



INSTRUCTION MANUAL

HTF Oil System

Model# H44A24WD

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

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.

Section 2 – Installation

2.1 Unpacking

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

Note: Refer to section 4.1 Maintenance and service.

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.

2.2 Location (cont)

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.

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.

2.4 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.

2.4 Electrical connections (cont)

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 ½ full is recommended (optimum fluid level is ¾ 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: Do not use brass, bronze or copper (yellow) metals in process plumbing that will come in contact with the heat transfer oil. Yellow metal promotes oxidation of the oil, drastically shortening its' life.

*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.

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 several minutes with the controller set to the minimum temperature to remove air from the system. All systems have as standard an auto-air purge, factory default set for 5 minutes. After 5 minutes of operation at the minimum temperature the system should automatically purge itself of air. 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.

3.1 Initial starting procedure (cont)

NOTE: Some processes require a different air purge timed cycle other than the factory default set value. Adjustments can be made to either lengthen or shorten this timed cycle. Please refer to sections 5.5 and 5.6 for additional information on the automatic air purge feature.

- 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.

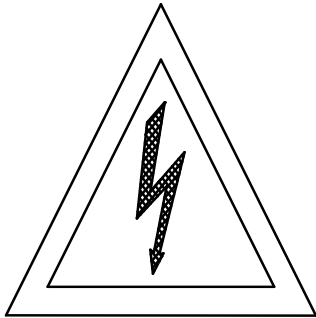
3.4 Restarting procedure

- 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 – 4.7 require that all power sources to the Mokon temperature control system be shut off, isolated and locked out (exceptions noted) and that the system be completely cooled. 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 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 - 4.7 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.


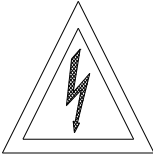
4.1 Preventative maintenance (cont)

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


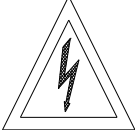


4.1 Preventative maintenance (cont)

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
 <p>Check that the packing gland is dripping approx. 1 drop per minute at 150°F (66°C)</p>	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
 <p>Check gauge readings on the suction and discharge side of the pump, and/or on the cabinet (Power On)</p>	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
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

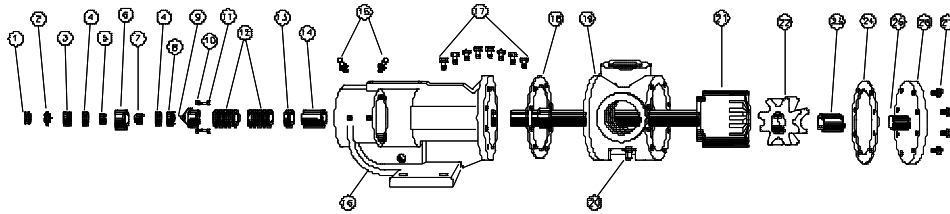


Figure 1
Exploded View

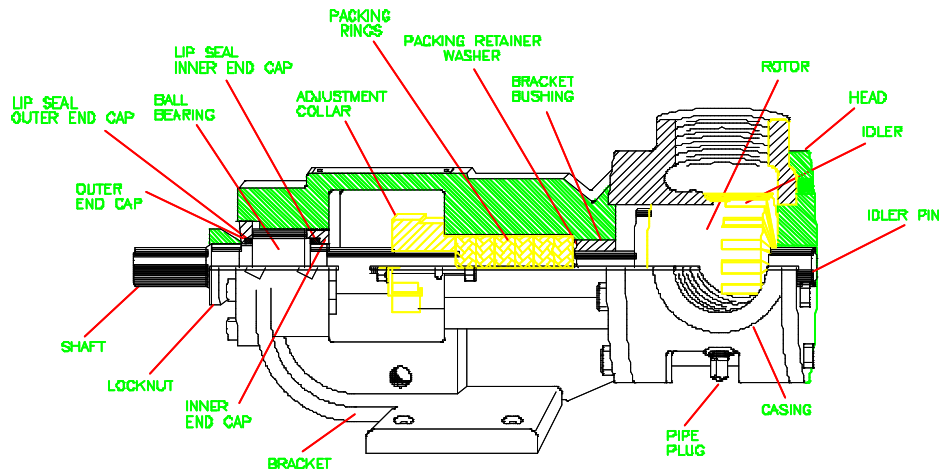


Figure 2
Cut-away View

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.

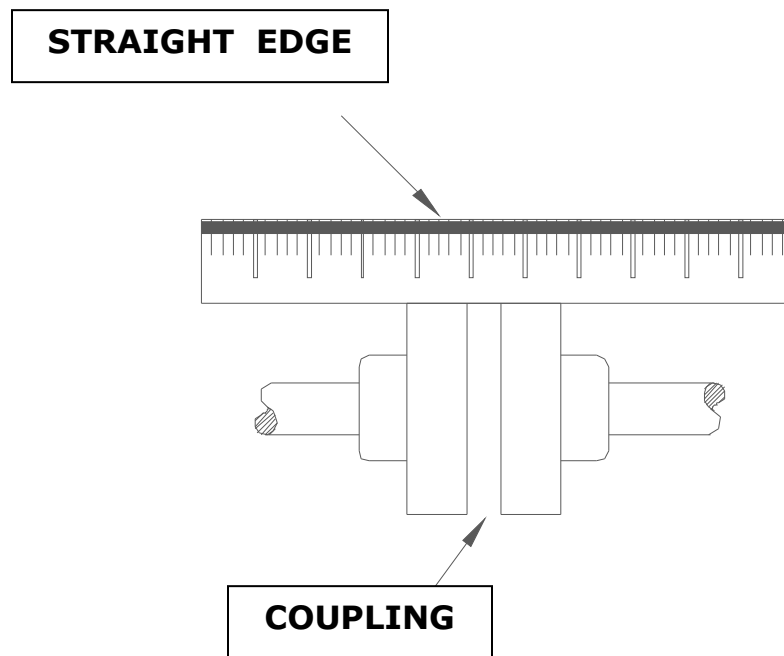


Figure 3

4.2 High temperature pump - zone pump (cont)

Thrust bearing

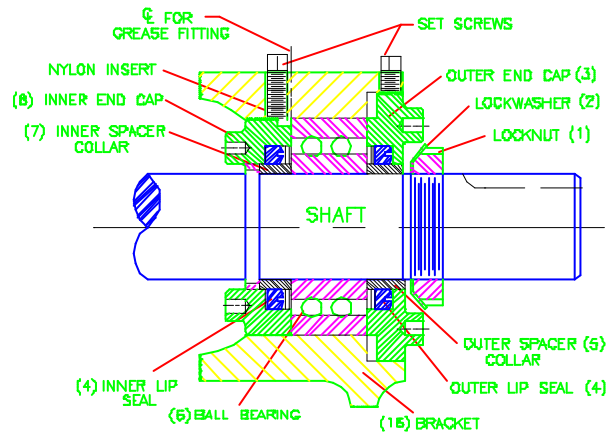


Figure 3

- 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

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 (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 Pump relief valve

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

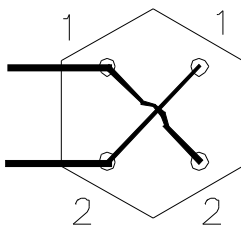
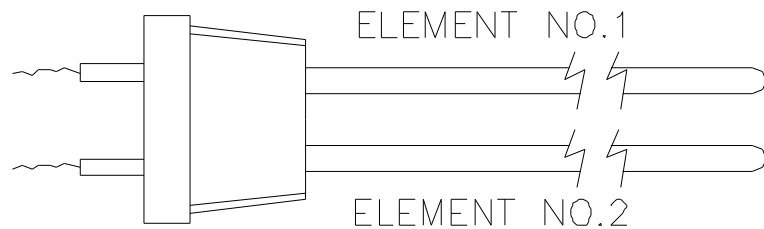
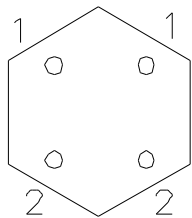
There is a pump relief valve on each pumping circuit. The pump relief valve is set at 100 PSI (689 kPa) on the H5 and H6 series systems; 60 PSI (414kPa) on the H4 series systems. When restrictions in the process are such that it will not accept the full pump output at less than the set pressure, this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

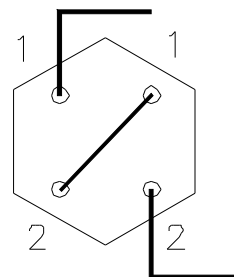
4.5 Heater element wiring

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

4.6 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.**

4.7 High temperature safety switch

The high temperature safety cut off is located in the heater manifold. This switch is factory set.

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

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

4.8 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.

4.8 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.

4.9 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 – Watlow Controller

See File on CD

Section 6 – Options

6.1 Nitrogen blanket 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, the 3/4" fill connection may be utilized to maintain a blanket of nitrogen side the tank.
- 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 5.0 inches of water column.

- Note: Any inert gas such as argon or helium may be used in place of nitrogen.

6.2 "Z" Purge Instructions all systems

- A 3 inch diameter threaded pipe connection is provided to receive an air or nitrogen supply, a 90 cfm blower is recommended. This blower shall not be installed or placed in the hazardous environment where hazardous fumes will be drawn from for supply air to the electrical enclosure or internal cabinetry of the Mokon system. The optimum nitrogen or air supply range to the Mokon system should be .15 to .5 inches of water column.

As an alternative to nitrogen, non-hazardous "clean" dry air can be supplied which can also include clean dry compressed shop air.

The discharge pressure of the fan or blower needs to be, at least, 3.0 inches of water column for every 100 equivalent feet of 3" duct. For 4" duct, 1.0 inch of water column per 100 feet is adequate. A 3" exhaust connection is also provided.

Note: Due to temperature considerations, the purge gas must flow (sweep) through the unit to insure adequate ventilation.

- Once the purge gas is introduced, the Dwyer model 1950-0-2F pressure switch will close, energizing a time delay relay. The relay prevents start up of the Mokon system until an adequate sweep inside the unit has taken place. The switch is set at its minimum setting of 0.15 inches of water. A green pilot light will illuminate once the relay has "timed out", indicating it is safe to operate the unit.
- The magnehelic gauge has a scale of 0 to .5 inches of water, and is clearly visible to allow the operator to monitor the unit.
- If the purge is lost, for any reason, the pressure switch will open, thus activating a customer supplied alarm through a set of auxiliary contacts. The Mokon system will also shut off.
- For systems that are classified and applied properly the applicable Class, Group and Division is listed on the bottom of the systems serial tag.

6.2 "Z" Purge Instructions all systems (cont)

- Methods: There are typically two methods for the supplies of purge gas to systems for "Z" purge applications, they are as follows:

Method # 1 (recommended): Due to temperature considerations, the purge gas must flow (sweep) through the unit to insure adequate ventilation. This method would apply to water, oil, chiller, and full range heater/chiller systems.

Method # 2: (not recommended): Pressurization of the cabinetry when temperature build up is not as much of a concern can be applied. Here the exhaust coupling on the cabinet would be plugged. This method would apply to water-cooled chiller systems or very low heating capacity systems.

Note: If the "Z" purge mechanism or any other system safety devices are modified or disable in any way Mokon considers them to be non operational and the systems warranty could be void.

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)
- 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 5 minutes; the adjustable range of the TDR is from zero to ten minutes.

Adjusting Auto Cool down/Shutdown Timer (factory default set for 5 minutes, adjustable from 0 to 10 minutes)

- Turn off machine.
- Locate the timer on the electrical subpanel.
- Refer to panel layout drawing for the particular machine, located in the door pocket. The Timer will be designated as auto cool/shutdown time delay relay.
- Turn adjustment dial on timer clockwise to increase time and counter-clockwise to decrease time.
- To determine the proper setting. Heat the machine up to operating temperature. Once you reach operating temperature, turn the setpoint down to the lowest setting. Start timing the cool down period; as soon as the unit reaches a temperature below 150F you can stop timing. The time you have recorded is where you want to set the auto cool timer to.

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
006266	40 amp contactor
006366	1.0 – 5.0 amp overload
008021	0 – 160 PSI pressure gauge (Glycerin)
009086	Heat exchanger 3.6 SQ FT
011002	1 kW steel immersion heater
022038	Start/stop button
022142	Low pressure safety switch
023070	High temperature safety switch (N.C.)
025009	½" relief valve
025075	¾" relief valve
025289	½" check valve
025432	Cooling solenoid valve
030001	Motor 1 HP
032001	High temperature pump
032088	Recirculating pump
023005	Thermometer 50 – 500 Deg F
040416	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 #
H54109Z6

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

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

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)

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

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

*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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