Installation & Operation Manual

MWS Series
Water & Water/Glycol System

CHROMALOX
Advanced Thermal Technologies

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MWS Series Water & Water/Glycol System
Installation Instructions

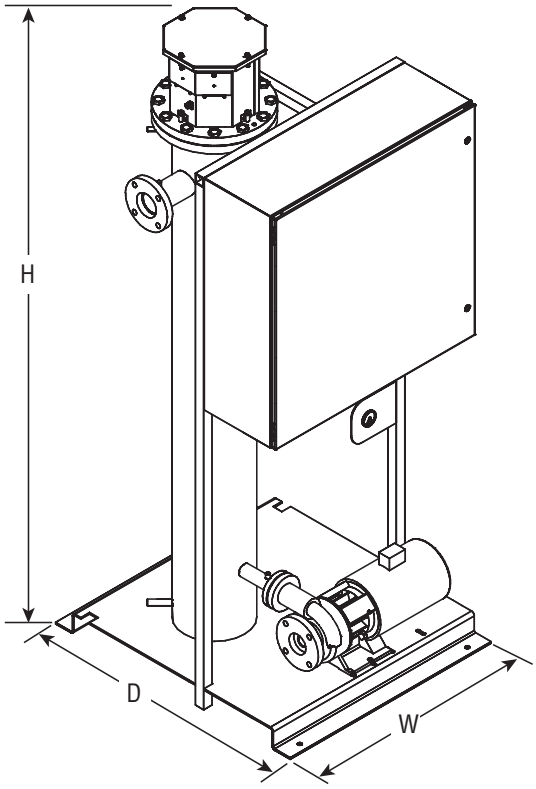
General Information

The Chromalox Heat Transfer Unit is a thoroughly engineered, pretested package, designed to give years of service, virtually maintenance free if properly installed. The MWS series can operate up to 300˚F (149˚C) (depending upon heat transfer fluid properties and unit configuration) with features that comply with the National Electrical Code.

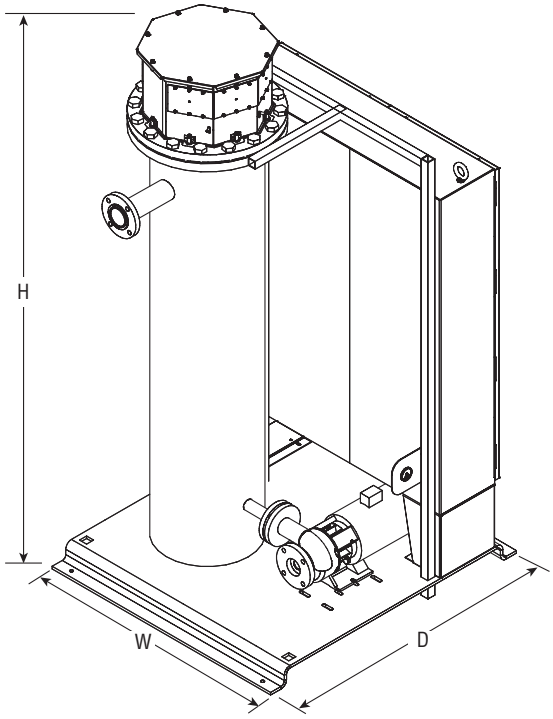
Common to all models: electronic process controller, air-cooled mechanical seal, chamber insulation, discharge pressure gauge, steel heater sheath, cast iron, centrifugal pump; power requirements 240 to 600 volts, 3 phase, 60 cycles, 50 thru 600kW.

⚠WARNING

In hazardous areas, pipe surfaces could achieve temperatures high enough to cause auto-ignition of the hazardous material present. Consult Article 500 of the National Electric Code for further information on the maximum allowable temperature for a specific application.



MWS 50-250 kW Unit (Front View)



MWS 300-600 kW Unit (Rear View)

Unit Proportions

Unit Size	Dry Weight (Lbs.)	Width (In.)	Depth (In.)	Height[1] (In.)	Flow Rate[2] GPM	Pressure[2] TDH (Ft.)	Motor HP	Inlet/Outlet Connection ANSI	System Capacity (Gal.)
50-150 kW	900	36	42	96	60	100	3	2", 150#	25
175-250 kW	1400	36	42	96	120	100	5	3", 150#	35
300-400 kW	2000	48	54	96	200	100	10	3", 150#	55
450-600 kW	2600	48	54	96	200[3]	100[3]	10	3", 150#[3]	65

[1] 650˚F Option will add 8" to overall height.
[2] Refer to pump graph for full operating range
[3] Option for 300 GPM 20HP pump with 4", 150# inlet/outlet

Fluid Compatibility

⚠CAUTION

This system is NOT for use with oil based or synthetic heat transfer fluids.

⚠CAUTION

To avoid possible damage to the heaters do not energize the heater unless the system is filled with fluid.

⚠WARNING

EXPLOSION HAZARD. When heating in closed vessels, controls and back-up controls must be used to regulate build-up of temperature and/or pressure.

Read manufacturer's technical bulletins and instructions carefully.

If you are not sure you are using an accepted heat transfer fluid, check with fluid manufacturer.

⚠WARNING

FIRE/EXPOSION HAZARD. This heater is not intended for use in hazardous atmospheres where flammable vapors, gases, liquids or other combustible atmospheres are present as defined in the National Electrical Code. Failure to comply can result in personal injury or property damage.

DO NOT mix heat transfer fluids unless authorized and approved by the fluid manufacturer. All heat transfer fluids are not compatible with each other, whether made by the same manufacturer or a different manufacturer. If you plan to switch fluids, check with the fluid manufacturer to determine the following.

A. Is the new fluid compatible with the old?

B. What is the recommended cleaning method to remove the old fluid, its sludge, or any deposits remaining in the system?

C. Does the fluid manufacturer have a reclaiming service for used fluid? Do they have recommended procedure for disposal of used or old fluid?

DO NOT allow heat transfer fluid to reach freezing temperatures, as this can permanently damage system.

Unit Installation

Note: When installing system, allow sufficient room to remove heating bundle.

Hydraulics

Note: The MWS systems should be mounted so the control box does not fall in direct sunlight.

The bed plate should be mounted on a level, solid foundation and bolted down.

1. Allow at least 1 foot or more around unit for proper maintenance,
2. Unit is designed for 104˚F (40˚C) maximum operating environment.
3. Unit will be operating at elevated temperatures. Proper care must be provided to ensure personnel safety.

Piping Installation

1. The pipe size should be the same as the system piping connections. All piping must be supported so the pump is not carrying any of the pipe weight. If these instructions are not followed, distortion in the pump may cause unnecessary wear and faulty operation.
2. The piping of the entire system should be arranged to minimize pockets where air may be trapped. Manual air vents or bleeder valves should be provided in the system where air pockets may occur, or where the flow of fluid may drop.
3. Piping should be properly supported so pump can be removed without changing the position of the piping. If piping moves when the pump is removed, pump malfunction is probably due to stresses and twisting caused by the piping. These stresses will multiply where the system is hot due to thermal expansion.
4. If there is a high differential pressure between the inlet and outlet of the heat transfer system at operating temperature, this is probably due to a piping restriction. A continuing high differential pressure can cause excessive wear on the pump and pump stuffing box packing or mechanical seal and will eventually cause premature failure of the pump. The major causes of restrictions are:
   a. Inlet and outlet pipes smaller than provided on the system.
   b. Piping many processes in series with one another. To reduce the pressure drop of the system, equipment should be re-piped in balanced parallel flow.

DO provide for expansion and contraction of process piping and connections to the system. Piping strains can cause pump and motor misalignment, excessive wear on pump body, bearings and stuffing box packing or mechanical seal and will eventually cause failure of the pump and system.

DO provide sufficient cross sectional area in the process piping connections equivalent to the system pipes. In order to prevent undue pressure drop, maximum velocity in all piping should be less than 10 feet per second.

DO check all vent tubes, purge valves, and bypass relief valves at least once a month. Blocked vent tubes may cause excessive system pressures and/or an explosion.

DO retighten all bolted connections and joints at operating temperature. Joints will expand and leak as they get hot. Check all threaded connections on controls, gauges, etc. for leaks.

DO vent all systems operating at atmospheric pressure properly. Vents must be rigid metal piping terminating outside the building or into a suitable container. The vent line should never be made of plastic, rubber or other low temperature material and should match the vent port size on the expansion tank.

DO NOT use process piping connections smaller than the pipes used in the system.

DO NOT use Magnesium bed or porous insulations which can absorb fluid. When soaked, these insulations will decrease unit efficiency and may cause a safety hazard for personnel.

DO NOT permit leaks of any heat transfer fluid to continue unattended. Periodic inspection of piping and insulation is essential.

DO NOT insulate expansion tank lines or the expansion tank. These components must be kept cool and below 130°F (54˚C) for most heat transfer fluids.

DO NOT insulate flanges, valves or other connections which may leak without being observed.

DO NOT use screwed pipe connections on any piping over 1 inch diameter. Use flanges for connections with composition gaskets.

⚠WARNING

Fluid saturated insulation on piping may cause a safety hazard for personnel. Repair leaks and replace soaked insulation immediately!!

Relief Valve Installation

The MWS can be operated with water and glycol/water liquid combinations. Varying combinations of fluid produce different boiling points and various pressures. See Tables 1 and 2 as examples.

Table 1 - 100% Water

Temp. (˚F)	Pressure (PSI)	Temp. (˚C)	Pressure (bar)
200	0	93	0
220	3	104	0.21
240	10	116	0.69
260	21	127	1.45
280	35	138	2.41
300	52	149	3.58

Table 2 - Ethylene Glycol / Water Mixture

% Glycol Mixutre	Boiling Point (˚F)	Boiling Point (˚C)
0	212	100
20	216	102
40	220	104
60	232	111
80	260	127
100	386	197

PLEASE NOTE: The charts are examples only! The user must review and completely understand the fluid properties chosen and the operating limits to be used in the heating system.

Operating at temperatures above the boiling point of the heat transfer fluid WILL PRODUCE PRESSURE in the system. Systems that operate above the boiling point MUST HAVE A USER INSTALLED RELIEF VALVE. The MWS has provided a 3/4" NPT connection in the outlet line for this purpose. Another user installation port may be used, provided there are no shutoffs or restrictions between the pressure chamber and relief valve.

If an optional relief valve was not ordered from the factory and the units is operating over the boiling point of the heat transfer fluid, the user MUST INSTALL AN APPROPRIATELY SIZED RELIEF VAVLE to avoid damage to the system and to avoid a potential safety hazard for personnel. Any other installed equipment in the process loop should also be adequately sized to handle the pressure developed during such operation.

Systems that operate over 15 psi are recommended to be ASME designed & certified. Please check local codes for requirements.

Units that will be operating 20˚F (11˚C) below the fluid boiling point will only have atmospheric pressure on the system and will only need to plug the 3/4" NPT outlet connection in the outlet line.

Expansion Tank Installation

Mount the expansion tank so it is the highest point in the system and if possible at least 15 feet (5m) above the height of the pump. Connect the fluid level sight glass to the expansion tank. To safeguard employees and equipment, run the vent line either out of the building or down into a 55 gallon drum. The vent line piping should match the port size on the expansion tank.

⚠CAUTION

To avoid possible rupture of expansion tank due to pressure, vent line should be checked on a regular basis to be sure it is always open to the atmosphere. Failure to do so may result in rupture of the expansion tank or other parts of the system causing injury or hazard.

Note: If the expansion tank cannot be mounted above the highest point in the system, or if the system is going to operate above the boiling temperature of the heat transfer fluid, the expansion tank will have to be pressurized. This eliminates the possibility of heat transfer fluid flashing into vapor in the heater, at the point of high velocity in the system, at the suction of the pump or causing the pump to vapor lock due to insufficient NPSH (net positive suction head). This pressure should be 5-10 PSI (0.34 - 0.69 bar) above the vapor pressure of the heat transfer fluid at its operating temperature.

⚠WARNING

If expansion tank is to be pressurized, then it must be equipped with safety relief valve(s). If this pressure exceeds 15 PSIG, then the heat transfer system and expansion tank should be ASME certified.

DO NOT mount expansion tank directly on top of system ***unless absolutely necessary.*** If mounted on system, provisions must be made for cooling of the expansion tank line. Maximum safe operating temperatures are reduced when expansion tank is mounted on system unless positive suction pressure of 2 to 3 psig (0.14-0.21 bar) is maintained on pump.

Pump Motor

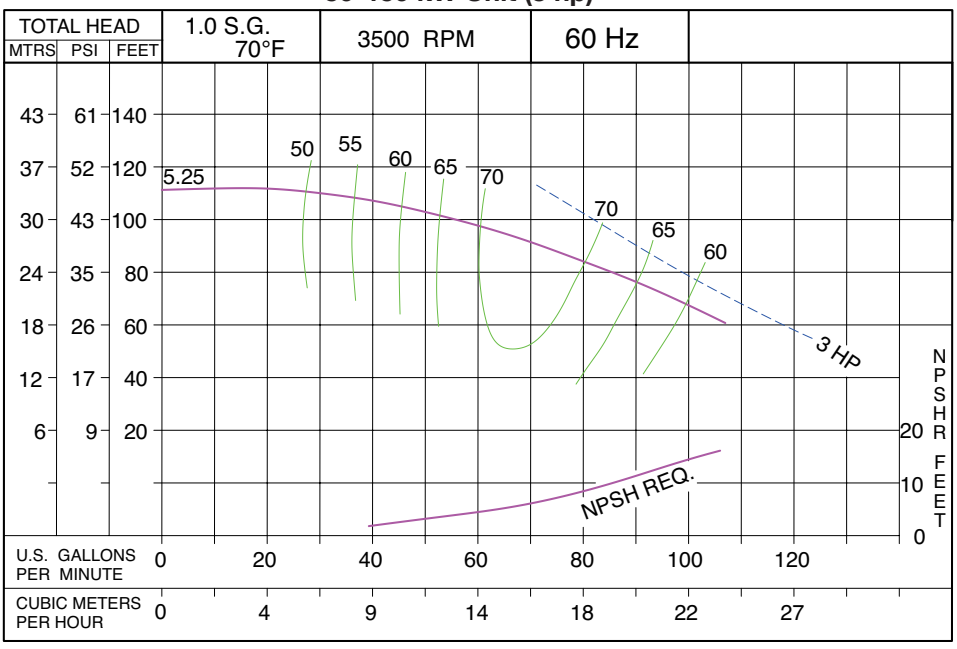
The pump/motor is a close-coupled centrifugal pump rated for 300˚F (149˚C). Pump and motor mounts should be checked and tightened if loosened during shipment.

DO provide for expansion and contraction of process piping and connections to the system. Piping strains can cause pump and motor misalignment, excessive wear on pump body, bearings and stuffing box packing or mechanical seal and will eventually cause failure of the pump and system.

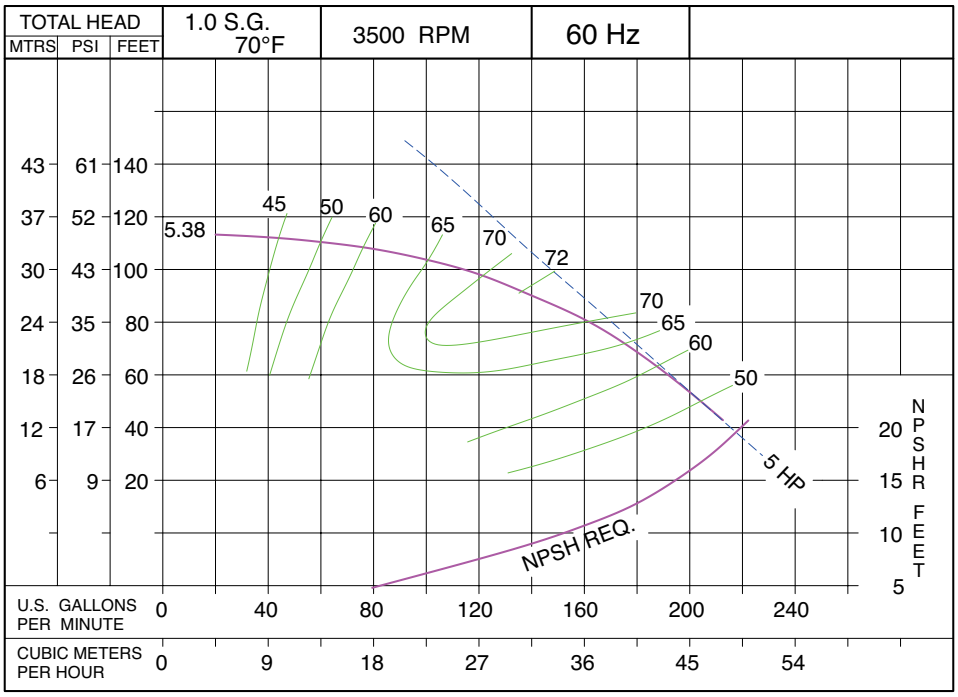
Piping should be properly supported so pump can be removed without changing the position of the piping. If piping moves when the pump is removed, pump malfunction is probably due to stresses and twisting caused by the piping. These stresses will multiply when the system is hot due to thermal expansion.

Refer to graphs for pump performance curves.

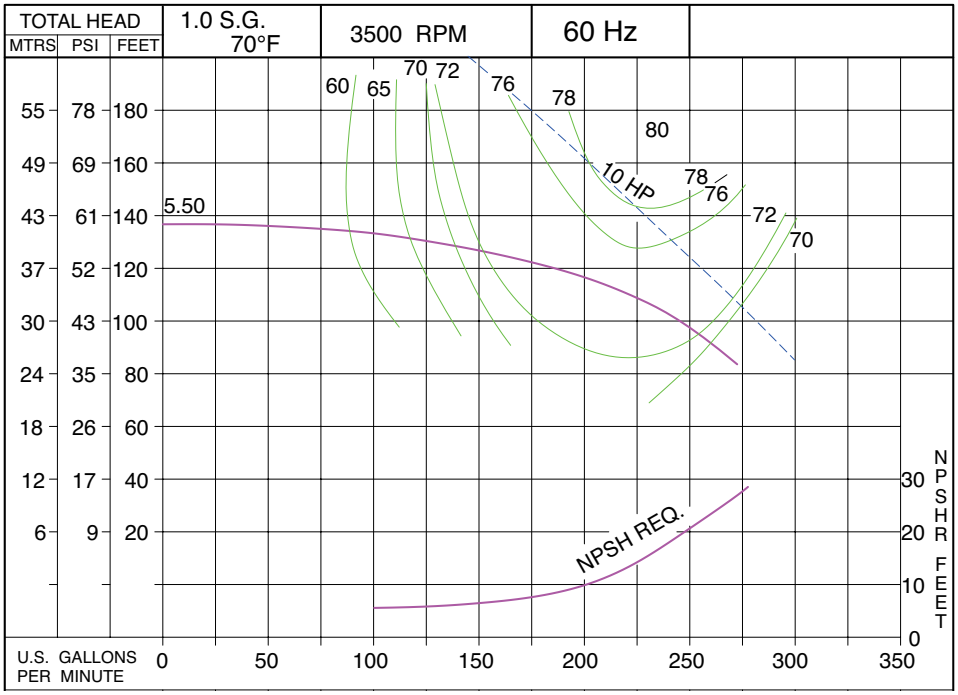
50-150 kW Unit (3 hp)



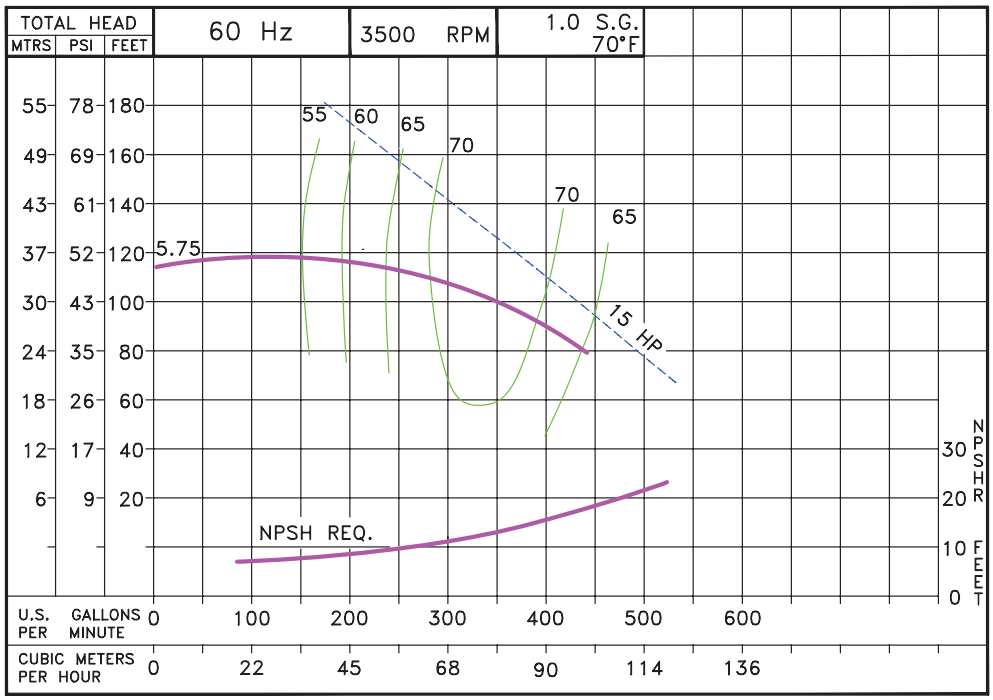
175 - 250 kW Unit (5 hp)



300 - 600 kW Unit (10 hp)



300 - 600 kW Unit (15 hp optional)



Electrical Wiring

⚠WARNING

ELECTRIC SHOCK HAZARD. Any installation involving electric heaters must be performed by a qualified person and must be effectively grounded in accordance with the National Electrical Code to eliminate shock hazard.

1. Electric wiring to heater must be installed in accordance with the National Electrical Code, International Electrical Code and/or with local codes by a qualified person.
2. Electrical wiring to heater should be contained in rigid conduit or sealed in flexible conduit to keep corrosive vapors and liquids out. If high humidity is encountered, the conduit should slope away from the heater.
3. If flexible cord is employed, a watertight connector should be used for entry of the cord. Outdoor applications require liquid-tight conduit and connectors.
4. The current carrying capacity of the power supply leads should exceed the heater amperage by at least 25%. Be sure to consider the ambient operating temperature and apply the appropriate correction factor to the ampacity rating of the wire.
5. The unit is completely wired. The only wiring necessary is to terminals L1, L2, and L3 in the control panel and the ground lug in the control panel.

⚠WARNING

ELECTRIC SHOCK HAZARD. Disconnect all power before installing or servicing heater. Failure to do so could result in personal injury or property damage. Heater must be installed or serviced by a qualified person in accordance with the National Electrical Code, NFPA 70.

6. Jog the motor by pushing the push button marked START, located on the front of the panel. This test is to check pump rotation and the unit should be turned off immediately upon learning the direction of rotation.
7. The pump rotation should be as indicated by arrows on motor. If direction of rotation is wrong, reverse the input leads (L1 and L3) at the master circuit breaker. Momentarily start the pump to check rotation.
8. Turn off power before checking electrical connections. All electrical connections should be checked and tightened if necessary. They may loosen during transit.

⚠CAUTION

A minimum 257˚F (125˚C) insulated wiring should be used.

Note: The control panel wiring diagram is typically included inside the control panel enclosure. If missing, a copy can be obtained by contacting your local Chromalox representative.

Filling System

⚠CAUTION

To avoid possible damage to the heaters, DO NOT energize the heater until the system is filled with fluid.

To Fill Using Expansion Tank

The expansion tank should be the highest point in the system. Simply fill the fluid in the expansion tank, while monitoring the air-bleed valves for complete fill. After filling by gravity, run pump and re-monitor air-bleed valves for any remaining air pockets.

To Fill Using Pump

1. On systems equipped with a float switch on the expansion tank it will be necessary to bypass this switch until the system is filled in order to operate the pump. After system is filled remove bypass jumper to obtain protection of float switch. This switch will shut the system down in the event of a low liquid level or loss of heat transfer liquid thus preventing damage to system.
2. During filling operation, heater setpoint should be set to ambient temperature. If heater on/off switch option is installed, switch should be on OFF position.
3. Close the system inlet gate valve and open the outlet and fill line (option) gate valves and heater bleed valve on all heaters. Prime the pump by pouring approximately 1 pint to 1 quart (1 L) of fluid through any inlet valve located above pump.
4. The system is then filled directly from the 55 gallon (208 L) drum(s) by connecting a hose to fill line and inserting it into the drum.
5. Next energize the pump to pull the fluid into the complete system and up into the expansion tank. When the fluid reaches the heater bleed valve, it should then be closed, and accordingly the bleeds on the customer's process closed when the fluid reaches them. The fill line remains open until the expansion tank sight glass indicates being 1/3 full. After the system is filled, shut down the pump and close the fill valve. Open system inlet valve.
6. Turn master circuit breaker off. Bleed air from all lines (including one located above pump) and re-close all bleed valves.
7. The temperature limiting device located inside the control panel should be checked to insure manual reset buttons are in the closed position. They should be set approximately 50˚F (28˚C) higher than the process control during normal operation.
8. Close control box door and turn circuit breaker on. Start pump – do not be alarmed if the pump is noisy during the initial start-up operation since it is due to air in the system.
9. Bleed out all air by opening bleeder valves. The pump should become quiet.

⚠CAUTION

During the initial start-up operation, the liquid level in the expansion tank must be checked continually. This level should not exceed the three-quarter mark on the glass nor drop below the one-quarter mark. Note: If abnormal expansion of fluid is detected, this is probably due to a pocket of air still present in the system. Check all bleed valves for air, and bleed if necessary. If problem continues, de-energize pump and bleed again.

10. Excessive air in the system will cause the heat transfer liquid to back up into the expansion tank, thus evacuating the heating chamber or chambers. If this happens, shut the system down, bleed off air and allow liquid to return to the heating chamber. If pump continues to be noisy and cavitates or if abnormal expansion persists there is excessive air in the system.
11. After the system has been completely charged and free of air pockets, set process controller at the desired temperature.

Operation

⚠CAUTION

Process temperature should never exceed maximum system rating.

For complete process controller instructions, please refer to Chromalox manual PK510.

If needed, factory settings for process controller can be referenced per table below:

Power Control	Drawing Number
Full Contactor	223-123625-308
Contactor, SCR Trim	223-123625-309
Full SCR	223-123625-310

Element overtemperature control is pre-set from the factory at 350˚F (177˚C). This should be adjusted to a range of 50-100˚F (28-56˚C) above the operating set-point. For complete overtemperature controller instructions, please refer to Chromalox manual PDS LIMIT.

⚠CAUTION

Chromalox MWS unit is a component to a customer integrated process. Ensure adequate safety devices have been installed and function properly. Ensure proper review of Control Panel Information Package for proper installation and use.

Optional Accessories

Some MWS units are provided with optional equipment that require additional installation concerns.

Strainer, Inlet/Outlet Valves and Dedicated Fill Connections

Ordering (2) or more of these options will require on-site installation to avoid shipment damage. The order of assembly, starting at pump inlet should be: strainer, fill connection, then gate valve. A bolting kit, with gaskets is provided for simple installation. Please note that during operation, the strainer should be checked as part of a regular maintenance program.

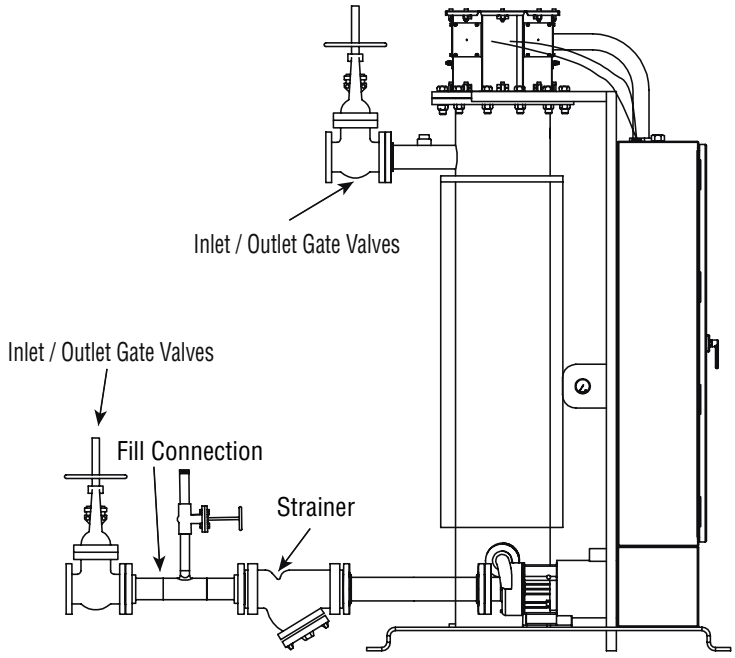
All added-on equipment must be adequately supported to avoid damage to pump.

Purge Connections

Nitrogen purge connections are provided for a hazardous area. Ensure nitrogen system is operational and installed correctly prior to operation. Incoming power wiring must also be installed in accordance with NEC requirements for hazardous area.

Digital Overtemperature Control

The overtemperature controller is pre-set at the factory to 350˚F (177˚C). The controller should be set for 50-100˚F (28-56˚C) higher than operating temperature. Please refer to Chromalox manual PK508 for complete operation.



Note: All piping add-on accessories must be adequately supported to avoid damage to pump.

Figure 2 Optional Piping Accessory Assembly

Start-Up Supervision

Factory trained personnel are highly recommended for those customers who are unfamiliar with the initial start-up.

Contact your local Chromalox sales office or call the Chromalox Service Center: 1-800-443-2640.

Maintenance

Factory trained personnel are recommended for those unfamilar with proper system maintenance.

Contact your local Chromalox sales office or call the Chromalox Service Center: 1-800-443-2640.

Maximum Temperatures

DO NOT attempt to operate any heat transfer system at temperatures higher than those recommended by the manufacturer.

Chromalox heat transfer systems are designed for a particular maximum temperature. If you do not know this design temperature, check with the Chromalox factory. Exceeding the designed temperature of the heat transfer system will void the warranty.

Exceeding the temperature limits of the heat transfer fluid will cause its thermal breakdown or degradation.

STANDARD HEAT TRANSFER SYSTEM TROUBLE SHOOTING CHART

	Problem	Cause	Corrective Action
A	Power light off	Main power feed off	Turn on main power
		Circuit breaker off	Turn on circuit breaker
		Control transformer Primary fuse blown Secondary fuse blown Transformer bad	 Replace fuse Replace fuse Check and/or replace
		Pilot light blown	Replace bulb
B	Power light on, pump will not start	Float switch open	Add fluid to system, If no float switch, jumper terminals 4 & 5
		Motor overloads tripped	Reset overloads, check running current
		Motor starter bad	Check motor starter coil
C	Power light on, pump light on, motor not running	Motor fuse blown	Replace fuse, check motor overloads
		Motor burned out	Replace motor, check motor for overload
D	Power light on, pump light on, motor running, pump not running	Broken coupling	Check and replace coupling
		Pump jammed by slag or foreign object	Turn off system and rotate pump by hand if jammed, disassemble and clean pump. Check and clean strainer.
E	Power light on, pump light on, motor running, pump running heat will not come on	Heat on-off switch in off position	Turn switch to on
		Process control set too low	Set process control to desired temperature
F	Insufficient heat	No flow	See items: pump noisy, see L; insufficient suction pressure, seal; high discharge pressure, see J
		Process piping too small or restricted	Check process piping, check heat transfer area of platen, etc.
		Heater fuses blown	Check and replace fuses
		Heater elements burned out	Check continuity and resistance of elements
G	System leaks when filling	Rough handling during shipment	Check piping and flange alignment retighten and torque all bolts to specifications
H	System leaks at temperature and after cool down	Expansion and contraction due to temperature has loosened connections	Check all flange bolts and connections retighten and torque to manufacturer's specifications
		Wrong gasket materials	Replace gaskets as necessary.
I	Insufficient suction pressure (0 or vacuum), pump noisy, gauges vibrating, discharge pressure low (below 20 psig)	System temperature too high causing vapor lock	See fluid manufacturer's data for maximum fluid temperature
		Vapors lock due to air in system	Bleed air from system
		Net positive suction pressure too low	Raise expansion tank to increase suction head, static head should be 4-5 psig.
		Strainer plugged	Remove and clean strainer
		Valve closed	Check all valves
J	High discharge pressure over 40 psig, pressure gauges fluctuating rapidly, pump noisy, expansion tank normal, system operating on bypass relief valve	System piping blocked or restricted	Check all valves, check strainer
		Process piping blocked or restricted	Check process piping sizing, check for closed valves or improperly installed automatic valves, check all bleed valves for air or steam
K	Expansion tank overflows or "burps" (over 220°F)	Expansion tank too low	Expansion tank should be mounted 15 ft. above system
		Expansion tank line too short	Lengthen expansion tank line to cool fluid and provide cold seal
		Tank too small for system	Check volume on process piping
L	Pump noisy and/or cavitation	Air in system	Bleed system periodically until all air is removed Insufficient bleed valves in process piping to remove trapped air
		Pump damaged by overtightened packing gland	Replace pump
		Insufficient suction pressure	Suction pressure should be 4-5 psig

Spare Parts

Gasket	Size (In.)	Rating
017222-017	2	150#
017222-015	3	150#
017222-019	4	150#

Miscellaneous	Description
306681-200	Discharge Pressure Gauge
122571-100	Suction Pressure Gauge
304460-096	Process Thermocouple
048419-018	Relief Valve

For Replacement Heater Bundle or spare parts not listed here, please contact Chromalox Service Center 1-800-443-2640

Pump seals in unit are not included in the product warranty. Pump seals can be purchased as a separate item.

Limited Warranty:
Please refer to the Chromalox limited warranty applicable to this product at http://www.chromalox.com/customer-service/policies/termsofsale.aspx.

Chromalox, Inc.
2150 N. Rulon White Blvd.
Ogden, UT 84404
(800) 368-2493
www.chromalox.com