

ThermoJet® Oil Purifier
H4500E Series
Operation and Maintenance
Manual



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**OPERATION AND MAINTENANCE
MANUAL**

**THERMOJET® OIL PURIFIER
H-4500E SERIES**

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I. **Preface**

The operation and maintenance of the **ThermoJet®** H-4500E Series are being covered in this manual.

The **ThermoJet®** H-4500E Series is designed for the hydrocarbon processing industry where the unit is in compliance with Class I Division 1 Groups C/D Hazardous Areas.

The ThermoJet® H-4500E Series uses electric heater as a mean to heat the contaminated oil.

The simplicity and ease of operation of the air/gas stripping devices far exceed any other oil purification technology. The primary purposes of purification are to remove water, particulate and sludge from circulating oil systems to improve machinery reliability, to avoid the cost of oil changes, and to minimize waste oil disposal concerns.

The air/gas stripping technology employed in the **ThermoJet®** is based on mass transfer principles. The capacity of air/gas to entrain moisture increases exponentially with temperature. An example of this principle is with a temperature increase of 100 °F the capacity of air to hold water increases 30-fold.

After the oil is filtered and heated, atmospheric air is drawn into the **ThermoJet®** through a dual-stage jet mixer. The air is the medium, which promotes the phase change of water from liquid to vapor.

The **ThermoJet®** is designed to operate on ISO 32 through ISO 220 oils from circulating oil systems. Oil with higher viscosity (ISO 150 and ISO 220) must be at 100 °F (40 °C) minimum temperature at the inlet to the **ThermoJet®** during start-up.

ThermoJet® Oil Purifiers, if properly installed and given minimal required maintenance attention, will provide years of highly satisfactory service.

NOTE: This manual should be reviewed in conjunction with the process and instrumentation diagram, electrical wiring diagram, and general assembly drawing provided in Appendix A.

II. Inspection and Installation

1. Remove all shipping materials and plastic plugs.
2. Inspect for shipping damage externally and internally (open enclosure door), and report any found to Lubrication Systems Company immediately. It is desirable to take photographs of any damage to substantiate your claim.
3. Inspect for completeness of materials and equipment against the packing list and the purchase order.
4. After verifying the adequacy and strength of all relevant support surfaces, place the **ThermoJet®** Oil Purifier as close as possible to the oil reservoir in an upright position.
5. If permanent installation is desired, bolt the four (4) mounting feet to the installation surface in accordance with standard plant practices.

NOTE: Be sure to leave working space around the system and consider space requirements for electric heater removal, fully opened access door, control panel enclosure door, and gauge monitoring.

6. If a flooded suction to the unit is not practical, ensure that the suction height from the reservoir drain to the inlet connection of the **ThermoJet®** is no more than 8 feet (2.4 meters) above the minimum oil level in the reservoir.

If the suction lift exceeds 8 feet (2.4 meters), install a foot-valve or foot-pump to ensure that the suction pump will prime and hold prime during long-term service.

7. Ensure that the oil return connection is above the oil level in the reservoir to prevent back flow and flooding of the separation tank when the **ThermoJet®** is shut down. Return oil must be introduced into the reservoir above the oil level to prevent siphoning when the **ThermoJet®** is shut down.
8. Ensure that free falling oil does not exceed 6 inches (150 cc) to prevent the potential risk of static electricity. If the oil return level exceeds 6" (150 mm), insert a guide baffle to smooth out flow to the oil surface in the reservoir.
9. Even if the **ThermoJet®** is to be installed temporarily, it should be hard-piped for safety reasons. Hoses are acceptable if they are certified not to collapse under vacuum conditions and are rated for 600 PSIG (42 bar g) at 200 °F (100 °C).
10. Since all wetted parts of the **ThermoJet®** are constructed of type 300 stainless steel, it is recommended (but not mandatory) that connecting hard pipe work is also stainless steel.

In accordance with good piping practice, the use of joints, bends, and unnecessary long pipe runs should be minimized. Elevated sections of suction piping in horizontal runs also must be avoided to prevent air pockets from existing.

11. Connect the suction line to the reservoir low point drain, or to existing purifier connections if the reservoir is constructed in accordance with API 614.

NOTE: Ensure that the inlet connection is not adjacent to or near any oil return connection, which could result in oil frothing.

12. When a flooded suction is provided to the unit, recommended practice is to install a manual shut-off valve (if one does not already exist) directly to the reservoir connection, which is routed to the **ThermoJet®** inlet connection.

If the oil reservoir is located below the **ThermoJet®** oil inlet connection, a manual shut-off valve is not required or desirable since it creates a line restriction unnecessarily.

13. The discharge line should be connected above the oil surface and at the opposite end of the reservoir versus the suction connection to ensure optimum circulation of oil through the **ThermoJet®**. An oil purifier return connection will exist if the reservoir is constructed in accordance with API 614.

NOTE: Do not install any valves or other restrictive devices in the discharge line, which could cause back flow and clouding of the unit.

14. The **ThermoJet®** is wired for the power supply stated on the nameplate. It must not be re-wired for any other voltage. A suitable power source with adequate safety margin should be selected according to the chart below.

System Full Load Amps

<u>Line Voltage</u>	<u>Full Load Amps</u>
380V 50HZ 3φ	67.9 A
415V 50HZ 3φ	62.2 A
460V 60HZ 3φ	56.1 A
575V 60HZ 3φ	44.8 A

III. Connections

1. The oil inlet and outlet connection sizes are 1 ½" FNPT and 1" FNPT, respectively. The user suction and discharge line sizes (either schedule 40 pipe or smooth I.D. hose) should be 1" I.D. minimum and 2" I.D. maximum to ensure that no flow restrictions will occur due to line lengths, high viscosity, etc. When processing high viscosity oils, the larger sizes of pipe or hose should be used. If tubing is used, increase the diameter by at least one size. All connections should be tight and free of air leaks.

NOTE: Even very small air leaks can dramatically affect pump suction performance. If air bubbles are visible in the sight glass after flow is established, re-tighten all suction connection points.

2. The vapor outlet connection is 1 ½" FNPT. It should not be reduced to a smaller size due to the potential for reducing the glow of air through the jet mixer.
3. Condensate purifier assembly outlet connection is 1/8" FNPT. Pipe the condensate outlet to the clean water sewer.
4. The oil filter drain is valved and is located within the package enclosure drip pan to prevent oil spills.
5. The electric heater drain connection is ½" stainless steel valve and is plugged. It is located within the package enclosure drip pan.
6. The electrical cable/conduit connection for the power supply is ¾" FNPT, and is located on the left side of the electrical enclosure.
7. An external grounding lug is located adjacent to the electrical enclosure.

IV. Product Description

1. When the **ThermoJet®** is energized, the inlet pump will begin to draw oil from the tank or reservoir. A sample/vent valve is provided to allow air to be purged from the suction piping.
2. A Y-strainer with a 40 mesh screen is installed to protect the suction pump from accidental damage due to debris.
3. Pressure gauges are used to monitor inlet pump discharge pressure, filter discharge pressure, and the outlet pump discharge pressure.
4. A 25 PSI spring-loaded pressure safety check valve is installed downstream of the inlet pump. The purpose of this check valve is to prevent oil from draining out of the reservoir and into the **ThermoJet®** due to head pressure. This possibility would otherwise exist if the **ThermoJet®** were shut down and the reservoir shut-off valve was left open.
5. An oil filter is installed after the inlet pump discharge line. The filter housing is equipped with a locking ring-nut closing mechanism. The chained allen wrench is used to remove the filter housing during the replacement of filter element. Unless otherwise specified by the user, the filter element is rated at 10 microns and has an efficiency rating of ISO code 13/10 per ISO standard 4406 (NAS Standard 1638, Class 6).
6. Liquid-filled pressure gauges are installed on both sides of the filter to indicate inlet pump discharge pressure, filter discharge pressure, and outlet pump discharge pressure. The filter element should be replaced at a maximum 30 PSID differential pressure as indicated on the inlet pump discharge pressure gauge and the filter discharge pressure gauge.
7. The ideal oil processing temperature is 160° - 185° F. Lower temperatures will result in decreased performance. Operating at higher temperatures will increase performance, but most oils should not be subjected to temperatures exceeding 200° F.

The standard 35 KW electric heater is capable of achieving a maximum 80° F temperature increase between the system inlet and outlet and is regulated by the temperature controller.
8. Each oil pump is protected by an external pressure relief valve.
9. Downstream of the heater, the oil flow is directed into the dual-stage jet mixer which promotes phase change of the water contamination from liquid to vapor. As atmospheric air is drawn into the jet mixer, the air becomes intimately mixed with the oil and assumes the temperature of the oil. Air filters are used to filter the drawn in atmospheric air.
10. As the oil exits the jet mixer, it enters a separation tank where the water vapor vents to the atmosphere while the oil collects in a standing reservoir. The oil absorption media sock inside the condensate purifier assembly absorbs the excess oil from the condensate and the water drains into a clean sewer system.
11. The oil is pumped out of the separation tank and discharges back to the oil reservoir. The pump also divers some oil flow back into the separation tank through the mechanical float-actuated level control valve located within the tank. The purpose of this level control valve is to equalize the inlet and the return oil volume. The level control valve is normally open and closes on rising level in order to prevent flooding of the separation tank.

V. Start-Up Procedures

1. Before each start-up, perform a “walk-around” of the purifier installation noting if the points covered in Section II of this manual are correct.
2. If oil hoses are used, ensure they are fully extended in as straight a line as possible.
3. Ensure that the block valve at the reservoir is closed, remove the screen inside the inlet Y-strainer and clean as necessary.
4. Ensure that the oil filter element is installed in the filter housing and that the O-ring is in good condition.
5. Open the reservoir inlet valve if one is installed.
6. Open the block valve on the bottom of the reservoir to drain any free water that has accumulated.
7. Energize the circuit breaker.
8. Jog the electric motor to ensure proper motor rotation. Verify the motor rotation against the directional arrow provided. If incorrect, interchange any two of the three incoming power supply leads at the circuit breaker. Restart the motor and verify once again.
9. Open the air bleed/sample valve on the downstream of the inlet pump so that air in the suction line can escape. As soon as oil flow is established, close this valve to prevent any oil spills. Wait a maximum of 2 minutes to determine if oil is flowing through the spinner sight flow indicator. If no oil is flowing, trace the inlet piping for blockages such as a closed valve. If the oil path is free from obstructions, manually prime the pump and the inlet piping. Ensure that the suction line distance is within the allowable limit as mentioned in Section II.

Check if any air bubbles are present in the sight flow indicator. If air bubbles are continued to appear on the sight flow indicator, re-check all inlet piping joints and re-tighten once again. Also ensure that the source of the air bubbles is not oil foaming inside the reservoir.

10. Heater Operation:

The electric heater will not energize until flow is established and all the air escapes from the heater compartment. A pressure switch located downstream of the heater permits the heater to energize when the pressure reaches 135 PSIG. This may be noted on the inlet pump discharge and filter discharge pressure gauges as well as by the amber “Heater 1” indicator light.

The 35 KW heater is composed of two independent circuits: Heater “1” is controlled by the 7 KW circuit and Heater “2” is controlled by the 28 KW circuit. At start up, the full capacity 35 KW is used to raise the oil temperature to the temperature set point. Once the set point is reached, the 7 KW circuit is de-energized. When the temperature falls below the set point, the temperature controller will energize the 7 KW circuit again to maintain the set point temperature.

11. The temperature controller is factory set at 180 ° F and is field adjustable. The temperature controller is accessed by unscrewing the glass window from the explosion proof electrical enclosure.

Verify that the temperature controller is set at the desired operating temperature. All the parameters on the controller have been factory set and locked in the controller's memory. User can only access the operating mode to adjust the temperature set point.

To adjust the temperature set point, depress the "Function" key. Use the "Raise" and "Lower" panel control keys to adjust the temperature value until the display reads 180 °F. At that point, depress the "Function" key to return to the operational mode. The controller is now properly set at 180 °F.

12. When the oil temperature reaches approximately 160 °F, observe if water vapor and condensate are discharging from the vent connection. If the oil is not highly contaminated, this exhaust may be minimal.
13. The pressure relief valve downstream of the inlet pump is factory set at 240 PSIG at heater process temperature of 180 °F. Initially, the filter inlet and outlet pressure will vary due to higher oil viscosity at start-up. Once the oil temperature approaches the normal operating range, the pressure will return to the normal 240 PSIG reading.

NOTE: In no case should the pressure be allowed to exceed 300 PSIG. If such a high pressure is indicated, immediately turn off the unit, and take any necessary steps to pre-heat the oil. Refer to Section VI for shut down procedures.

VI. Shut-Down Procedures

1. On electric heated units, turn the motor on/off switch to the “off” position. Then turn the circuit breaker handle to the “off” position.
2. Close the reservoir valve that is connected to the **ThermoJet®** inlet if one has been installed.
3. If the **ThermoJet®** is to be moved, disconnect the suction and discharge lines and the power supply.
4. If the **ThermoJet®** is to be shut down for a long period of time, drain all the oil inside the heater tube vessel and the separation tank.
5. Replace the oil filter element and the oil mist eliminator filter element.
6. Clean the air filters mounted on top of the jet mixer.
7. Clean the screen inside the Y-strainer.

VII. Monitoring Normal Operation

1. The sight flow indicator is spinning, and is free of air bubbles to ensure adequate oil flow into the system.
2. The inlet pump discharge pressure gauge reading is 210-240 PSIG at operating temperature.
3. The filter discharge pressure gauge reading is between 210-240 PSIG.
4. The outlet pump discharge pressure gauge reading is between 50-100 PSIG at operating temperature depending upon size/configuration of the oil return line.
5. The temperature gauge reading is relatively steady within 10 degrees F of the temperature controller set point. The process temperature is between 160-185 degrees F.
6. Water vapor/condensate is exhausting through the oil mist eliminator filter outlet.

NOTE: If the oil is relatively dry, little or no vapor/condensate will be observed, and an oil sample maybe taken to verify the water content.

VIII. Maintenance Requirements

1. Remove and inspect the jet mixer air filters once per month and clean as necessary. If air filters are not kept clean, system performance will deteriorate due to loss of airflow.

NOTE: This procedure may be required more frequently if the **ThermoJet®** is installed in an extremely dusty environment.

2. Check the inlet pump discharge and filter discharge pressure gauges for the pressure loss between the two readings. If the pressure loss is approaching 30 PSID, the filter element is plugged and must be changed. The filter element should be changed when the pressure loss is 30 PSID.

To change the filter element, first shut down the **ThermoJet®** and then remove the vent plug located on top of the filter housing to prevent the siphoning of oil out of the heater tube.

Open the drain valve at the bottom of the filter housing and allow the oil to drain into a suitable container.

Turn the locking ring on the filter housing counter-clockwise using the supplied wrench that is attached to the filter housing until the housing is loose. Drop the filter housing down from the filter head.

Remove the dirty oil filter element and install a new one. Check the condition of the O-ring in the filter housing and replace the O-ring as necessary.

Reinstall the filter housing and using the spanner wrench to tighten and secure the filter housing with the lock nut.

Reinstall the vent plug on top of the filter housing.

Restart the **ThermoJet®** and verify normal readings on the inlet pump discharge and filter discharge pressure. Pressure loss between the two readings should be zero.

3. Check and clean the screen inside the Y-strainer.
4. Replace the oil mist eliminator filter element if saturated. This filter element should remain effective for at least three to six months depending on the wetness of the oil in the contaminated reservoir. Periodic visual inspection for signs of heavy liquid loading and particle build up is recommended.
5. Replace oil absorption media sock if saturated. This absorption media sock should remain effective for two to four weeks. Periodic visual inspection is the only way to determine if sock is saturated.

IX. Draining and Cleaning Procedures

Draining and cleaning procedures must be practiced if the **ThermoJet®** is being used to remove water contaminant in a different type of oil and from different reservoirs. The following procedures are listed in order of criticality. Depending upon any variety of individual situations, they may be either followed to conclusion, modified as desired, or discontinued at any point.

1. Shut off the reservoir drain valve, energize the motor so that the major portion of oil in the system can be pumped out within a few minutes. If the suction and the discharge hoses were attached to the portable unit, care must be taken to ensure that oil in these lines are pumped out.

NOTE: This procedure allows the pumps to run “dry”, but it will not damage them since they are lubricated with the residual oil. However, this procedure should not continue for more than a few minutes because the pump requires inlet oil to lubricate and cool the gears of the pump, and the operator should be in attendance to monitor it.

2. Remove the drain cap from the separation vessel and drain the oil into a suitable container.
3. To drain the oil filter housing, remove the air vent screw on the top of the filter housing to prevent siphoning of oil out of the heater tube. Then open the drain valve at the bottom of the filter housing and allow the oil to drain into a suitable container.
4. To drain the heater vessel, open the drain valve and drain the oil into a suitable container.

NOTE: For many situations the above procedures are adequate for removing most of the oil from the system in order to prepare the **ThermoJet®** for use on similar or compatible oil.

If the system is to be used on a significantly different type of oil (e.g. Synthetic vs. Mineral, Transformer vs. Lube, or Heavy vs. Light viscosity), plug all connections except for a high point and a low point. Install an air pressure gauge at the high point in order to monitor the pressure inside the separation tank. Then, connect the compressed air to the high point and exhaust the oil from the low point into a suitable container.

CAUTION: Take care to open the low point drain before applying any air pressure because the separation tank is rated for atmospheric pressure and could suffer distortion or other damage if pressurized.

5. Remove the oil filter element and install a new one.
6. Remove the screen from the Y-strainer and clean it.
7. Remove the air filters mounted on top of the jet mixer and clean the wire mesh elements.
8. If preparing the unit for use on a significantly different type of oil, perform one or all of the following procedures:
 - A. Connect the **ThermoJet®** to a small supply of the next oil to be purified (minimum 20 gallons), and circulate the fresh oil to flush out the existing oil for a minimum of 15 minutes, or up to 60 minutes if the **ThermoJet®** is especially dirty.
 - B. Connect the system to a supply of compatible solvent (or other cleaning agent) and circulate to flush for a minimum of 15 minutes.

NOTE: It is very important from a safety standpoint not to heat the oil while flushing with a solvent. Be sure to set the temperature controller to a low temperature setting in order to keep the heater from energizing.

9. On rare occasions, it may be necessary to perform the following procedures to clean out the **ThermoJet®**. One example is if the **ThermoJet®** has been operated without the oil filter element installed.
 - A. Remove the access door on the separation tank, and manually wipe the interior.
 - B. Remove the heater from the heater vessel. The flanged heater can be unbolted from the vessel to gain access to the inside of the heater vessel so that it may be wiped clean.

X. Troubleshooting Guide

1. No Flow in the Suction Line
 - A. Verify motor rotation is in the proper direction.
 - B. Verify that any valves between the oil supply tank and the system inlet are open.
 - C. Verify that there are no inlet line blockages other than the closed valves.
 - D. Check and clean the screen inside the Y-strainer.
 - E. Ensure that hoses are fully extended without kinks, or if hard-piped, that there are no elevated section to create air pockets.
 - F. Verify that inlet line sizes are as specified in Section III of this manual.
 - G. Verify that suction line does not exceed 8 feet (2.4 meters).
 - H. Verify that oil viscosity does not exceed 3,000 SSU.
 - I. If the pump is noisy, check for damage, wear, foreign objects, relief valve set too low or stuck open.

NOTE: The pump may be noisy upon cold start-up and while air is being bled from the suction line, but will quiet down once it achieves normal operating temperature.

2. No Flow in the Discharge Line
 - A. Ensure that there are no valves or other line-blocking devices or debris in the discharge line. If there are, remove them.
 - B. Verify that the inlet pump flow into the separation tank is sufficient to supply the outlet pump by observing the oil flow through the sight glass.
 - C. If the pump is noisy, check for damage, wear, foreign objects, relief valve set too low or stuck open.
3. No Vapor Discharge
 - A. Verify that no line-blocking devices are installed in the vapor/condensate discharge connections or the drain lines.
 - B. Check oil condition. If there is little or no water present, no vapor or condensate will exhaust.
 - C. Check the filter element of the oil mist eliminator to ensure that the element is not plugged with solid particulate. If the element is filled with oil, this is a normal condition and no action should be taken.
4. Oil Spills from the Jet Mixer First-Stage Air Inlet Connection
 - A. Verify that the pressure into the jet mixer is adequate as indicated on the gauges located downstream of the inlet pump and oil filter.

- B. If not, re-adjust the inlet pump pressure control valve to 240 PSIG.
- C. Check oil mist eliminator filter element. Replace filter element if saturated.

NOTE: When there is a severe low-pressure condition at the jet mixer first-stage nozzle, the second stage nozzle also is deprived of sufficient oil pressure to overcome the restriction of the orifice. This causes oil to back up into the first-stage and spill.

5. Temperature Control Problems

The following section of the troubleshooting guide is dedicated to problems associated with temperature control for electric heated units. There are two separate indicators of temperature on the electric heated **ThermoJet®** which are the calibrated temperature gauge (which is located on the gauge panel located above the door on the front of the unit) and the temperature controller (which receives a signal from a type J thermocouple and is located inside the electrical enclosure, but the display of the controller can still be seen without opening the electrical enclosure).

There is no need for alarm if the temperature readings of the temperature controller and the temperature gauge are not displaying exactly the same temperature. There are going to be some differences between the calibration of Type J thermocouple and the temperature gauge. The difference between the two temperature readings is within 10 degrees Fahrenheit.

Low Oil Temperature

- A. Verify that the “heater on” light is illuminated.
- B. Verify the unit is connected to the correct power supply.
- C. Verify that the temperature controller is set at the desire operating temperature. All the parameters on the controller have been factory set and locked in the controller’s memory. User can only access the operating mode to adjust the temperature set point. The process temperature for the **ThermoJet®** is factory set at 180 F degrees.

To adjust the temperature set point, depress the “Function” key. Use the “Raise” and “Lower” panel control keys to adjust the temperature value until the display reads 180 ° F. At that point depress the “Function” key to return to the operational mode. The controller is now properly set at 180 ° F.

If the temperature controller is set to the desired temperature, then the parameters of the temperature controller may have drifted and need to be readjusted. To adjust the parameters of the temperature controller, initiate the auto-tune function of the controller.

To initiate the auto-tune function, depress and hold down simultaneously the “Raise” and “Lower” keys until the “AT” indicator blinks once (after approximately three seconds – the numeric displays will stop flashing). Then, depress and hold down the “Auto/Manual” key for another three seconds. The “AT” indicator will then be ON continuously, indicating that the auto-tune function is engaged and operating.

To disengage the auto-tune function, depress and hold down simultaneously the “Raise” and “Lower” keys until the “AT” indicator blinks once (after approximately three seconds – the numeric displays will stop flashing). Then, depress and hold down the “Auto/Manual” key for another three seconds. The “AT” indicator will then stay OFF, indicating that the auto-tune function is disengaged.

- D. Verify that the temperature gauge is not damaged. Confirm its reading with a surface temperature probe.
- E. Verify that the temperature the controller is reading from the thermocouple is accurate. A method of accomplishing this might be to remove the thermocouple that is in the **ThermoJet®** and attempt to read ambient condition or a known temperature. Then verify that the temperature reading being displayed by the temperature controller would match the temperature of the ambient or known condition. If the two temperatures do not match, then either the temperature controller or the thermocouple may need to be replaced.
- F. If all the above are correct, then check the heater resistance, the heater contactor, the temperature controller contactor, and the pressure switch for possible malfunction.

High Oil Temperature

- A. Verify that oil is flowing normally through the inlet sight glass and that the pressures of the system are normal.
- B. Verify that the temperature controller is set at the desired operating temperature. All the parameters on the controller have been factory set and locked in the controller's memory. User can only access the operating mode to adjust the temperature set point. The process temperature for the **ThermoJet®** is factory set at 180 F degrees.

To adjust the temperature set point, depress the "Function" key. Use the "Raise" and "Lower" panel control keys to adjust the temperature value until the display reads 180 °F. At that point depress the "Function" key to return to the operational mode. The controller is now properly set at 180 °F.

If the temperature controller is set to the desired temperature, then the parameters of the temperature controller may have drifted and need to be readjusted. To adjust the parameters of the temperature controller, initiate the auto-tune function of the controller.

To initiate the auto-tune function, depress and hold down simultaneously the "Raise" and "Lower" keys until the "AT" indicator blinks once (after approximately three seconds – the numeric displays will stop flashing). Then, depress and hold down the "Auto/Manual" key for another three seconds. The "AT" indicator will then be ON continuously, indicating that the auto-tune function is engaged and operating.

- C. Verify that the temperature controller is set at the desired operating temperature.
 - D. Verify that the heater contactor is neither stuck, nor has failed in the energized position. If so, replace the contactor.
6. Excessive Noise/Vibration
- A. Ensure there are no air bubbles in the sight glass. If bubbles are present, check that all inlet line connections are tight and properly sealed.
 - B. Ensure that the suction connection in the reservoir is not adjacent to or near to any oil return connection, which could cause oil foaming.
 - C. With a 1" wrench, exercise the inlet pressure control valve. There may be a piece of trash stuck in the valve chamber and the valve to chatter. After exercising that the valve and trash has been removed, reset the valve to its previous position by ensuring that all the

operating pressures are back to the normal values. Exercising the inlet pressure control valve will change the pressure in which the unit is running.

XI. Quick Reference Troubleshooting Guide

DO

Drain free water from the bottom of reservoir

Install oil filter element

Change oil filter element at 30 PSID

Clean Y-strainer screen

Clean jet mixer's air filters

Operate at recommended pressures and Temperature

Return oil above reservoir level

Slope vent line downward

Operate at correct voltage and frequency

Ensure power supply breakers or fuses are Adequately sized for full load amps

Operate motor clockwise facing the fan

Change oil mist eliminator filter element

Change oil absorbent media sock

DON'T

Operate with inadequate oil flow caused by suction line too small, elevated sections of suction piping, excessively high viscosity, excessive suction life or suction line restrictions

Operate with air bubbles in sight glass

Operate with excessive solids contamination. The filter element within the **ThermoJet®** is not designed to clean up the solid particulate in oil reservoirs. The element is designed to protect critical systems within the **ThermoJet®** and will load up with particulate very quickly and required frequent changes if a pre-filter package is not used. Contact LSC for technical assistance if frequent filter loading occurs.

Attempt to remove contaminants not designed for air stripping such as heavy hydrocarbons, ethylene glycol, carbon black, or motor oil contaminants

Operate with contaminants that attack Viton Seals

Connect to a pressurized reservoir without inlet pressure-reducing valve or discharge boosting Means

Expect satisfactory performance when rate of contaminant intrusion exceeds removal rate

Adjust factory set (290 PSI) pop-off relief valve

Reduce the inner diameter of the suction and discharge lines.

XII. Spare Parts List



<u>Part Number</u>	<u>Description</u>	<u>Quantity</u>
19103020	Oil Filter Element 10 Microns	1
40520235	Filter Houston O-Ring, Viton	1
77750103	Oil Mist Eliminator Filter Element 1 Micron	1
77750111	Oil Absorbent Media Sock (Box of 12)	1




XIII. Types of Product Misapplication And Misuse Not Covered By Warranty Or Guarantees




1. Prolonged operation with air bubbles in the sight glass which causes pump cavitation and/or relief valve chattering.
2. Excessive water ingression beyond the system capability at maximum operating temperature.
NOTE: If this is a temporary condition, free water may be drained manually from the reservoir while a permanent solution is implemented. If it is a constant condition, request Lubrication Systems Company on the feasibility of installing an automatic water drain valve.
3. Operating with inadequate oil flow caused by:
 - A. Suction lines too small.
 - B. Elevated sections of suction piping.
 - C. Suction line restrictions.
 - D. Excessively high viscosity.
 - E. Excessive suction lift.
4. Excessive solids contamination with no pre-filter.
5. Presence of contaminants which are not within the scope of removal for air stripping technology, for example heavy hydrocarbons, ethylene glycol, carbon black, or attempting to purify motor oils.
6. Presence of contaminants that attack Viton seals.
6. High differential pressure on oil filter.
7. Operating without oil filter element or inlet Y-strainer screen.
8. Operating with inlet Y-strainer plugged.
9. Operating with air filters plugged.
10. Incoming oil temperature too cold for heater capacity (except for small reservoir volumes).
11. Operating either above or below recommended operating pressures.
12. Discharging oil into reservoir below the oil level.
13. Operating on under-voltage, over-voltage or wrong voltage.
14. Inadequate power supply, i.e. amperage rating of breaker or fuses under-sized for load required.
15. Connection to pressurized reservoir without inlet pressure reducing valve or discharge boosting means.

XIV. Programming The Temperature Controller

The temperature controller has 5 Modes that can be accessed using Select Mode, (Operator, Setup, Configuration, Product Info, and Automatic Tuning Modes).





Select mode is used to access the configuration and operation menu functions. It can be accessed at any time by holding down the  and press .

In select mode, press  or  to choose the required mode, press  to enter.







An unlock code is required to prevent unauthorized entry to Configuration & Setup modes. Press  or  to enter the unlock code, then press  to proceed.















MODE	Upper Display	Lower Display	Description	Default Unlock Code
Operator	OPtr	SLCt	Normal operation	None
Set Up	SEtP	SLCt	Tailor settings to the Application	10
Configuration	ConF	SLCt	Configure the instrument	20
Product info	Info	SLCt	Check Manufacturing information	None
Auto-Tuning	Atun	SLCt	Invoke Pre-Tune or Self-Tune	0

SELECT MODE



1. Enter the Select Mode by pressing the  and . Use the Up and Down keys to move to the Configuration mode and press enter , then it will call for an Unlock Code (20) then press enter .

CONFIGURATION MODE








1. (InpT) Use the Up and Down keys to go to (JF) {NOTE: be careful not to use the (J.F.)}. press  to save. Press  to move to the next function.
3. (ruL) enter (1400) and press  to save, then press  to scroll.
4. (rLL) enter (32) and press  to save, then press  to scroll.


5. Scroll down until you get to (Ctrl) make sure it is in (rEu). If not use the up and down keys to go to (rEu) and press  to save, the press  to scroll.
6. Scroll down until you get to (ALAI) use the up and down keys to set it to (nonE) and press  to save, then press  to scroll.
7. Scroll down to (AIA2) use the up and down keys to set it to (dE) and press  to save, then press  to scroll.
8. Scroll down to (dAL2) using the up and down keys enter a (-10) and press  to save, then press  to scroll.
9. Scroll down to (USE1) use the up and down keys to enter (Pr1) and press  to save, then press  to scroll.
10. Scroll down to (USE2) using the up and down keys to enter (A2_d) and press  to save, then press  to scroll.
11. Press  &  at the same time to take you back to Select Mode.






SELECT MODE

1. Use the up and down keys to go to the Setup Mode (SetP) press  . This will take you to an unlock code, enter (10) and press  and this will take you to the Select Mode.







SETUP MODE

1. Press  to scroll down to (SpuL) Set Point Upper Limit, using the up and down keys enter (225) and press  to save, then press  to scroll.
2. Scroll down to (Ct1) Output Cycle Time, using the up and down keys enter (4) press  and press  to scroll.
3. Scroll down to (Apt) Auto Pre-Tune, using the up and down keys enter (enable) and press  to save, then press  to scroll.
4. Scroll down to (SP) Set Point, using the up and down keys, set the set point at (180) and

press  to save.

5. Once the set point has been set, the Lower Limit Set Point has to be changed. Scroll back to the beginning of the setup mode by pressing  key. The first parameter is (Filt). Then scroll down through the settings to (SPLL) Set Point Lower Limit and change it to (100), then press  to save.
6. Go back to the Select Mode by pressing  &  use the up and down keys to go to (Atun) Auto-Tuning, and press  to enter.

AUTO-TUNE

1. Pre-tune is a single-shot routine and is thus self-disengaging when complete. If (Apt) in setup mode = (EnAb) enable, pre-tune will attempt to run at every power up.
2. The first parameter is (Ptun) Pre-Tune, use the up and down keys to set it in the (ON) position and then press  to save, then press  to scroll.
3. Scroll to the next parameter (Stun) Self-Tune, use the up and down keys to set it in the (ON) position and the press  to save, no other parameters need to be changed.
4. Press the  &  to go back to the select mode, use the up and down keys to go to the (Optr) mode and press  to enter.

The controller is now programmed with LSC parameters.

If there's any problem with navigating through this procedure, contact the Engineering Department

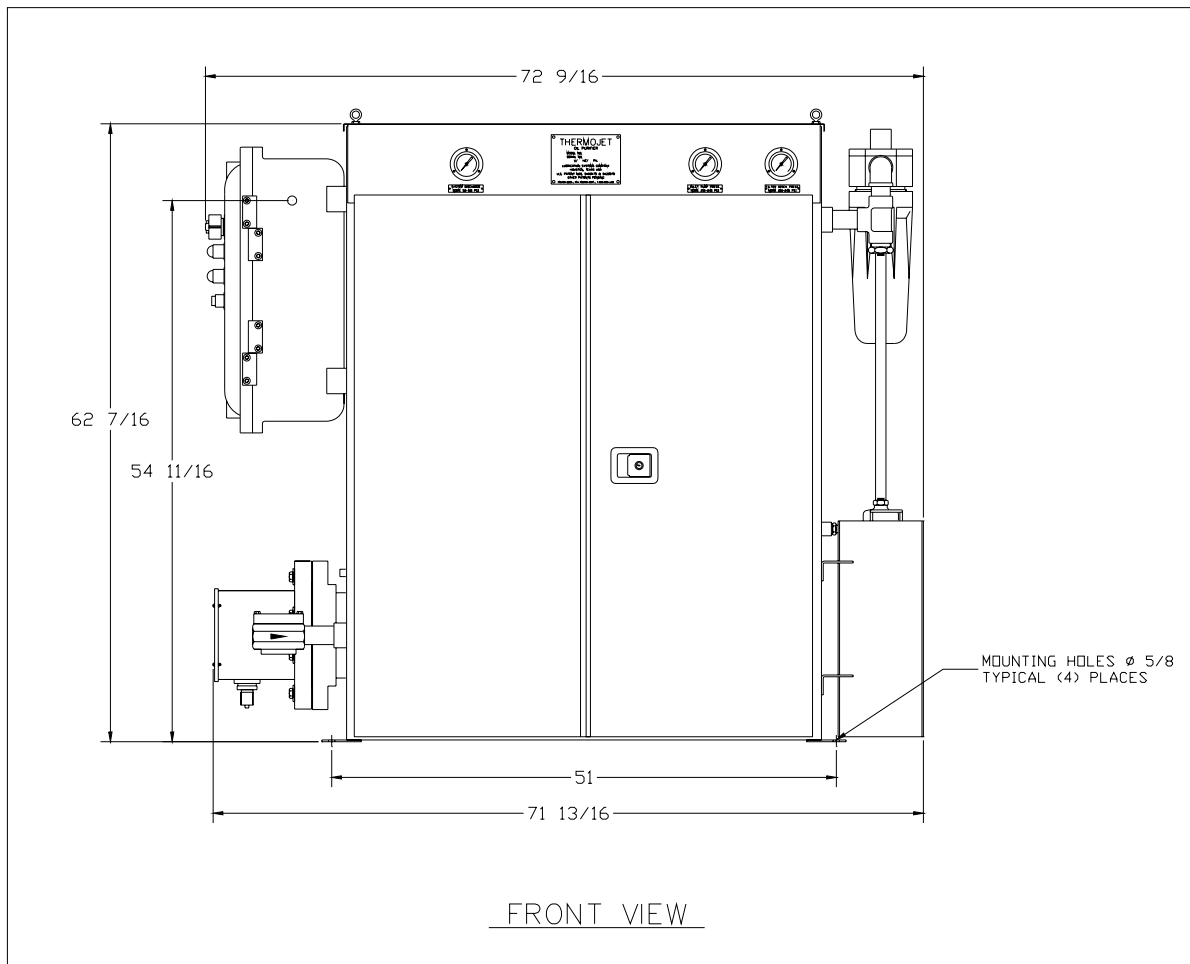
XV. **Bill Of Materials**

ITEM	PART NO	QTY	ZONE	DESCRIPTION
1	02000002	1		DOUBLE SPUR GEAR PUMP
2	02100003	1		C-FACE PUMP MOUNTING ADAPTER
3	02100005	1		FLEX COUPLING MOTOR END
4	77750162	1		7-1/2 HP, ELECTRIC MOTOR, 230-460V/60/3 X-Proof 213TC
5	777501041	1		HANKINSON DEMISTING FILTER HOUSING
6	77750104	1		DEMISTING FILTER ELEMENT 1 MICRON
7	19701100	1		OIL FILTER HOUSING 1" NPT S.S.
8	19003020	1		FILTER ELEMENT 10 MICRON
9	48000150	1		OIL FLOW SIGHT GAUGE 1 1/2" NPT, S.S.
10	777500106	1		THERMOCOUPLE TYPE J NEMA 7 1/4" OD x 3" LG.
11	4944015	1		SUCTION STRAINER 1 1/2" NPT, S.S.
12	51001137	1		RELIEF VALVE SET @ 240 PSI S.S.
13	77750204	2		RELIEF VALVE SET @ 290 PSI S.S.
14	52020100	1		VALVE CHECK 20 PSI S.S.
15	52050100	1		VALVE CHECK 55 PSI S.S.
16	15000300	3		PRESSURE GAUGE 0-300 PSI
17	77600563	1		TEMPERATURE INDICATOR 0-250 F
18	34367421	1		PRESSURE SWITCH
19	36001035	1		35KW FLANGED HEATER 460V/60/3 NEMA 7 CSA ENCLOSURE
20	33000100	1		FLOAT 6" DIA. 316 S.S.
21	51950100	1		VALVE LEVEL CONTROL 1/2" NPT, S.S.
22	03502000	1		JET MIXER 304 S.S.
23	19000100	1		AIR BREATHER 1" NPT
24	19000150	1		AIR BREATHER 1 1/4" NPT
25	77750110	1		OIL ABSORBANT SOCK
25	77750150	1		CONDENSATE PURIFIER ASSEMBLY
27	40500150	2		GASKET 1 1/2" 300# R.F. FLEX
28	40500200	1		GASKET 2" 300# R.F. FLEX
29	30050020	1		2" DIA VIEW GLASS WINDOW NEMA 7
30	30600101	1		SOLID STATE TEMPERATURE CONTROLLER (120V/60HZ)
31	30150011	1		2-POSITION ON/OFF SELECTOR SWITCH NEMA 7
32	30177122	3		AMBER PILOT LIGHT NEMA 7
33	30272300	1		OPERATOR HANDLE FOR MAIN DISCONNECT NEMA 7
34	30600350	1		MERCURY RELAY 35 AMPS NO (120V/60HZ COIL)
35	30181300	2		FUSE BLOCK 30 AMP 3-POLE 600V
36	30181600	1		FUSE BLOCK 60 AMP 3-POLE 600V
37	30551060	1		MAIN DISCONNECT 600V 60 AMPS
38	30601000	1		MERCURY RELAY 100 AMPS NO (120V/60HZ COIL)
39	30110241	1		MAGNETIC MOTOR STARTER (120V/60HZ COIL)
40	30100601	1		CONTROL TRANSFORMER W/FUSE BLOCK 460V/120V
41	77750206	3		FUSE LOW PEAK 25 AMPS
42	77750205	3		FUSE LOW PEAK 40 AMPS
43	30180010	2		FERRULE FUSE 1 AMP
44	30180020	1		FERRULE FUSE 2 AMPS
45	30650101	1		THERMAL OVERLOAD 9-12 AMPS
46	51025225	2		1/4" NPT PLUG VALVE S.S.
47	40511031	1		GASKET LEVEL CONTROL
48	50000010	1		TRAP FLOAT S.S.

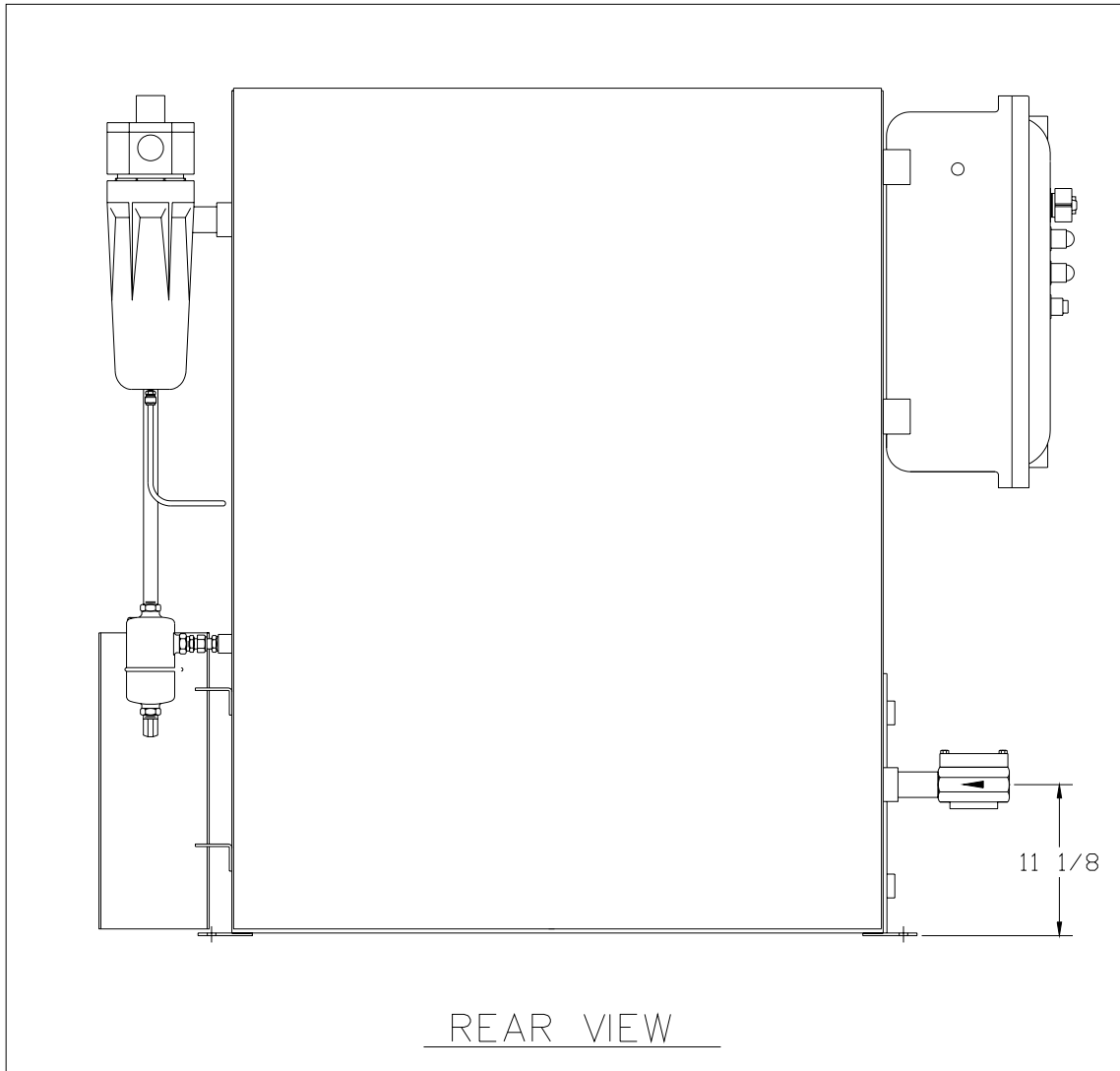
XVI. Drawings

1. DIMENSIONAL OUTLINE

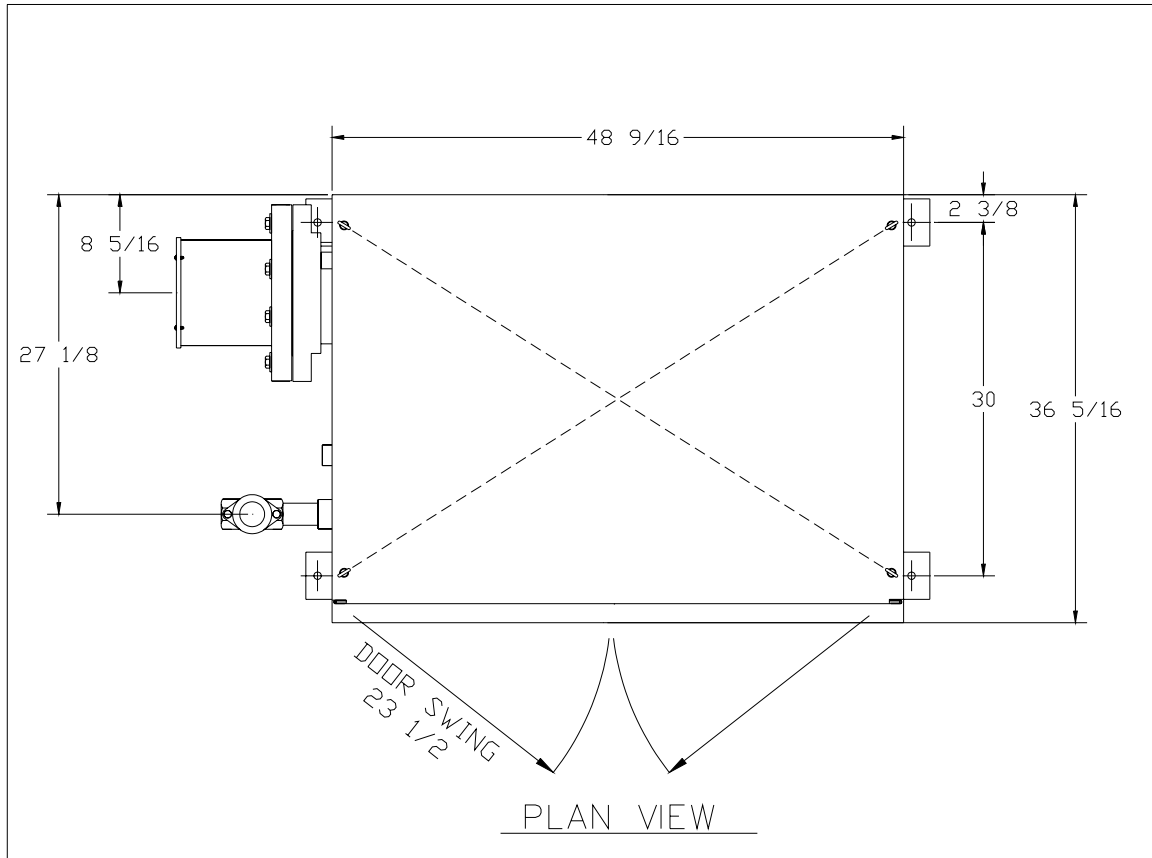
FRONT VIEW



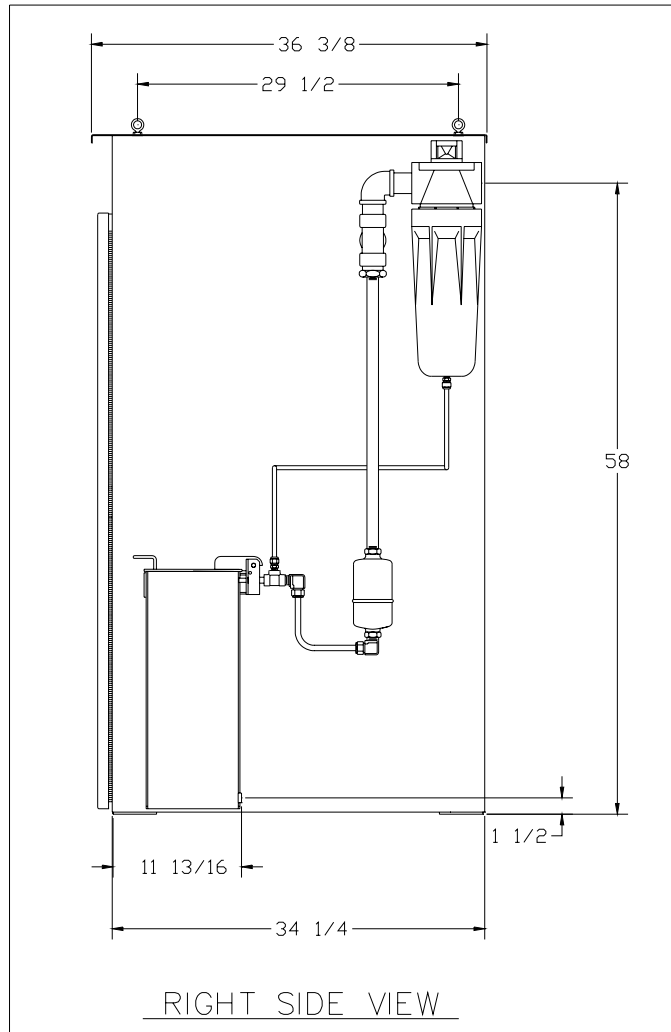
REAR VIEW



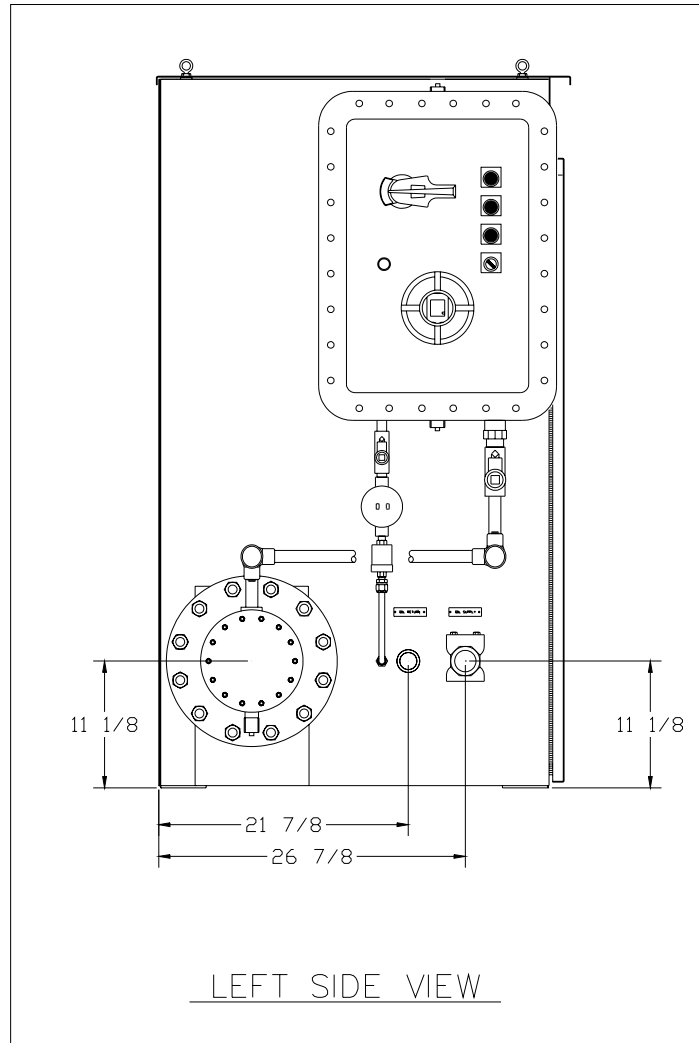
PLAN VIEW



RIGHT SIDE VIEW

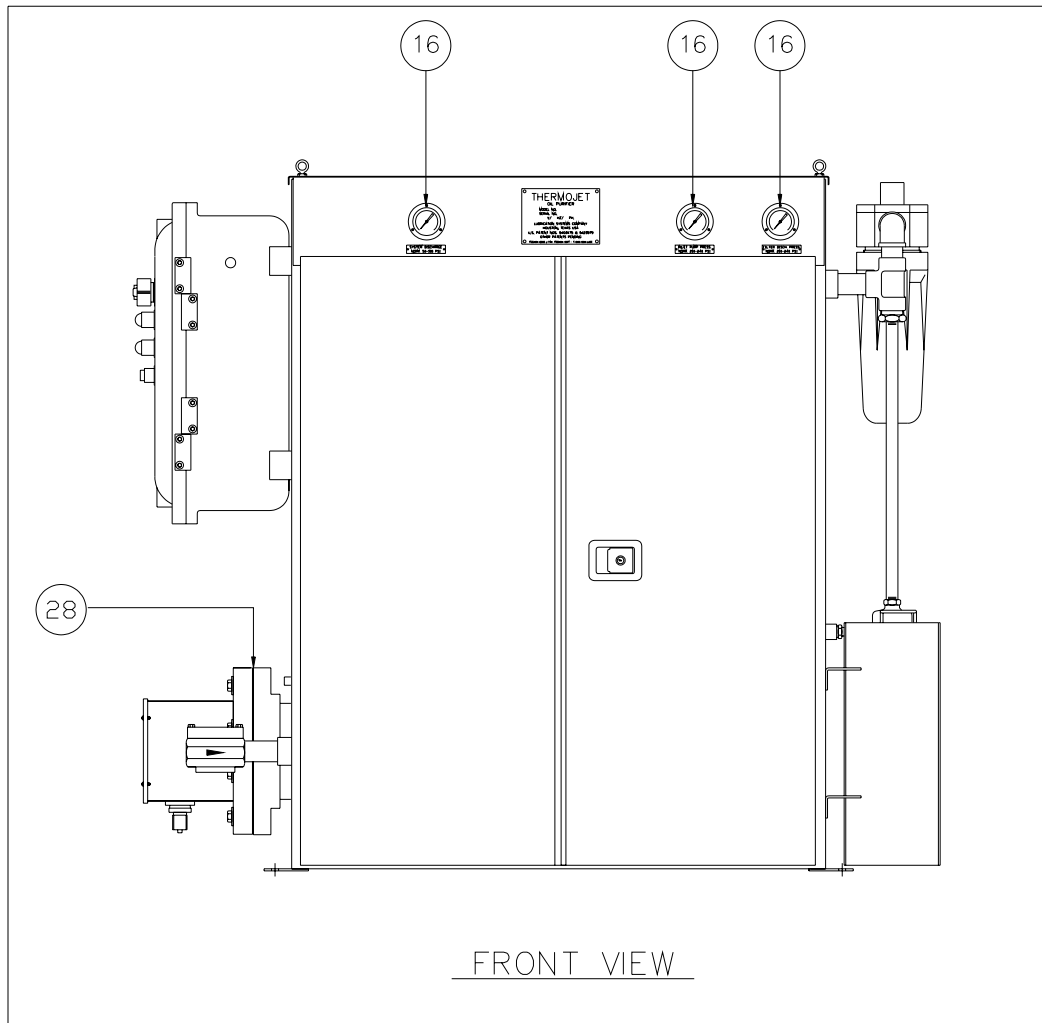


LEFT SIDE VIEW

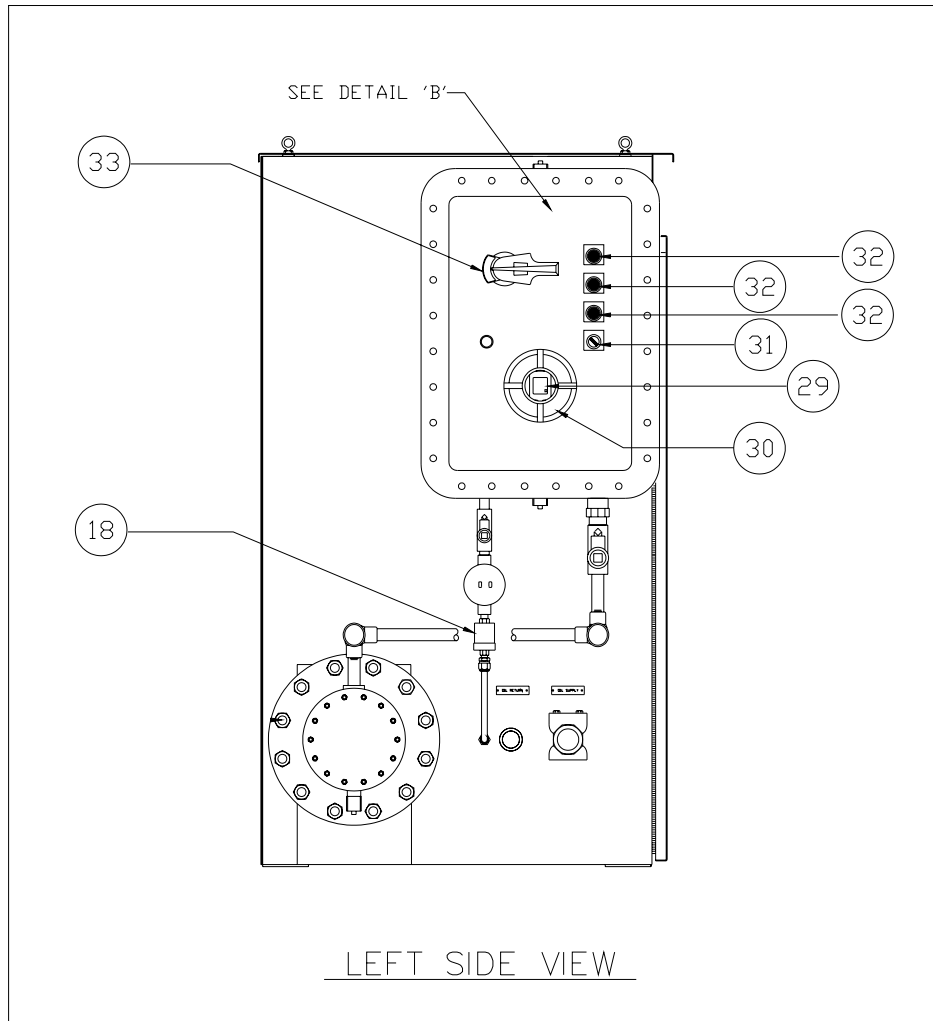


2. GENERAL ARRANGEMENT

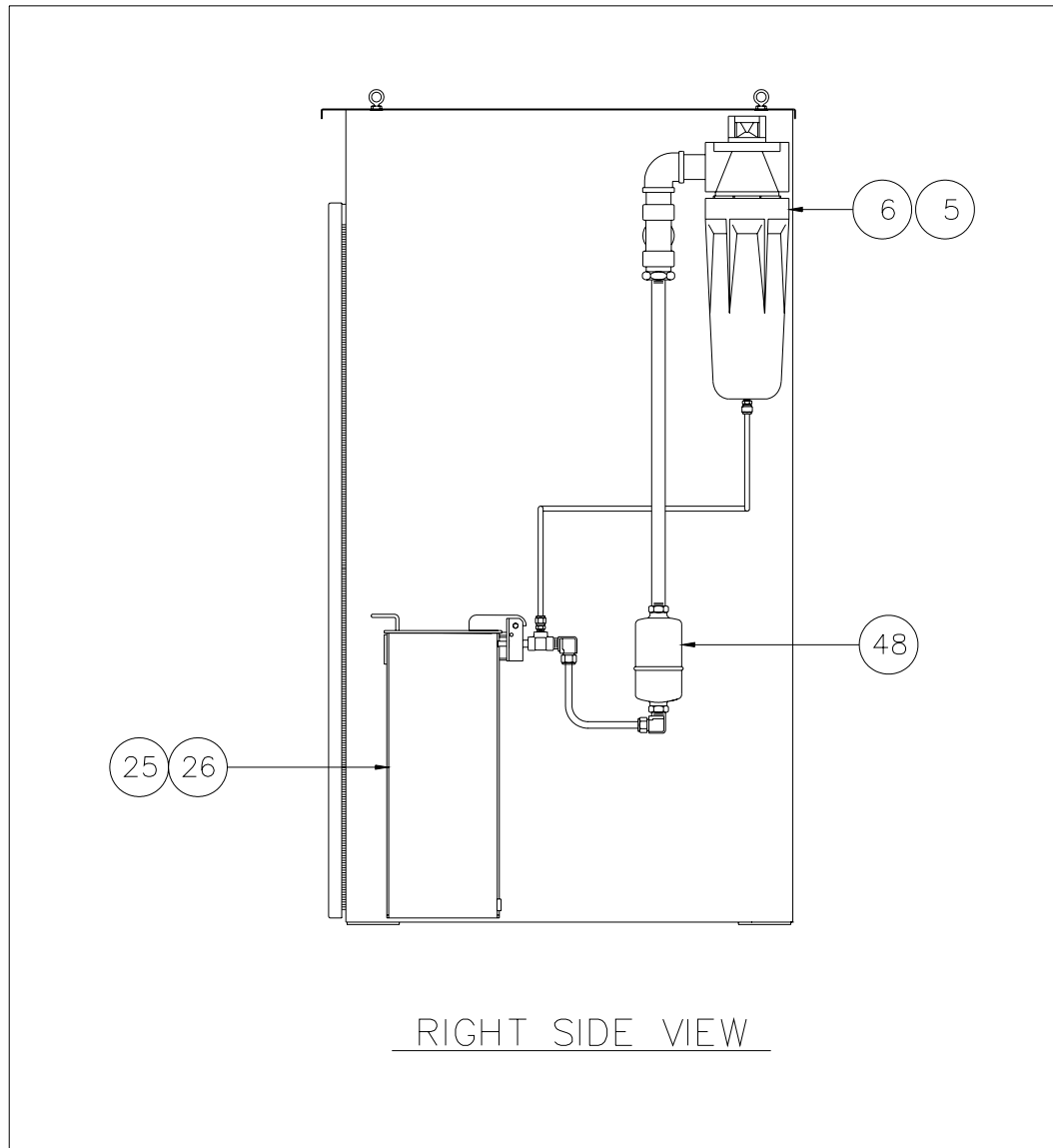
FRONT VIEW



LEFT SIDE VIEW

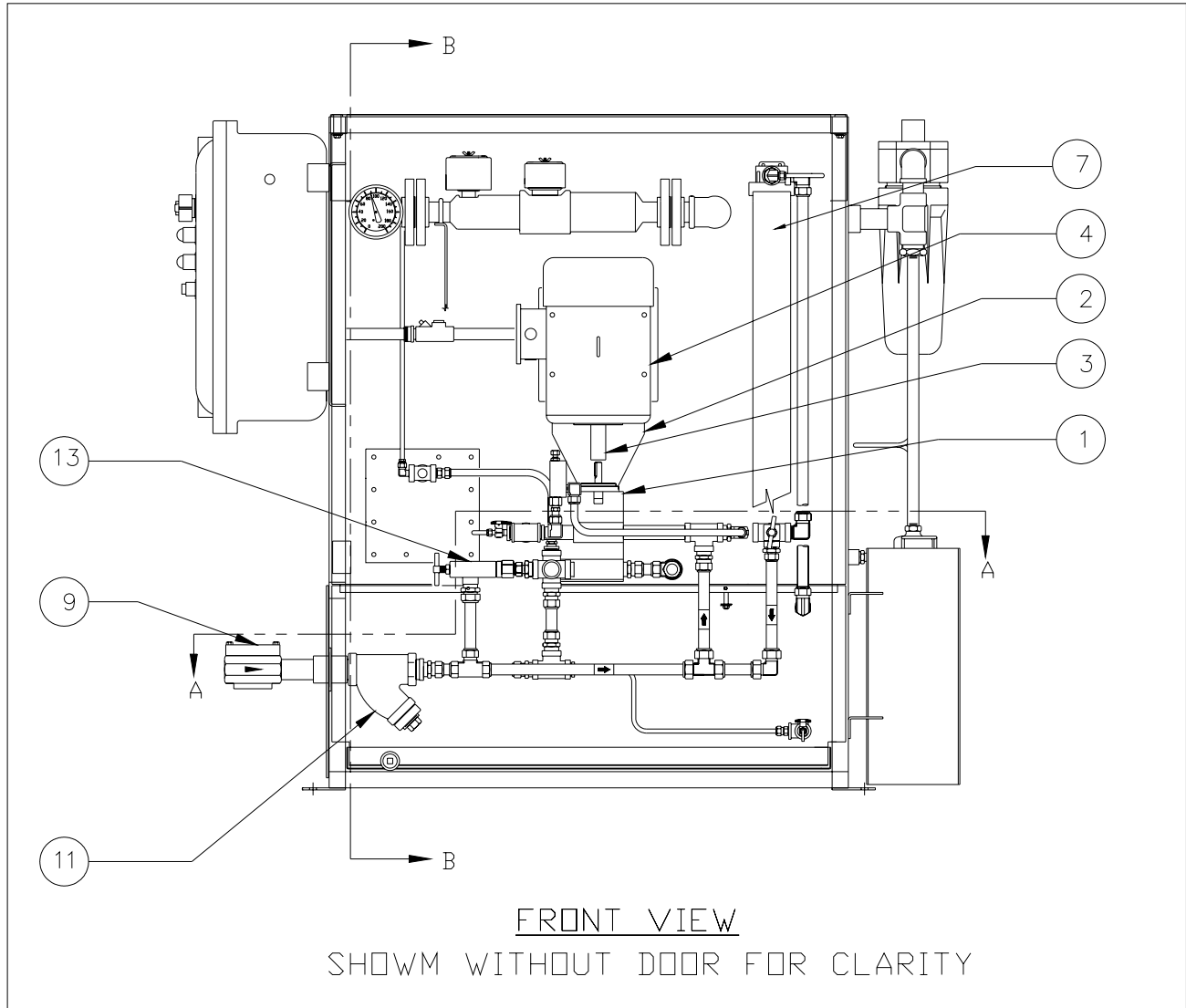


RIGHT SIDE VIEW

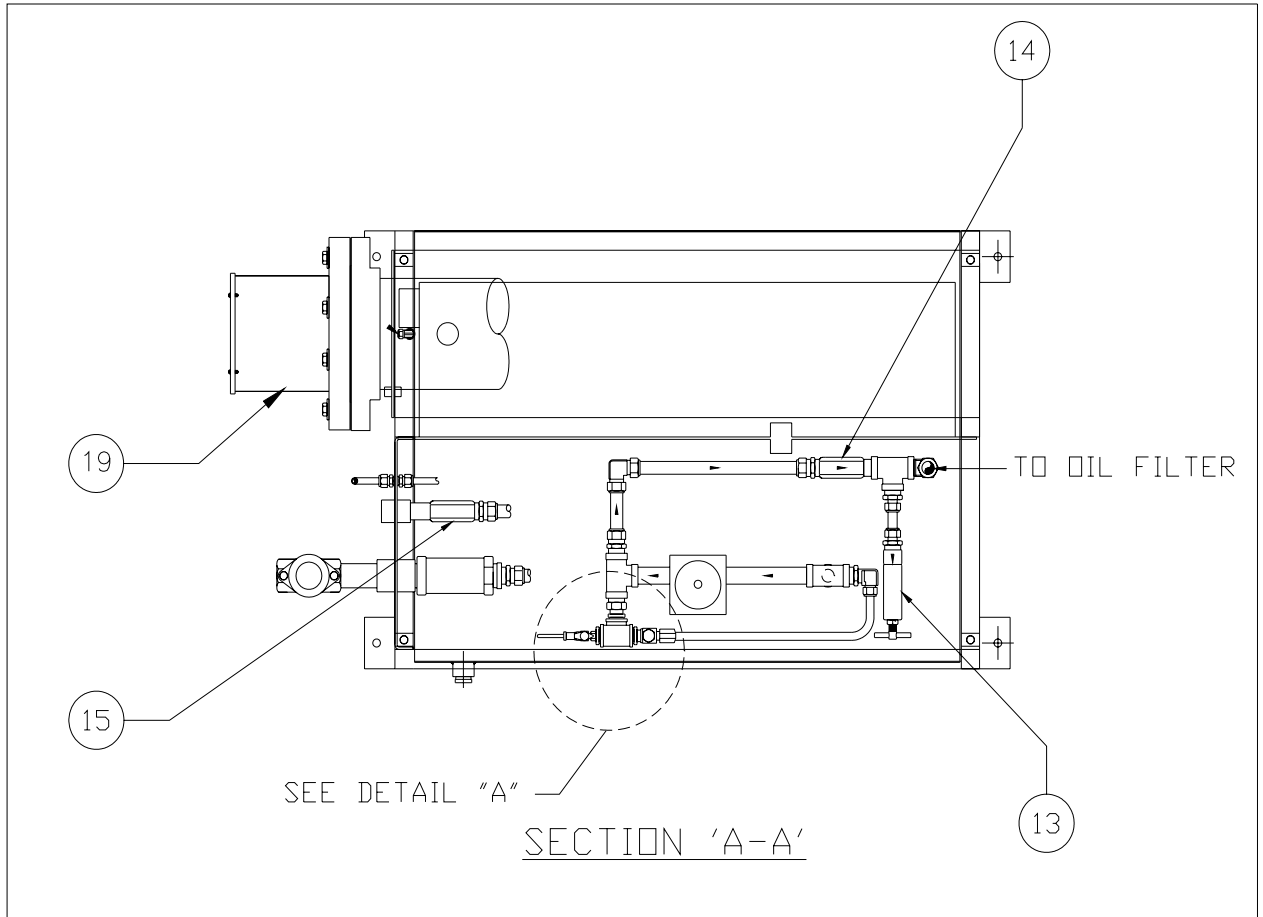


RIGHT SIDE VIEW

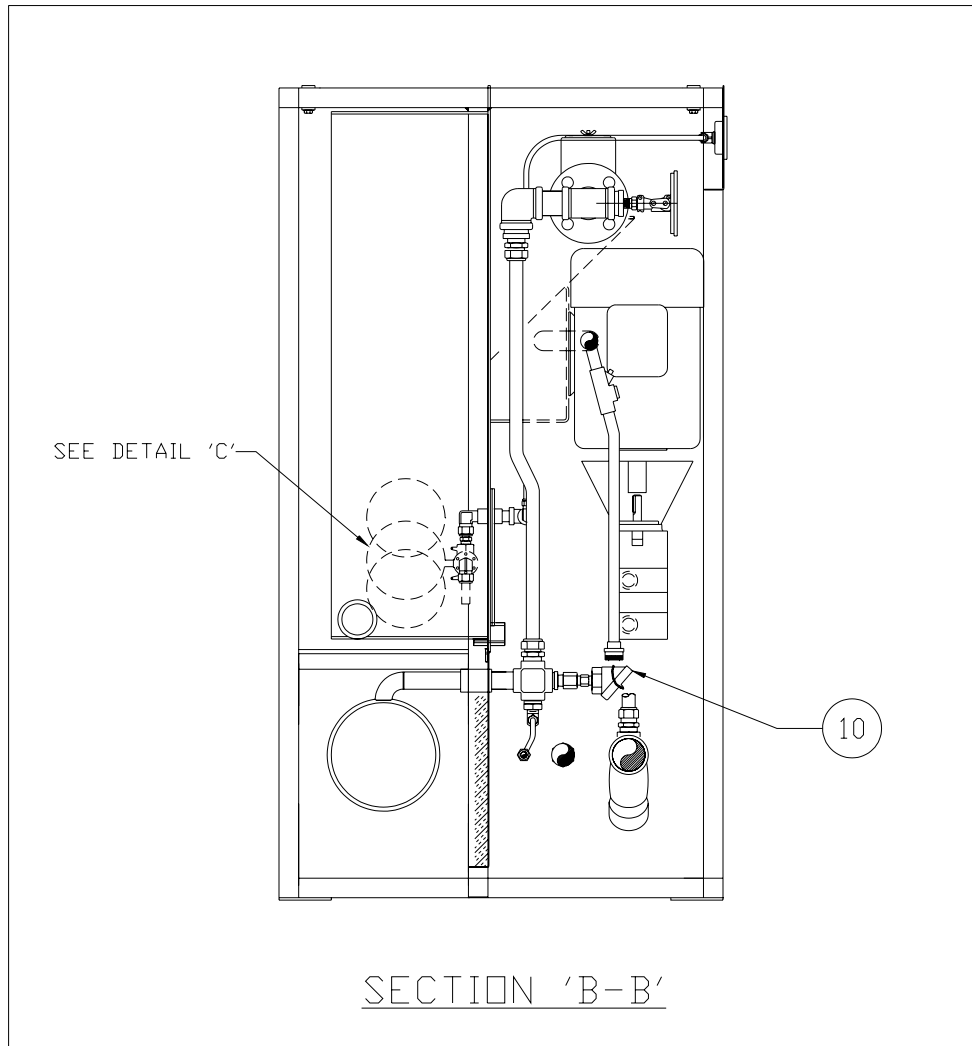
FRONT VIEW WITHOUT DOORS



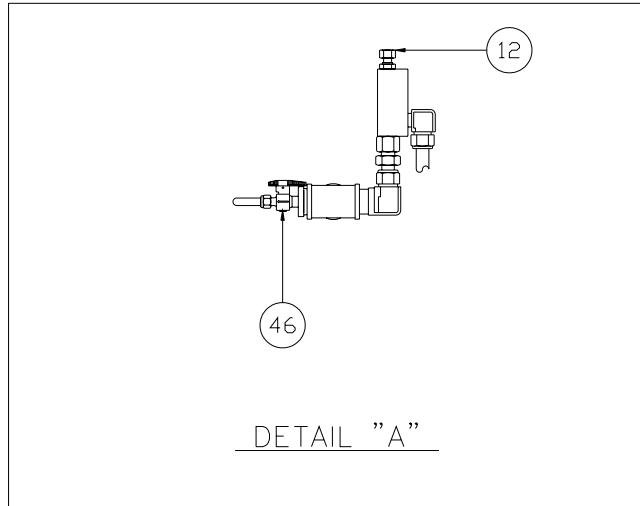
SECTION A' - A'



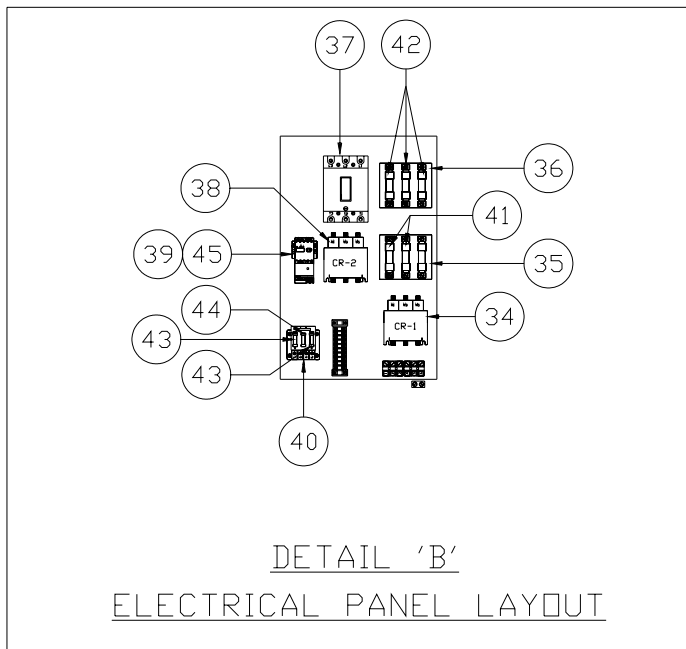
SECTION B' – B'



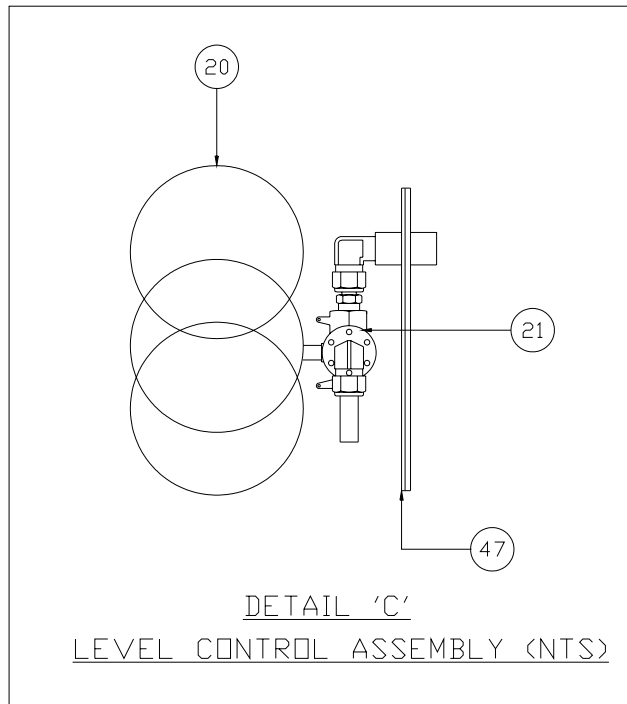
DETAIL "A"



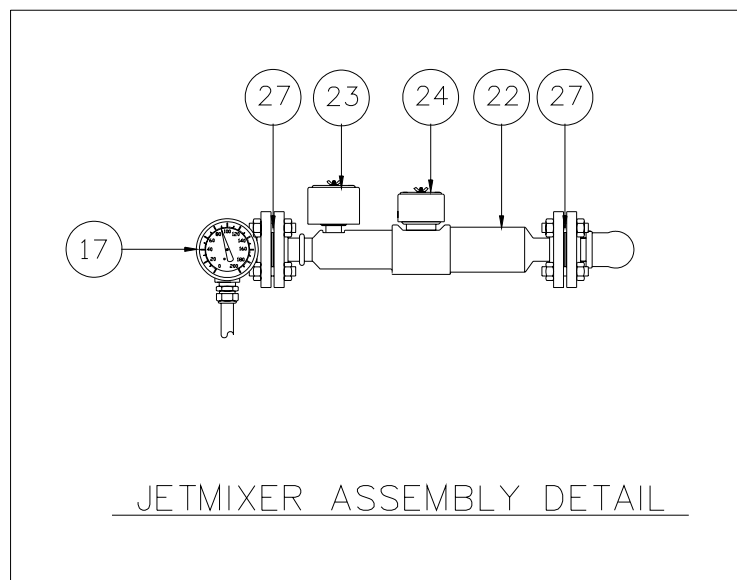
DETAIL "B"



DETAIL C

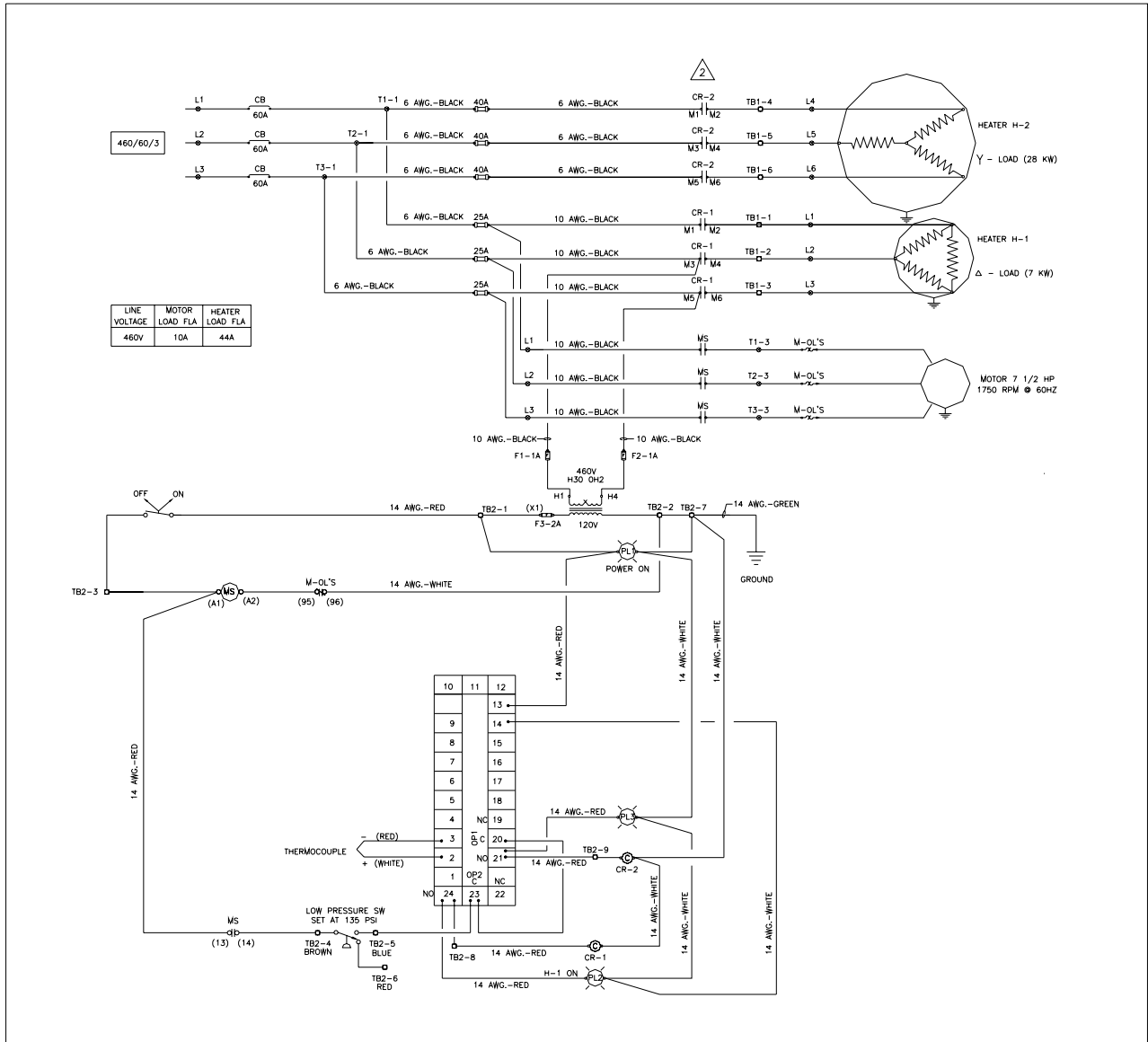


JET MIXER

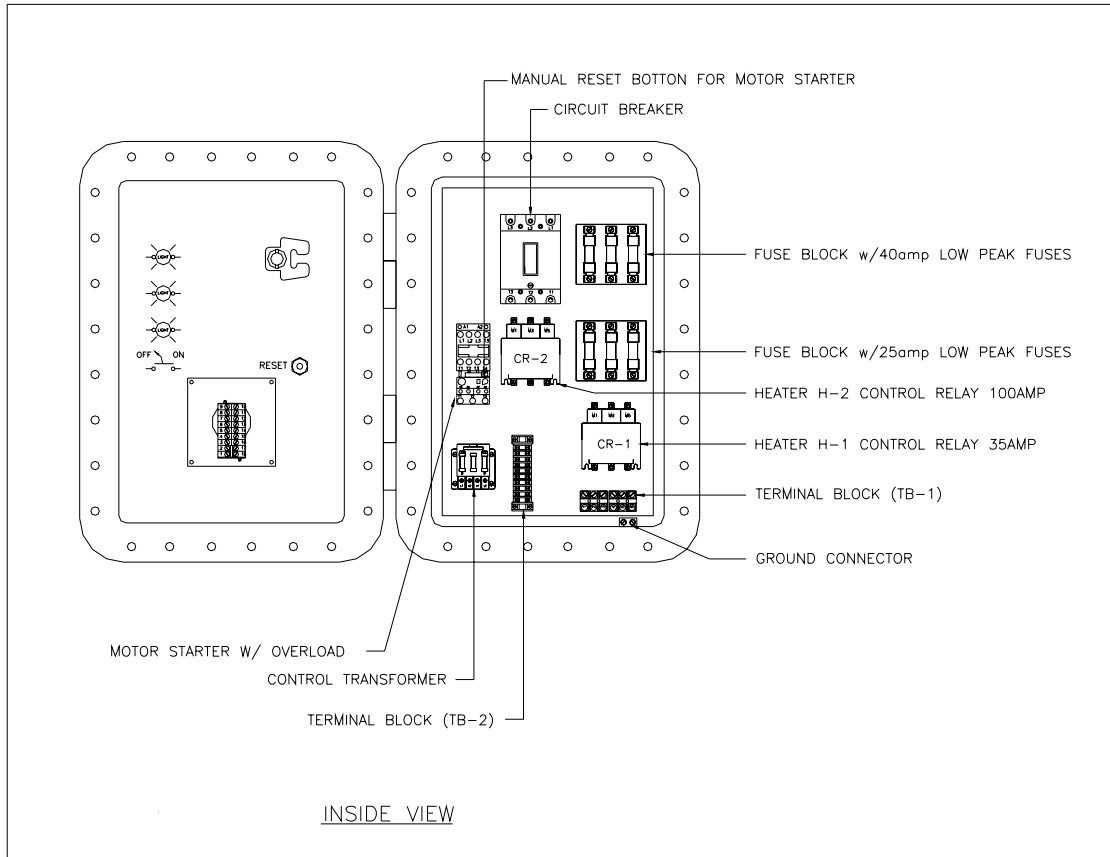


3. ELECTRICAL WIRING DIAGRAM

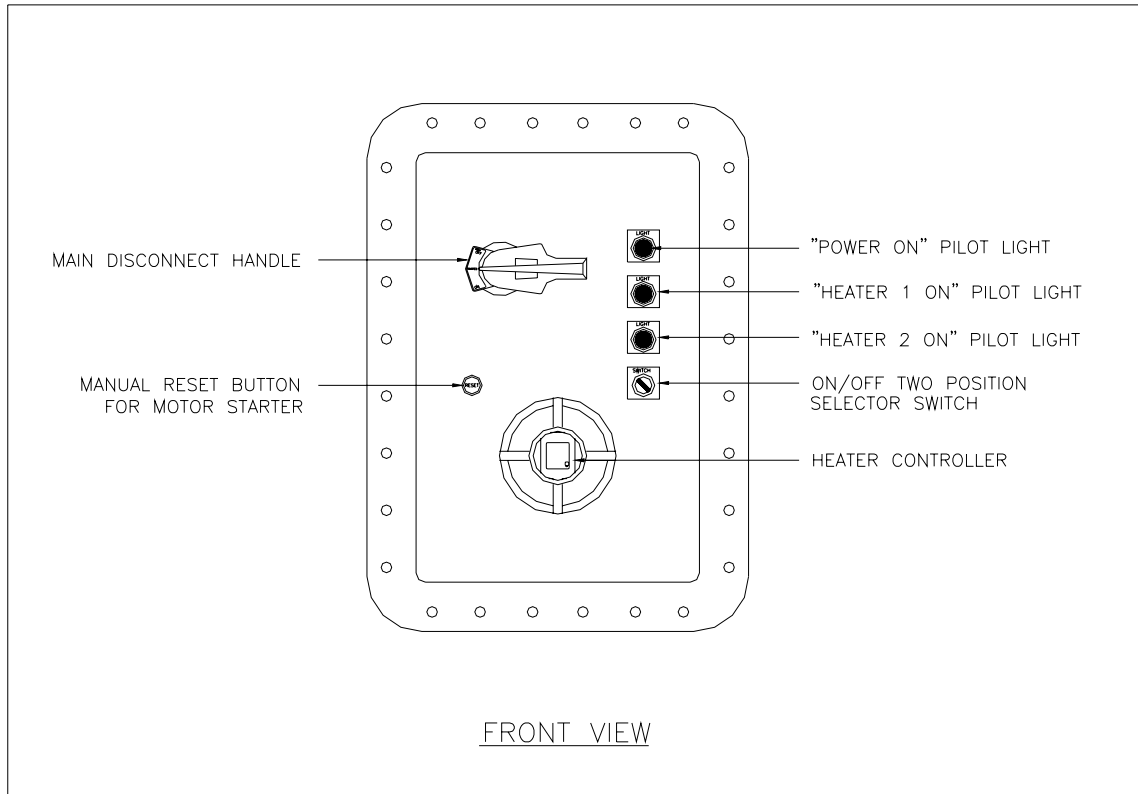
WIRE DIAGRAM



INSIDE ELECTRICAL BOX



FRONT OF ELECTRICAL BOX



4. PROCESS AND INSTRUMENTATION DIAGRAM

