



38AJ 008-074 (R-22)
38AZ 008-074 (R-407C)
Air-Cooled Condensing Units

50 Hz



Installation, Operation and Maintenance Instructions

**QUALITY ASSURANCE
SYSTEM**



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The photo shown on the front cover is solely for information, and not contractually binding. The manufacturer reserves the right to make changes without previous notification.

START-UP CHECK LIST

Start-up date: _____

Equipment sold by: _____ Contract No.: _____

Installed by: _____ Contract No.: _____

Site address: _____

Equipment type and serial numbers: _____

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. 1 _____ V

Ph. 1 _____ V

Ph. 1 _____ V

Compressor:

Circuit 1: Suction gas temperature: _____ °C

Suction gas pressure: _____ kPa

Circuit 2: Suction gas temperature: _____ °C

Suction gas pressure: _____ kPa

Ph. 2 _____ V Ph. 3 _____ V

Ph. 2 _____ V Ph. 3 _____ V

Ph. 2 _____ V Ph. 3 _____ V

Ph. 2 _____ V Ph. 3 _____ V

Safety device setting:

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

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

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 _____

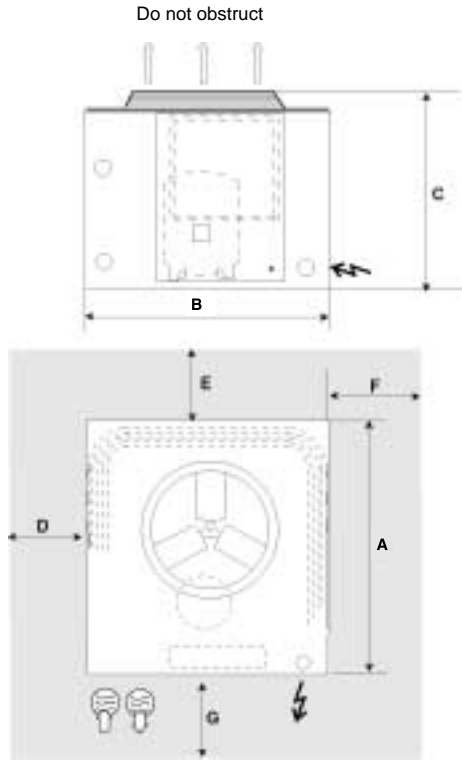
Remarks:

NOTE: Please fill in this sheet during the installation

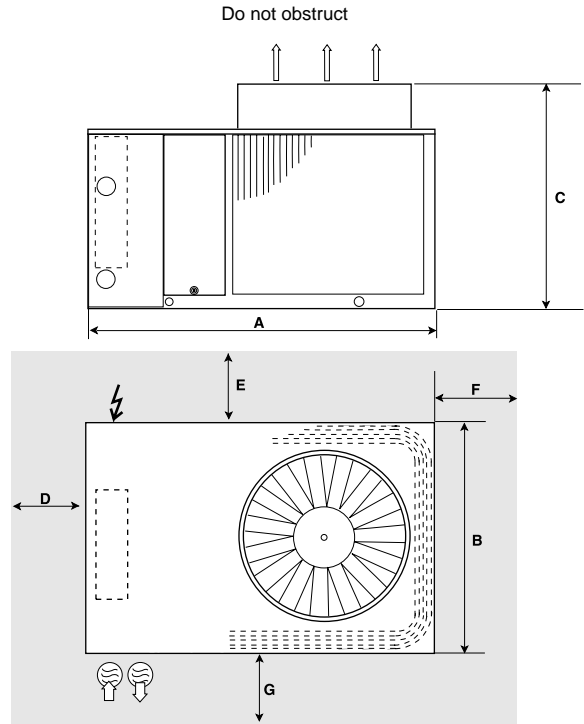
Dimensions and clearances

38AJ/AZ	A	B	C	D	E	F	G
008-012	1220	1160	977	1200	1000	1000	1000
014-024	1720	1160	1112	1200	1000	1000	1000
030-036	2060	1370	1231	1000	1000	1000	1200
046	2450	1870	1912	2500	1200	500	1200
062-074	2900	2156	2060	2500	1200	500	1200

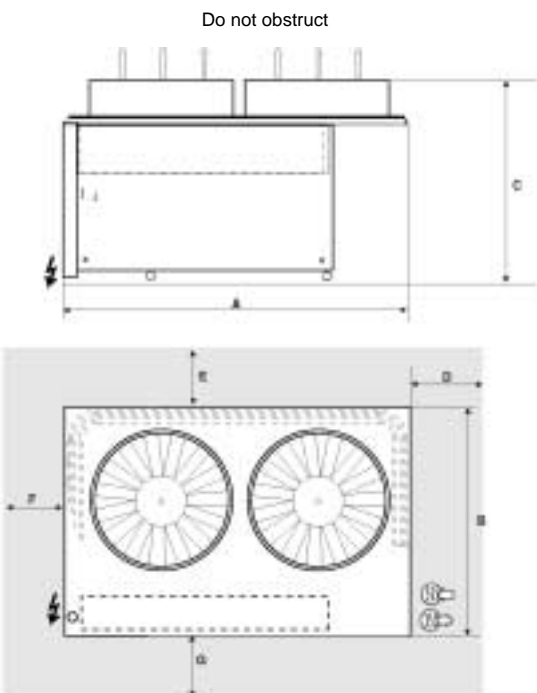
38AJ/AZ 008-012



38AJ/AZ 014-024



38AJ/AZ 030-036



Legend:

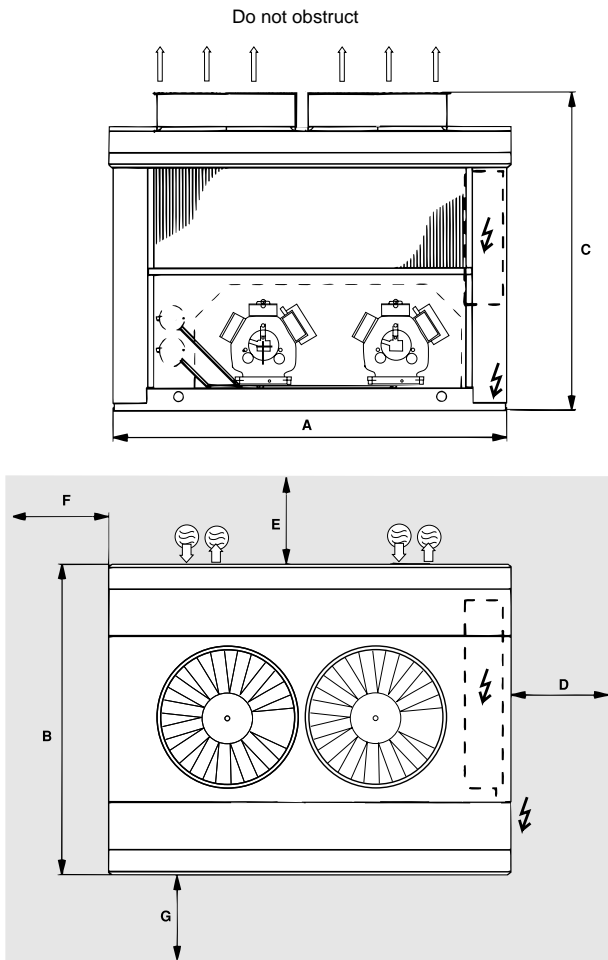
All dimensions are given in mm.

- Required clearance space for servicing
- Power supply
- Water inlet
- Water outlet

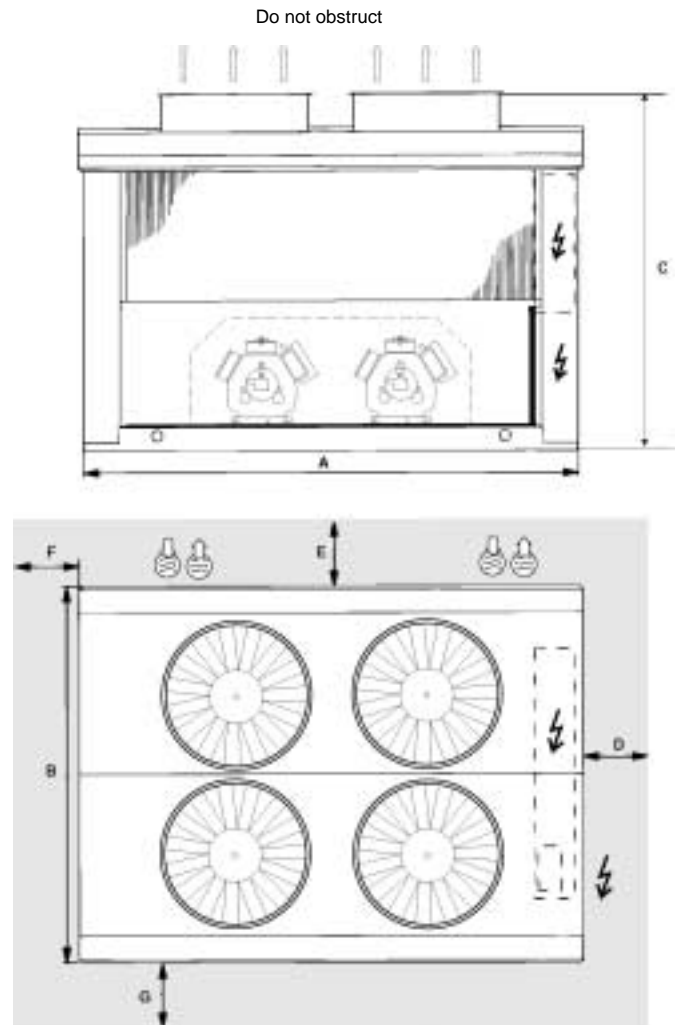
NOTE: The drawings above are not contractually binding. Certified dimensional drawings are available on request

Dimensions and clearances

38AJ/AZ 046



38AJ/AZ 062-074



Floor mounting

- For unit mounting holes, weight distribution and centre of gravity coordinates, refer to the dimensional drawings supplied with the unit.
- 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

38AJ/AZ		008	010	012	014	018	024	030	036	046	062	074
Nominal cooling capacity 38AJ*	kW	23.3	29.4	36.5	51.0	61.0	76.0	93.0	119.0	139.0	170.0	233.0
Nominal cooling capacity 38AZ*	kW	21.5	27.5	34.2	47.3	57.0	69.0	85.0	113.0	129.0	158.0	219.0
Operating weight**	kg	248	250	264	376	431	477	644	682	1185	1422	1492
Refrigerant												
38AJ		R-22										
38AZ		R-407C										
Compressor												
		Hermetic					Semi-hermetic					
Number of compressors		1	1	1	1	1	1	1	1	2	2	2
Number of capacity steps		1	1	1	2	2	2	2	2	4	4	4
Minimum capacity	%	100	100	100	66	50	66	66	66	33	33	33
Outdoor coil												
		Copper tubes and aluminium fins										
Fan												
		Direct drive, propeller					Shrouded axial, Flying Bird low-noise fan					
Quantity		1	1	1	1	1	1	2	2	2	4	4
Total air flow	l/s	2640	2640	2640	4700	4700	4700	9400	9400	9400	18800	18800
Speed	r/s	15	15	15	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
Pipe connection diameter												
	in											
Suction line		1-1/8	1-1/8	1-1/8	1-3/8	1-5/8	1-5/8	1-5/8	2-1/8	1-5/8	2-1/8	2-1/8
Liquid line		5/8	5/8	5/8	5/8	5/8	7/8	7/8	7/8	7/8	7/8	7/8

Legend:

- * Nominal capacities are based on:
 - a saturated suction temperature (R-22) or a suction dew point temperature (R-407C) of 7.2°C
 - an outdoor air temperature (OAT) of 35°C
- ** Unit weight without options

Electrical data

38AJ/AZ		008	010	012	014	018	024	030	036	046	062	074
Power supply												
Nominal power supply	V-ph-Hz	400-3-50										
Voltage range	V	360-440										
Auxiliary circuit												
	V-ph-Hz	230-1-50										
Auxiliary circuit power input (heaters)	W	70	70	70	100	200	200	200	200	400	400	400
Fan power input	kW	0.70	0.70	0.70	1.14	1.14	1.14	2.30	2.30	2.30	4.60	4.60
Fan power supply		400-3-50										
Nominal unit power input*	kW	7.5	10.4	14.5	13.5	18.3	25.9	27.0	39.4	51.0	55.0	77.0
Maximum unit power input**	kW	8.6	13.0	16.1	18.6	22.3	29.2	34.9	47.3	59.0	70.0	95.0
400 V-3 ph-50 Hz (360 V-440 V)												
Maximum starting current (ICF)	A	81	110	135	84	104	134	152	207	194	219	296
Nominal unit current drawn*	A	12.9	17.8	24.9	23.2	31.5	44.5	46.4	68.0	88.0	95.0	133.0
Maximum unit current drawn**	A	24.5	31.0	38.5	34.0	38.9	51.0	60.0	83.0	102.0	120.0	166.0
230 V-3 ph-50 Hz (207 V-253 V)												
Maximum starting current (ICF)	A	140	190	233	146	180	232	263	359	336	379	512
Nominal unit current drawn*	A	22.3	30.9	43.2	40.2	55.0	77.0	80.0	117.0	152.0	165.0	230.0
Maximum unit current drawn**	A	42.4	54.0	67.0	59.0	67.0	88.0	104.0	144.0	177.0	208.0	288.0

Legend:

- * Saturated suction temperature (R-22) or a suction dew point temperature (R-407C) of 7.2°C, outdoor air temperature (OAT) of 35°C
- ** Maximum unit operating conditions (saturated suction temperature (R-22) or a suction dew point temperature (R-407C) of 10°C, saturated discharge temperature (R-22) or discharge dew point temperature of 68.3°C.
- *** ICF = maximum instantaneous current during starting, equal to the current value of the last compressor to start, plus the sum of the maximum currents of the other compressors and fans operating.

Electrical data notes:

- The units have a single power connection point.
- 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.
- These Carrier units are designed and built to ensure conformance with local 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:

- Conformance with EN 60 204 is the best means of ensuring compliance with the Machines Directive § 1.5.1. Generally the recommendations of IEC 364 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 these units is specified below:
 - Environment* - Environment as classified in EN 60 721:
 - outdoor installation*
 - ambient temperature range: -25°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)
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 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 units are protected to IP44CW and fulfill this protection condition.**

APPLICATION DATA

Operating limits

Varifan III (option)

The Carrier Varifan III allows adjustment of the fan speed or of the three-phase motors (400 V-3 ph-50 Hz) at low outdoor temperatures.

Varifan III is an adjustment device that is directly controlled by a pressure transducer that permits very precise maintenance of the condensing pressure.

38AJ/AZ	008-024	030-036	046-074
Min. outdoor air temperature °C			
Unit with Varifan option	-18	-18	-18
Standard unit	12	2	0

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.).

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

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.

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

The 38AJ/AZ units can be hoisted with rigging or lifted by forklift. 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°.

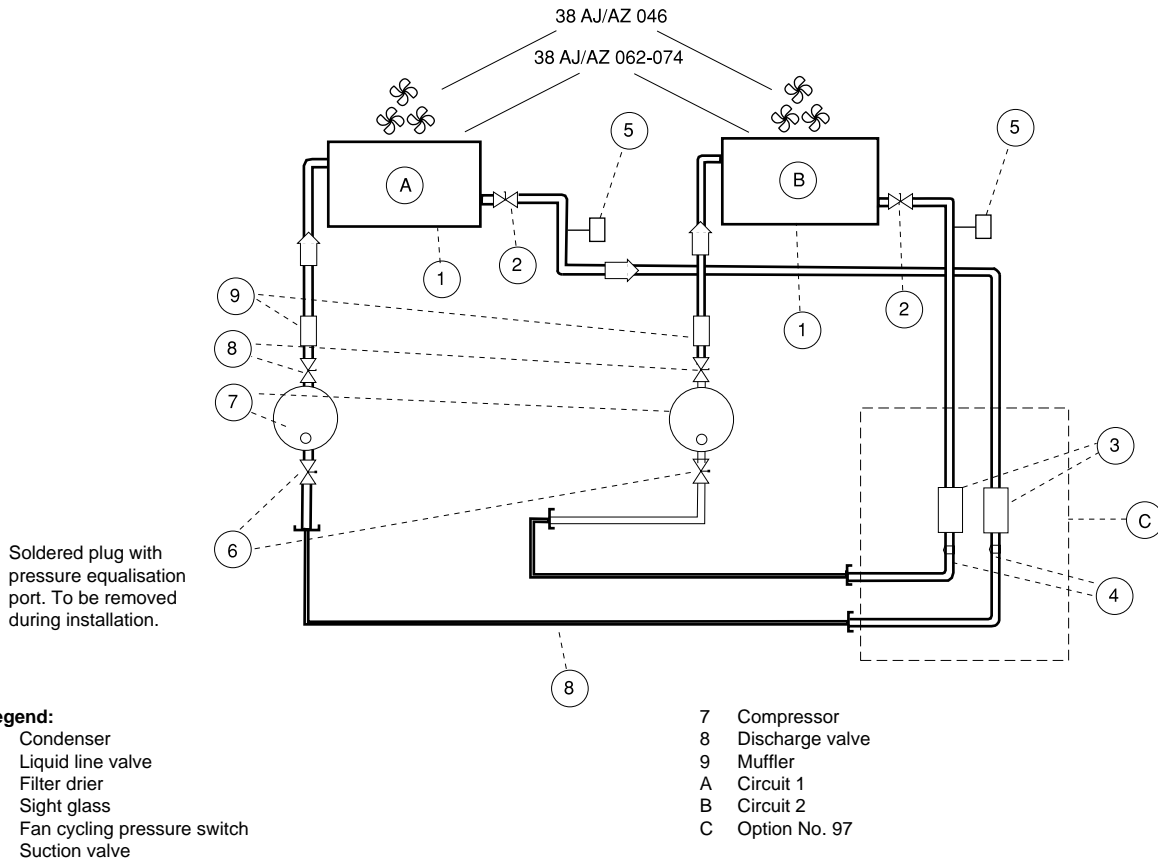
WARNING: Never push or lever on any of the enclosure panels of the unit. Only the base of the unit frame is designed to withstand such stresses.

REFRIGERANT CONNECTIONS

Size the refrigerant lines. Consider the length of piping required between condensing unit and evaporator, the amount of liquid lift, and the compressor oil return.

Refer to the dimensional drawings for the size, type and location of the suction and liquid line pipe connections. Refer to the Carrier System Design Manual (Refrigerant lines). Include a liquid receiver in the installation.

Refrigerant piping diagram



NOTE: The typical refrigeration circuit diagram shown does not apply to all control types used.

Single circuit only for 38AJ/AZ 008-036 units

General recommendations for field installation

Thermostatic expansion valve (TXV) and solenoid valve

- The thermal expansion valve sensing bulb must be installed after at least two 90° bends at the evaporator outlet.
- Ideally the TXV should be installed in a vertical pipe run. If that is not possible, the valve may be rotated through a full 90°, with the horizontal pipe remaining at the base.
- The TXV and solenoid valves are installed as shown in Figs. 1 to 5 (pages 9 and 10).
 - Liquid line solenoid valves are not necessary, if single-circuit evaporators are used and the evaporator has sufficient capacity to hold the whole refrigerant charge. In this case the unit wiring must be modified; please refer to Carrier Service Bulletin No. SB 005-76-96 E.
 - Solenoid valves are needed with dual-circuit evaporators to deactivate the upper section of the evaporator coil and reduce the load on the compressor (capacity unloaders operated by suction pressure).

Installation of piping

IMPORTANT:

- *In order to prevent vibration and possible pipe breaks install proper pipe supports for all pipes at the point where they leave the unit.*
- *On all units, relieve the pressure of the holding charge before opening the circuit.*
- Open all service valves:
 - on models 014 to 074, open the compressor suction and discharge valves
 - on all models, open the liquid line shut-off valves.
- Remove the protective cap from the Schrader port in the liquid line valve and press on the valve depressor to release the holding charge (nitrogen).
- Unsolder the plugs and prepare the pipes for connection.
- Install the filter-drier and moisture indicator (for 38AZ units these must be specific for R-407C), as shown in Figs. 1 to 5. Select the filter-drier for maximum unit capacity and minimum pressure drop. Install the filter-drier in the liquid line before the expansion valve and the moisture indicator just after the shut-off valve in the same line. These are available as factory-fitted option 97.

- The second moisture indicator must be installed close to the condenser to provide a means of checking the refrigerant charge.
- Complete the liquid line valve connections between the moisture indicator and the evaporator.
- Complete the low-pressure suction line connections between the compressor and the evaporator. Do this with nitrogen or another inert gas flowing through the pipework to prevent oxidation of the copper.

Oil return

Condensing units with multiple-step unloading may require double suction risers to ensure proper oil return at minimum load.

A reduction of the evaporator coil surface should be considered as a means of achieving a refrigerant velocity that will ensure that enough oil returns to the compressor. Liquid line solenoid valves may be used in certain situations to accomplish this. Bypass hot gas, if used, should be introduced before the evaporator. Consult your local Carrier distributor.

The oil charge must be adjusted to allow for extra line length. This is done by adding 1% of the nominal oil charge for the compressor every 3 m of piping in excess of 16 m.

Insulation

The refrigerant suction line should be insulated in accordance with the guidelines set forth in the Carrier System Design Manual (3rd part).

Fig. 1 - 38AJ/AZ 008-036, single evaporator

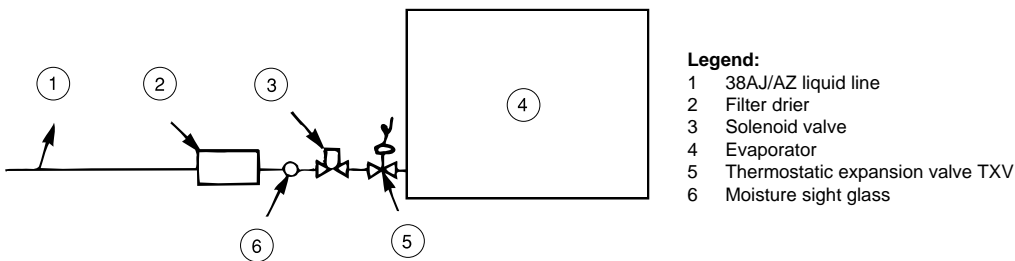


Fig. 2 - 38AJ/AZ 014-036, dual evaporator

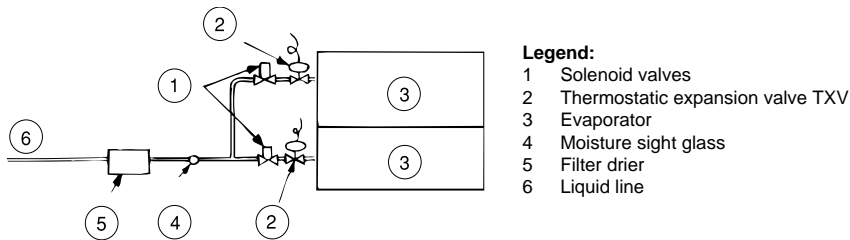


Fig. 3 - 38AJ/AZ 046-074, single evaporator

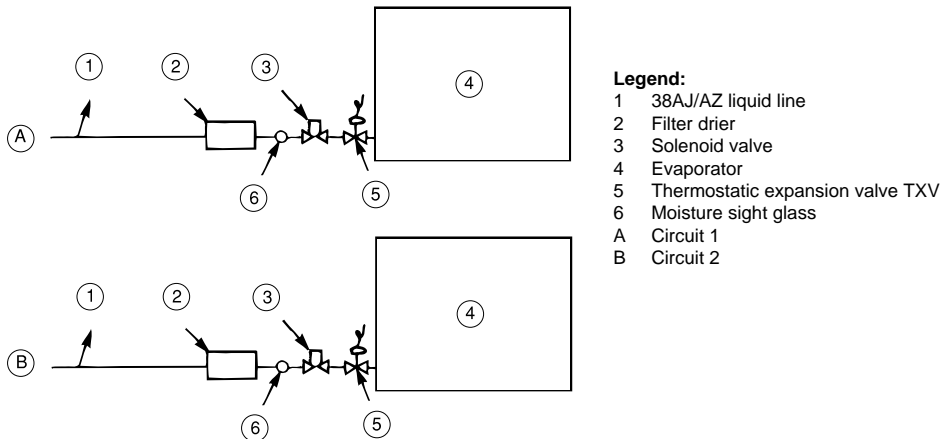


Fig. 4 - 38AJ/AZ 046-074, dual evaporator

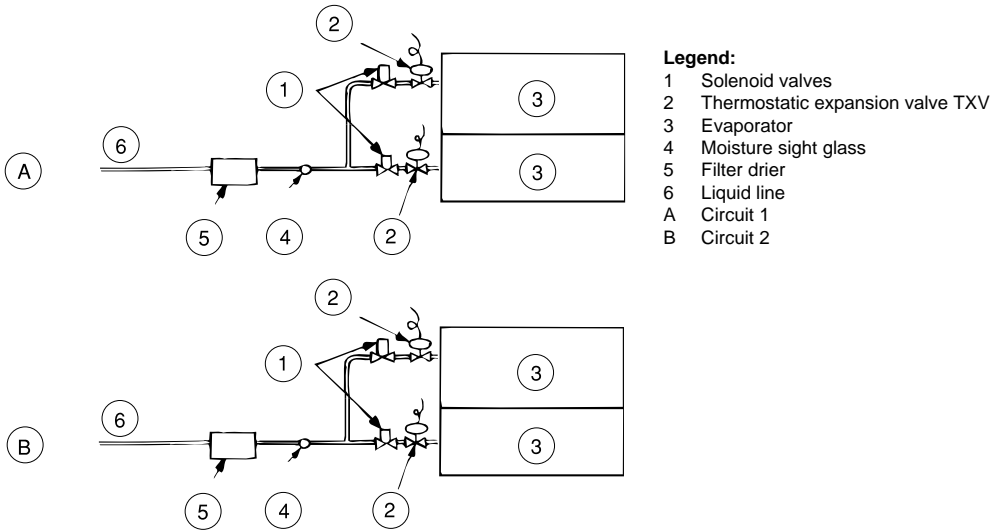
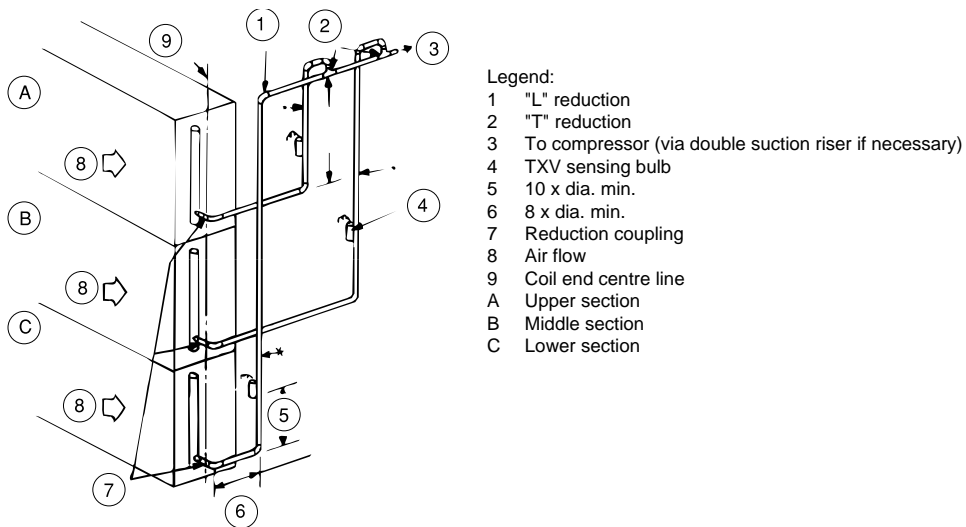
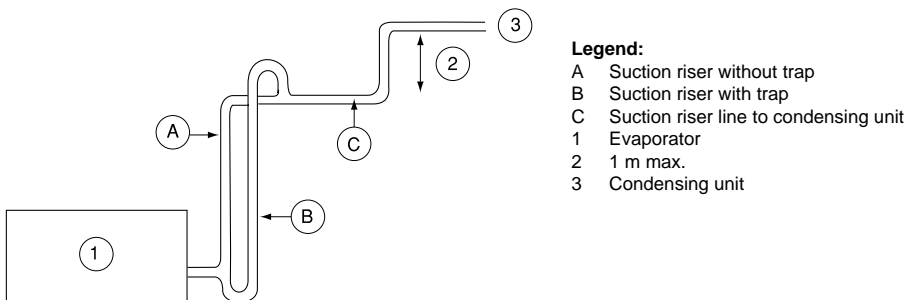


Fig. 5 - Suction line piping to three-section split evaporator coil



- Notes:**
1. The suction line is connected to the coil entering air side.
 2. For a single-section coil use the piping shown for the upper section. For coils with two sections use the piping shown for the upper and the middle sections.
 3. The lower section is always the first section to be activated and the last to be shut off.
 4. Refer to the Carrier System Design Manual, Part 3, for more guidance on piping techniques.

Fig. 6 - Suction line piping



ACCESSORIES

The field-installed accessories are shipped with full installation instructions and/or a wiring diagram.

- Single- or two-stage low voltage thermostat.
- Additional capacity unloader
- Fan speed controller to maintain the condensing pressure in the winter months
- Hot gas bypass
- Control circuit transformer
- Coil protection grilles
- Compressor operating hours counter
- Compressor oil differential pressure gauge
- Gauge panel (HP-LP)

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.

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 (%) :

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

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.

Start-up

IMPORTANT: Commissioning and start-up of the chiller must be supervised by a qualified refrigeration engineer.

Preliminary checks

Before the unit pre-start-up, or start-up follow the start-up checklist on page 3 of this document. Use of this list will ensure a troublefree start-up, maintaining the initial operating parameters.

Never start the unit, even momentarily, without fully understanding the instructions in this document and without having taken the following precautions:

- Confirm that the power supply corresponds to the data on the unit nameplate.
- Check that the crankcase heaters are securely in place.
- Touch the compressor crankcase to confirm that the crankcase heaters are working. Each compressor is equipped with a heater (see wiring diagram) which is energized when the unit is switched off to ensure proper lubrication of the compressor.

- Open the compressor suction and discharge line valves, and then close them one turn each to stabilise the pressure to the control gauges (if fitted).
- Open the liquid line service valves.
- Check that the compressor sight glasses show an oil level between 1/8 and 3/8 (check all compressors).
- Check that there are no refrigerant leaks.
- Confirm that the discharge muffler securing bands are secure.

Electrical checks

Switch the power off.

Open the control circuit switch. Check the mains supply voltage at the power supply bus bars.

- Check the connections to the transformers.
- Check the control circuit with reference to the unit wiring diagram.
- Check the tightness of all electrical connections (terminals, connectors, bus bars etc.)
- Check the direction of rotation of the three-phase fan motors. Viewed from above the unit the direction of rotation of the plastic blades must be counter-clockwise. Swap any two of the three wires to correct the direction of rotation, if necessary.

Unit start-up

Set the room thermostat to a temperature that is lower than the room temperature in order to try to start up the unit. After this check reset the thermostat to the set point which corresponds to the required temperature.

Pressure-operated capacity control valves

See Fig. 7 and capacity reduction table.

Pressure-operated control valve

These valves are suction pressure-controlled and discharge pressure-actuated. Each valve controls two cylinders. At start-up the controlled cylinders do not load up until the differential between the suction and discharge pressure is 70 kPa (10 psig).

Control setpoint

The cylinder control setpoint is set between 0 kPa and 586 kPa. The differential pressure (difference in pressure between the suction and discharge ports in a cylinder) is controllable between 41 kPa and 152 kPa.

Setpoint control (cylinder load point)

Turn adjustment nut ① clockwise to its maximum position. The setpoint is now 586 kPa.

The setpoint can now be adjusted to the desired pressure by turning the adjustment nut counter-clockwise. The number of turns required can be determined from the curve. Each full turn counter-clockwise decreases the setpoint by approximately 51 kPa. 11-1/2 turns will decrease the setpoints from 586 kPa to 0 kPa.

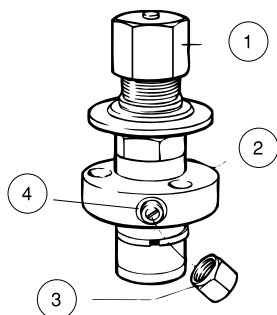
Pressure differential (difference between cylinder load point and unloader points)

Turn the adjusting screw ④ counter-clockwise to its back stop position. In this position the differential is 41 kPa. The pressure differential is set by turning the adjusting screw clockwise. Each full turn increases the differential by 10 kPa. Approximately 10 turns clockwise will increase the pressure to 152 kPa.

The capacity control factory settings for 4-cylinder units are: 475 kPa gauge control setpoint (cylinder load point), 70 kPa differential, 405 kPa gauge cylinder unload point.

The settings for 6-cylinder units are: the left cylinder bank setpoint is 482 kPa gauge (70 kPa differential); the right cylinder bank setpoint is 469 kPa gauge (70 kPa differential).

Fig. 7 - Pressure-operated control valve



- Legend:**
- 1 Control setpoint adjustment screw
 - 2 Valve body
 - 3 Sealing cap (covering the differential adjustment screw)
 - 4 Differential pressure adjustment screw

Modifications

It is possible to convert pressure-controlled capacity reductions to electrically controlled reductions or to add capacity reductions in accordance with the table below.

38AJ/AZ	Pressure-controlled unloader standard	Possibility of changing press. to electric unloader	Possibility of 2 pressure-contr. unloaders
008	-	-	-
010	-	-	-
012	-	-	-
014	yes	yes	yes
018	yes	yes	yes
024	yes	yes	yes
030	yes	yes	yes
036	yes	yes	yes
046	yes	yes	yes
062	yes	yes	yes
074	yes	yes	yes

Low and high pressure switch control and condensing pressure pressostat control

Pressostat control: 38AJ/AZ	High pressure, kPa		Low pressure, kPa		Condensing pressure, kPa	
	Opens	Closes	Opens	Closes	Opens	Closes
008-012	2500	2150	50	150		
014-036	2900	2200	50	150	870	1820
046-074	2900	2500	240	390	870	1820

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

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.

WARNING: To ensure proper operation of these units there must be at least 5 K of subcooling as the liquid refrigerant enters the expansion valve (difference between the saturated pressure at the liquid valve and the liquid temperature).

The 38AJ/AZ units use a liquid 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.

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.

CAUTION: 38AZ units are designed to run on refrigerant HFC-407C. 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.

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).
 - After detection and repair completely drain the refrigerant charge, using a refrigerant recovery unit, then recharge completely, following the precautions given above.

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 compressors 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 absolutely not compatible with R-407C.

Recommended oil:

R-22 semi-hermetic compressors:

- Mineral oil, Carrier specification No. PP 33-02
- Suniso 3 GS (Sun Oil Co)
- Capella WF 32-150
- Clavus G 32 (Shell Oil Co)
- Gargoyle Artic (Mobil Oil) - original charge

R-407C semi-hermetic compressors:

- Polyester oil without additives (POE), Carrier specification No. PP 47-26
- Polyolester Mobil Oil EAL 68

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 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.

Oil pressure safety switch

38AJ/AZ 014-074 units have an oil pressure safety switch which shuts down the unit if the oil differential pressure at the compressor either fails to reach or to be held at the proper level.

To restart the unit press the manual reset button on the main circuit breaker and set the fan switch to OFF and then to ON.

NOTE: Damage resulting from failure to follow these instruction is not covered by the product warranty. Compressor motor protection

Compressor protection devices

Circuit breaker

Calibrated, thermo-magnetic, manually reset circuit breaker protects the compressors against locked rotors and overloads. It also offers protection against excessive current draw up to the trip capacity given in 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 - 38AJ/AZ 018-074

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.

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.

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.

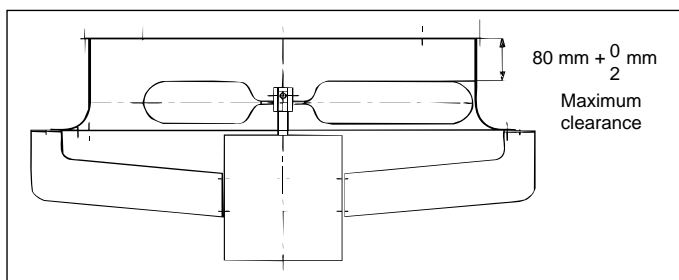
WARNING: Never use pressurized air or water, as this will damage the fins, and always clean them against the normal air flow direction.

Fan motor replacement

38AJ/AZ 008-012 units

Follow the safety considerations. Fan motors can be easily removed through the top of the unit. Take care not to damage the propeller. Label the wires to facilitate correct reassembly later.

38AJ/AZ 008-012 fan



38AJ/AZ 018-024 units

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.

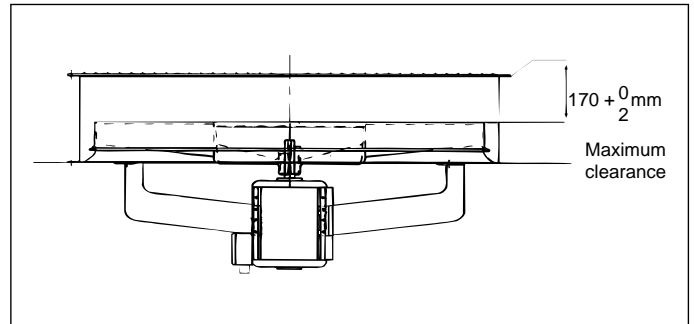
WARNING: Remove only the lower bolts to prevent the motor from falling.

- 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 170 + 0/2 mm between the upper edge of the fan and the upper edge of the volute. The tightening torque on the fan motor support fixing screws must be 9 Nm.

CAUTION: On unit sizes 38AJ/AZ 014-074 the fan rotation is counter clockwise, viewed from above.

38AJ/AZ 014-074 fan



Fan motor protection

All fan motors have thermal protection which will stop the current flow when the fan motor temperature becomes too high. The fans will restart automatically when the motor temperature drops to a safe level. In addition all fan motors are protected by one or several circuit breakers.

Refrigerant circuit

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
Compressor does not run	Power line open Tripped circuit breaker Safety thermostat tripped Contactor stuck open Loose terminal connection Improperly wired controls Low line voltage Compressor motor defective Seized compressor Chilled water flow switch open	Reset circuit breaker Check control circuit for ground or short; repair and reset breaker Reset thermostat Replace contactor Check connections Check wiring and rewire Check line voltage - determine location of voltage drop and remedy deficiency Check motor windings for open or short. Replace compressor, if necessary Replace compressor Check chilled water pump. Check switch.
Compressor stops or cycles rapidly on low-pressure control	Low-pressure control erratic in action Compressor discharge valve partially closed Low refrigerant charge Filter-drier blocked or fouled	Raise differential setting. Check capillary for pinches. Replace control. Open valve Add refrigerant Clean strainer. Clean or replace.
Compressor cycles rapidly on high-pressure control	High-pressure control erratic in action Compressor discharge valve partially closed Air in system Condenser fan(s) not operating or low air flow	Check capillary tube for pinches. Set control as required. Open valve, or replace if defective. Purge, dehydrate and recharge. Check motor and wiring. Repair or replace if defective. Check fan position and security on shaft.
Operating cycles too long or continuous operation	Low refrigerant charge Control contacts fused Air in system Partially blocked or blocked expansion valve or strainer Defective insulation Inefficient compressor	Add refrigerant. Replace control device concerned Purge Clean or replace Replace or repair Check valves, replace if necessary.
System noises	Piping vibrations Expansion valve hissing Compressor noisy	Support piping as required. Check for loose pipe connectors. Add refrigerant. Check for blocked liquid line strainer. Check valve plates for valve noise. Replace compressor (worn bearings). Check for loose compressor hold-down bolts.
Compressor loses oil	Leak in system Crankcase heaters not energizing during shutdown	Find and repair leak, pump down and recharge. Replace heaters, check wiring.
Frosted or sweating suction line	Expansion valve admitting too much refrigerant	Adjust expansion valves.
Hot liquid line	Shortage of refrigerant due to leak Expansion valve closed too far	Repair leak and recharge. Adjust expansion valve.
Frosted liquid line	Restricted filter-drier	Remove restriction or replace filter-drier.
Compressor will not unload	Burnt-out coil Leaky bypass piston Miswired solenoid Weak bypass piston spring	Replace coil. Replace. Wire correctly. Replace.
Compressor will not load	Damaged bypass piston Miswired solenoid Blocked bypass port strainer (high side)	Replace. Wire correctly. Clean.



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Manufacturer reserves the right to change any product specifications without notice.

**ENVIRONMENTAL
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