30SZ)



Legend

- 1 Water chiller (30SZ)
- 2 Fan coil units
- 3 Water circulating pump
- 4 Inertia accumulator
- 5 Expansion vessel
- 6 Pressure gauges at pressure intake
- 7 Manual shut-off valves
- 8 Mesh filter
- 9 Pressure inlets
- 10 Thermometers
- 11 Flow switch
- 12 Automatic purge
- 13 Drain
- 14 Charge valve
- 15 Flexible coupling

Typical hydraulic installation (30SZV)



Legend

- 1 Water chiller (30SZV)
- 2 Fan coil units
- 3 Water circulating pump
- 4 Inertia accumulator
- 5 Expansion vessel
- 6 Pressure gauges at pressure intake
- 7 Manual shut-off valves
- 8 Mesh filter
- 9 Pressure inlets
- 10 Thermometers
- 11 Flow switch
- 12 Automatic purge
- 13 Drain
- 14 Charge valve
- 15 Flexible coupling
- 16 Condenser

IMPORTANT: Refer to the certified drawings, to make the unit hydraulic connections.

6.1 - Refrigerant line connections (30SZV)

6.1.1 - Recommendations for the installation of liquid chillers with remote condensers

To guarantee optimum and reliable performance of the 30SZV units (split units for connection to condensers) it is necessary to comply with the regulations described below, when these units are connected to remote condensers.

1. Install a valve in the discharge piping.
2. Size the discharge and liquid line piping according to the recommendations in the following paragraphs (if necessary, install a double riser to ensure correct oil circulation in the refrigerant circuit).
3. Depending on the layout and the routing of the discharge piping it may be necessary to install additional silencers (to reduce pulsations and noise emission) between the liquid chiller and the condenser.
4. Select a condenser with an integrated subcooler to obtain a minimum of 3 K subcooling at the inlet to the expansion device.
5. Keep the condensing pressure as stable as possible (pressostat staging or fan control via Pro-Dialog Plus). A speed controller may be required for the first fan stage for operation at low ambient temperature and partial load.
6. If the system can have several operating modes (summer/winter, dual set point etc.), it is necessary to install a tank (or receiver) to absorb the variations in charge.

6.1.2 - General

Refrigerant pipe sizing must be carried out, taking account of the following constraints:

Oil return to the compressor must be ensured for the majority of applications. Oil return is ensured by entrainment. A minimum refrigerant velocity is required to ensure entrainment. This velocity depends on the pipe diameter, the refrigerant and oil temperature (these are treated as being the same in most cases). A reduction of the pipe diameter permits an increase of the refrigerant velocity. The problem of a minimum entrainment velocity does not exist for the pipes that carry liquid refrigerant as the oil is fully miscible here.

The pressure drop at the compressor discharge (pipes linking the compressor outlet with the condenser inlet) must be limited to avoid system performance losses (the compressor power input increases, and the cooling capacity decreases).

As a first estimate and for standard air conditioning applications, a one degree Celsius pressure drop on the discharge side decreases the cooling capacity 2% and increases the compressor power input by 3%. Increasing the pipe diameter permits limiting the pressure drops.

The pressure drop in the liquid line (linking the condenser outlet to the expansion device) must not result in a change in phase. The estimate of these pressure drops must include those for the possible accessories, such as solenoid valves, filters, dehumidifier etc.

6.1.3 - Use of pipe sizing diagrams

On page 16 of this document two pipe sizing diagrams are shown. They allow an estimate of the cooling capacity, corresponding to 1.5 K pressure drop for different pipe diameters, based on the pipe length.

The following procedure can be used for pipe sizing:

1. Measure the length (in metres) of the piping under consideration.
2. Add 40 to 50% to take account of special characteristics.
3. Multiply this length by the appropriate correction factor from Table 1 (this correction factor depends on the saturated suction and discharge temperatures).
4. Read the pipe size from diagrams "Discharge piping" and "Liquid line piping".
5. Calculate the equivalent lengths for parts included in the piping under consideration (such as valves, filters, connections).
The equivalent lengths are normally available from the component supplier. Add these lengths to the length calculated in step 3.
6. Repeat steps 4 and 5 is necessary.

The diagrams in the appendix can obviously be used to calculate the actual pressure drops for the piping under consideration:

7. Based on the pipe diameter and the cooling capacity find the equivalent length, producing 1.5 K pressure drop in Figs. "Discharge piping" and "Liquid line piping".
8. Calculate the equivalent pipe length as described in steps 1, 2, 3 and 5.
9. Calculate the length ratio from steps 8 and 7 (equivalent length from step 8 DIVIDED by the equivalent length from step 7).
10. Multiply this ratio by 1.5 to find the equivalent pressure drops in °C.

6.1.4 - Discharge pipe sizing

The discharge piping must be sized to achieve reasonable pressure drops: a variation of 1.5 K of the saturated temperature is normally accepted (approx. 60 kPa variation for a condensing temperature of 50°C).

For most applications the refrigerant gas velocity is sufficient to entrain the liquid refrigerant/oil mixture. Nevertheless, Table 2 shows the minimum required cooling capacities for different pipe diameters and different saturated discharge temperatures.

This table is based on 8 K superheat, a saturated suction temperature of 4°C and 8 K subcooling. Table 3 shows the correction factors to be applied to the values from Table 2, if the operating conditions are different from those previously stated.

6.1.5 - Liquid line sizing

The 30SZV compressors are supplied with an oil that is fully miscible with refrigerant R407C in the liquid phase. Consequently low refrigerant velocities in the liquid lines are not a problem.

The admissible pressure drops in the liquid lines depend mainly on the subcooling level of the liquid refrigerant at the condenser outlet. Pressure drops corresponding to 1.5°C saturated temperature must not be exceeded.

Special attention must be paid to the liquid line sizing when the expansion device is positioned higher than the condenser. It may now be necessary to increase the pipe diameter to compensate for the additional pressure of the liquid refrigerant column. If the liquid refrigerant head is very high, it may even be necessary to increase the subcooling to prevent a phase change in the liquid line. This can be done e.g. by a liquid-vapour heat exchanger or an additional coil.

At 45°C the volume mass of refrigerant R407C in the liquid phase is approximately 1050 kg/m³. A pressure of 1 bar corresponds to a liquid head of: $100\ 000 / (1050 \times 9.81) = 9.7$ m.

Table 1 - R-407C correction factors for copper tube

30SZV	Saturated suction temperature, °C																	
	Cond. temp. °C	-18			-12			-7			-1			4			10	
	S	HG	L	S	HG	L	S	HG	L	S	HG	L	S	HG	L	S	HG	L
27	2.01	1.36	1.09	1.61	1.34	1.07	1.31	1.30	1.06	1.07	1.26	1.04	0.89	1.23	1.03	0.74	1.19	1.01
32	2.11	1.27	1.08	1.69	1.23	1.06	1.37	1.19	1.04	1.12	1.16	1.03	0.93	1.12	1.01	0.77	1.09	1.00
38	2.22	1.17	1.08	1.78	1.13	1.06	1.44	1.10	1.04	1.18	1.06	1.02	0.97	1.03	1.01	0.81	1.00	0.99
43	2.34	1.09	1.08	1.88	1.06	1.06	1.52	1.02	1.04	1.24	0.99	1.02	1.03	0.96	1.00	0.85	0.93	0.99
49	2.49	1.03	1.09	1.99	0.99	1.07	1.61	0.96	1.05	1.32	0.93	1.03	1.09	0.90	1.01	0.90	0.87	0.99
54	2.66	0.97	1.12	2.13	0.94	1.10	1.72	0.90	1.07	1.40	0.87	1.05	1.16	0.85	1.03	0.96	0.82	1.01
60	2.87	0.93	1.16	2.29	0.90	1.13	1.85	0.86	1.11	1.50	0.83	1.08	1.24	0.81	1.06	1.03	0.78	1.04
66	3.13	0.91	1.21	2.49	0.87	1.18	2.01	0.84	1.15	1.63	0.81	1.12	1.34	0.78	1.10	1.11	0.75	1.08
71	3.46	0.89	1.29	2.74	0.85	1.26	2.21	0.82	1.22	1.79	0.78	1.19	1.47	0.76	1.16	1.21	0.73	1.13

Legend
 S Suction
 HG Hot gas
 L Liquid

Table 2 - Minimum capacity for oil entrainment in the discharge piping (kW) for R407C copper tube

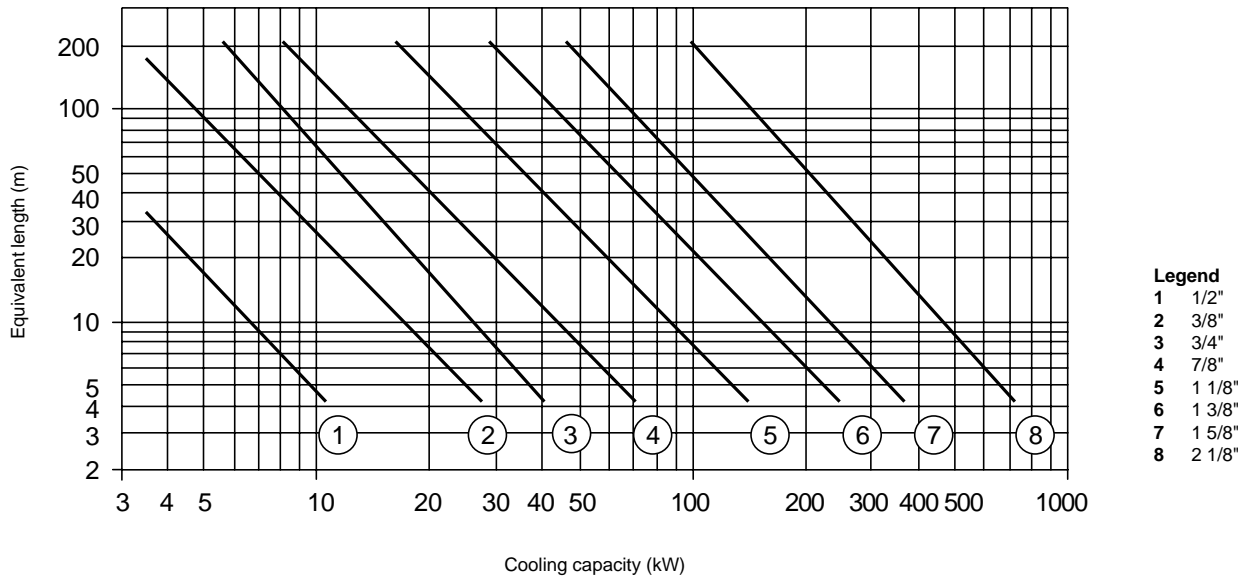
30SZV	Outside pipe diameter											
	Saturated condensing temperature, °C											
	1/2"	5/8"	3/4"	7/8"	1-1/8"	1-3/8"	1-5/8"	2-1/8"	2-5/8"	3-1/8"	3-5/8"	4-1/8"
27	0.81	1.48	2.39	3.66	7.14	12.06	18.64	37.21	63.94	99.81	145.60	201.98
32	0.84	1.51	2.46	3.76	7.28	12.34	19.06	38.09	65.42	102.13	148.94	206.66
38	0.84	1.51	2.50	3.80	7.42	12.56	19.41	38.76	66.61	103.96	151.62	210.35
43	0.88	1.55	2.53	3.87	7.53	12.73	19.66	39.25	67.42	105.23	153.48	212.92
49	0.88	1.55	2.53	3.87	7.56	12.80	19.77	39.50	67.84	105.90	154.43	214.26
54	0.88	1.55	2.53	3.87	7.56	12.80	19.77	39.46	67.81	105.86	154.40	214.19
60	0.84	1.55	2.53	3.87	7.49	12.70	19.62	39.18	67.32	105.05	153.24	212.60
66	0.84	1.51	2.46	3.80	7.39	12.45	19.27	38.44	66.08	103.12	150.42	208.66
71	0.81	1.48	2.43	3.69	7.17	12.17	18.78	37.49	64.43	100.55	146.69	203.49

Table 3 - R407C correction factors for oil entrainment in the discharge piping

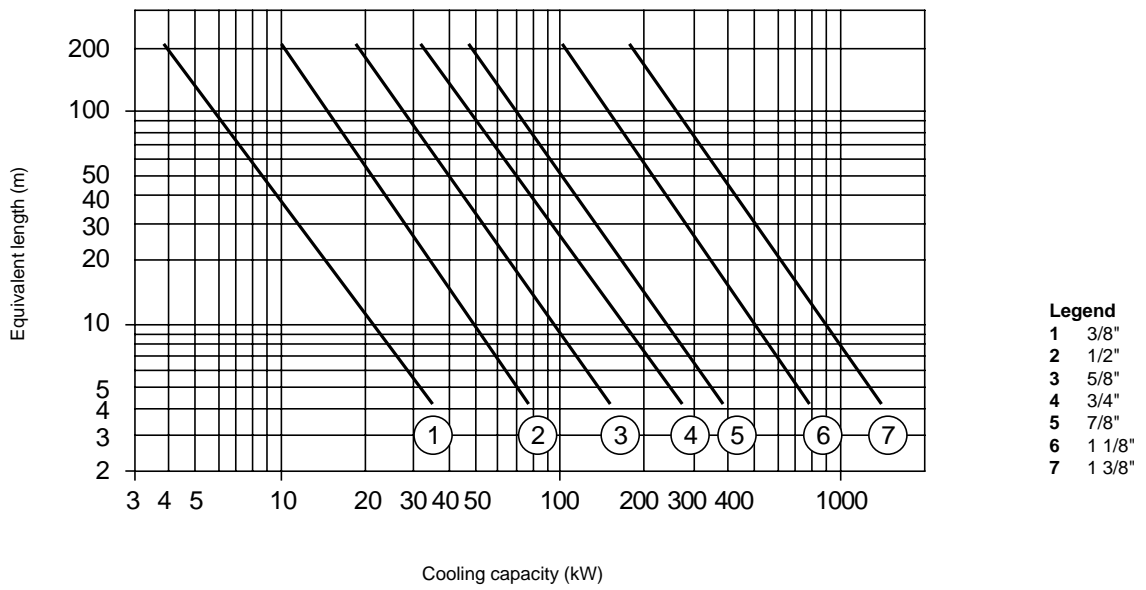
Saturated suction temperature, °C						
-23	-18	-12	-7	-1	4	10
0.86	0.89	0.92	0.94	0.97	1.00	1.03

See chapter "Discharge pipe sizing"

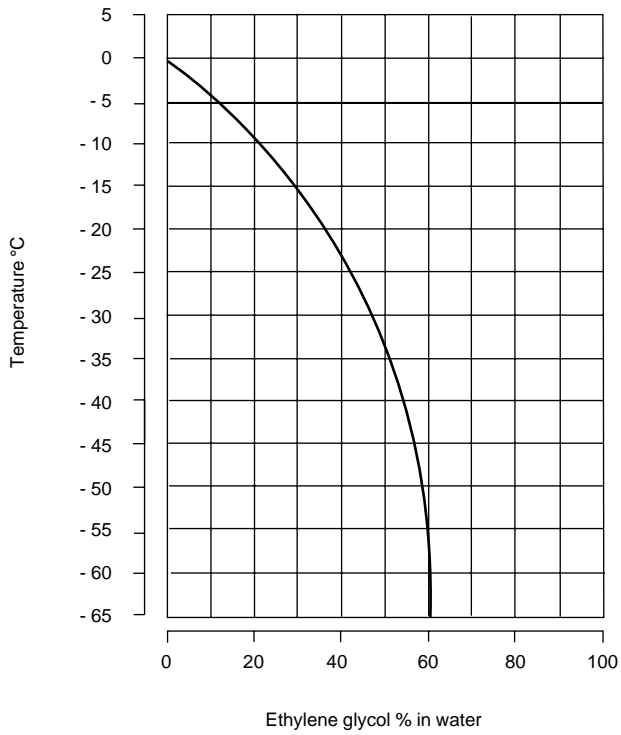
Discharge piping



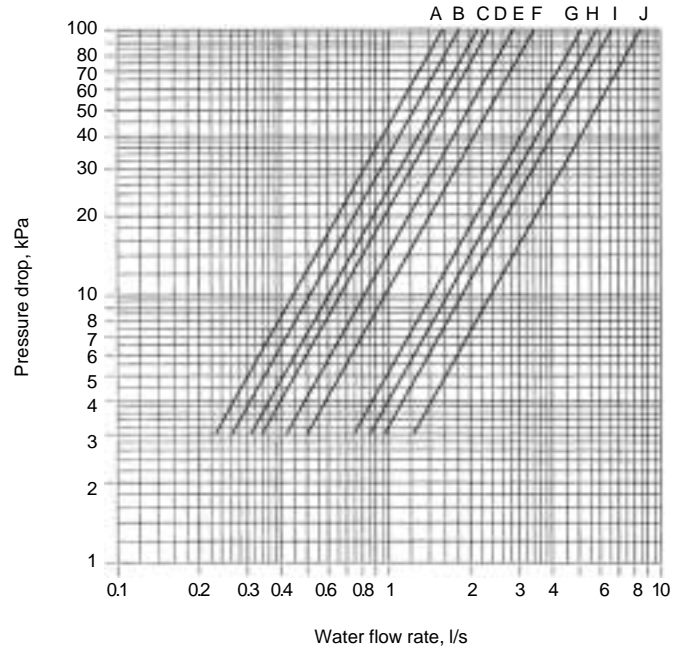
Liquid piping



Ethylene glycol curve

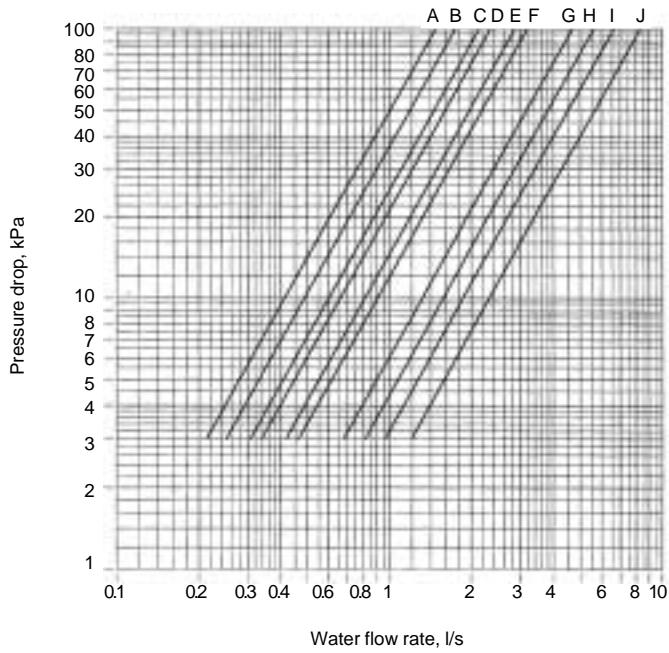


Evaporator water pressure drop



- | | |
|-------------------|-------------------|
| A. 30SZ - SZV 004 | F. 30SZ - SZV 011 |
| B. 30SZ - SZV 005 | G. 30SZ - SZV 018 |
| C. 30SZ - SZV 006 | H. 30SZ - SZV 024 |
| D. 30SZ - SZV 007 | I. 30SZ - SZV 027 |
| E. 30SZ - SZV 009 | J. 30SZ - SZV 036 |

Condenser water pressure drop



- | | |
|-------------|-------------|
| A. 30SZ 004 | F. 30SZ 011 |
| B. 30SZ 005 | G. 30SZ 018 |
| C. 30SZ 006 | H. 30SZ 024 |
| D. 30SZ 007 | I. 30SZ 027 |
| E. 30SZ 009 | J. 30SZ 036 |

6.2 - Electrical connections

WARNING: To prevent electrical shock or equipment damage, make sure disconnects are open before electrical connections are made. If this action is not taken, personal injury may occur.

Field wiring must comply with all applicable codes.

Take special care when making the earth connection.
(**Caution: Not all cables marked GND are earth cables.**)

Voltage to the unit must be within 10% of the voltage and 10% of the current indicated on the nameplate. Contact your local power company for correction of an incorrect line voltage.

Check the voltage before selecting supply wiring fuses and controls.

WARNING: Operation of the unit on improper line voltage constitutes abuse and is not covered by the Carrier warranty.

IMPORTANT: To ensure the correct unit power supply (cable entry, conductor cross section, protection devices etc.), consult the electrical data table, the wiring diagram supplied with the unit and the applicable standards concerning the installation of air conditioning equipment.

Never operate a unit if the voltage imbalance exceeds 2%. The following formula must be used to determine the percentage of voltage imbalance.

Voltage imbalance % =

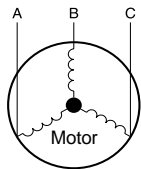
$$\frac{\text{Largest deviation from average voltage}}{\text{Average voltage}}$$

Example: Nominal supply: 400-3-50

AB = 404 V

BC = 399 V

AC = 394 V



$$\text{Average voltage} = \frac{404 + 399 + 394}{3} = 399 = 400 \text{ V}$$

Determine maximum deviation from average voltage:

AB = 404 - 400 = 4

BC = 400 - 399 = 1

AC = 400 - 394 = 6

Largest deviation is 6 volts. Percentage voltage imbalance is therefore:

$$\frac{6}{400} \times 100 = 1.5 \%$$

CAUTION: The installer must install protection devices, as required by the applicable legislation.

6.2.1 - Inserting line power leads into the unit

Install airtight cable conduit connectors through the knockouts provided. Route all cables across the connectors to the terminal blocks in the control box.

Use copper cables for the power supply into the unit.

6.3 - Liquid refrigerant charge

6.3.1 - Checking the charge

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

30SZ units are shipped with a sufficient charge of refrigerant. Refer to the Physical Data table. If it is nevertheless 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.

30SZV condenserless units are shipped with only a nitrogen charge, leaving the whole system to be charged after the installation is complete. To adjust the charge continue adding liquid refrigerant, with the unit running at full capacity until there are no bubbles visible in the sight glass.

WARNING: To ensure proper operation of 30SZ units there must be at least 5 K of subcooling as the liquid refrigerant enters the expansion valve.

30SZ and 30SZV units use a HFC-407C refrigerant charge. 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.

6.3.2 - 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 (not supplied).
- 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.

6.3.3 - Recharging liquid refrigerant

CAUTION: 30SZ units are charged with liquid HFC-407C refrigerant.

This zeotropic refrigerant 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 made, using the appropriate pressure/temperature diagram.

Leak detection is especially important for units charged with refrigerant R-407C. A refrigerant leak in the liquid or vapour phase will have an effect on the composition of the remaining fluid.

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

6.3.4 - 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). Completely drain the refrigerant charge, using a refrigerant recovery unit, repair and 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%).

WARNING: If brazing is necessary, it should be done in a neutral atmosphere: nitrogen. Combustion of refrigerant produces toxic phosgene gas.

VERY IMPORTANT:

- Never use the compressor to pump down the system.
- Never introduce liquid refrigerant into the suction line.
- Do not overcharge the system with refrigerant.

7 - START-UP

Unit start-up is done by the electronic control described in the manual “30SZ/SZV Pro-Dialog Plus control”, and must always be carried out under the supervision of a qualified air conditioning engineer.

7.1 - Necessary checks/precautions before start-up

- Ensure that all electrical connections are properly tightened.
- Ensure that the unit is level and well-supported.
- Check that the hydraulic circuit has sufficient water flow and that the pipe connections correspond to the installation diagram.
- Ensure that there are no water losses. Check the correct operation of the valves installed.
- All the panels should be fitted and firmly secured with the corresponding screws.
- Make sure that there is sufficient space for servicing and maintenance purposes.
- Ensure that there are no refrigerant leaks.
- Confirm that the electrical power source agrees with the unit nameplate rating, wiring diagram and other documentation for the unit.
- Ensure that the power supply corresponds to the applicable standards.
- Make sure that compressors float freely on the mounting springs.

WARNING: The compressors are mounted on vibration isolators. Do not loosen or remove the support mounting bolts.

7.2 - Initial checks

With the unit in operation, ensure that the high and low pressure values shown on the display are within the normal limits. It is advisable to simulate unit shutdown due to high pressure, in order to make sure that the pressurestat works properly. To do so, proceed as follows:

- High pressure shutdown: Shut off the water inlet to the outdoor heat exchanger. The unit should stop at a pressure of 2700 kPa.

The high pressure switch has manual reset.

Check that the motor and compressor power consumption is approximately the same as shown on the unit nameplate. These values are also shown in the Electrical Data table.

7.3 - Refrigerant system description

The refrigerant circuit incorporates the following principal elements:

- Plate heat exchanger, made of brazed steel. The special shape of these plates makes them very efficient.
- Copper refrigerant lines
- Expansion valve
- Compressors (hermetic or semi-hermetic)
- Filter drier
- Schrader valves
- Safety elements: high pressurestats, fusible plugs
- High-pressure, low-pressure and oil pressure sensor (30SZV 018-036)

- Liquid solenoid valve (30SZV)
- All units, except condenserless units, include the R-407C refrigerant charge necessary for correct operation.

7.4 - Compressor replacement

30SZ/SZV 004-011

As the compressors are hermetic, when an internal fault occurs, the compressor must be replaced. This must be done as detailed below:

- Disconnect the unit from the electrical supply.
- Remove the panels.
- Remove the gas from the refrigerant circuit using recovery equipment to avoid contaminating the atmosphere.
- Electrically disconnect the compressor.
- Unbrazed or unscrew the suction and discharge lines, taking care not to damage the rest of the components.
- Remove the fastenings.
- Replace the compressor, ensuring that it contains sufficient oil.
- Braze or screw in the lines (brazing in a neutral atmosphere).
- Connect the compressor according to the wiring diagram.
- Pump down the compressor.
- Fill in the refrigerant charge indicated on the nameplate.

30SZ/SZV 018-036

These units have semi-hermetic compressors, and their internal components can be repaired, if it not necessary to replace the compressor.

7.5 - Description of unit protection devices

The unit includes the following protection devices:

- Internal or external compressor protection (depending on the model)
- Main switch
- Anti-short-cycle protection
- Thermomagnetic compressor switch
- Thermomagnetic control switch
- Anti-freeze protection
- Evaporator leaving water limit thermostat
- Temperature sensor fault detector
- Oil pressure safety switch (30SZV 018-036)
- High pressurestat: This protects the unit against excessive condensing pressure. The high pressurestat has factory-fixed non-adjustable settings. To check, see section “Initial Checks”.
- Low pressure safety switch.

7.5.1 - Pressure switch settings

	Cut-out	Cut-in	Reset
30SZ/SZV 004-011 High pressurestat	2700 kPa*	-	Manual
30SZ/SZV 018-036 High pressurestat	2700 kPa*	-	Manual

* Factory-fitted

WARNING: Alteration of factory settings other than the design set-point, without manufacturer's authorisation, may void the warranty.

If ethylene glycol is used in the system, the manufacturer must be asked for permission to change the unit protection parameters.

7.6 - Operating limits

These units have been designed to operate within the following limits:

30SZ

Water	Minimum	Maximum
Evaporator entering temperature	+9°C	+16°C
Evaporator leaving temperature	+5°C*	+13°C
Condenser entering temperature	+16°C	+50°C
Condenser leaving temperature	+18°C	+55°C

* Operation down to 0°C leaving water temperature is possible with anti-freeze solution and special control configuration by Carrier Service.

30SZV

Water	Minimum	Maximum
Evaporator entering temperature	+9°C	+16°C
Evaporator leaving temperature	+5°C*	+13°C
Condensing temperature at the dewpoint	+30°C	+60°C

* Operation down to 0°C leaving water temperature is possible with anti-freeze solution and special control configuration by Carrier Service.

8 - GENERAL MAINTENANCE

ATTENTION: Before starting any servicing or maintenance operation on the unit, make sure that the power supply has been disconnected. A current discharge could cause personal injury.

In order to obtain maximum performance from the unit special attention should be paid to the following points.

8.1 - Electrical connections

The supply voltage should be within the limits permitted by the compressor.

Ensure that there are no faulty contacts in the terminal blocks, printed circuits, contactors, etc. Make sure that all the electrical connections are properly tightened, and that all the electrical components (contactors, relays, etc) are firmly secured to the corresponding rails. Pay special attention to the condition of the connecting cables between the control elements and the electrical box, and to that of the unit power supply cable. Check the starting and running consumptions are within the limits specified in the corresponding technical information.

8.2 - Hydraulic connections

Ensure that there is no water leakage in the system. Drain the unit, if it is expected to be shut down for a prolonged period. This operation is essential if temperatures are expected to drop below freezing, and if no glycol solution is used.

Carefully clean the system water filter.

8.3 - Plate heat exchanger cleaning

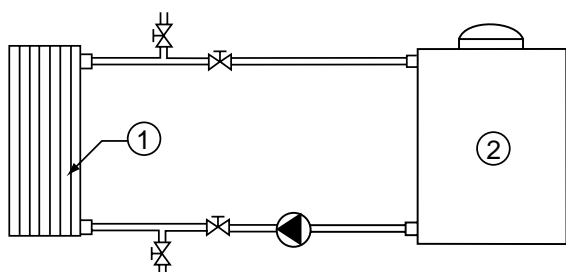
In some applications, for example when very hard water is used, there is more tendency for fouling. The heat exchanger can always be cleaned by circulating a cleaning fluid.

A weak acid solution should be used (5% phosphoric acid or, if frequently cleaned 5% oxalic acid), and the cleaning fluid should be pumped through the heat exchanger (Fig. "Tank installation").

The tank installation can be permanent or, alternatively, the connections can be prepared and, at any given time, a portable cleaning device can be connected.

To achieve optimum cleaning the acid solution should be circulated at a minimum of 1.5 times the normal operational flow speed, and preferably in reverse direction. The installation should then be flushed with large amounts of water to totally remove the acid before the system is started up.

Tank installation



Legend

- 1 Heat exchanger
- 2 Weak acid solution tank

Cleaning should be done at regular intervals and should never be left until the unit has become blocked. The time intervals between cleaning depend on the quality of the water used, but as a general rule it is advisable to clean it at least once a year.

8.4 - Refrigerant circuit

Ensure that there is no leakage of refrigerant or oil from the compressor. Check that the high and low side operating pressures are normal. Check the cleanliness of the refrigerant-water heat exchangers by checking the pressure drop across them.

8.5 - Controls

Check the operation of all relays, high/low pressurestats and controls.

9 - SERVICE

9.1 - Lubrication

The compressor has its own oil supply and oil should not be added unless a leak has occurred.

9.2 - Servicing recommendations

- Before replacing any of the elements in the cooling circuit, ensure that the entire refrigerant charge is removed from both the high and low pressure sides of the unit.
- The control elements of the cooling system are highly sensitive. If they need to be replaced, care should be taken not to overheat them with blowlamps whilst soldering. A damp cloth should be wrapped around the component to be soldered, and the flame directed away from the component body.
- Always use silver soldering rods.
- If the total unit gas charge has to be replaced, the quantity should be as given on the nameplate and the unit should be properly evacuated beforehand.
- During unit operation all panels should be in place, including the electrical box access panel.
- If it is necessary to cut the lines of the refrigerant circuit, tube cutters should always be used and never tools which produce burrs. All refrigerant circuit tubing should be of copper, specially made for refrigeration purposes.
- If a temperature sensor needs to be replaced, the new sensor should be correctly installed. The sensor cable must be positioned as the original sensor cable.



Order No.: 13401-76, 11.2000. Supersedes order No.: New
Manufacturer reserves the right to change any product specifications without notice.



Environmental Management System Approval

Manufactured by: Carrier SA, Montluel, France
Printed in the Netherlands on totally chlorine-free paper.