



INSTRUCTION MANUAL

HTF Oil System

Models covered H4, H5 and H6

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General machinery description and intended use

The Mokon temperature control system is a portable temperature control system circulating fluid to control the temperature of a process. A typical machine consists of a pump, heating/cooling elements, sensors and a microprocessor controller.

Example processes controlled by a Mokon system may include jacketed vessels, heat exchangers and injection molding tools.

Refer to the flow schematic included with the instruction manual to better understand the operation of the system.

Section 1 – Warnings and Cautions

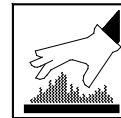
Please read and understand this section before operating the system!

1.1 Electrical warning



The Mokon temperature control 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 Hot fluid warning



Exercise **EXTREME CAUTION** while working on or in the area of the Mokon temperature control system. The high temperature of the fluid will cause the process lines, the system components, and the metal cabinetry to become **VERY HOT** and therefore should **NOT** be touched. To the upper right is a symbol for **SURFACE MAY BE HOT, HIGH TEMPERATURE**. When it is seen on the following pages of this manual, care should be taken to avoid possible burns. All maintenance and service must be performed with the system completely cooled. It is advisable to plug the process ports of any unused zones so that if a wrong button is pressed, fluid will not be pumped through them.

1.3 Cold weather caution



If the Mokon temperature control 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 added to prevent serious water damage from freezing.

1.4 Pump cavitation warning

The process utilizing a Mokon temperature control system should be tested PRIOR to use. It is essential that all water to be removed from the process prior to charging with oil. Water concentration as low as 500 PPM in the oil will result in pump cavitations at about 220°F (104°C) operating temperature.

1.5 Overhead piping warning

When overhead piping is connected to a Mokon temperature control 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.

1.6 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.

1.7 No flow warning

It should be noted that if any external valves are installed in the process flow path, they must be opened before starting the Mokon temperature control system or risk causing serious damage to the system and the process.

Fluid must be established (flowing) through the Mokon temperature control system in order for the safety features to work properly and adequately protect the Mokon temperature control system.

The use of valves downstream of the Mokon temperature control system are not recommended as they could potentially render the system safeties inoperative if closed. This could cause serious system damage and would void the warranty. To avoid disabling the standard safety features, please contact Mokon to discuss optional safety features that may be required to adequately protect the assembly.

1.8 PPE

Personal Protective Equipment (PPE) should be worn when operating or performing maintenance on machine. The minimal recommended PPE to be worn should be safety glasses, gloves and hearing protection (where required)

1.9 Ergonomic Conformance Warning

Depending on the configuration of your machine, the Human Machine Interface (HMI) may be lower than ergonomic standards.

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

Incoming inspection should be performed to assure that no shipping damage has occurred. All electrical and mechanical connections should be inspected to ensure that they are secure and tight, including electrical terminations, mechanical fitting union bulbs, compression fittings, etc.

Note: Refer to section 4 Maintenance and Service

The **minimum** weight of a Mokon oil system when drained of fluid is typically 200 Lbs. Properly rated equipment should be used to move this machinery.

When removing system from pallet, lift from bottom only using appropriate equipment for the weight. Note: Actual weight of system is on serial tag. 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, oil and electricity.

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

2.4 Warnings (cont)

Under normal operating conditions, the decibel level of the machinery is 85 db or lower. When operating the machine, 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.

Note: If your system was purchased with a process purge option, review section 6.3 or 6.4 for operating instructions.

2.5 Electrical connections



Warning: The Mokon temperature control 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 temperature control 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.

Connect ground wire to the ground screw (labeled PE or GND) located in the electrical box. Connect power lines L1, L2, L3, to disconnect switch or terminal blocks marked L1, L2, and L3 respectively, inside the electrical box. Overcurrent protection of the supply conductors should be sized according to The National Electrical Code (NEC) and any other applicable state and local codes.

2.5 Filling reservoir

Fill the reservoir with heat transfer fluid (see section 4.10 for recommended fluids) through the fill port. The fill port is located on the side of the system on 500 and 600 series systems. Fill to the highest level on the sight glass. See chart below for the total fluid capacity of your system.

# of zones	Heating capacity kW per zone	Reservoir tank volume (gallons)	Reservoir tank volume (liters)
1	6	18	70
	12	18	70
	18	18	70
	24	18	70
	30	38	144
	36	38	144
	48	38	144
2	6	38	144
	12	38	144
	18	38	144
	24	38	144
	30	58	220
	36	58	220
3	6	58	220
	12	58	220
	18	58	220
	24	58	220

Note: On initial start up, while purging the air from the system, it may be necessary to add additional heat transfer fluid to the reservoir to compensate for the volume of fluid consumed by this process.

Warning: On a standard system, a minimum operating fluid level of $\frac{1}{2}$ full is recommended (optimum fluid level is $\frac{3}{4}$ full). It must be maintained at all times. If the proper fluid level is not maintained, serious damage may occur to the Mokon system. It is mandatory to periodically inspect the fluid level sight glass and add heat transfer fluid if required.

2.6 Fluid connections

Exercise extreme caution while working on or in the area of the Mokon temperature control system. The high temperature of the fluid will cause the process lines, the system components, and the metal cabinetry to become very hot and therefore, they should not be touched.

There are four (4) convenient and clearly marked connections, "To Process" (one for each zone), "From Process" (one for each zone), "Supply Water" and "Drain Water." They are located on the rear of the HTF system.

Note: Quick disconnects should not be used on any of the connections, they will restrict the flow.

Use full size unrestricted high temperature, insulated hose or pipe for each connection.

To Process: Connect the port(s) to the process inlet(s), through which heat transfer fluid will enter the process.

From Process: Connect the port(s) to the process outlet(s), from which heat transfer fluid will leave the process.*

Supply Water: Connect the port to an adequate source of cold, clean supply water.

Drain Water: Connect the port to drain (or return line in an in plant closed recirculation system).

Caution: If you are using brass, bronze or copper (yellow) metals in process plumbing that will come in contact with the heat transfer oil, contact Mokon. Yellow metal promotes oxidation of the oil, drastically shortening its life. DELF fluid greatly reduces the possibility of fluid degradation due to metal deactivators in the fluid.

*A "Y" type strainer is provided to be installed in the "From Process" line. Make sure the direction indicating arrow, on the body of the strainer, corresponds to the flow direction of the fluid. It is recommended that the strainer be installed in the horizontal position, with the "Y" pointed downward.

If the strainer must be mounted in the vertical position, below the process connection on the Mokon system, a drip leg should be installed to trap debris that will dislodge from the screen upon shutdown. Consult the factory if the strainer must be installed in this fashion.

2.7 Ambient Operating Conditions

Temperature: 5 – 40° C

Humidity: 0 – 95%

Altitude: 1000 meters above mean sea level

Storage/Transportation Conditions

Temperature: -25°C – 55°C

Humidity: 0 – 95%

(See section 1.3)

2.8 Dismantling/Decommissioning

Reference local codes for disposal

Section 3 – Operation

Prior to starting the Mokon system it may be necessary to tighten the mechanical fittings on the piping. Vibration cause during transport can loosen the fittings. Before proceeding, check and tighten all of the mechanical fittings.

3.1 Initial starting procedure

- Fill the Mokon temperature control system with heat transfer fluid. (See section 2.5 for filling reservoir)
- Turn on the water supply connected to the Mokon temperature control system. (See section 2.6 for water connections)
- Turn on the electrical main disconnect switch. (See section 2.4 for electrical connections)
- If your system is supplied with the process fluid purge via switch option, make sure the three position, "Forward / Reverse" selector switch is in the forward position.

NOTE: The cover of the system must be removed for the next two (2) procedures. The side cover for HTF series 500 and 600 oil systems.

- For each zone, check the pump alignment. (See section 4.2 for pump alignment)
- For each zone, check the motor rotation by turning on the system momentarily (press the "Start" button then the "Stop" button). As the pump slows down, check the motor rotation. If the motor is not rotating in the direction of the arrow label located on the motor housing (clockwise from the lead end), reverse any two power cord leads (See section 2.4) to change the direction of the motor rotation.
- Restart the system and set the controller to the minimum temperature. (See section 5 for specific controller operation instructions)

NOTE: The start button may have to be held in for up to 30 seconds in order to build adequate pressure to start the system.

- Allow the system to run for approximately 5 to 10 minutes at the minimum temperature to purge the air from the system. The air is purged from the system when the pressure gauge reading is steady (typically between 40 to 80 psi / 276 to 552 kPa depending on restrictions in your process) and when the pump runs smooth and steady.

If the above procedure does not eliminate air in the system, turn the unit off then on once or twice to break up the air pockets.

NOTE: The air purge button may be pressed to eliminate air in the system at any time during operation.

- Set the controller to the desired temperature. The system will reach the setpoint temperature. (See section 5 for controller instructions)

3.2 Changing temperature setting

If a new temperature setting is required while the system is in operation, adjust the controller to the new desired setpoint temperature. (See section 5 for controller instructions)

3.3 Shut down procedure

Cool the Mokon temperature control system down by reducing the setpoint temperature to 150°F (66°C) or lower. When the system is cooled, push the "Stop" button to shut off the system. **DO NOT SHUT THE SYSTEM OFF AT ELEVATED TEMPERATURES; THIS CAN BE DETRIMENTAL TO SYSTEM LIFE.** The water and main electrical power to the Mokon temperature control system may be turned off if desired but is not necessary unless the system is being relocated or for prolonged shut down.

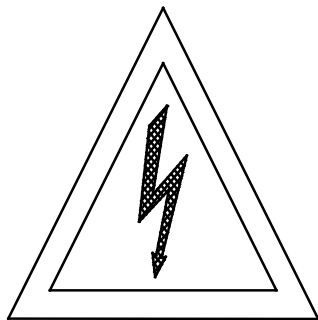
3.4 Restarting procedure

- 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 2.6 for water 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 – 4.9 require that all energy sources need to be de-energized and locked out/tagged out (exceptions noted) prior to opening or removing any panels, covers or doors to perform maintenance. The system should also be completely cooled. Energy sources on this machine include electrical and water. 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 is performed.

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 temperature control 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 - 4.9 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.


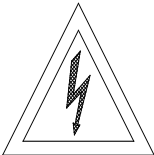
4.1 Preventative maintenance (cont)

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)
	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 solid contact to its attached component. Pay close attention to the ground wires.	Tighten with proper tooling (Torque to component specs)
For units with solid state contactors, inspect the screen covering the fan inside the electrical enclosure	If clogged with debris, clean or replace the screen. If not cleaned or replaced excessive heat build up can occur in the electrical enclosure reducing component life and wiring. System warranty will be void.
Monthly Checks	Corrective Procedures
Check that a N.C. contact exists across the temperature switch	Replace the switch if necessary
Check that the low pressure switch (PS) has a set of N.O. and N.C. contacts, and it is properly wired	Correct wiring if necessary
	Replace the switch if necessary
Tighten all high voltage terminal connections	Tighten with proper tooling (Torque to component specs)
Every 3 Months Checks	Corrective Procedures
Check that the interior electrical and mechanical components are securely fastened to the panel	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
Check the pump for lubrication	Apply external lubrication slowly with a hand grease gun top all lubrication fittings located on the outside of the cabinet. Use a multi-purpose high temperature grease.
Monthly Checks	Corrective Procedures
Check that all bolts and screws are securely tightened	Tighten with proper tooling
 Check that the packing gland is dripping approx. 1 drop per minute at 150°F (66°C)	See section 4.2 for packing gland lubrication
Check for pump alignment	See section 4.2 to correct alignment
Visually check all threaded fittings for signs of leakage	Tighten with proper tooling
	Replace necessary parts if leaks persist
Check the electrical conduit fittings are securely tightened, and there is no evidence of cracked, burned, or discolored conduits	Tighten with proper tooling
	Replace cracked or burned conduit
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
 Check gauge readings on the suction and discharge side of the pump, and/or on the cabinet (Power On)	Verify suction or discharged line not partially clogged
	Verify no restrictions in process or supply lines
Monthly Checks	Corrective Procedures
Check that all threaded fittings within the fluid loop are securely tightened	Tighten with proper tooling
	Replace necessary parts if leaks persist

4.1 Preventative maintenance (cont)

Miscellaneous preventative maintenance

Monthly Checks	Corrective Procedures
 <p>Check that all applicable lights, gauges, and optional indicators are functioning properly (Power On)</p>	<p>Replace necessary components</p>
 <p>Check the cooling solenoid operation by elevating setpoint temperature manually. While in the heating mode, push the manual air purge button. Listen for the cooling solenoid's audible energizing and de-energizing "clicking sound." Observe process temperature decreasing. (Power On)</p>	<p>Using a Voltmeter, determine if solenoid coil is energizing</p>
	<p>Replace a solenoid valve, if necessary</p>
 <p>Check the controller calibration by setting the controller for three random setpoints within the operating range of the system. Observe that the process temperature output is within the accuracy of the controller. (Power On)</p>	<p>Calibrate controller using section 5 in the instruction manual (Power On)</p>
	<p>Verify the thermocouple wires at controller are secure</p>
	<p>If controller does not respond to any of the above steps, consult the Mokon factory Do not attempt repairs as the warranty could become void.</p>
 <p>Check the system for leaks at operating temperatures. As the system reaches the setpoint temperature, visually check for leaks. Pay close attention to the heater elements. (Power On)</p>	<p>Repair leaks and/or tighten fittings</p>
	<p>Replace necessary parts</p>

4.1 Preventative maintenance (cont)

Miscellaneous preventative maintenance

Monthly Checks	Corrective Procedures
Check that the heater current draw matches the serial tag rating	Verify heater wiring stake-on is secured
	Correct heater wiring
	Verify customer supply voltage is balanced and fluctuations are within 15% of nominal
	Resistance reading is approximately 100 ohms across each element
	Replace elements if necessary
Check that the "Warning," "High Voltage" and "Caution" labeling are adhering to the correct locations	Replace torn, damaged or missing labels
Clean drain line from Packing area of Viking Pump	Disconnect the 90-degree compression fitting from the pipe nipple connected to the packing drain area. Clean out the inside of the steel tubing leading to the reservoir and the nipple leading to pump.
Check heat transfer fluid level through the reservoir sight glass	Fill to at least ½ full, if low
Check Y-type strainer, located on the From &/or To Process Line(s), for debris	Remove and clean

4.2 High temperature pump - zone pump

Warning: Disassembling the Viking pump will void the pump manufacturers warranty as well as the Mokon warranty.

Danger: Before opening any Viking pump or liquid chamber (pumping chamber, reservoir, jacket, etc.) Be sure:

- That any pressure in chamber has been completely vented through suction or discharge lines or other appropriate openings or connections.
- That the driving means (motor) has been "locked out" or made non-operational so that it cannot be started while work is being done on the pump.

Failure to follow the above listed precautionary measures may result in serious injury.

The Viking pumps are designed for long, trouble-free service life under a wide variety of application conditions with a minimum of maintenance. The following points will help provide long service life.

Lubrication: External lubrication must be applied slowly with a hand gun to all lubrication fittings every 500 hours of operation with multi-purpose grease. DO NOT OVER-GREASE.

Cleaning pump: Keep pump as clean as possible. This makes inspection, adjustment, and repair work easier and helps prevent overlooking a dirt covered grease fitting when lubricating.

Storage: If the pump is to be stored, or not to be used for six months or so, the pump must be drained and a light coat of non-detergent SAE 30 weight oil must be applied to all internal pump parts. Lubricate fittings and apply grease to the pump shaft extension. Viking suggests rotating the pump shaft, by hand, one complete revolution every 30 days to circulate the oil.

4.2 High temperature pump - zone pump (cont)

Exploded view drawing

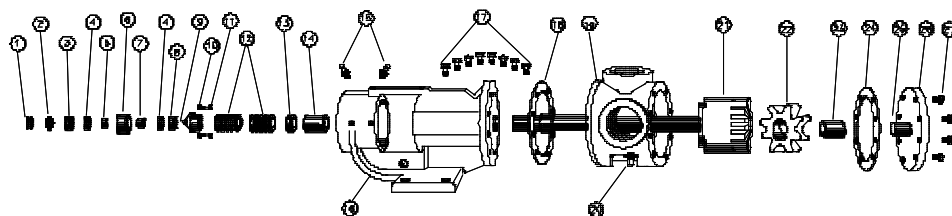


Figure 1
Exploded View

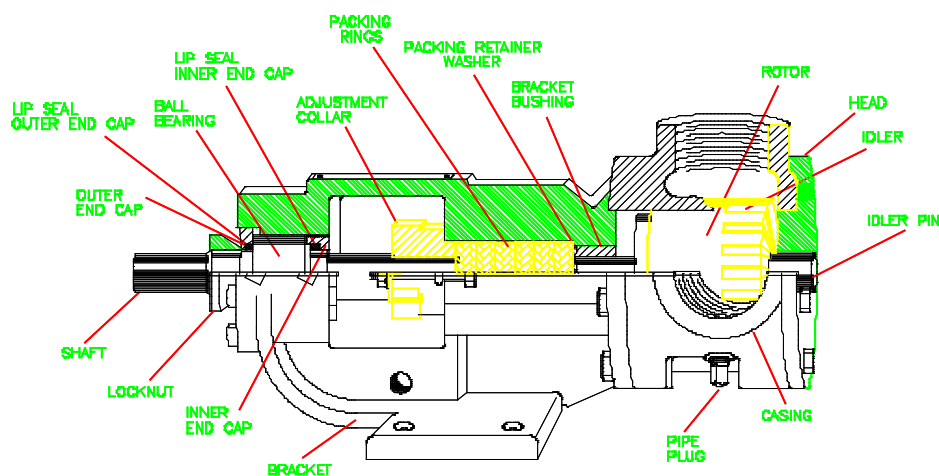


Figure 2
Cut-away View

REF #	QTY	PART #	DESCRIPTION
1	1		Locknut
2	1		Lock Washer
3	1		End Cap Outer
4	2		Lip Seal for End Cap
5	1		Bearing Spacer Collar Outer
6	1		Ball Bering
7	1		Bearing Spacer Collar Inner
8	1		End Cap Inner
9	1		Packing Gland Adjustment Collar
10	2		Adjustment Collar Capscrew
11	2		Adjustment Collar Capscrew
12	6	032030	Packing Rings
13	1		Packing Retaining Washer
14	1		Bracket Bushing (Carbon Graphite)

REF #	QTY	PART #	DESCRIPTION
15	2	032019	Grease Fitting
16	1		Bracket
17	8		Cap Screws For Bracket/ Casing
18	1	032039	Bracket Gasket
19	1		Casing
20	1		Pipe Plug
21	1		Rotor / Shaft
22	1		Idler
23	1		Idler Bushing (Carbon Graphite)
24	1	032038	Head Gasket
25	1		Idler Pin
26	1		Head
27	8		Cap Screw for Head

4.2 High temperature pump - zone pump (cont)

Pump alignment

The pump and motor were properly aligned during assembly. During shipping and with time the alignment can be disturbed. Use the following procedure to check the alignment:

- Check the pump ports to be sure that they are square and in the proper position.
- Place a straight edge across the coupling. It should reset evenly on both rims at the 3, 6, 9, and 12 o'clock positions. See figure below.
- Loosen the motor bolts and realign if adjustment is necessary.

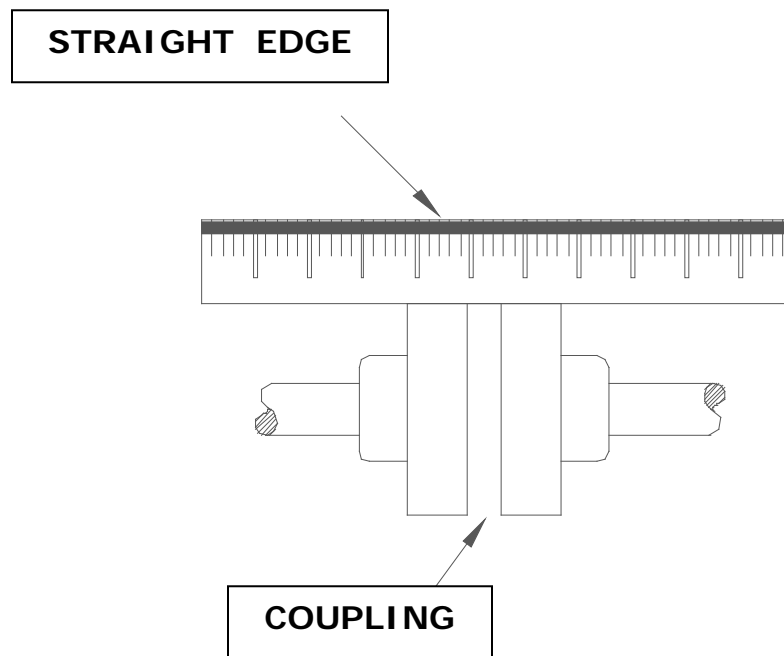


Figure 3

4.2 High temperature pump - zone pump (cont)

Thrust bearing

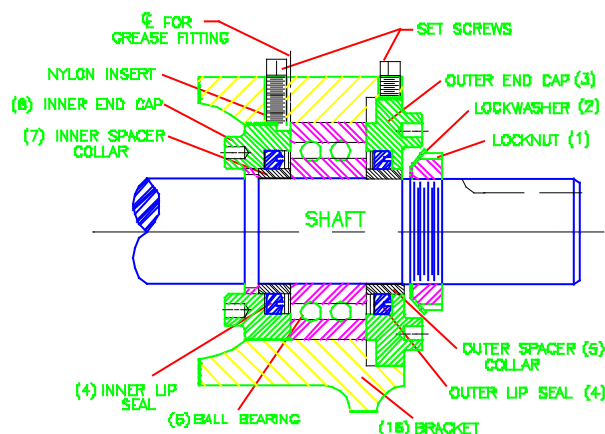


Figure 3

- Loosen both setscrews over the outer and inner end caps. See figures 1 and 3.
- Using a spanner wrench, turn inner end cap (8) clockwise, viewed from the motor end, until it projects from bracket (16), exposing approximately three threads.
- Turn the outer end cap (3) clockwise, by hand, until rotor is tight against the pump head (26) and rotor/shaft (21) can not be turned.
- Make a reference mark on the bracket end, opposite a notch on the outer end cap (3). Back off outer end cap (3) counterclockwise nine notches. Each notch represents 0.001 inch (0.0254mm) end clearance.
- End clearances set per Step 4 are for Mokon recommended heat transfer fluids (see section 4.10) or other heat transfer fluids with similar viscosity characteristics within the operating range of 150°F to 600°F (38°C to 316°C).
- Tighten inner end cap with a spanner wrench. Tap spanner wrench lightly but DO NOT OVERTIGHTEN as it will damage the threads.
- Tighten both setscrews that hold inner and outer end caps

Caution: The setscrews have nylon seats and you may sense a false seating. Be assured they are truly set.

- Rotate the rotor/shaft slowly, by hand, one complete revolution. If the rotor/shaft does not turn smoothly, repeat steps 1 – 7.

4.2 High temperature pump - zone pump (cont)

Packing gland lubrication



The pump gland should drip approximately 1 drop per minute at 150°F (66°C) operating temperature.

Exercise extreme caution while working on or in the area of the Mokon temperature control system. The high temperature of the fluid will cause the process lines, system components, and metal cabinetry to become very hot and therefore they should not be touched.

To check/correct the packing gland lubrication:

- Remove the front and back panels from the system (system should not be on at this point).
- Remove the splashguard from the pump gland area.
- Start pump by pressing the start button.
- Set temperature controller to 150°F (66°C). (See section 5 for controller instructions).
- Observe the oil dripping from the packing gland. If it is not dripping at the recommended 1 drip per minute, adjustment is needed.

NOTE: If installing new packing rings it will be necessary to allow the system to run for a period of time before checking the dripping rate of the oil.

- The pumps adjustment collar mechanism consists of two capscrews (11), one on each side. They may be tightened to decrease the dripping or loosened to increase the dripping. See figure 1.

NOTE: The adjustment collar capscrews must be EVENLY tightened or loosened, one flat at a time, to achieve proper adjustment. Failure to do so will result in damage to the pump. Overtightening will destroy the packing.

4.2 High temperature pump - zone pump (cont)

Replacing pump packing

To replace the pump packing:

- Loosen the adjustment collar capscrews (11).
- Remove the adjustment collar (9).
- Using a packing hook, remove the packing rings (12).
- Install new packing rings (12), staggering the joints left to right. Lubricate the packing rings with oil, grease, or graphite to aid assembly. A length of pipe will help seat each packing ring. Install the same quantity of rings removed. (Typically, 6-7 rings)
- Replace the adjustment collar (9). Make sure that it is installed squarely.
- Reinstall the capscrews (11). Tighten wrench tight then back off until gland is slightly loose.

NOTE: The capscrews must be tightened **EVENLY**.

- See page 18 to check and/or correct the packing gland lubrication.

4.3 Recirculating pump for H4 and H5 systems

Mokon 500 series models feature a "Continuous Flow" cool oil reservoir using a recirculating pump to force the flow. When cooling is needed, hot oil from the process loop is released into the reservoir and is replaced by cool oil. The fluid is cooled by forcing the released process oil through the continuous flow heat exchanger where it is mixed with a continuous flow of cool oil from the reservoir.

The recirculating pump requires no maintenance but should you need to replace the pump see the following installation procedures.

Position of the terminal box:

Proper installation of the pump will have the terminal box located to one side of the pump or the other, with the conduit entry down.

If the terminal box position needs to be changed, it is best to do so before installation. However, if the pump is already installed, ensure that the electrical supply is turned off and close the isolation valves before removing the Allen screws.

4.3 Recirculating pump for H4 and H5 systems (cont)

To change the terminal box position:

- Remove the four (4) Allen screws (4mm) while supporting the stator (motor).
- Carefully separate the stator from the pump chamber and rotate it to the correct terminal box orientation.
- Replace the Allen screws and tighten diagonally and evenly (7lb-ft /9.5 Nm) torque.
- Check that the impeller turns freely. If the impeller does not turn easily, repeat the disassembly/reassembly process.

Installation requirements:

Thoroughly clean and flush the system prior to pump installation.

Pump Mounting:

Arrows on the side of the pump volute indicate direction of flow through the pump. The pump must be installed with the motor shaft positioned horizontally. Under no circumstances should the pump be installed with the shaft vertical or where the shaft falls below the horizontal plane.

Electrical:

All electrical work should be performed by a qualified electrician in accordance with the latest edition of the National and local codes and regulations.

The proper operating voltage and other electrical information can be found on the nameplate attached to the top of the motor. The motor is impedance protected and does not require additional external protection. The temperature of the windings will never exceed allowable limits, even if the rotor is locked.

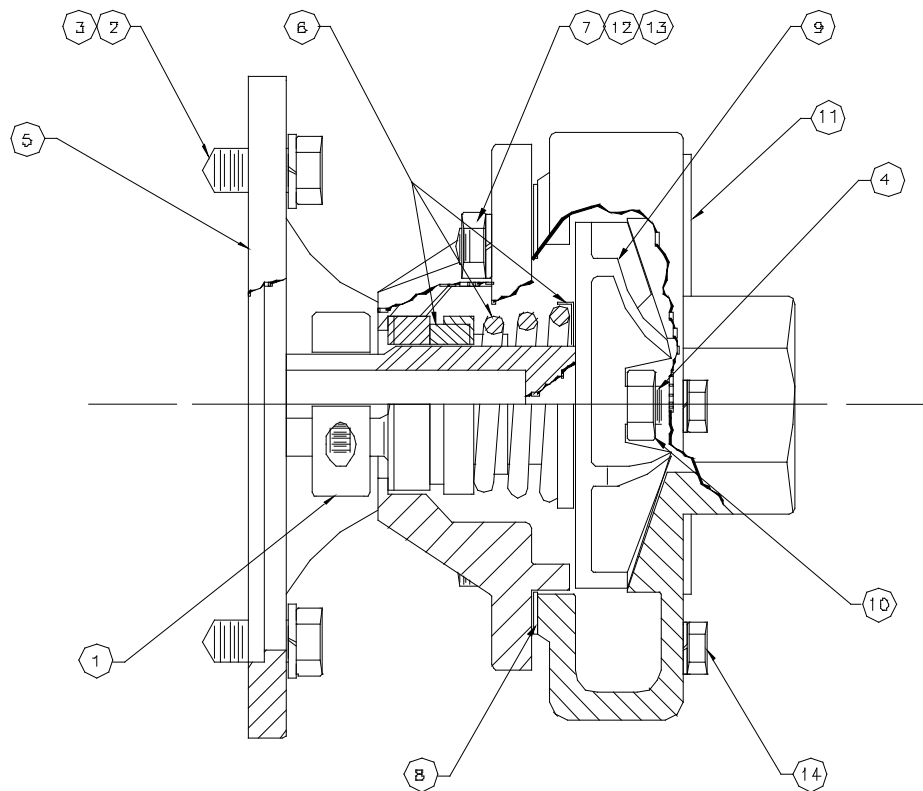
Start-up:

Do not start the pump until the system has been filled. Completely vent the system prior to starting the pump. Never operate the pump dry.

4.4 Supply pump assembly for H6 systems

Exploded view drawing

NOTE: This section applies only to systems, which include a supply pump assembly. Only the H6 series systems contain a supply pump assembly. If your system is a single zone, H6 Unit, 24 KW or less, skip to Section 4.5.



Ref No.	Qty	Mokon Part No	Description
1	1	034020	Clamp Assembly
2	4	034004	S.S. Lock-washer 3/8 x 1/8
3	4	034009	S.S. Bolt 3/8 - 16 x 3/4 LG
4	1	034040	S.S. 5/8 Bore Drive Sleeve
5	1	034048	Adaptor Frame
6	1	034008	Seal Assembly. 1" Viton Niresist o-ring, seat
7	4	034043	S.S. Stud 5/16"

Ref No.	Qty	Mokon Part No	Description
8	1	034039	Gasket
9	1	034046	Brass Impeller 3.25"
10	1	034047	S. S. Lock Nut 3/8"
11	1	034042	Housing
12	4	034044	Brass Hex Nut 5/16"
13	4	034045	Brass Washer 5/8"
14	1	017044	Brass Pipe Plug 1/8"

4.4 Supply pump assembly for H6 systems (cont)

Maintenance and installation

NOTE: This section applies only to systems, which include a supply pump assembly. Only the H6 series systems contain a supply pump assembly.

The supply pump assembly consists of a housing, adaptor frame, stainless steel sleeve, shaft seal, seal spring, impeller, drive clamp, gaskets, impeller lock nut, and stainless steel fasteners. See the previous page for a drawing and a parts breakdown.

The impeller is threaded onto the shaft sleeve and locked in place by a lock nut. The shaft sleeve is machined to precisely fit the shaft on the recommended motor. No provision is made for an internal drive key and none is required. The drive clamp assembly replaces internal drive keys, securely locks the shaft sleeve to the motor shaft, and serves additionally as a liquid slinger to protect your motor.

The mechanical seal is the self-adjusting, greaseless type being lubricated by the liquid in the pump. It requires no maintenance and provides long and trouble-free operation. Because the seal is lubricated by liquid in the pump, **the pump should never be operated without liquid in the housing.**

Mounting motor to supply pump assembly

- Check the rotation of the motor to be sure it coincides with the required rotation of the supply pump assembly.
- Loosen the drive clamp assembly (1) but do not remove.

NOTE: If the motor shaft is a keyed shaft, remove the key before installing the Mokon supply pump assembly. The drive clamp assembly on the Mokon supply pump assembly is all that is required to drive the pump.

- Slide the supply pump assembly onto the motor drive shaft (4), aligning the holes in the adaptor frame (5) with tapped holes in the motor mounting face, until adaptor frame (5) contacts the motor mounting face.
- Install two S.S. bolts (3) (diagonally opposite) and tighten to secure the supply pump assembly to the motor.
- Center the drive clamp assembly (1) and tighten.
- Proceed to page 23 to check the impeller clearance.

4.4 Supply pump assembly for H6 systems (cont)

Pump impeller clearance adjustment

Remove the strip stock shim from the suction eye of the pump housing. This shim was inserted to establish clearance between the face of the impeller and the housing. Rotate the motor slowly, by hand, to make certain that the impeller does not rub the housing or the adaptor frame. If the impeller does not rub install and tighten the remaining S.S. bolts to secure the supply pump assembly to the motor.

If the impeller rubs, the impeller clearance can be adjusted by the following procedure:

- Loosen the drive clamp assembly (1), but do not remove.
- Move the impeller (9) either forward or backward using a screwdriver or move impeller drive sleeve forward.

If the impeller still rubs after using the above procedure, it can then be adjusted as follows:

- Remove the S.S. studs (7) and the housing (11).
- Loosen the drive clamp assembly (1), but do not remove.
- Remove the gaskets (8) from the housing (11).
- Replace the housing (11), pushing against the impeller face. Secure the housing with two S.S. studs (7), 180° apart.
- Tighten the drive clamp assembly.
- Remove the housing (11) and install one gasket (8).
- Replace the housing (11) securing with two S.S. studs (7) 180° apart.
- Rotate the motor shaft to check that the impeller does not rub. If it does, return to step 6 and add another gasket. If not, install and tighten all remaining S.S. studs (7).

If none of above procedure stops the impeller from rubbing, **CONSULT THE FACTORY.**

Pump installation

Use high temperature Teflon tape or high temperature RTV on all connections and be sure all fittings are airtight, especially on the suction side of the pump. An air leak on the suction side of the pump will prevent proper operation.

4.4 Supply pump assembly for H6 systems (cont)

Pump disassembly

- Close the gate valve on the reservoir tank.
- Remove the S.S. studs (7) holding the housing (11) to the adaptor.
- Remove S.S. bolts (3) which hold the adaptor frame (5) to the motor.
- Loosen the drive clamp assembly (1) and remove the supply pump assembly.

The seal seat and seal cup will remain in the pump adaptor frame. If not damaged or worn, do not remove. If necessary, remove the adaptor frame counter bore with a piece of wood or a screwdriver handle inserted through the adaptor frame from the drive end. A sharp tap or two is usually sufficient to knock out the seal seat. Use caution when removing the seal seat so as not to damage the face or distort the metal seat.

Pump impeller removal

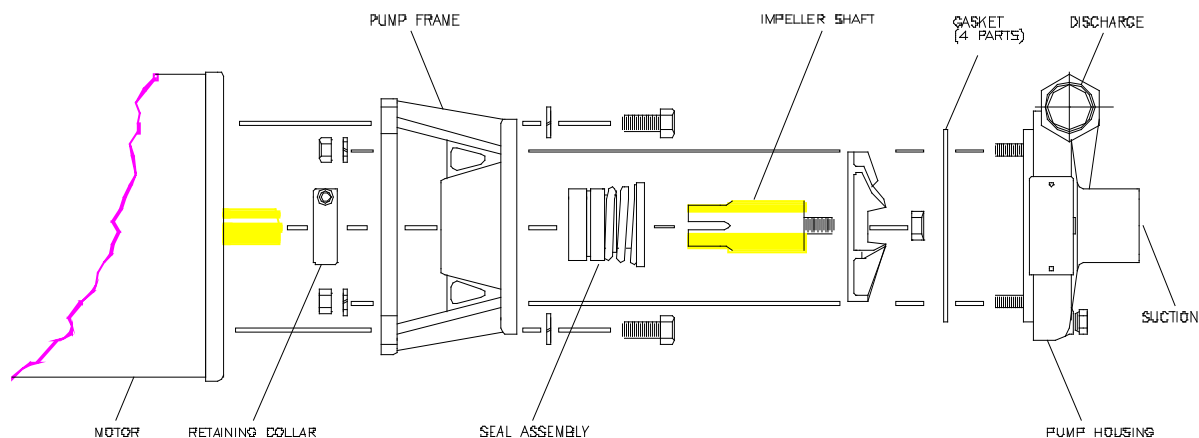
- Remove the seal bellows and the spring assembly (6).

NOTE: The seal bellows will be bonded to the shaft sleeve and will require some patience and caution to remove in order not to damage the seal bellows and cage.

- Place the impeller drive sleeve (4) between two pieces of wood in a vise. Take care so as not to damage sleeve.
- Remove the impeller S.S. lock nut (10) from the end of the shaft sleeve. Unthread the impeller (9) by turning counterclockwise (left hand).

4.4 Supply pump assembly for H6 systems (cont)

Pump seal replacement



- Make sure impeller shaft is **CLEAN** and free of nicks or burns. Use fine steel wool to polish sleeve.
- Lubricate the shaft with any good grade of water pump grease.
- Lightly lubricate all internal surfaces of the seal spring with grease.
- Place the spring over the impeller shaft (large diameter end) against the impeller hub. Place the seal cage over the sleeve with carbon washer facing away from the impeller.

NOTE: Do not use oils or S.T.P. They allow the seal bellows to set up too quickly on the sleeve thus preventing free movement of the seal cage after assembly.

- Press the seal assembly down far enough to compress spring and release. The seal assembly will return to free height.
- Lubricate the seal seat cavity in the pump frame with grease.
- Lubricate the seal seat gasket with grease.
- Use a wood dowel of sufficient diameter to press the seal seat squarely into cavity on pump frame. HAND PRESSURE ONLY.

NOTE: Polished metal surface must face opposite the seal seat cavity on pump frame. Optional ceramic seal assemblies require less pressure to seat squarely, too much pressure will crack ceramic seal.

- Place the impeller and the seal assembly in the pump housing. Affix the gasket on the frame over the drive sleeve onto the housing.

4.4 Supply pump assembly for H6 systems (cont)

Pump seal replacement

- Attach the pump frame to pump head with bolts and secure evenly. Install the shaft retaining collar onto the shaft and attach entire assembly to motor. Tighten the retaining collar with Allen wrench.
- See page 23 to adjust impeller clearance

Pump inspection

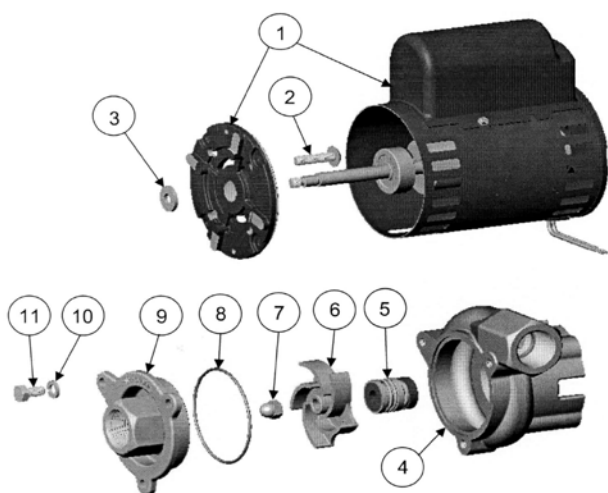
Check all parts for wear. For ease of reassembly, the shaft sleeve should have all nicks and burns removed. Replace damage parts with new parts. Inspect the seal seat and seal cup for grooves, scuff marks, or other deterioration. If a perfect lapped surface remains on the seal seat, it may be reused. If the seal cup is in good condition it may be reused. If the seal seat, cup, washer, or bellows are damaged or worn, a new seal assembly should be installed. (See page 25 for seal replacement)

Pump reassembly

Clean all castings with mild solvent such as kerosene. All dirt and foreign matter should be removed.

Reassemble the supply pump assembly. See page 22 for instructions on mounting the motor to the supply pump assembly.

4.5 Supply pump assembly for single zone H6 systems, 24 kW or less



ITEM		DESCRIPTION
1	1	115VAC MOTOR
2	1	1/4-20 X 1" CAPSCREW
3	1	RUBBER SLINGER
4	1	HOUSING- 316 SS
5	1	MECH. SEAL- VITON
6	1	IMPELLER- 316 SS
7	1	ACORN NUT- 316 SS
8	1	ORING- VITON
9	1	COVER- 316 SS
10	3	LOCKWASHER- 316 SS
11	3	1/4-20 X 1/2" CAPSCREW

4.5 Supply pump assembly for single zone H6 systems, 24 kW or less (cont)

Repair and maintenance

The pump has a viton seal that may last several thousand hours based upon the application. If the motor is replaced, the mechanical shaft seal should also be replaced. A seal that leaks will show leakage through the slot between the pump housing and the motor. Extreme leakage may damage the motor bearings and contaminate the inside of the motor.

Pump disassembly

- Remove three cover screws and remove the cover, discarding the o-ring.
- Secure the impeller and remove the impeller locknut. Pull the impeller straight out off the motor shaft.
- Remove the seal-rotating porting by pulling the seal off by hand.
- Remove the two capscrews that hold the pump housing onto the motor. Remove the pump housing and push the seal seat out using a screwdriver.

Pump inspection

Always replace the mechanical seal. Check the seal for dry run wear or damage. Check the motor shaft for wear at the secondary sealing surface from the mechanical seal. If worn, replace the motor. Check the motor bearings by rotating the motor by hand. If the shaft rotation is not smooth or has radial/axial endplay, replace the motor. Check the impeller running surface between the impeller and cover. If the surfaces are worn or irregular, replace each item.

Clean the parts that are to be reused using a solvent or mild cleaner. Remove abrasive material.

Pump reassembly

- Press the new seal seat into the pump housing. A light lubricant may be used to aid the assembly. Install the pump housing onto the motor and fasten the screws through the motor.
- Install the rotating portion of the mechanical seal by sliding the seal over the motor shaft. Do not use any lubricant.
- Place the impeller onto the shaft over the "D" drive against the shoulder and tighten the impeller lock nut until the impeller is securely shouldered on the motor shaft. Thread locking grade Loctite should be used to secure the nut.
- Stretch the o-ring over the cover pilot. Install the cover onto the housing and fasten the capscrews and lockwashers.

Check the pump for internal interference by rotating the impeller. The pump should rotate freely with only seal friction.

4.6 Pump relief valve

NOTE: The pump relief valve is not to be used as a process bypass!

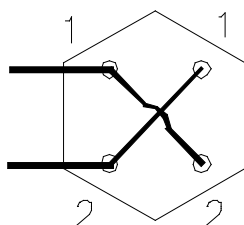
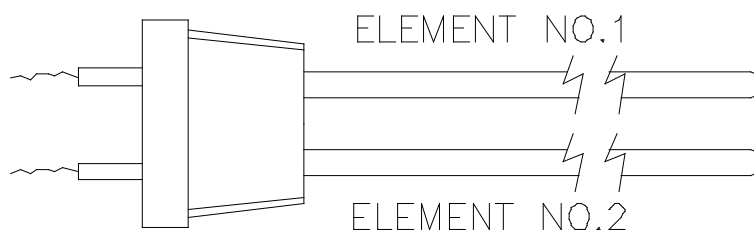
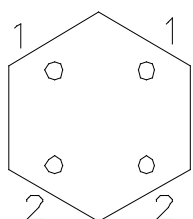
There is a pump relief valve on each pumping circuit. The pump relief valve is set at 100 PSI (689 kPa) on the H5 and H6 series systems; 60 PSI (414kPa) on the H4 series systems. When restrictions in the process are such that it will not accept the full pump output at less than the set pressure, this valve opens and maintains full oil flow over heaters regardless of the flow to the process.

The valve has been factory set and should not require further adjustments. If it is necessary to recalibrate, **CONSULT THE MOKON FACTORY.**

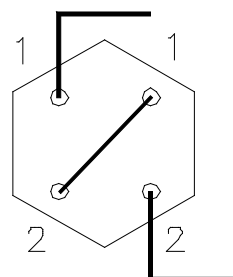
4.7 Heater element wiring

Use the following chart to select between wiring method A and B to wire Mokon replacement heaters (dual element – hair pin type). Refer to the Mokon system electrical schematic for complete heater wiring illustrations.

	190-240 Volts	380-460 Volts	550-575 Volts
Oil Systems	A	B	B



A



B

4.8 Low pressure safety switch

Mokon systems are equipped with a low pressure safety shut down switch. The low pressure switch is standard on the 500 and 600 series systems. This switch incorporates an interlock to prevent the operation of the system should the heat transfer fluid be insufficient. The switch is factory set at 5 PSI (34 kPa) and should not be adjusted without **WRITTEN CONSENT FROM THE MOKON FACTORY**.

4.9 High temperature safety switch

The high temperature safety cut off is located in the heater manifold. This switch is factory set to shut the Mokon system off at the following temperature limits:

- 500 series systems 510°F (266°C)
- 600 series systems 610°F (321°C)

This switch should not be adjusted without **WRITTEN CONSENT FROM THE MOKON FACTORY**.

NOTE: Refer to section 1.7 for the No flow warning.

4.10 Recommended heat transfer fluids

Heat transfer systems manufactured by Mokon are thoroughly tested prior to shipment for leaks, component operation, and accuracy (calibration).

All Mokon heat transfer systems are tested using Mokon's DELF600 heat transfer fluid.

NOTE: The use of any heat transfer fluid other than the ones listed below may void your warranty. Consult the Mokon service department with questions on fluid selection.

When operating the Mokon system, routine fluid samples should be taken and analyzed regularly. These samples can help determine your unique change point. A fluid sample should be taken from a flowing line and cooled below 100°F (38°C) before placing in a clean sample container and sent to the heat transfer manufacturer for analysis. The information gathered from the sample can then be useful in developing a heat transfer fluid maintenance program.

Mokon recommends the following heat transfer fluids for use in Mokon systems. A short description of each fluid offered including the recommended applications for the fluids.

Mokon's heat transfer fluids:

Mokon's heat transfer fluids last longer and help keep your system cleaner...which means longer life for parts like pumps and rotary seals!

Mokon's heat transfer fluids are:

- ❖ Extremely stable
- ❖ Highly refined using naturally resilient base stocks like, severely hydro treated paraffinic oils
- ❖ Enhanced with a proprietary blend of additives.

DELF450 - engineered for applications between 30°F and 450°F (-1 to 232°C) offering an excellent alternative to costly synthetics and aromatic fluids. The fluid delivers superior resistance to sludging, a problem plaguing most other fluids, and defends against extreme oxidation.

DELF600 - rated to 600°F (315°C), it contains the industry's most aggressive blend of additives specifically engineered to withstand the extreme oxidation environments in open systems and give unsurpassed levels of protection and service life. All Mokon HTF systems are tested using this fluid!

DELF450FG and **DELF600FG** - are engineered to comply with the demands of food grade applications and meet USDA requirements for incidental food contact (H1) and 21CFR1783570, and are NSF registered.

DELF 450 & 600 and DELF 450FG & 600FG may be used safely in the Mokon HTF 350, 500, 600, and HF Series systems.

4.10 Recommended heat transfer fluids (cont)

Other heat transfer fluids suitable for use with Mokon's systems:

Multitherm

PG-1 is a food grade heat transfer fluid for use up to 600°F (316°C). PG-1 meets specifications of 21CFR72.878, which covers the use of white mineral oils in food applications according to the limits and conditions of the regulations. PG-1 is Kosher certified and rated HT-1 for incidental contact by NSF.

IG-4 for use in systems up to 600°F.

Paratherm

NF is formulated for service up to 600°F (316°C). NF fluid provides excellent heat transfer and is low in viscosity.

HE is a high flash and fire point heat transfer fluid is rated for an optimal service range of 150°F - 600°F (66°C - 316°C).

Petro-Canada Products

Calflo FG for use in closed loop, non-pressurized, indirectly heated, liquid phase heat transfer systems with operating temperatures up to 620°F (326°C). It is accepted by the Canadian Department of Agriculture and approved USDA H1 for incidental food contact.

Calflo HTF is recommended for use in heat transfer systems with operating temperatures up to 620°F (326°C) and film temperatures up to 650°F (343°C). Calflo HTF is a unique heat transfer fluid that combines the thermal efficiency and cleanliness of paraffinic hydrocarbon with the high temperature stability of a chemical synthetic.

Solutia Inc.

Therminol 66 heat transfer fluid is designed for use in non-pressurized/low pressure, indirect heating systems with maximum bulk temperatures up to 650°F (343°C) and film temperatures up to 705°F (374°C).

Duratherm

Duratherm 450 – Heat transfer fluid rated to 450°F.

Duratherm 600 – Heat transfer fluid rated to 600°F, used in a variety of applications.

Duratherm Lite - Heat transfer fluid with the same physical properties as Duratherm 600 but formulated with a lighter dose of additives. Duratherm Lite is economically ideal for applications that are prone to fluid loss or attrition due to equipment change.

Duratherm FG is rated for use up to 620°F and is engineered and manufactured to comply with the demands of food grade applications. Duratherm FG meets USDA requirements for incidental food contact (H1) and meets the requirements of 21CFR1783570 and is NSF registered.

4.11 Recommended system cleaning fluids

NOTE: The use of any system cleaning fluid other than the ones shown below may void your warranty. Consult the Mokon service department with questions on fluid selection.

The use of these fluids is done at the owners own risk. Mokon assumes no responsibility for the effectiveness or the liability for damages that may occur while using these fluids. Please consult the manufacturer's instructions for safe and proper use prior to using any of the cleaning fluids listed in this manual.

*When operating the Mokon HTF system, routine fluid samples should be analyzed. Fluid samples for analysis should be taken regularly. These samples can help determine your unique change point. A fluid sample should be taken from a flowing line and cooled below 100°F (38°C) before placing in a clean sample container and sent to the heat transfer manufacturer for analysis. The information gathered from the sample can then be useful in developing a heat transfer fluid maintenance program.

Mokon's heat transfer system cleaner:

The industry's first heat transfer system cleaner that provides full production while cleaning!

Mokon's DELFClean - a long life, preventative maintenance and light duty system cleaner that is capable of functioning as a long-term heat transfer fluid up to 550°F (288°C). This fluid is odorless and easily handles long term operation while seamlessly allowing production to continue uninterrupted for a complete oil cycle.

Other cleaners suitable for use with Mokon's systems:

Multitherm

Multitherm PSC cleaning fluid is designed for use in general maintenance of larger heat transfer fluid systems. PSC is formulated to be compatible with all MultiTherm heat transfer fluids as well as most others so that small residual amounts left in the system will not cause a problem.

Paratherm

Paratherm SC® system cleaning liquid is formulated to dissolve and suspend sludge and carbon lumps frequently produced in hot oil temperature control units where petroleum or glycol-based heat transfer fluids have been used.

Duratherm

Duratherm Duraclean is a preventative maintenance and light duty system fluid up to 550°F.

Duratherm's Duraclean Ultra is a high performance, fast acting and High flash point terpene solvent. A unique combination of terpene, alcohols, penetrants, and surfactants designed to remove grease, oil, and carbon deposits. This fluid can be run to 150°F max. Duraclean Ultra is environmentally safe, low toxicity, biodegradable, and comes from a renewable natural resource.

Section 5 – Eurotherm controller (2200 and 2400 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 levels: Operator 1, Operator 2, Operator 3 and the configuration level.

Home list navigation

To step through list headers press the Page button until the required header is obtained.

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 page 35 for button locations and descriptions.

Headers	Home List [20.0]	Setpoint [SP]	* Access List [ACCS]
Parameters	OP - % of Output Level	SPI.L - Setpoint Low Limit	* codE
	AT - Auto Tune Enable	SPI.H - Setpoint High Limit	* Goto
	OFST - P.V. Offset		* ConF
	mV - Millivolt Input		
Alarm	DEV = 10		
Alarm Hyst	Hy = 2		
CID	0 - Customer Defined Identification Number		
L - r	Switches from local to remote using up and down buttons.		
Rmsp	Remote setpoint		
OFST2	Input 2 calibration offset		
mV2	Input 2 millivolt signal		





***** - A factory lockout prevents access to any further parameters.

5.1 Operation

Keys

NOTE: Pictured is the 2404 Eurotherm controller, this also applies to the 2408, 2204 and 2208 series controllers.



Button or Indicator	Name	Explanation
OP1	Output 1	When lit, it indicates that heating output is on.
OP2	Output 2	When lit, it indicates that cooling output is on.
	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.
Lower Display	Alarm	Flashes when in alarm condition.

5.2 Automatic tuning

Eurotherm Controllers use a 'one-shot' tuner, which works by switching the output on and off to induce an oscillation in the measured 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 during tuning, then the level of heating or cooling can be restricted by setting the heating and cooling power limits in the Output list. 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-tune again for the new conditions.

It is best to start tuning with the process at ambient temperature. 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 at or 20% of the span of the instruments whichever is greater.

Example: Setpoint maximum value – Setpoint minimum value, 20% of this value

- In the Home List, select [tunE] and 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.
- The controller will induce an oscillation in the temperature by turning the heating on and then off. The first cycle will not complete until the measured value has reached the required setpoint.
- After two cycles of oscillation the tuning will be completed and the tuner will switch itself off.

5.3 Remote setpoint and retransmission “scaling”

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

4mA = 75°F (23.9°C) and
20mA or 10V = 500°F (260°C)

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

5.4 Troubleshooting

Diagnostic alarms:

Display Shows	What it means	What to do about it
EEEr	<i>Electrically Erasable:</i> Memory Error: The value of an operator or configuration parameter has been corrupted.	This fault will automatically take you into configuration level. Check all of the configuration parameters before. In operator level, check all of the operator parameters before resuming normal operation. If the fault persists or occurs frequently, contact Mokon Customer Service.
S.br	<i>Sensor Break:</i> Input sensor is unreliable or the input signal is out of range.	Check that the sensor is correctly connected.
Hw.Er	<i>Hardware error</i> Indication that a module is of the wrong type.	Check that the correct modules are fitted.
rmt.F	<i>Remote input failure.</i> The PDSIO® input is open circuit. (PDSIO® Also known as SST – Smart Setpoint Transmission)	Check for open or short circuit wiring on the PDSIO® input.
Err1	<i>Error 1:</i> ROM self-test fail	Return the controller for repair.
Err2	<i>Error 2:</i> RAM self-test fail	Return the controller for repair.
Err3	<i>Error 3:</i> Watchdog fail	Return the controller for repair.
Err4	<i>Error 4: Keyboard failure</i> Stuck button, or a button was pressed during power up.	Switch the power off and then on without touching any of the controller buttons.
Err5	<i>Error 5: Input circuit failure</i>	Return the controller for repair
PwrF	<i>Power failure.</i> The line voltage is too low	Check that the supply to the controller is within the rated limits

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

Section 6 – Options

6.1 Nitrogen blanket/sealed reservoir instructions

- For systems with this option, the system is provided with a sealed reservoir top in order to accommodate a blanket of nitrogen inside the oil reservoir.
- The purpose of the blanket is to prevent oxidation of the heat transfer fluid.

Once the reservoir is filled, and the process is fully purged of air, the ½" connections (if supplied) on the rear of the unit should be utilized to maintain a blanket of nitrogen inside the tank. Do not install a fitting in the Overflow/Fill port until the process is fully purged of air.

- Pressure 0.1 inches of water column is all that is required to maintain an adequate blanket.

Use extreme caution when purging the reservoir. The reservoir is not designed as a pressure vessel. The nitrogen blanket shall not exceed 1 psi.

6.2 Emergency stop

The emergency stop device will shut the machine down regardless of the operating mode. Once the emergency stop device has been activated, it must be disengaged by turning the button clockwise. Disengaging the emergency stop will not restart the machinery but only permit restarting.

- Per the risk assessment of the machine, the emergency stop is not wired to a safety rated relay.
- Do not wire additional safety components to the Mokon stop relay **or** modification of the emergency stop circuit is prohibited.

6.3 Process purge option (reverse flow switch)

To facilitate mold changes with a minimum amount of oil loss from the hoses and the process, a reverse flow purge system is provided as an option. There will be a switch labeled "Process Purge" on the control plate if you have this option.

NOTE: If additional fluid has been added to the Mokon system after initial start up, it will be necessary to drain the excess fluid prior to using the process purge as to avoid overflowing the reservoir tank.

The following is the procedure to utilize this process purge option:

- Turn the controller to the minimum setting and wait until the process temperature is below 130°F (54°C). (See section 5 for controller instructions)

Process purge option (reverse flow switch) (cont)

- Shut off the zone by pressing the “Stop” button.
- Turn the three position selector switch labeled “Process Purge” to the “Rev” position.
- Start the pump by pressing and holding in the “Start” button. The “Start” button must be pressed and held during the entire reverse purge sequence. The fluid in the process loop will be returned to the reservoir.
- Turn the pump off by releasing the “Start” button.
- Turn the three position selector switch to the forward position.
- Repeat steps 1 – 6 for each zone.
- Refer to section 3.1 to restart the system.

NOTE: The time required to purge the system is based on the hold up volume of the process.

6.4 Process purge option (air connections)

To facilitate mold changes with a minimum amount of oil loss from the hoses and the process, a process purge system via air is provided as an option.

NOTE: If additional fluid has been added to the Mokon system after initial start up, it will be necessary to drain the excess fluid prior to using the process purge as to avoid overflowing the reservoir tank.

The following is the procedure to utilize this process purge option:

- Turn the controller to the minimum setting and wait until the process temperature is below 130°F. (See section 5 for controller instructions)
- Shut off the zone by pressing the “Stop” button.
- Connect the Air Supply to the Air Inlet on the system.

Warning: Air supply pressure should not exceed 15 PSIG (103 kpa).

- Depress the “Process Purge” button on the control panel.

The fluid in the process loop will be returned to the reservoir.

- Repeat steps 1 – 4 for each system.
- Refer to section 3.1 to restart the system.

NOTE: The time required to purge the system is based on the hold up volume of the process and the air supply to the system.

6.5 Automatic high-low heat

- For systems supplied with this feature, the low-heat setting is achieved whenever the temperature controller calls for heat. The high-heat setting is activated by a relay output from the controller based on an "event".
- On start-up from a temperature lower than set point, the unit will be in high-heat. When the "to process" fluid temperature reaches 10°F below set point, the controller will switch to low-heat. It will stay in low-heat until the fluid temperature drops to 10°F below set point.

6.6 In-line heat exchanger for additional cooling

- To achieve a lower "to process" fluid temperature. Mokon provides an option of installing a shell-and-tube heat exchanger directly in the "to process" line. This is to supplement the indirect cooling already provided by the cool-oil reservoir.
- The heat transfer fluid is allowed to flow through the exchanger constantly. A solenoid valve, cycled by the temperature controller, based on an "event", controls the flow of cooling water.
- To prevent thermal shock, the cooling water is not allowed to flow through the heat exchanger until the oil temperature reaches 150°F from a higher set point.
- The controller is programmed so that the "event" is not triggered on the ramp to set point. When the controller set point is lowered to 150°F or lower, the cool-oil reservoir will be adequate to cool the fluid to 150°F. Once the 150°F temperature is achieved, the controller will open the cooling water solenoid and control the process accordingly.

6.7 Cool down and automatic shut off

This option consists of an activation button labeled Auto Cool / Shutdown, a relay, and a timed relay.

To enable this feature:

While the unit is currently in operation, push the black button labeled Auto Cool / Shutdown. The machine will disable heating and start cooling for the preset amount of time. When the time runs out the machine will shut down.

If needed the machine can still be shut down by pressing the stop button.

A Timed Relay (TDR) mounted inside the machine's electrical enclosure controls the amount of time the machine cools before shutting down. Rotating the dial on the front of the TDR can change the amount of time. The factory-preset time limit is 3 minutes; the adjustable range of the TDR is from zero to ten minutes.

Section 7 – Troubleshooting guide

Problem	Possible Cause	Corrective Measure
System 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
	High temperature safety switch	Consult factory
	Process purge switch (if supplied) in neutral position	Switch to "Forward" or "Reverse"
Running pilot does not go on	System unplugged / power off	Plug system in / turn power on
	Blown fuse at power supply	Isolate open fuse and replace
	Blown control circuit fuse	Replace and check for ground condition
	Bulb burn out	Replace bulb
System runs momentarily	High temperature safety switch	Consult factory
	Motor starter thermal overloads tripped due to motor overload	Consult factory
Pressure will no build up	Incorrect pump location	See section 3.1 to check and correct motor rotation
	Entrapped air	See section 3.1
	Pump relief valve stuck open	Consult factory
	Inadequate fluid level	Check that sight glass reads at least ½ full, if not add fluid
	Pump needs adjusting	See section 4.2
	No fluid in the pump	Prime the pump
	Reservoir tank valve closed	Open valve
Pressure surges erratically and system will not hold temperature	Entrapped air	See Section 3.1
	Inadequate fluid level	Check that sight glass reads at least ½ full, if not add fluid
	Suction line leak	Repair leak
	Contaminated fluid	Drain and replace fluid

Troubleshooting guide (cont)

Problem	Possible Cause	Corrective Measure
Extreme pressure build up	Plugged flow paths, inadequate circulation through process and connecting lines	Inspect; if plugged, dislodge
		Clean strainers
High pressure and erratic temperature	Plugged flow paths, inadequate circulation through process and connecting lines	Inspect; if plugged, dislodge
		Clean strainers
	Entrapped air	See section 3.1
Loss of pressure and volume output	Zone pump needs adjusting	See section 4.2
	Pressure gauges	Inspect/replace component
	Inadequate fluid level	Check that sight glass reads at least ½ full, if not add fluid
	Cooling valve	Inspect/replace component
	Pump relief valve stuck open	Consult factory
Temperature climbs beyond setpoint	Heater contactor	Inspect/replace component
	Temperature controller	Inspect/replace component
	Thermocouple or RTD	Inspect/replace component
	Controller calibration	See controller section 5
System does not reach and/or hold temperature or slow response after changing temperature setting	Contaminated fluid	Drain/replace fluid
	Heater burn out	Inspect/replace component
	Temperature controller	Inspect/replace component
	Kilowatt capacity inadequate	Consult Mokon engineering
	Loose electrical connections	Tighten connection or replace broken wires
	Thermocouple or RTD	Inspect/replace component
	Controller calibration	See section 5
	Cooling valve stuck open	Consult factory
Variance in temperature readings	Plugged flow paths, inadequate circulation through process and connecting lines	Inspect; if plugged, dislodge
		Clean strainers
	Contaminated fluid	Drain and replace fluid
	Kilowatt capacity inadequate	Consult Mokon engineering
Reservoir tank overheating	Inadequate fluid level	Check that sight glass reads at least ½ full, if not add fluid
	Water not flowing through heat exchanger	Consult factory
	Cooling valve stuck open	Consult factory
	Relief valve stuck open	Inspect/replace component

Troubleshooting guide (cont)

Problem	Possible Cause	Corrective Measure
Noisy pump	Entrapped air	See section 3.1
	Pump needs adjusting	See section 4.2
	Pump needs alignment	See section 4.2
	Worn coupling and/or grommet between pump and motor	Inspect/replace component
	Worn bearing on pump	Inspect/replace component
	Leak on suction side of pump	Repair leak

Section 8 – Condensed parts list

Part No	Description
006256	24 amp motor contactor 110V coil
006257	40 amp heater contactor 110V coil
006366	1.0 – 5.0 amp overload (refer to motor name plate information for
006367	3.2 – 16 amp overload proper overload)
008021	0 – 160 PSI pressure gauge (Glycerin)
011002	1 kW steel immersion heater (for systems 230 and 460 Volt)
011011	1 kW steel immersion heater (for systems 208 and 380 Volt)
011013	1 kW steel immersion heater (for systems 575 Volt)
022038	Start/stop button
022142	Low pressure safety switch
023070	High temperature safety switch (N.C.)
025107	Cooling solenoid valve (H6 oil system only)
025432	Cooling solenoid valve (H4 and H5 oil systems)
032030	Packing for pump
032072	Seal kit for mechanical pumps
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

Oil Model Codes

Model #
H54109H6

Maximum Operating Temperature	
C	345°F Maximum (1987)
H	500°F Maximum (1985*/1997**)
M	450°F Maximum (1985)
X	600°F Maximum (1985)

*1985-500°F Max when followed by C, H, K
 ** 1997-HTF series when followed by 3, 4, 5, 6

Pumping Capacity	
A	30 GPM/100 PSI (1985)
C	20 GPM/100 PSI (1985)
K	10 GPM/60 PSI (1985)
R	10 GPM/100 PSI (1985)
2	5 GPM / 350°F Maximum (350 Series)
3	10 GPM / 350°F Maximum (350 Series)
4	10 GPM / 500°F Maximum (500 Series)
5	20 GPM / 500°F Maximum (500 Series)
6	20 GPM / 600°F Maximum (600 Series)

Voltage	
2	230 Volts / 3 Phase / 60 Hertz
3	380 Volts / 3 Phase / 50 Hertz
4	460 Volts / 3 Phase / 50/60 Hertz
5	500-575 Volts / 3 Phase / 60 Hertz
6	415 Volts / 3 Phase / 50/60 Hertz
7	208 Volts / 3 Phase / 60 Hertz
9	Special Voltage, see option code

New Style Replacements	
"Old" Style Systems are now "New"	
MK	H4
HC (20 gal)	H5
XC (20 gal)	H6
HA (30 GPM)	HF/320
XA (30 GPM)	HF/320

See Option Code

Kilowatt Capacity	
00	Special Combination or no heat
03	3 KW
06	6 KW
09	9 KW
12	12 KW
18	18 KW
24	24 KW
30	30 KW
36	36 KW
48	48 KW

Controller	
A	Special, One Zone
B	Special, Two Zones
C	Special, Three Zones
F	Comp 1000, One Zone
G	Comp 1000, Two Zones
H	Comp 1000, Three Zones
1	*Eurotherm, One Zone
2	*Eurotherm, Two Zones
3	*Eurotherm, Three Zones

*Prior to 08/21/06, 1/4 DIN Eurotherm

Effective 08/21/06 – UL labeled Electrical subpanel

Section 10 – Warranty

OIL SYSTEMS WARRANTY

All new temperature control systems manufactured by MOKON are guaranteed to be free from defective material or workmanship for a period of one (1) year from the date of purchase. All Standard Microprocessor controllers are covered by a five (5) year warranty, Microprocessors with special features are covered by a three (3) year warranty and Solid State controllers are covered by 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, UPON CUSTOMERS 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.

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 any heat transfer fluid other than the ones recommended in the instruction manual or approved by Mokon in writing, may void your warranty. Consult the Mokon service department with questions on fluid selection.

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.



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P# 716-876-9951 - F#716-874-8048 - www.mokon.com

Parts List

No.	Description	
006256	CONT 3 PL 24A RES 120V	\$82.50ea stock
006257	CONT 3 PL 40A RES 120V	\$111.60ea stock
006366	OVLD 1.0-5A AB193EA1EB	\$99.40ea stock
006266	CONT 3 PL 40A RES 120V ALLEN	\$72.30ea stock
008021	GAUG PRESS 0-160PSI WIKA	\$28.70ea
008052	"SIGHTGLS 13"" FLNG MNT 1/2"" FIN"	\$65.10ea stock
009086	HTEX 3.6 SQFT RESERVOIR	\$1610.60ea stock
021009	STRAINER OIL IRON BODY NO 20 M	\$46.00ea stock
022038	BUTN	\$74.50ea stock
022142	"PRES 2-10PSI BUNA 1/2""NPT X "	\$50.00ea stock
022185	BUTN F/PURGE	\$32.40ea stock
022239	DISC 32A DR MNT 3 PIECE AB	\$139.50ea stock
023070	SWIT TEMP 3/8NPT(NC)110/230V	\$179.80ea stock
025009	RELF 1/2MPTX1/2FPT PCS	\$28.00ea stock
025068	"RELF 1"" FPT 50-150PSI F/HC/XC "	\$449.70ea stock
025107	"SOL 1/2""X.375ORF X 2.5CV 120V "	\$526.00ea stock
025291	"CHK STL 1"" FPT W/5# SPG "	\$193.20ea stock
030026	MTR 2HP 575 3 60 TEFC 1160	\$1061.10ea stock
031005	PUMPACCY CPLNG LOVEJOY	\$96.30ea stock
032007	PUMP 20-30GPM HC SERIES	\$1971.90ea stock
032088	PUMP RECIRCULATING 115V BRUTE	\$351.50ea stock
040002	T/C TYPE J 5FT GROUNDED	\$34.30ea stock
040479	2204ECCVHTHTCXXXXXX2XX TRIAC	\$960.00ea 4 week lead
011013	HTR 1KW	\$53.20ea stock