



# **INSTRUCTION MANUAL**

## **Iceman Portable Chiller System**

Models covered AC, AS, WC, and WS

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# Section 1 – Warnings and Cautions

Please read and understand this section before operating the system!

## 1.1 Electrical warning



The Mokon portable chiller system, as with all high voltage electrical equipment, should be connected according to all local and national codes. All installation, maintenance, service, repair, adjustment, and operation should be done only by qualified trained electrical personnel who have read and completely understood this instruction manual. To the upper right is a symbol for **ELECTRICAL DANGER**. When it is seen on the following pages of this manual as well as on the system, care should be taken to avoid possible electric shock. All maintenance and service should be performed with the power isolated and locked out except where noted.

## 1.2 Evaporator freeze-up caution



Protect the evaporator on the Mokon portable chiller system from freeze-up. Evaporator temperatures are 10°F - 15°F (-2° to -9°C) lower than the coolant temperature shown on the thermostat or the temperature controller. **Standard systems are set to operate between 50°F – 65°F (10°C - 18°C), but are engineered to operate as low as 20°F (-7°C). Unless your system was set to operate below 50°F (10°C) at the time of purchase, do not attempt to operate your Mokon portable chiller system below 50°F (10°C) without first contacting the Mokon customer service department.** It will be necessary to derate the capacity of the system, change the default settings, and add glycol to the Mokon portable chiller system.

**Do not use automotive antifreeze in the Mokon portable chiller system due to waxy deposits that will form on the internal components at lower temperatures, reducing efficiency. Using automotive antifreeze will void your warranty!**

Only pure ethylene glycol/water mixture should be used. Mokon recommends that a food coloring dye be added to signify that glycol is present in system. The glycol should have a corrosion inhibitor added to reduce the risks of metallic degradation.

**NOTE:** The automatic fill option should not be used when system operating temperatures are below 50°F. The glycol in the reservoir tank will become diluted which will lead to system freezing.

## 1.3 Cold weather caution



If the Mokon portable chiller system will be moved from your plant and will be subjected to freezing temperatures, the water in the system must be completely drained and/or sufficient antifreeze (not automotive antifreeze) added to prevent serious water damage from freezing.

## **1.4 Overhead piping warning**

When overhead piping is connected to a Mokon portable chiller system equipped with an open reservoir or non pressurized expansion tank there is risk of overflow of the system's reservoir tank upon shutdown, this is due to the back flow of fluid volume from the overhead piping system.

To prevent reservoir tank overflow an overhead piping kit should be installed. This kit is available from Mokon as an option.

## **1.5 Reservoir tank overflow connection**

A reservoir tank overflow connection is supplied on all Mokon portable chiller systems with an automatic fill option. Should the automatic fill option malfunction the overflow connection will protect the system against an overflow condition. This connection is clearly labeled on the system and must be plumbed to a non-pressurized open drain connection.

## **1.6 Short circuit current rating caution**

Equipment supplied with a safety door disconnect is design rated for a short circuit current rating (SCCR) of 5,000 amperes RMS if protected with a class "RK5" fuse and, equipment supplied with a power cord is design rated for a short circuit current rating (SCCR) of 10,000 amperes RMS if protected with a class "J" fuse.

## Section 2 – Installation

### 2.1 Unpacking

Upon arrival inspection should be done to assure there was no damage during shipping. In addition, all electrical and mechanical connections should be inspected to ensure that they are secure and tight. This includes all electrical terminations, mechanical fitting union bulbs, compression fittings, etc.

**Note:** Refer to section 4.1 Preventative maintenance.

The **maximum** weights of the Mokon chiller systems when drained of water are:

1 hp and smaller - 350 lbs (160 kg)

2 and 3 hp - 650 lbs (295 kg)

5 hp - 725 lbs (340 kg)

7.5 thru 10 hp - 1500 lbs (680 kg)

Properly rated equipment should be used to move this machinery.

When removing system from pallet, lift from bottom only. Care should be taken to ensure that the system will not tip. After removing from pallet, the system should only be placed on a level surface.

### 2.2 Location

Mokon systems should be located in an area that provides adequate space for pedestrian and vehicle traffic. If this is not feasible, owner should provide additional safeguards including safety signs.

For optimum system performance, allow adequate space and ventilation around entire system, as well as a means to direct vapors away from work area.

There should be a minimum of four (4) feet of clearance around the entire Mokon system (all sides) for adequate ventilation and operation of the system.

If braking casters are included, they must be in the locked position when system is in the operating position. Prior to moving, unlock the casters.

Customer supplied and installed air vents (mechanical or electrical) should be placed at the highest point in the process for application where the process height is greater than eight (8) feet above Mokon system.

## 2.3 Warnings

Owner should ensure by adequate supervision that correct safety, installation, maintenance and operating procedures described in this manual, as well as recognized industry practice, are followed by all personnel.

All panels must be in place during normal operation.

The top of the machinery should not be used for storage.

Power sources or energy types referred to in this manual are water, glycol and electricity.

This machinery is not for use in hazardous or explosion proof environments.

Under normal operating conditions, the decibel level of the machinery is 80 db or lower from 5' away from the system. When operating the system, hearing protection is recommended.

Any alteration, additions or modifications to any part of the system must receive prior written approval from Mokon's Engineering or Customer Service Departments.

Refer to serial tag for motor and heater electrical information and schematic drawing number.

## 2.4 Electrical connections



**Warning: The Mokon portable chiller system, as with all high voltage electrical equipment, should be connected according to all applicable state and local codes. All installation, maintenance, service, repair, adjustment, and operation should be done only by qualified trained electrical personnel who have read and completely understood this instruction manual.**

**Before operating the Mokon portable chiller system, the grounding wire must be connected. The grounding wire is the green or green and yellow wire connected to the frame of the system.**

For all systems, connect ground wire to the ground screw (labeled PE or GND) located in the electrical box.

For three phase systems: Connect the power cord leads inside the electrical box L1, L2, and L3 to terminals 2, 4, and 6 respectively on the safety disconnect switch located inside the electrical box. The customer supplied main electrical disconnect should be fused for the proper amp draw (see specifications on the serial tag).

## 2.4 Electrical connections (cont)

For single phase systems: Connect the power cord leads inside the electrical box L1 and L3 to terminals 2 and 6 respectively on the safety disconnect switch located inside the electrical box. The customer supplied main electrical disconnect should be fused for the proper amp draw (see specifications on the serial tag).

**NOTE:** For systems without an optional power cord, there is an entry hole in the electrical box for the customer-supplied power cord. Depending on the size of your power cord it may be necessary to enlarge this hole.

## 2.5 Fluid connections



Following are the fluid connections for the Mokon portable chiller system, both the water-cooled and the air-cooled version. **Connect each port with full size, unrestricted, insulated hose or pipe.** The hose or pipe should be equivalent in diameter to the port and rated for 100 PSI (689 kPa) and 100°F (38°C).

Fluid connection/port sizes

Water cooled tonnage	Connection size	
	Process	Condenser
2	1"	0.5"
3	1"	0.5"
5	1.5"	0.75"
7.5	1.5"	1.5"
10	1.5"	1.5"
15	1.5"	1.5"
20	1.5"	1.5"
25	2"	2"
30	2"	2"

Air cooled tonnage	Process connection size
0.5	0.5"
1	1"
2	1"
3	1"
5	1.5"
7.5	1.5"
10	1.5"
15	1.5"
20	1.5"
25	2"
30	2"

### Process fluid connections (all systems)

**NOTE:** If the Mokon portable chiller system will feed a pulsating system such as a temperature control system, a bypass valve must be installed to ensure flow.

There are two process fluid connections, "To Process" and "From Process" located on the back of the system.

To Process: Connect this port to the process inlet, through which chilled fluid will enter the process.

From Process: Connect this port to the process outlet, through which fluid will leave the process and return to the chiller. **The fluid returning from the process must have a temperature of lower than 80°F (27°C).**

**NOTE:** Mokon recommends that you install a strainer on the "from process" line to prevent contamination from the process to enter the chiller. These strainers are available from the Mokon factory.

## 2.5 Fluid connections (cont)

### Reservoir tank overflow connection

A reservoir tank overflow connection is supplied on all systems with an automatic fill option. Should the automatic fill option malfunction the overflow connection will protect the system against an overflow condition. This connection clearly labeled on the system and must be plumbed to a non-pressurized open drain connection.

### Condenser cooling water connections (WC, WS systems only)

Condenser cooling water may be obtained from city or tower water supplies. The water usage is dependent on the tonnage of the system and temperature of the water. Variation in the cooling water temperature will lead to variation in water usage. If city water is being used, it will need approximately 1.5 gpm (5.7 lpm) per ton of refrigeration. If tower water is being used, it will need approximately 3 gpm (11.3 lpm) per ton of refrigeration. Mokon recommends that you install a strainer on the condenser water supply line to eliminate any unnecessary fouling. The connections for the condenser cooling water are located in the back of the system, labeled "Supply Water" and "Drain Water".

Supply Water: Connect this port to an adequate source of cold, clean supply water. Do not restrict incoming water to the condenser.

Drain Water: Connect this port to drain. Do not restrict outgoing water from the condenser.

## 2.6 Filling reservoir tank

- Isolate and lock out all power sources.
- Remove the top panel of the Mokon portable chiller system.
- Remove the lid to the reservoir tank.
- Fill the reservoir tank to a minimum of 3/4 full of water or water/glycol mixture. Use of glycol **IS REQUIRED FOR OPERATION BELOW 45°F**. The table on page 7 lists the correct glycol/water mixtures for operating at temperatures below 45°F.

**Warning: The use of "ultra" pure fluids (de-ionized, de-mineralized, etc.) in the standard Mokon systems is prohibited and will void the systems warranty.**

**Please contact the Mokon factory for further recommendations.**

**Warning: Use a pure ethylene glycol/water mixture with a corrosion inhibitor in the Mokon portable chiller system. Do not use automotive antifreeze! Automotive antifreeze will cause damage to the system, voiding your warranty and result in reduced efficiency.**

## 2.6 Filling reservoir tank (cont)

- After the Mokon portable chiller system is operating and all lines to the process and within the chiller are full, maintain a minimum 3/4 full tank level. This will require the addition of more water or water/glycol to the tank after start up. The table below is for reference only.

Water/Glycol mixture

Fluid temperature from system	% Glycol	% Water
44°F to 32°F (7°C to 0°C)	10	90
31°F to 25°F (-6°C to -4°C)	15	85
24°F to 20°F (-4°C to -7°C)	20	80
20°F to 0°F (-7°C to -18°C)	40	60
0°F to -20°F (-18° to -29°C)	50	50

**NOTE:** Evaporator temperatures are 10°F – 12°F (-12°C to -11°C) lower than process fluid temperatures.

**NOTE:** Standard systems are set to operate between 50°F – 65°F (10°C - 18°C), but are engineered to operate as low as 20°F (-7°C). Unless your system was set to operate below 50°F (10°C) at the time of purchase, do not attempt to operate your Mokon portable chiller system below 50°F (10°C) without first contacting the Mokon customer service department. It will be necessary to derate the capacity of the system, change the default settings, and add glycol to the Mokon portable chiller system.

**NOTE:** Do not operate your chiller below 50°F (10°C) if system is equipped with an automatic fill option. The glycol will become diluted and your system will freeze.

## Section 3 – Operation

The Mokon portable chiller system is a circulating fluid temperature control system, which is capable of providing chilled water or a water/glycol mixture to a process at lower temperatures than available from conventional water supplies. The system is designed for normal operating temperatures of 20°F to 65°F (-7°C to 18°C) unless otherwise noted. The Mokon portable chiller system is a system consisting of a refrigeration loop and water or water/glycol loop.

The refrigerant loop circulates refrigerant through a variety of components, which causes the refrigerant to change phase from a gas to a liquid and then back to a gas. This produces a chilling action on the chilled water loop. The compressor takes the refrigerant from a low pressure, low temperature gas and compresses it to a high pressure, high temperature gas which flows to the condenser. The condenser changes the refrigerant from a gas to a liquid under high pressure. This flows through a filter dryer (to remove any dirt, debris, and moisture) then to a moisture indicator (to indicate any moisture problem) and then to a thermal expansion valve. The thermal expansion valve regulates the flow of high pressure liquid refrigerant into the evaporator, where the refrigerant changes from a high-pressure liquid to a low-pressure gas. The refrigerant absorbs heat from the water or water/glycol mixture in chilled fluid loop on the other side of the evaporator causing a phase change of the refrigerant, from a liquid to a gas. The refrigerant, as a low-pressure gas, returns to the compressor and the evaporator to dissipate it.

The circulating fluid is pumped through the evaporator via a supply pump. As mentioned above, the refrigerant on the refrigerant loop absorbs heat from the water or water/glycol mixture and chills it. The water then flows to the process where it again picks up heat and returns to the evaporator to dissipate it.

Due to the use of high-pressure refrigerant and to ensure proper operation of the system, several safety devices are standard on the Mokon portable chiller system. **Only a qualified refrigeration technician should be allowed to service the system.**

### 3.1 Initial starting procedure

After all connections are made and the reservoir tank is filled as described in section 2.6, the Mokon portable chiller system is ready to be started.

**NOTE:** Regardless what type of heat-generating process your Mokon portable chiller system is used on, **it is important that the Mokon portable chiller system is the first piece of equipment started.** If you do not start the Mokon portable chiller system first, too much heat can accumulate and the system will not be able to catch up, appearing to be undersized for the application.

### 3.1 Initial starting procedure (cont)

- For “initial start-up” it is recommended to turn on the main electrical disconnect **for at least 12 hours before starting the Mokon portable chiller system.** This will preheat the compressor oil and liquid refrigerant helping to protect the compressor.

If the power has been disconnected more than 2 hours and less than 3 where the Mokon disconnect switch is in the “off” position, power to main electrical disconnect is recommended **for at least 4 hours before starting the Mokon portable chiller system.** This applies if the ambient air temperature is above 60°F (15.5°C), and the system is located indoors. If the system is not located indoors or the ambient air temperature is lower than 60°F (15.5°C), refer to the initial start-up instructions.

If power disconnection to the compressor is longer than 3 hours refer back to initial start-up instructions above.

Ideally, it is recommended that power be applied to the system continuously except for service purposes.

It is recommended that the crankcase heater should be checked for proper operation on a regular basis.

**Warning: During normal operation the compressor can get very hot which can cause burns. Do not touch the compressor or any of the refrigeration system piping during operation or if the system has been in operation.**

- Remove both side panels for access to, and observation of, the system.
- For water-cooled condensing systems, turn on the water flow to “supply water” connections. (See section 2.5 for fluid connections)
- Check the pump rotation using the following procedure (for 3 phase systems):
  - Turning on the supply pump **momentarily**; press the “start” button (the green light will illuminate) then the “stop” button (the green light will go off).
  - Check the rotation of the supply pump by viewing the motor armature through the louvers on the back of the motor as it slows down. The armature should be turning clockwise from the lead (rear) end.
  - If the rotation is incorrect, deactivate the power supply to the Mokon portable chiller system and switch any two power cord wires (L1, L2, L3) on the inlet of the disconnect switch.
- Restart the supply pump by pressing the “start” button (the green light will illuminate). The supply pump should provide 35 - 45 PSIG (241 - 310 kPa) of pressure to the process. Allow the fluid to circulate for a few minutes to eliminate air pockets from the lines. This will decrease the possibility of cavitations.

### 3.1 Initial starting procedure (cont)

- Turn on the compressor by pressing the “start” button (the green light will illuminate).
  - For systems equipped with a scroll compressor: Check the rotation of the compressor using the following procedure.
    - Observe the high/low refrigeration gauges.
    - Turn on the compressor by pressing the “start” button (the green light will illuminate).
    - The high/low refrigeration gauges should rise/fall to proper levels (refer to the last step)

**NOTE:** Phasing of the compressor is verified at the Mokon factory and should not be tampered with in anyway. If compressor phase verification is required contact the Mokon customer service department for instructions. Failure to do so will void your system’s warranty.

**Warning: Do not run the scroll compressor in reverse direction.**

- Check the refrigerant pressure for the proper reading. The high-pressure reading is 200 - 300 PSI (1379 - 2068 k Pa) for R-22/R-407C or 110 – 230 PSI (758 - 1586 k Pa) for R-134A dependent on load. The normal low-pressure readings are listed below in the table. If the pressures are other than these, **CONSULT THE MOKON FACTORY.**

Normal low pressure gauge readings

Chilled fluid temperature	Nominal low pressure gauge reading	
	R-22/R-407C	R-134A
60°F (16°C)	80 PSIG (552kPa)	45 PSIG (310kPa)
50°F (10°C)	65 PSIG (448kPa)	35 PSIG (241kPa)
45°F (7°C)	60 PSIG (414kPa)	30 PSIG (207kPa)
40°F (4°C)	55 PSIG (379kPa)	25 PSIG (172kPa)
30°F (-1°C)	30 PSIG (207kPa)	18 PSIG (124kPa)
20°F (-7°C)	30 PSIG (207kPa)	11 PSIG (76kPa)

- Set the controller or thermostat to the desired temperature. See section 5 for complete controller directions for systems, which have a controller.

## 3.2 Shut down procedure

**Note:** The Mokon portable chiller system should be the last piece of equipment shut off to protect the system from overheating.

- Turn off the compressor by pressing the “stop” button (the green light will go off).
- Turn off the supply pump by pressing the “stop” button (the green light will go off).
- The main electrical power to the Mokon portable chiller system should remain connected.

**Note:** When the power is turned off to the system, the compressor crank case heater is also turned off which will hamper the system’s ability to burn off liquid in the compressor which will result in damage to the compressor.

- The main electrical power and the supply water (for water-cooled systems) to the Mokon portable chiller system may be turned off if the system is being relocated or for prolonged shut down.

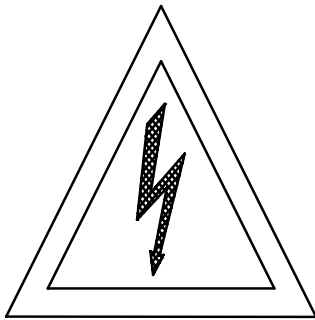
## 3.3 Restarting procedure

- If the water lines and main electrical power have not been disconnected, refer to section 3.1.
- If the water lines and/or the main electrical power have been disconnected, refer to section 2.4 for electrical connections, section 2.5 for fluid connections, and section 3.1 for initial start-up procedure.

## Section 4 – Maintenance and Service

**Warning:** The maintenance and service procedures included in sections 4.1 – 4.2 require that all power sources to the Mokon portable chiller system be shut off, isolated and locked out (exceptions noted). Follow all local and national codes and procedures for working on electrical equipment. Failure to do so could result in injury or death. Only qualified electrical personnel should install, maintain, repair, adjust, and operate Mokon portable chiller systems. The instruction manual furnished with the system should be completely read and understood before system maintenance.

The following hazard warning symbols will be used to denote a specific hazard associated with a procedure.



Electrical Danger



High Temperature  
Surface May Be Hot



High Voltage &  
Hot Surface

### 4.1 Preventative maintenance

Mokon portable chiller systems are designed for a long, trouble free service life under a variety of conditions, with a minimum of maintenance. Performing the following preventative procedures will extend the life of your system. Refer to section 4.1 - 4.2 in the instruction manual for specific adjustment or service procedures. Refer to the condensed parts list included in section 8 of the instruction manual for proper replacement parts if required.

The preventative maintenance section is broken into weekly, monthly, and every three months checks. Associated with each check is a series of corrective procedures that may solve a problem detected in the check. If the corrective procedures do not resolve a problem detected in the check, see the trouble shooting guide in section 7 for a complete list of corrective measures.

#### 4.1 Preventative maintenance (cont)

##### Electrical preventative maintenance


Weekly Checks	Corrective Procedures
Check electrical box interior components for any discoloration, or any burn marks	Correct component wiring
	Verify voltage and frequency stamped on system matches customer supply voltage and frequency
	Correct excessive system load (current draw)
Check voltage and current capacities	Verify customer supply voltage is balanced and fluctuations are within 15% of nominal
	Verify wire gauge for main power hookup is properly sized
	Replace components if needed
Slightly tug on each conductor to make sure it makes a solid contact to its attached component. Pay close attention to the green grounding wires.	Tighten with proper tooling
Every 3 Months Checks	Corrective Procedures
Check that the interior electrical and mechanical components are securely fastened to the back panel, and/or to the sides of the electrical box	Tighten with proper tooling
Check that the ratings of overload protection (such as fuses and circuit breakers) adequately protect the line's maximum current carrying capacity	Inspect/replace fuses
	Inspect/replace motor starter overloads

## 4.1 Preventative maintenance (cont)

### Pump/motor and mechanical connections preventative maintenance

Weekly Checks	Corrective Procedures
Check for foreign materials obstructing airflow in the motor and pump area	Remove all dust, lint, grease or oil with a cloth and/or brush
Monthly Checks	Corrective Procedures
Check that all bolts and screws are securely tightened	Tighten with proper tooling
Check that the motor current draw matches the serial tag rating	Correct motor wiring Verify supply voltage is balanced and fluctuations are within 15% of nominal
Visually check all threaded fittings for signs of leakage. <b>Note:</b> If refrigeration oil has visibly leaked from the refrigeration loop plumbing, it must be repaired only by a qualified refrigeration technician.	Tighten with proper tooling
	Contact Mokon customer service or a qualified refrigeration technician
	Replace necessary parts if leaks persist
Semi Annual Check	Corrective Procedures
The system's internal and external hoses and clamps should be inspected	Tighten with proper tooling
Check that all threaded fittings within the fluid loop are securely tightened. <b>Note:</b> If refrigeration oil has visibly leaked from the refrigeration loop plumbing, it must be repaired only by a qualified refrigeration technician.	Tighten with proper tooling
	Contact Mokon customer service or a qualified refrigeration technician
	Replace necessary parts if leaks persist

### Miscellaneous preventative maintenance

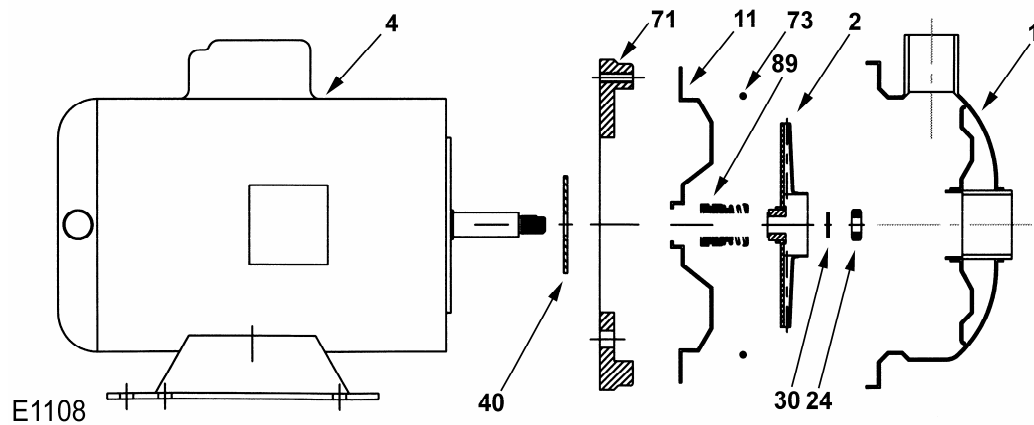
Monthly Checks	Corrective Procedures
 <p>Check that all applicable lights, gauges, and indicators are functioning properly (Power On)</p>	Replace necessary parts
Check that the "Warning," "High Voltage," "Caution," and lamicaid labeling are adhering to the correct locations	Replace torn, damaged or missing labels
Check the condenser coil (air-cooled systems) is free of dirt and debris	Vacuum, blow clean, or chemically clean

## 4.2 Pump maintenance

Exploded view drawing

REF NO.	QTY	3 HP	1 HP	1.5 HP	5 HP	3/4 HP	DESCRIPTION	PART #
1	1	✓	✓	✓		✓	CASE 1.25 x 1 NPT	018266
	1						CASE 1.25 X 1 NPT	018268
	1				✓		CASE 1.5 x 1.25 NPT	018267
2	1					✓	IMPELLER 4.88", STAINLESS	018275
	1		✓	✓			IMPELLER 5.25", STAINLESS	018276
	1	✓					IMPELLER 6.3", STAINLESS	018277
	1				✓		IMPELLER 6.3", STAINLESS	018342
4	1	✓	✓	✓	✓	✓	MOTOR 56J	CONSULT FACTORY
11	1	✓	✓	✓	✓	✓	COVER, STAINLESS	018269
24*	1	✓	✓	✓	✓	✓	NUT	018270
30*	1	✓	✓	✓	✓	✓	D-WASHER	018271
40*	1	✓	✓	✓	✓	✓	FLINGER	018272
71	1	✓	✓	✓	✓	✓	DISC IRON	018273
73*	1	✓	✓	✓	✓	✓	GASKET, CASE	018274
89*	1	✓	✓	✓	✓	✓	SEAL, 5/8"	IN REPAIR KIT

\* - DENOTES COMPONENTS INCLUDED IN REPAIR KIT 018246.



## 4.2 Pump maintenance (cont)

Seal replacement/maintenance

**Warning: Make certain that the system is disconnected from the power source in compliance with all local and national codes before attempting to service or remove any components. Never run the pump when dry.**

Maintenance:

Inspection: Pump should be periodically checked for proper operation. If the system has changed or if the pump is operating noisily or erratically, then the pump should be removed and examined. It should be repaired and parts replaced as necessary.

Cleaning: Remove oil, dust, dirt, water, chemicals from exterior of pump and motor. Blow out interior of open motors with clean compressed air at low pressure. Regularly drain moisture from TEFC motors.

Draining: If the pump is located in an area subject to freezing temperatures, the pump must be drained when not in operation or add sufficient antifreeze.

Seal replacement:

Disassembly:

- Turn off power.
- Drain the Mokon portable chiller system. Flush if necessary.

Necessary tools:

- 3/8" drive ratchet
- Pry bars (2)
- Flat blade screwdriver
- 6" socket extension 3/8"
- Gloves
- 1/4" Hex Allen wrench/socket
- 1/2" Socket

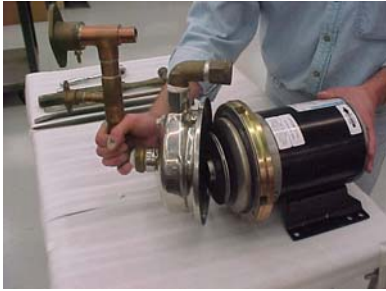


## 4.2 Pump maintenance (cont)

### Seal replacement/maintenance



- Remove pump/motor from cabinet.

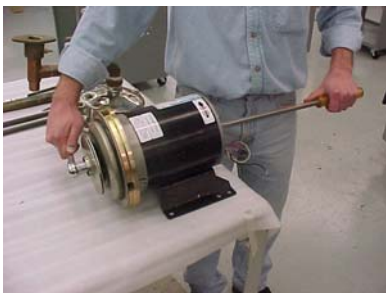


- Remove casing screws and remove case. Inspect o-ring for wear or damage.



- Remove the cap at the lead end of the motor. A screwdriver slot will be exposed. Use a screwdriver to stop the shaft from turning.

**Caution: Do not insert screwdriver between impeller vanes to prevent rotation. This can damage the impeller.**



- Remove the impeller lock nut and washers by turning counter clockwise when looking at the front of the pump.

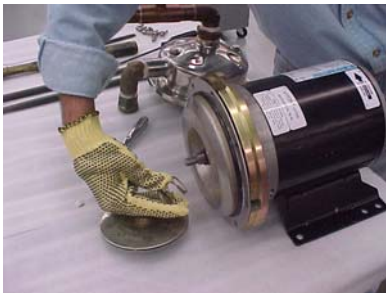
## 4.2 Pump maintenance (cont)

### Seal replacement/maintenance



- Remove the impeller by turning counter clockwise. Protect the hand by wearing a glove.

**Caution: Failure to remove the impeller in a counterclockwise direction may damage the threading on the impeller, the shaft or both.**



- Remove the spring to the mechanical seal assembly.



- With two pry bars 180° apart and inserted between the seal housing and the motor plate adapter and carefully separate the two parts. The mechanical seal assembly will come off of the shaft inside the seal housing. It is not necessary to remove the cast iron disc from the motor.



- Using a dowel, push the mechanical seal assembly out of the seal housing from the motor side.

## 4.2 Pump maintenance (cont)

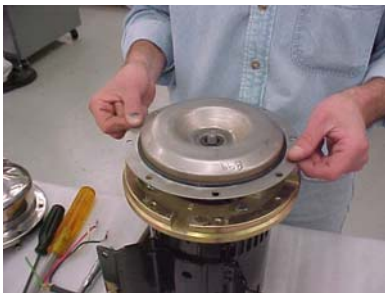
### Seal replacement/maintenance

#### Reassembly:

**Caution: The mechanical seal is a precision product and should be handled accordingly. Use care when handling lapped running surfaces of the mechanical seal to ensure they remain clean and are free of chips or scratches. Clean gasket and flange faces, seal seat cavity and shaft, in particular, shaft shoulder fitting against impeller.**



- Lubricate the seal seat cavity of the cover and the rubber cup or O-ring of stationary seal seat with the lubricating fluid that comes with the mechanical seal or repair kit. Press the stationary seat in seal seat cavity in the cover squarely and evenly using an arbor press (if possible) and the cardboard disc supplied with the seal. Be certain that the lapped face (shiny side) is facing you.



- Place the seal assembly housing (with the seal assembly inserted) onto the shaft and replace the spring. Lubricating fluid can be applied to the motor shaft and the rubber bellows of the seal used to facilitate assembly. **Do not contaminate the mechanical face seals with lubricant. Do not use petroleum based lubricants.**

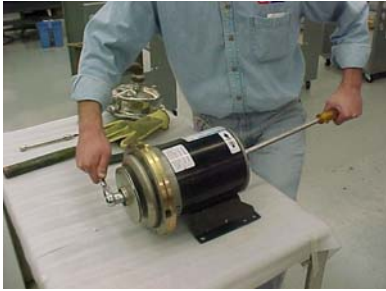


## 4.2 Pump maintenance (cont)

### Seal replacement/maintenance



- Thread the impeller onto the shaft by turning clockwise. Protect the hand with a glove. Prevent shaft rotation by using a screwdriver on the shaft end screwdriver slot.



- Replace the impeller lock nut and washer by turning clockwise. Prevent shaft rotation by using a screwdriver on the shaft end screwdriver slot.



- Replace the casing and casing screws and tighten finger tight. Finish tightening the cap screws alternately and evenly to approximately 6 ft. lbs. torque.

**Note:** It is imperative that screws be tightened alternately and evenly, as this action centers the cover in the casing, assuring proper alignment. Binding of the impeller in the case and adaptor may occur if the cap screws are not tightened as listed above.



## 4.2 Pump maintenance (cont)

### Seal replacement/maintenance



- Check for free rotation then replace the cap at the rear of motor. Reinstall pump/motor into system.

### 4.3 Glossary of indicators, gauges, and buttons

Supply pumps start/stop buttons:	Pilot light illuminates green to supply pump (chilled water circuit) to process is activated.
Compressor start/stop buttons:	Pilot light illuminates green to indicate refrigeration loop and compressor pump is activated.
No flow indicating light:	When illuminated indicates inadequate fluid flow returning to the Iceman system to ensure safe operation.
Freezestat indicating light:	When illuminated, indicates compressor has shut down due to coolant temperatures below safe operation.
Low refrigerant pressure indicating light:	When illuminated, indicates compressor has shut down due to low refrigerant pressure.
High refrigerant pressure indicating light:	When illuminated, indicates compressor has shut down due to high refrigerant pressure.
Supply pump pressure gauge:	Indicates fluid pressure for the "chilled water loop" going to the process.
Return temperature gauge:	Indicates the temperature of "chilled water loop" returning from the process.
High refrigerant pressure gauge:	Indicates the pressure of the refrigerant, as it is being condensed in the condenser. This pressure is critical to the performance of the chiller and is generated by the compressor. The normal pressure is between 200-300 PSIG/ 1379-2068 kPa (R-22/R-407C) or 110-230 PSIG/ 758-1586 kPa (R-134A) (depending on load).
Low refrigerant pressure gauge:	Indicates compressor suction pressure and is related to temperature setting and the adequacy of refrigerant charge.

## Section 5 – Eurotherm controller (3000 series)

Refer to the 4<sup>th</sup> character in the model code on the serial tag and then the model code in section 10 to determine your controller type.

### 5.1 Operation

This section of the manual contains all essential information needed to operate the controller. Contact Mokon Customer Service with controller problems as well as warranty and repair issues.

The controller is configured by model number. Inputs, outputs and alarm types are preset. Final setup and configuration are done from the keypad. The controller has four basic modes: Operator 1, Operator 2, Operator 3 and the configuration mode.

The controller's default level is Operator 1, and is used for day to day operation.

**Note:** Operator 2, 3 and configuration are password protected.

#### Home list navigation

To step through list levels press and hold the Page button until level 1 is obtained. Press the up button or the down button to change levels.

To step through parameters within a particular list, press the Scroll button until the required parameter is obtained.

To change the value (or state) of a parameter, press the Up button or the Down button.

**\*Refer to section 5.1 Keys for button locations and descriptions.**

Levels	Operator 1	Scroll	Function
	Parameter Mnemonic		
	WRK.OP	WORKING OUPUT The active output value	Output %
	SP1	SETPOINT 1	-----
	SP2	SETPOINT 2	-----
	DWELL	SET TIME DURATION	Auto air purge time setting
	T-REMIN	TIME REMAINING	Time remaining for Auto Air Purge
*	A1.xxx	ALARM 1 SETPOINT	Only shown if the alarm is configured. Where: xxx = alarm type. HI = High alarm; LO = Low alarm d.HI – Deviation high: d.LO = Deviation Low: D.HI = Deviation high
*	A2.xxx	ALARM 2 SETPOINT	
*	A3.xxx	ALARM 3 SETPOINT	
*	A4.xxx	ALARM 4 SETPOINT	
	A.TUNE	Auto Tune Enable	
	ID	Customer ID	Controller Revision #





\*Optional

## 5.1 Operation (cont)

### Keys

**NOTE:** Pictured is the 3216 Eurotherm controller - this also applies to 3204 and 3208 series controllers.



Button or Indicator	Name	Explanation
OP1	Output 1	When lit, it indicates that heating output is on. "HEATING" will scroll.
OP2	Output 2	When lit, it indicates that cooling output is on. "COOLING" will scroll.
	Page button	Press to select a new list of parameters.
	Scroll button	Press to select a new parameter in a list.
	Down button	Press to decrease a value in the setpoint.
	Up button	Press to increase a value in the setpoint.
*ALM	Alarm	Flashes when in alarm condition. "ALARM MESSAGE" will scroll.
OP4	Output 4	When lit indicates that the air purge output is on. "AUTO AIR PURGE" will scroll.
RUN	Timer Running	When lit indicates that the air purge output is on. "AUTO AIR PURGE" will scroll.

\*Optional

## 5.2 Automatic Tuning

In tuning, you match the characteristics (PID parameters) of the controller to those of the process being controlled in order to obtain good control. Good control means:

- Stable, 'straight-line' control of the PV as setpoint without fluctuation.
- No overshoot or undershoot, of the PV setpoint.
- Quick response to deviations from the setpoint caused by external disturbances, thereby rapidly restoring the PV to the setpoint value.
- Tuning involves calculating and setting the value of the parameters listed in the table below.

The PID controller consists of the following parameters:

Parameter	Meaning or Function
Proportional Band	The proportional term, in display unit or %, delivers an output which is proportional to the size of the error signal.
Integral Time	Removes steady state control offsets by ramping the output up or down in proportion to the amplitude and duration of the error.
Derivative Time	Determines how strongly the controller will react to the rate of change in the measured value. It is used to prevent overshoot and undershoot and to restore the PV rapidly if there is a sudden change in demand.
High Cutback	The number of display units, above setpoint, at which the controller will increase the output power, in order to prevent undershoot on cool down.
Low Cutback	The number of display units, below setpoint, at which the controller will cut back the output power, in order to prevent overshoot on heat up.
Relative Cool Gain	Only present if cooling has been configured. Sets the cooling proportional band, which equals the heat proportional band value divided by the cool gain value.

The controller uses a one shot tuner which automatically sets up the initial values of the parameters listed in the table.

The 'one-shot' tuner works by switching the output on and off to induce an oscillation in the measure value. From the amplitude and period of the oscillation, it calculates the tuning parameter values.


If the process cannot tolerate full heating or cooling being applied, then the levels can be restricted by setting the high power limit ('O P .HI') and low power limit ('O P .LO'). However, the measured value *must* oscillate to some degree for the tuner to be able to calculate values.

A One-Shot tune can be performed at any time, but normally it is performed only once during the initial commissioning of the process. However, if the process under control subsequently becomes unstable (because its characteristics have changed), you can return again for the new conditions.

## 5.2 Automatic Tuning (cont)

It is best to start tuning with the process at ambient conditions and with the SP close to the normal operating level. This allows the tuner to calculate more accurately the low cutback and high cutback values that restrict the amount of overshoot or undershoot.

### How to Tune:

- Set the setpoint to the value at which you will normally operate the process.
- Operator level 1 list, press,  until A.Tune appears. Set to ON.
- Press the Page and Scroll buttons together to return to the Home display. The display will flash [tunE] to indicate that tuning is in progress.
- After one (1) minute to determine steady state conditions the controller will induce an oscillation in the temperature by turning the output on and then off. The first cycle will not complete until the measured value has reached the required setpoint.

## 5.3 Troubleshooting

Diagnostic alarms:

Display Shows	What it means	What to do about it
E.ConF	A change made to a parameter takes a finite time to be entered. If the power to the controller is turned off before the change has been entered then this alarm will occur.  Do <b>not</b> turn the power off to the controller while ConF is flashing.	Enter configuration mode then return to the required operating mode. It may be necessary to re-enter the parameter change since it will not have been entered in the previous configuration.
E.CAL	Calibration error	Re-instate Factory calibration
E2.Er	EEPROM error	Return to factory for repair
EEEr	Non-vol memory error	Note the error and contact your supplier
E.Lin	Invalid input type. This refers to custom linearization which may not have been applied corrector or may have been corrupted.	Go to the INPUT list in configuration level and set a valid thermocouple or input type.

Note: Some error messages may not appear, depending on the controller options.

## 5.4 Alarm indicators

- ALM beacon flashing red = a new alarm (unacknowledged).
- This is accompanied by a scrolling alarm message. A typical default message will show the source of the alarm followed by the type of alarm. For example, "ALARM 1 FULL SCALE HIGH".
- If more than one alarm is present further messages are flashed in turn in the main display. The alarm indication will continue while the alarm condition is present and is not acknowledged.
- ALM beacon on continuously = alarm has been acknowledged.

To acknowledge an alarm

Press  and  together.

### Non-Latched Alarms

Alarm condition present when the alarm is acknowledged.

- ALM beacon on continuously.
- The alarm message(s) will continue to scroll.

This state will continue for as long as the alarm condition remains. When the alarm condition disappears all indication also disappears.

If the alarm condition disappears before it is acknowledged the alarm reset immediately.

## 5.5 Remote setpoint and retransmission "scaling"

Scaling of the 4-20mA and 0-10V signals for this option are as follows:

- 4mA or 0V = minimum system operating temperature.
- 20mA or 5V, 10V = maximum system operating temperature.

**NOTE:** Maximum system operating temperature value is reflective of the series system purchased, (refer to serial tag for maximum operating temperature located on Mokon system).

**Consult customer service at Mokon factory (716) 876-9951, regarding system's minimum and maximum temperatures if there are any questions.**

## Section 6 – Options

### 6.1 “Z” purge instructions for Mokon portable chiller systems

- A 3 inch diameter threaded pipe connection is provided to receive an air or nitrogen supply. To accommodate “Method 1” listed below, a 90 cfm blower or fan is recommended. The discharge pressure of the fan or blower needs to be, at least, 3.0 inches of water column for every 100 equivalent feet of 3” duct. For 4” duct, 1.0 inch of water per 100 feet is adequate. A 3” exhaust connection is also provided. **COMPRESSED “SHOP AIR” IS NOT RECOMMENDED.**

**Note: There are two methods for the supply of purge gas to systems for “Z” purge applications, they are as follows;**

- *Method # 1 (recommended): Due to temperature considerations, the purge gas must flow (sweep) through the system to insure adequate ventilation. This method would apply to water, oil, chiller, and full range heater/chiller systems.*
- *Method # 2: Pressurization of the cabinetry when temperature build up is not as much of a concern can be applied. Here the exhaust coupling on the cabinet would be plugged. This method would apply to water-cooled chiller systems or very low heating capacity systems.*
- Once the purge gas is introduced, the Dwyer model 1950-0-2F pressure switch will close, energizing a time delay relay. The relay prevents start up of the Mokon system until an adequate sweep inside the system has taken place. The switch is set at its minimum setting of 0.15 inches of water. A green pilot light will illuminate once the relay has “timed out”, indicating it is safe to operate the system.
- The magnehelic gauge has a scale of 0 to .5 inches of water, and is clearly visible to allow the operator to monitor the system.
- If the purge is lost, for any reason, the pressure switch will open, thus activating a customer supplied alarm through a set of auxiliary contacts. The Mokon system will also shut off.
- The applicable Class, Group and Division is listed on the bottom of the systems serial tag.

## Section 7 – Troubleshooting guide

### Process Loop

Problem	Possible Cause	Corrective Measure
Supply pump will not start	System unplugged / power off	Plug system in / turn power on
	Improper power source wiring	Check wiring (electrical schematics) and correct
	Blown fuse at power supply	Isolate open fuse and replace
	Blown control circuit fuse	Replace and check for ground condition
	Low voltage	Measure incoming voltage, if too low correct
	Overload on pump/motor starter	Consult factory
	Inadequate flow of process fluid	Inspect process and process lines for blockage; if blocked correct
	Flow switch	Inspect/replace component
Supply pump shuts down during operation	Overload on pump/motor starter	Consult factory
	Blown fuse at power supply	Isolate open fuse and replace
	Blown control circuit fuse	Replace and check for ground condition
Pump seal leaks	Faulty seal	Replace seal (see section 4.2 for seal replacement)
	Improperly aligned seal	
	Over-pressured seal	
Tank overflows or will not fill on systems with autofill option (water makeup valve)	Float switch	Inspect; if stuck, replace
	Solenoid diaphragm will not seat	Inspect/replace

## Troubleshooting guide (cont)

### Refrigeration Loop

Only a qualified refrigeration technician should attempt repairs in the refrigeration loop.

Problem	Possible Cause	Corrective Measure
Compressor will not start or shuts down with supply pump running	Process fluid temperature below set point	Change set point
	Scroll compressor rotating in the wrong direction	Consult Mokon factory
	Low or high refrigerant pressure	Consult a Qualified Refrigeration Technician
	Compressor shut down due to thermal protection	Let cool, restart, and verify amp draw
	Inadequate flow of process fluid	Inspect process and lines for blockage, clear blockage if necessary
	Controller or thermostat (controller optional on 1/2 and 1 ton systems)	Consult factory ( <b>DO NOT attempt repairs, this will VOID your warranty!</b> )
	Freezestat	Inspect/replace
	Blown control circuit fuse	Replace and check for ground condition
System shuts down on high refrigerant pressure  Water-cooled systems	Low water flow through the condenser	Verify condenser supply water flow rate is as stated in section 2.5
	Water regulating valve	Inspect/clean or replace
	Condenser supply water lines too small	Replace lines with insulated hose or pipe of equal diameter as the port (see table on page 5)
	Insufficient water pressure drop across condenser due to plugged or fouled condenser tubes	Inspect/clean or replace
	Condenser supply water temperature too high (above 85°F / 29°C)	Find colder source of water
System shuts down on high refrigerant pressure  Air-cooled systems	Dirty condenser coils	Inspect/clean
	Fan rotation	Verify fan is rotating (counterclockwise)
	Fan not rotating	Blown control fuse
		Fan limit switch – Consult Qualified Refrigeration Technician
	High ambient air temperature	Find a cooler source or force more air
	Refrigeration loop overcharged	Consult a Qualified Refrigeration Technician

## Troubleshooting guide (cont)

Problem	Possible Cause	Corrective Measure
System shuts down on low refrigerant pressure	Low refrigerant charge	Consult a Qualified Refrigeration Technician
	Low head pressure	
	Restriction to refrigerant flow in refrigerant loop	
	Ambient air temperature too cold (air-cooled)	Find warmer source of air
		Condenser cooling water temperature too low (water-cooled)
	Air in process loop	Purge – see start up procedure in section 3.1
	Water/glycol solution foaming	Replace water/glycol mixture
System shuts down on freezestat	Attempting to operate below setting (45°F/7°C)	Consult Mokon factory
	Freezestat	Inspect/replace
Chiller does not keep up with load	Low water flow causing icing in condenser (water cooled)	Consult a Qualified Refrigeration Technician
	Hot gas bypass valve stuck open	
	Condenser tubes limed over/blocked (water cooled)	
	Poor condensing	
	Over condensing	
	Bad valves in compressor	
	Chiller not started correctly (before heat generating process)	See section 3.1 for correct starting procedure
	Scroll compressor rotating in the wrong direction	Consult Mokon factory
	Chiller undersized for load	Consult Mokon engineering
System does not come down to set point temperature	Lack of refrigerant	Consult a Qualified Refrigeration Technician
	Dryer clogged	
	Too large process load	
	Evaporator freezing	Remove restrictions
	Restrictive process or process connections	
	Thermocouple or RTD	Inspect/replace component
	Controller calibration	See controller section 5

## Section 8 – Condensed parts list

### ½ - 10 ton systems:

Part No	Description
006256	Motor starter/24 amp heater contactor 110V coil (pump/motor)
006257	40 amp heater contactor 110V coil (compressor)
006366	1.0 – 5.0 amp overload
006367	3.2 – 16 amp overload
008021	0 – 160 PSI pressure gauge, suction, and discharge
018246	Seal kit for pump/motor assembly
022038	Start/stop button
023089	Thermometer
040002	Thermocouple

### 15 and 20 ton systems:

Part No	Description
006256	Motor starter/24 amp heater contactor 110V coil (pump/motor)
006257	40 amp contactor 110V coil (compressor)
006298	50 amp contactor 110V coil (compressor)
006366	1.0 – 5.0 amp overload
008021	0 – 160 PSI pressure gauge, suction, and discharge
018246	Seal kit for pump/motor assembly
022038	Start/stop button
023089	Thermometer
040002	Thermocouple

**For additional part numbers refer to the specific section in the instruction manual or consult the Mokon factory (716) 876-9951.**

## **Section 9 – Model Codes**

See following pages

## Chiller Model Codes

Model #			
AC4A05H1			
<b>Condensator</b>		See Option Code	
<b>A</b>	Air-Cooled		
<b>W</b>	Water Cooled		
<b>Compressor Style</b>		<b>Tonnage</b>	
<b>C</b>	Standard	.5	1/2 Ton
<b>S</b>	Scroll	01	1 Ton
<b>D</b>	Dual Circuit- <i>(Portable Chillers only)</i>	1H	1.5 Ton
		02	2 Ton
		2H	2.5 Ton
		03	3 Ton
		05	5 Ton
		07	7.5 Ton
		08	8 Ton
		10	10 Ton
		15	15 Ton
		20	20 Ton
		30	30 Ton
		40	40 Ton
		50	50 Ton
		60	60 Ton
		80	80 Ton
<b>Voltage</b>			
<b>1</b>	115 Volts / 1 Phase / 60 Hertz		
<b>2</b>	230 Volts / 3 Phase / 60 Hertz		
<b>3</b>	380 Volts / 3 Phase / 50 Hertz		
<b>4</b>	460 Volts / 3 Phase / 60 Hertz		
<b>5</b>	575 Volts / 3 Phase / 60 Hertz		
<b>6</b>	415 Volts / 3 Phase / 50 Hertz		
<b>7</b>	208 Volts / 3 Phase / 60 Hertz		
<b>9</b>	Special Voltage, <i>see option code</i>		
<b>Controller / Freon</b>			
<b>0</b>	Thermostat / R-22 (HCFC)		
<b>A</b>	*Eurotherm / R-22 (HCFC)		
<b>B</b>	Special / R-22 (HCFC)		
<b>C</b>	**Eurotherm / R-22 (HCFC)- <i>Do Not Use</i>		
<b>D</b>	PLC / R-22 (Portables)		
<b>E</b>	***Eurotherm / R-22 (HCFC) <b>ZR Scroll Compressor</b>	*Prior to 6/18/01, was Barber Colman	
<b>F</b>	***Special / R-22 (HCFC) <b>ZR Scroll Compressor</b>	** Prior to 6/18/01, was Eurotherm, not used since Eurotherm has been standardized	
<b>G</b>	***Eurotherm / R-134A (no CFC) <b>ZR Scroll Compressor</b>	***Effective 7/1/05-ZR compressor change	
<b>H</b>	***Special / R-134A (no CFC) <b>ZR Scroll Compressor</b>	<i>For AS &amp; WS Scroll Units only</i>	
<b>J</b>	Eurotherm / 407C (no CFC) Scroll Compressor		
<b>K</b>	Special / 407C (no CFC) Scroll Compressor		
<b>1</b>	Thermostat / R-134A (no CFC)		
<b>2</b>	*Eurotherm / R-134A (no CFC)		
<b>3</b>	Special / R-134A (no CFC)		
<b>4</b>	Eurotherm Single Circuit / R-22 Centrals		
<b>5</b>	PLC Single Circuit / R-22 Centrals	Effective 8/21/06-UL labeled Electrical subpanel	
<b>6</b>	PLC Dual Circuit / R-22 Centrals		
<b>7</b>	PLC Single Circuit / 407C (No CFC) Centrals		
<b>8</b>	PLC Dual Circuit / 407C (No CFC) Centrals		

## Section 10 – Warranty

### ICEMAN PORTABLE CHILLER WARRANTY

All new ICEMAN CHILLER systems manufactured by MOKON are guaranteed to be free from defective material or workmanship for one (1) year from the date of purchase. All Standard Microprocessor controllers carry a five (5) year warranty, Microprocessors with special features carry a three (3) year warranty and Solid State controllers carry a one (1) year warranty. MOKON'S obligation under the WARRANTY SHALL BE LIMITED, TO THE ORIGINAL CUSTOMER, TO REPAIR OR REPLACE DEFECTIVE PART(S) OF THE TEMPERATURE CONTROL SYSTEM, and UPON CUSTOMER COMPLIANCE WITH THE INSTRUCTIONS CONTAINED HEREIN. Upon discovery of any alleged defect, it is the responsibility of the customer to contact the MOKON Service Department with the complete model number, serial number and the date of purchase. MOKON'S obligation under this warranty is limited to make good, from or at its factory, any parts that are returned to the company (prepaid) and deemed to defective, within the time frame of the warranty. The customer also has the option of forwarding the system to MOKON (Buffalo, NY), prepaid by the customer and with a return authorization from MOKON for inspection and component replacement or repair. Repair or replacement in any manner provided above shall constitute a fulfillment of all liabilities of MOKON concerning the quality of the temperature control system. Freeze-ups of any kind are not covered under this warranty.

No allowances, credits or reimbursements will be made for any replacement or repair made or provided for by the customer unless authorized in advance, in writing, by MOKON.

**Note: The use of automotive anti-freeze in a chiller system will void the above warranty!**

**The warranty set forth above is in lieu of any and all other warranties expressed or implied including warranties of merchantability and fitness for a particular purpose. Mokon shall in no event be liable for any consequential damages or for any breach of warranty in an amount exceeding the original price of the unit.**



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