INSTRUCTION MANUAL

Iceman Fractional Chiller System

Models covered AF and WF

2150 Elmwood Avenue - Buffalo, NY 14207
P# 716-876-9951 - F#716-874-8048 - www.mokon.com

MOK3004A 03/20

Table of Contents

EQUIPMENT START-UP CHECKLIST
AIR/WATER COOLED CHILLERS

✓ ELECTRICAL INSPECTION

Yes	No	
☐	☐	Verify amp draws and voltage on serial tag match electrical service being supplied.
☐	☐	Electrical wiring completed and disconnect sized and installed per code and compliance.
☐	☐	Motor rotation verified, motors and compressors bumped.
☐	☐	All termination points checked for tightness.
☐	☐	Verify any remote control wiring is complete.

✓ DISTRIBUTION

☐	☐	All piping in accordance with specifications listed instruction manual.
☐	☐	All piping is completed and is per code and compliance.
☐	☐	Piping pressure tested per contract documents.
☐	☐	Labeling and insulation per contract documents.

✓ LOCATION AND GOOD STANDARD INSTALLATION PRACTICES

☐	☐	Confirm safe access to equipment for maintenance, removal and lockout- tag out.
☐	☐	(Water-cooled) Confirm water supply to condenser, if city water 1.5 gpm/ton, if tower water 3 gpm/ton.
☐	☐	(Air-cooled) Confirm no short-circuiting of exhaust air into intake of condenser.
☐	☐	If systems are to be installed side by side where one system will be exhausting hot air on the next unit, they should be spaced apart a minimum of 15 feet for proper & efficient operation.
☐	☐	Allow a minimum of 4 feet on all sides to allow for proper ventilation of condenser.
☐	☐	Proper glycol mixture is being used for selected temperature range. See instruction manual for details.

NOTE: Refer to manufacturer's manual for additional data and requirements.

This checklist should be completed prior to commissioning.

MOKON

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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 – 60˚F (10˚C – 15.5˚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 die be added to signify that glycol is present in system. The glycol should have a corrosion inhibitor added to reduce the risks of metalic degradition.

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 or power cord is design rated for a short circuit current rating (SCCR) of 10,000 amperes RMS if protected with a class "J" fuse.

This system has been designed for use in non-potable water applications only. For applications requiring potable water use please contact Mokon directly to discuss a product offering.

Section 2 – Installation

2.1 Unpacking

Upon arrival inspection should be done to assure there was no damage during shipping.

The **maximum** weights of the Mokon chiller systems when drained of water are 150 lbs (68 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.

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 50 PSI (345 kPa) and 100°F (38°C).

Fluid connection/port sizes

Water cooled tonnage	Connection size	
	Process	Condenser
1/4	1/2″	3/8″
1/3	1/2″	3/8″

Air cooled tonnage	Process connection size
1/4	1/2″
1/3	1/2″

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 85°F (29.4°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.

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.

2.5 Fluid connections (cont)

Condenser cooling water connections (WF 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 – 60˚F (10˚C – 15.5˚C), but are engineered to operate as low as 20°F (-7˚C). Unless your system was set to operate <u>below</u> 50°F (10˚C) at the time of purchase, d<u>o not attempt to operate your Mokon portable chiller system below 50˚F (10˚C) without first contacting the Mokon customer service department as a low temperature seal assembly will need to be installed to the supply pumpak & various items re-set for low temperature operation</u>. 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 of 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 20ºF to 60ºF (-7ºC to 15.5ºC) 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)

- Restart the supply pump by pressing the "start" button (the green light will illuminate). The supply pump should provide 10 - 15 PSIG (69 - 103 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.

  NOTE: The compressor will automatically start (when required) after the supply pump is started. The controller and internal timer will work to energize the compressor automatically.

3.1 Initial starting procedure (cont)

- Check the refrigerant pressure for the proper reading. The high-pressure reading is 200 - 300 PSI (1379 - 2068 k Pa) for R-22 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-134A
60°F (16°C)	80 PSIG (552kPa)	45 PSIG (310kPa)
50°F (10°C)	65 PSIG (448kPa)	35 PSGI (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

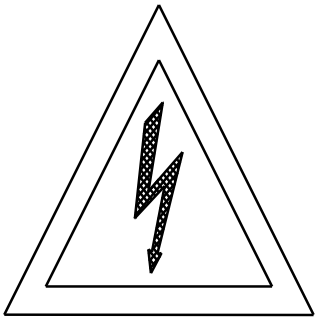
- If the water lines and main electrical power have not been disconnected, refer to section 3.1.

- 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 temperature control 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 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 for plumbing leaks	Repair solder joints
	Replace necessary parts if leaks persist
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
Semi Annual Check	**Corrective Procedures**
The system's internal and external hoses and clamps should be inspected	Tighten with proper tooling

Miscellaneous preventative maintenance

Monthly Checks	Corrective Procedures
 Check that all applicable lights, gauges, and indicators are functioning properly (Power On)	Replace necessary parts
 Check the system for leaks at operating temperatures	Repair leaks and/or tighten fittings
	Replace necessary parts
Check that the "Warning," "High Voltage," "Caution," and lamicoid 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

MARCH PUMPS
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INSTRUCTIONS & REPAIR PARTS FOR MODEL AC-5C-MD PUMP

MODEL AC-5C-MD
ASS'Y. NO. 0150-0026-0100

MODEL NO.	CONNECTORS		ELECTRICAL			G.P.M. AT LISTED HEAD						PSI	DIMENSIONS			PACK
	INLET	OUTLET	HP	WATTS	AMPS	1 FT.	3 FT.	6 FT.	12 FT.	18 FT.	24 FT.	GAGE	HT.	WD.	LG.	WT.
AC-5C-MD	1" FPT	½" MPT	⅛	227	2.2	18	16.3	15	12.5	9.5	4.2	11.2	6-3/16"	4-½"	9-¼"	14 LBS.

PUMP CONSTRUCTION & SERVICING

March "Orbital" Magnetic Drive Pumps eliminate the conventional shaft seals found in most pumps. This means that there is no rotating seal to wear and allow the liquid being pumped to leak out. The pumping action may eventually fail, however the liquid can never leak out. The Model AC-5C-MD has an open air fan cooled, moisture protected motor, allowing the pumps to be run continuously.

All pumps can be serviced with the use of a screwdriver. The only moving part in the pump, other than the motor, is the impeller-magnet assembly. This assembly rotates on a stationary spindle and up against a thrust washer. These are the only parts that can wear, and may need to be replaced. See the Repair Parts List for replacement parts.

ELECTRICAL CONNECTIONS AND RUNNING DRY

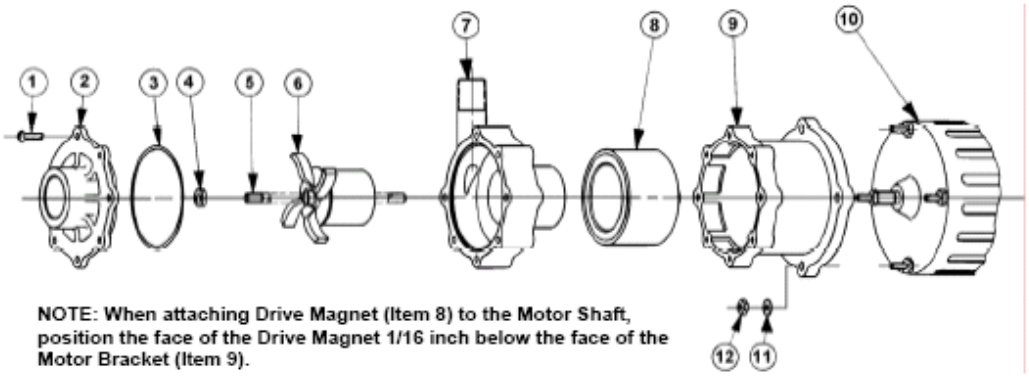
All models are standard with115 volt, 50/60 cycle, 1 phase, A.C. motor. The motors are thermal overload protected, and the motor and overload combinations are U.L. and C.S.A. listed. All cord sets are U.L. approved 18/3 wire, SJO or SJT cords. The AC style pumps have 3 foot long cords with no plug attached.

We rely on the liquid being pumped to lubricate the impeller-magnet assembly spinning on the stationary spindle. The pump is not to run dry as the plastic may "freeze" onto the spindle. Teflon, and Carbon bushings are available if needed for dry run protection. Contact the factory for special applications.

PUMP MATERIALS

All screws are type 18-8 stainless.
All "O" ring gaskets are Buna-N rubber.
All stationary spindles are ceramic.
All wetted plastic parts are Glass Filled Polypropylene plastic.
Motor Bracket is Glass Filled Polypropylene.
The thrust washer is ceramic.
Other materials are available, contact the factory for other than standard parts.

4.2 Pump maintenance (cont)



NOTE: When attaching Drive Magnet (Item 8) to the Motor Shaft, position the face of the Drive Magnet 1/16 inch below the face of the Motor Bracket (Item 9).

MODEL AC-5C-MD REPAIR PARTS LIST			
ITEM	DESCRIPTION	QTY.	PART NO.
1	#8 x 1¾ Long Screws	7	0150-0021-1000
2	Cover	1	0150-0032-1000
3	"O" Ring, Buna-N	1	0135-0007-1000
3A	"O" Ring, Viton	1	0135-0023-1000
4	Ceramic Thrust Washer	1	0130-0028-1000
5	Spindle	1	0130-0024-1000
6	Impeller-Magnet Ass'y.	1	0150-0030-0100
6A	Impeller-Magnet Ass'y with Stainless Cover	1	0150-0030-0200
7	Pump Housing	1	0150-0031-0100
8	Drive Magnet Ass'y.	1	0150-0081-0100
9	Motor Bracket	1	0150-0070-0100
10	Motor, 115 Volt	1	0150-0027-1000
11	Bracket Washer	4	0802-0006-1000
12	Bracket Nuts	4	0625-0024-1000

Contact factory for other materials and/or parts not listed.

LIMITED WARRANTY

March pumps are guaranteed only against defects in workmanship or materials for a period of one year from date of manufacture pumping water. On all other solutions, contact the factory for application assistance. March Pump Application Worksheet 750-130-10 is available for additional warranty information.

4.3 Glossary of indicators, gauges, and buttons

Supply pump start/stop button:	Pilot light illuminates green to supply pump (chilled water circuit) to process is activated.
Compressor start/stop button:	Pilot light illuminates green to indicate refrigeration loop and compressor pump is activated.
Low refrigerant pressure indicating light:	When illuminated, indicates compressor has shut down due to low refrigerant pressure. (Optional)
High refrigerant pressure indicating light:	When illuminated, indicates compressor has shut down due to high refrigerant pressure. (Optional)
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. (Optional)
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) or 110-230 PSIG/ 758-1586 kPa (R-134A) (depending on load). (Optional)
Low refrigerant pressure gauge:	Indicates compressor suction pressure and is related to temperature setting and the adequacy of refrigerant charge. (Optional)

Section 5 – Eurotherm controller (3000 series)

Refer to the 4th 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 is 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		
	Parameter Mnemonic	**Scroll**	**Function**
	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.

*Optional

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.

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 and 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 numbers 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 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 re-turn 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	Enter configuration mode then return to the required operating mode. It may be

	power to the controller is turned off before the change has been entered then this alarm will occur. Do **not** turn the power off to the controller while ConF is flashing.	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 s 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 – 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 (**DO NOT attempt repairs, this will VOID your warranty!**)
	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)	Find warmer source of water
	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	
	Restrictive process or process connections	Remove restrictions
	Thermocouple or RTD	Inspect/replace component
	Controller calibration	See controller section 5

Section 8 – Condensed parts list

Part No	Description
006256	Motor starter/24 amp heater contactor 110V coil
006366	1.0 – 5.0 amp overload
006367	3.2 – 16 amp overload
006396	0.5 amp mini contactor
006400	0.9 – 1.3 amp overload
006401	1.1 – 1.6 amp overload
006402	1.4 – 2.0 amp overload
006403	1.8 – 2.5 amp overload
006404	2.3 – 3.2 amp overload
006405	3.5 – 4.8 amp overload
008050	-30 - 60 PSI pressure gauge (glycerine)
022038	Start/stop button
026575	Timer (for pumpdown)
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

Fractional Chiller Model Codes

Model #
AF112500

Condensor	
A	Air-Cooled
W	Water Cooled

See Option Code

Tonnage	
25	1/4 Ton
33	1/3 Ton

Compressor Style	
F	Fractional

Voltage	
1	115 Volts / 1 Phase / 60 Hertz

Controller / Freon	
1	Thermostat / R-134A (no CFC)
2	*Eurotherm **1/16 Din R-134A (no CFC)**
3	Special / R-134A (no CFC)
0	Thermostat / R-22 (HCFC)
A	*Eurotherm **1/16 Din R-22 (HCFC)**
B	Special / R-22 (HCFC)

***Prior to 8/21/06, was Barber Colman 16 Din**

Effective 8/21/06-UL labeled Electrical subpanel

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.

Mokon's products are not guaranteed against damage caused by corrosion.

End of Life Industrial Waste - Saving our Environment

In the interest of preserving our environment, please reclaim, reuse or dispose of any refrigerant, refrigerant oils, heat transfer fluid, glycol and/or water glycol mixtures contained in these systems in accordance with federal, state and local codes, prior to any equipment disposal. All metal and other materials should be repurposed and recycled where possible.

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