THERMOJet® Model N2000
Oil Purifier
Installation and Operating Manual

P/N (later)
REV 01
June 2020

TABLE OF CONTENTS

UNIT IDENTIFICATION AND LABELING

INTRODUCTION

The THERMOJet® N2000 Oil Purifier is a self-contained machine used for removing water and particulate contamination from lubricating oils in machineries and oil supplies in industrial applications. The Model N2000 is not suitable for use in applications where the operating environment may contain hazardous, flammable or explosive gases, chemicals or agents. This publication provides instruction and information for the THERMOJet® Model N2000 Oil Purifier. For additional information contact the manufacturing office nearest you or check out our website.

For questions regarding this publication or if you have specific questions regarding the installation of the THERMOJet® Model N2000 Oil Purifier, contact.

Manufacturer
5615 W Fuqua St. B-201
Houston, Texas 77085
USA
Ph 713.464.6266
Fx 713.464.7375

THERMOJet®® Model N2000 Model Code Designations

- **Application Type Electrical Area Classification:**
  The THERMOJet® Model N2000 is for use in general purpose non-hazardous industrial applications. If your application is in a hazardous or explosive environment or atmosphere DO NOT USE THIS MACHINE. Other models are available for these applications. Contact manufacturer for more information.

- **Heater Type:**
  The THERMOJet® Model N2000 is available only with electric heaters.

- **Electrical Power Power:**
  The THERMOJet® Model N2000 is available for connection to various three phase AC voltage power sources. The purchaser specifies the supply voltage.

- **Filtration:**
  The standard filter supplied with the THERMOJet® Model N2000 uses a 2-3/8” D x 18” L filter element. An optional higher dirt holding capacity filter is available.

- **Alarms:**
  The THERMOJet® Model N2000 is standard without the noted alarm features.

  The high level alarm provides local annunciation if the separation vessel starts to overfill. When the high level is detected the pump is turned off and system operation stops. Operator intervention is required to restart operation.

  The high temperature alarm provides local annunciation if a high oil heater temperature is exists. When a high temperature condition is detected the oil heater is denergized. Operator intervention is required to restart heater operation

  - **ISOPur™ Agglomeration Unit:**

  ISOPur™ agglomeration technology is available as a “add on” feature to the THERMOJet® N2000 Oil Purifier. Additional information can be found in an appendix to this manual. ISOPur™ is a trademark of ISOPur™ Fluid Technologies Inc. Rocky Hill CT.

Model Code Designation Key

THERMOJet®® Model N2000 OIL PURIFIER Model Code and Pricing		
Option Description	**Option Code**	**Description**
Application Type **Electrical Area Classification**	N2000	For General Purpose Non-Hazardous Industrial NApplications
Heater Type	E	12KW Electric Heater
Electrical Power	A	460 Vac, 60 Hz, 3 Phase
	B	380 Vac, 60 Hz, 3 Phase
	D	575 Vac, 60 Hz, 3 Phase
	E	380 Vac, 50 Hz, 3 Phase
	K	415 Vac, 50 Hz, 3 Phase
Filtration	18	Element 2-3/8" Dia x 18" Lg Stainless Steel Housing
	36	Element ?" Dia x ?" Lg Carbon Steel Steel Housing
Alarms	X	None
	L	High Oil Level Alarm
	T	High Oil Temperature Alarm
	Z	High Oil Level Alarm and High Oil Temperature Alarm
ISOPur™ Agglomeration Unit	I	ISOPur™ CMU Agglomeration Technology Included

PRODUCT DESCRIPTION

Introduction:

The THERMOJet® N-2000 Series is designed for the general-purpose industrial applications. The primary purposes of the THERMOJet® Oil Purification Technology is 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 simplicity and ease of operation of these air/gas stripping devices far exceed any other oil purification technology.

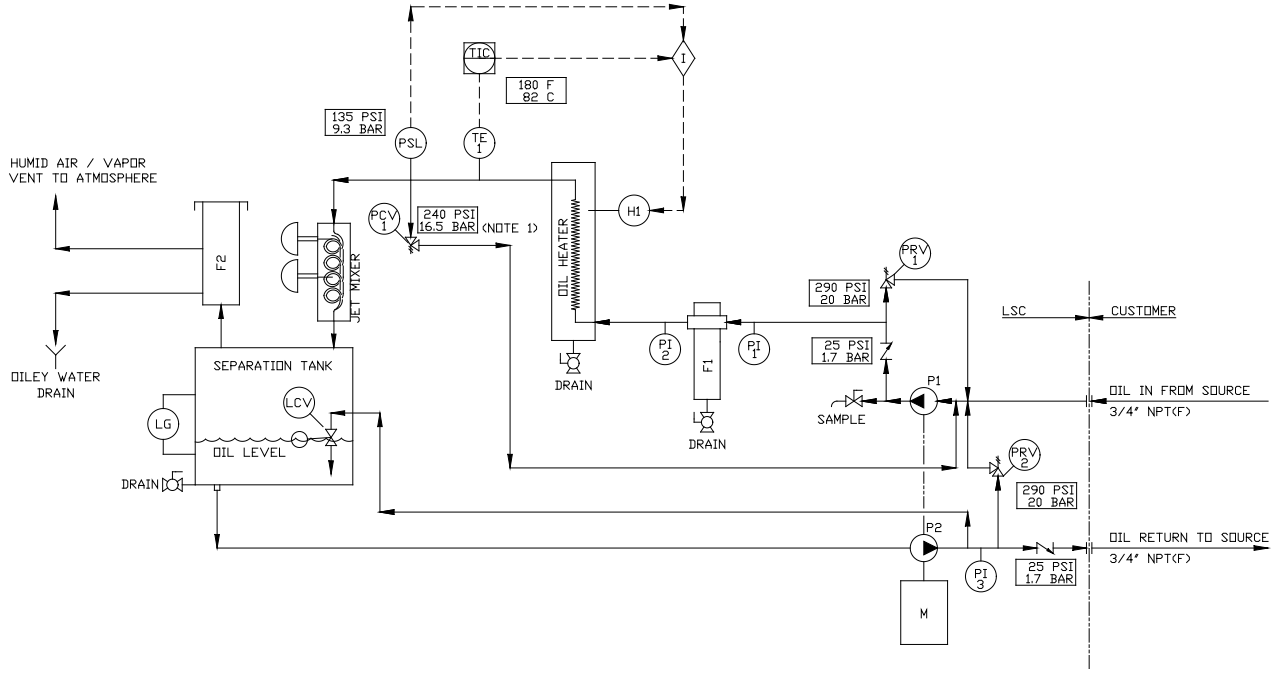
The air/gas stripping technology employed in the THERMOJet® is based on mass transfer principles. The capacity of air/gas to entrain moisture increases exponentially with temperature. An example of this principle is with a temperature increase of 100° F the capacity of air to hold water increases 30-fold.

The THERMOJet® N-2000 Series uses electric heater as a mean to heat the contaminated oil. 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 that promotes the phase change of water from liquid to vapor. The water vapor is expelled and the oil returned to its source.

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. When properly installed and given minimal required maintenance attention, the THERMOJet® N-2000 will provide years of highly satisfactory service.

NOTE: This manual should be reviewed in conjunction with the process and instrumentation diagram, the electrical wiring diagram, and general arrangement drawings provided in the *Drawings* section of this manual.

The THERMOJet® Process



The THERMOJet Oil Purification process can be easily broken down into two basic flow streams. The first flow stream takes the oil from the customers' source and supplies it to the jet mixer where air is introduced into the process. Once the oil passes through the jet mixer it goes into the separation tank where the water vapor is expelled from the system. The second part of the process is the return flow stream, which takes the oil from the separation tank and returns it to the customers' source.

The Inlet Flow Stream

Oil is supplied to the THERMOJet N2000 Oil Purifier from the customer machinery sump or oil reservoir via the customer supplied piping. The inlet oil pump (P1) boosts the oil supply pressure t 240 PSI (165 BAR) at the jet mixer inlet. Pressure adjustment is made using pressure control valve (PCV 1). A valve is located at the inlet pump discharge to collect oil samples for water and particulate contamination tests. The oil passes through an oil filter (F1) to remove particulate contamination. A pressure relief valve (PRV 1) is located between the pump and the filter for over pressure protection. Filter inlet (PI 1) and outlet (PI 2) pressure gauges monitor pressure differential across the filter and monitor the system operating pressure (PI 2). The oil is then heated to 180F (82C) at the oil heater (H1). Heater control and indication is managed using a type K thermocouple (TE 1)) and a PID control (TIC). Note that the oil heater does not turn ON until the low oil pressure switch (PSL) setting is satisfied. This is to ensure that the heater tube is filled with oil prior to the heater elements being energized. The filtered and heated oil then passes through the jet mixer, where air is mixed into the oil and the dehydration process begins. The oil/air mix then enters the separation tank where the wet humid air passes through a coalescing filer (F2) and expelled to atmosphere. The oil is collected in the separation tank sump. The separation tank reservoir is equipped with an oil level sight glass (LG) and drain valve.

The Return Oil Stream

The oil collected in the separation tank is supplied to the return pump. A check valve at the outlet pumps discharge (P2) maintains a backpressure on the level control valve (LCV) located in the separation tank. At startup the separation tank is empty and LCV is full open. As the tank starts to fill and the oil level rises, LCV starts to close and pressure increases until the check valve cracks and opens. The check valve and LCV maintains equilibrium between the flow rate coming into the THERMOJet in the inlet flow stream and what is being returned to the user oil reservoir in the return oil stream. Pressure gauge (P3) monitors the return oil stream pressure and a pressure relief valve (PRV 2) protects the circuit from over pressure.

The THERMOJet® N2000 Equipment

The THERMOJet® Model N2000 is free standing and totally self contained. The customers must secure it to a suitable foundation, connect it to the oil supply to be cleaned with the supply and return oil piping and install the appropriate electrical power service.

Oil Pump And Motor

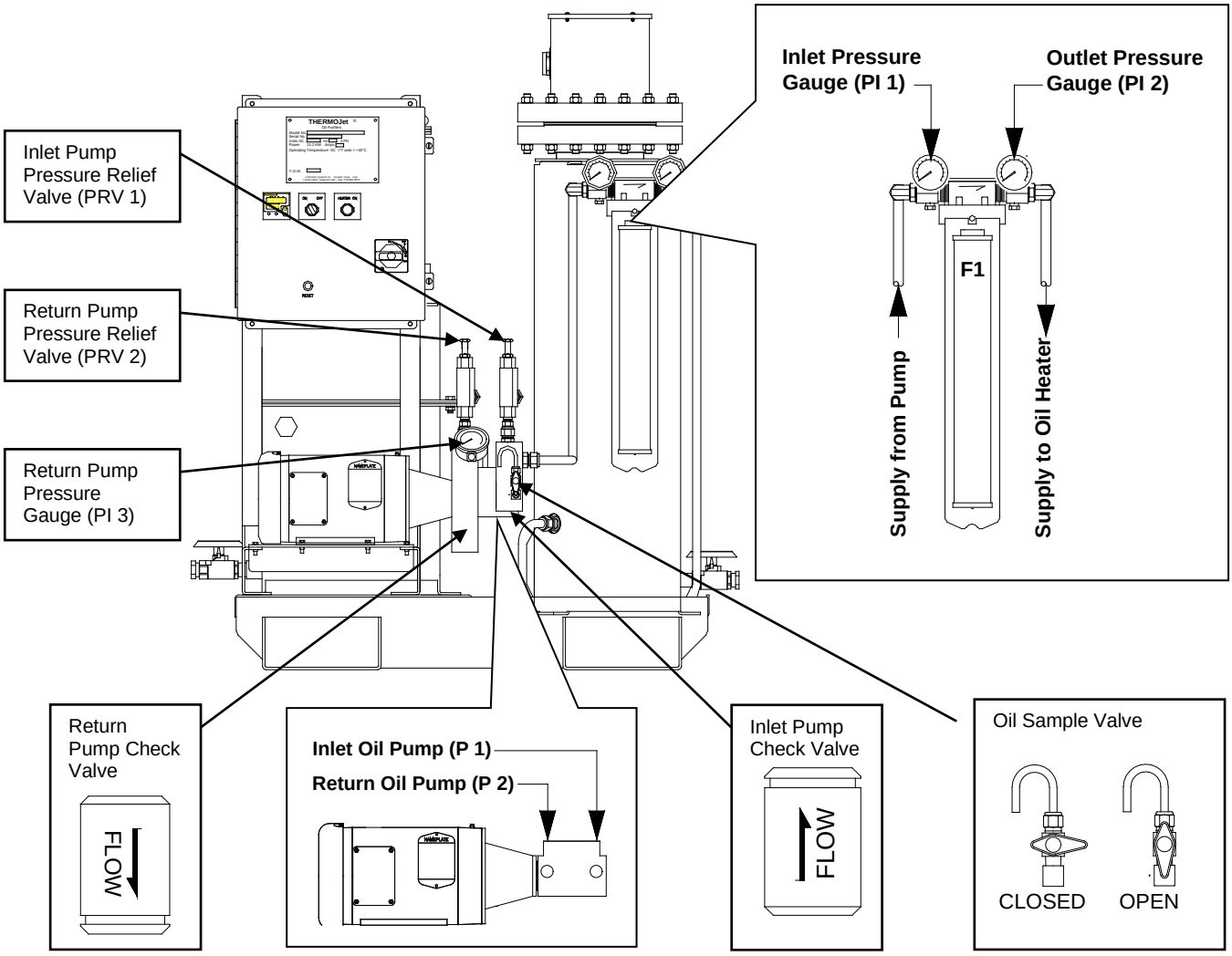
The oil pump is a double spur gear pump driven by a single 1-1/2 HP electric motor. Pumps are C-Face mounted to the motor driver. The inlet oil pump takes the oil from the user reservoir and supplies oil to the oil filter and the jet mixer (inlet oil stream). An oil sample valve is located at the discharge of the inlet pump. The return oil pump returns the oil from the separation tank back to the user oil reservoir (return oil stream). Return oil pressure is monitored with the pressure gauge (PI 3) located at the discharge of the return oil pump.

Pump Relief And Check Valves

Pressure relief valves are located at the discharge of both the inlet and return oil pumps. The relief valves are set to relieve at 290 PSI (20 BAR). Check Valves are cartridge type and are installed in the manifolds located at the outlet of both pumps.

Oil Filter

The standard oil filter (F 1) housing is constructed from stainless steel and is supplied with a 2-3/8" ϕ x 18" long micro glass media element. A larger oil filter housing and element is an available option. See the model code key on page 7. Oil filter inlet (PI 1) and outlet (PI 2) pressure gauges are supplied to monitor filter element condition. The oil filter outlet pressure gauge (PI 2) also serves to monitor the oil supply pressure to the jet mixer.



Oil Heater

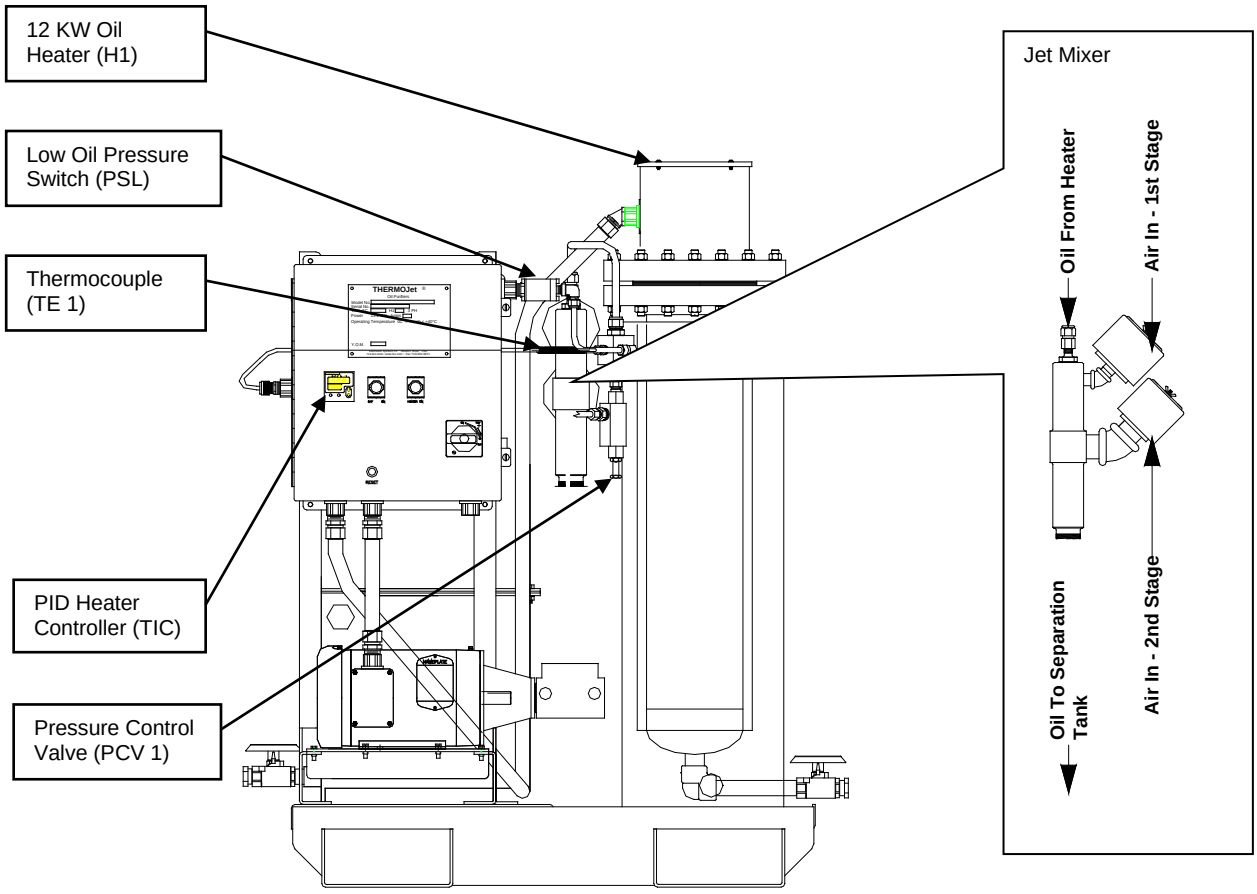
The oil must be heated in order for dissolved water to efficiently be converted into vapor and removed from the oil. Heating is done with a vertical 12 KW single pass circulation heater (H 1). A thermocouple (TE 1) mounted in the heater outlet and a PID temperature controller (TIC) keeps the oil temperature to the jet mixer at a constant preset temperature. A pressure switch (PSL), connected at the oil heater outlet insures that oil fills the heater tube before the heater is energized. Loss of oil pressure turns the oil heater OFF. An optional high temperature alarm with heater cutout is available. See appropriate sections elsewhere in this manual for additional information.

Pressure Control Valve

A direct acting back pressure relief type valve (PSV 1)is used to control the supply pressure to the jet mixer. The back pressure control valve is located at the discharge of the oil heater. When adjusting the supply pressure to the jet mixer, use the oil filter outlet pressure gauge (PI 2) to monitor the pressure while making adjustments.

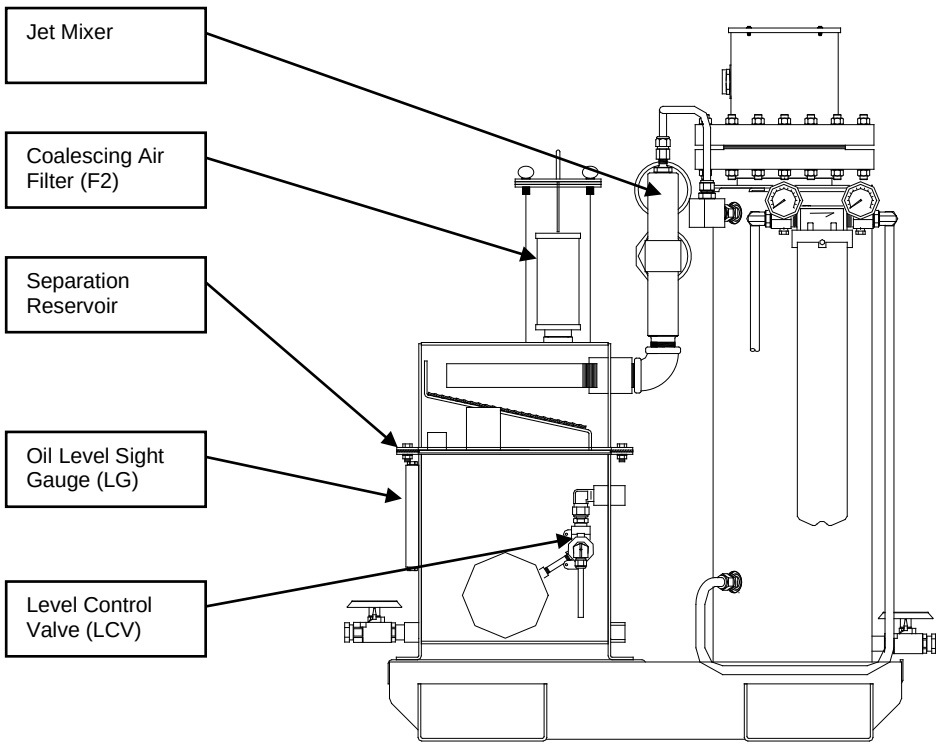
Jet Mixer

The heart of the technology is the THERMOJet jet mixer. As filtered and heated oil passes through the jet mixer, air is added and mixed with the oil. The mixing of air and oil crates air pockets or bubbles, resulting is a increase in the oil / air surface area. This increased surface area allows the heated water to efficiently “evaporate” into the resulting air pockets or bubbles.



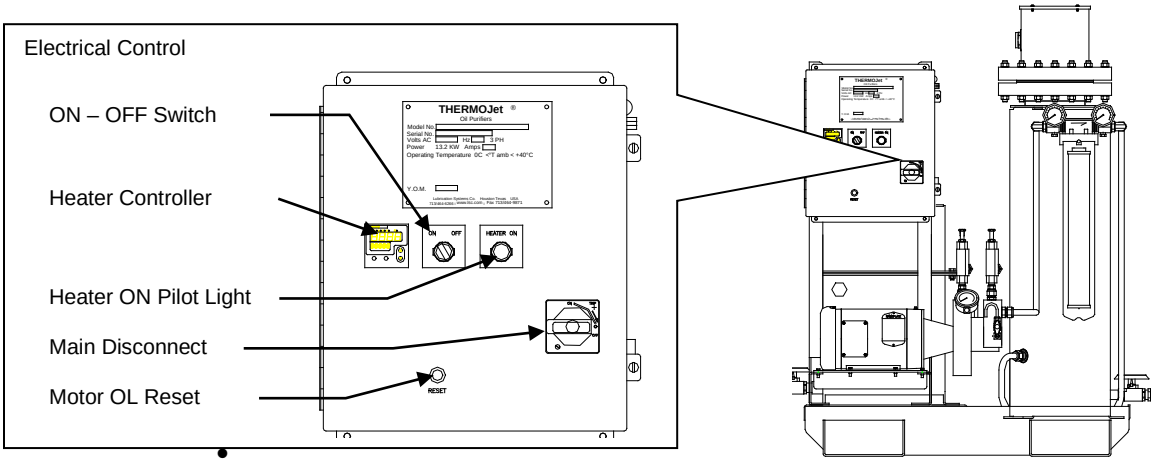
Separation Tank

Once the oil / air leaves the jet mixer, it flows into the top chamber of the separation tank. This is where the air bubbles burst, releasing the water vapor. Trays in the separation chamber enhance the air and oil separation. The air and water vapor vent to atmosphere after passing through a coalescing air filter (F2). This filter is used to capture oil mist generated by the jet mixer. The drain connection on the side of the demisting filter housing should be piped to a proper collection system for the disposal of oily water. The oil from the jet mixer collects in the reservoir. An oil level sight gauge (LG) located on the side of the separation tank reservoir monitors oil level. The level control valve (LCV) balances the inlet and return oil flow rates to and from the user oil reservoir. An optional high oil level alarm is available. See appropriate sections elsewhere in this manual for additional information.



Electrical and Control

The N2000 Oil Purifier includes a terminal enclosure for housing electrical terminals, relays and electrical operating apparatus. The enclosure in NEMA 12 and is suitable for most industrial applications. User supplied electrical service is made in this enclosure.



INSTALLATION

Unpacking

Remove all shipping materials and plastic plugs.

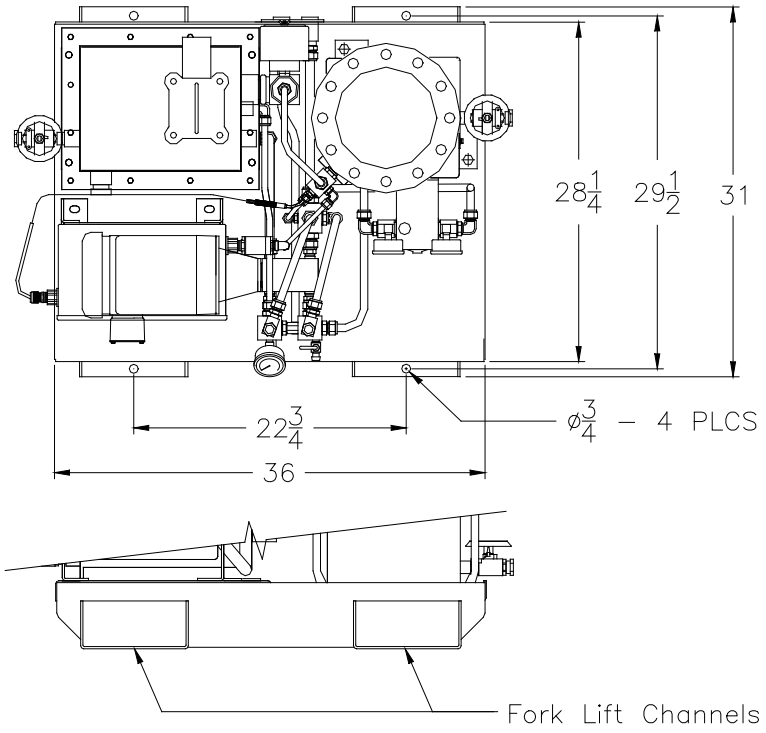
Inspect for shipping damage and report any found to manufacturer immediately. It is desirable to take photographs of any damage to substantiate your claim.

Inspect for completeness of materials and equipment against the packing list and the purchase order.

Location / Mounting

Choose a central convenient location, allowing enough room to connect electrical services and access around the machinery, allowing for service and maintenance. The THERMOJet® should be located as close to the user machinery or oil reservoir as possible. Ensure that unrestricted operator access is maintained at the front of the unit.

The N2000 platform skid is constructed as integral base plate 36" wide X 28-1/4" deep (914 mm X 721 mm). It is designed to be moved using a fork lift and can be lifted from either the front or rear. There are four 3/4" diameter boltholes spaced in a rectangle 22-3/4" wide X 29-1/2" deep (578 mm X 749 mm) for anchoring the skid to the foundation. Install the unit in an upright and level position. Use four anchor bolts suitable for the type of foundation used (i.e. wood, concrete, steel etc.). Anchor bolts are not provided with the unit



Oil Inlet and Return Piping Connections

Connections for the oil inlet and return piping are located on the backside of the skid. A skid drain pan connection is located at the rear of the skid. All connections are ¾' NPT(F).

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

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 THERMO*Jet*® is shut down. Return oil must be introduced into the reservoir above the oil level to prevent siphoning when the THERMO*Jet*® is shut down. Ensure that

free falling oil does not exceed 6 inches (150 mm) 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.

It is recommended (but not mandatory) that connecting hard pipe work be stainless steel. and installed In accordance with good piping practice. The use of excess bends and unnecessary long pipe runs should be minimized. Elevated sections of piping in horizontal runs also must be avoided to prevent air pockets from existing. Even if the THERMO*Jet*® 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).

Connect the suction (THERMOJet® inlet connection) line to the source reservoir low point drain, or to existing purifier connections if the reservoir is constructed in accordance with API 614. The THERMOJet® oil inlet and outlet connection sizes are 3/4" FNPT. The user suction and discharge line sizes (either schedule 40 pipe or smooth I.D. hose) should be ¾" 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.

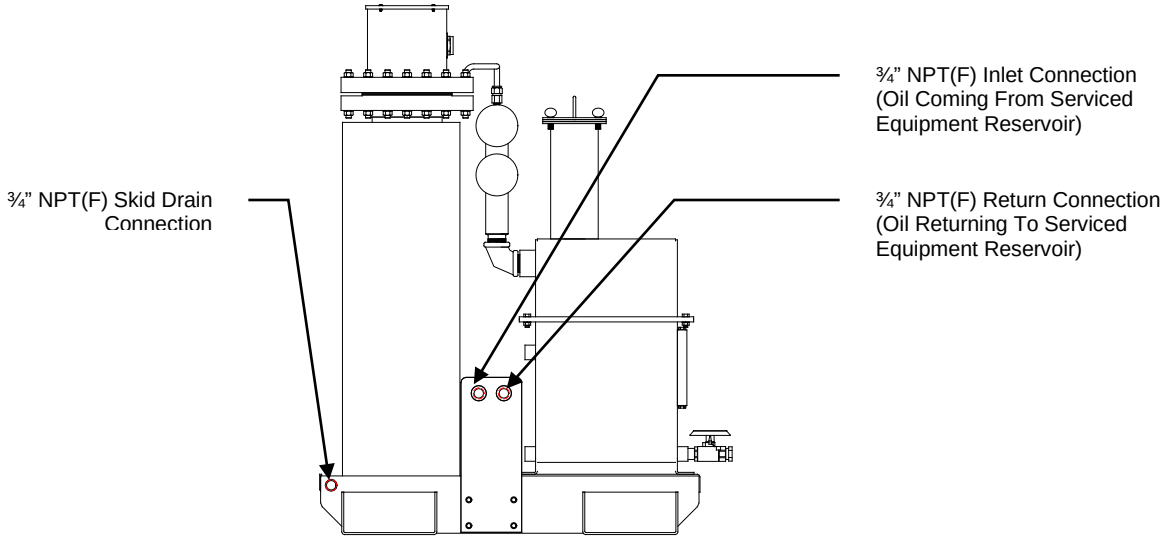
NOTE: Ensure that the inlet connection at the user machinery reservoir is not adjacent to or near the oil return connection, which could result in oil frothing.

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 source reservoir connection, which is routed to the THERMO*Jet*® inlet connection.

If the oil reservoir is located below the THERMO*Jet*® oil inlet connection, a manual shut-off valve is not required or desirable since it creates a unnecessary line restriction. If the suction lift exceeds 8 feet (2.4 meters), install a foot-valve or foot-pump to ensure that the inlet pump will establish and maintain prime during long-term service.

The return oil line from the THERMOJet® to the source reservoir should be connected above the oil level and at the opposite end of the reservoir as the THERMOJet® inlet connection line. This is to ensure optimum circulation of oil through the THERMO*Jet*® and oil turn over in the source reservoir. 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 flooding of the unit.



Venting Condensed Water And Water Vapor

As water is removed from the oil, it is evacuated from the system as water vapor and vented from the rear of the THERMOJet.®. The vented air and water vapor passes through a coalescing filter to remove any oil mist generated as the oil passes through the jet mixer. The coalesced oil and some condensed water collect in the demisting filter housing, located on top of the separation tank. Find the ¼" NPT(F) connection located near the bottom of the filter housing. This connection should be routed to a liquid collection system or drain suitable for the disposal of oily water. Minimum pipe size should be ¼" pipe. Piping should be sloped toward the drain point to ensure that no traps exist that would hinder drainage and cause the filter housing to collect and fill with water.

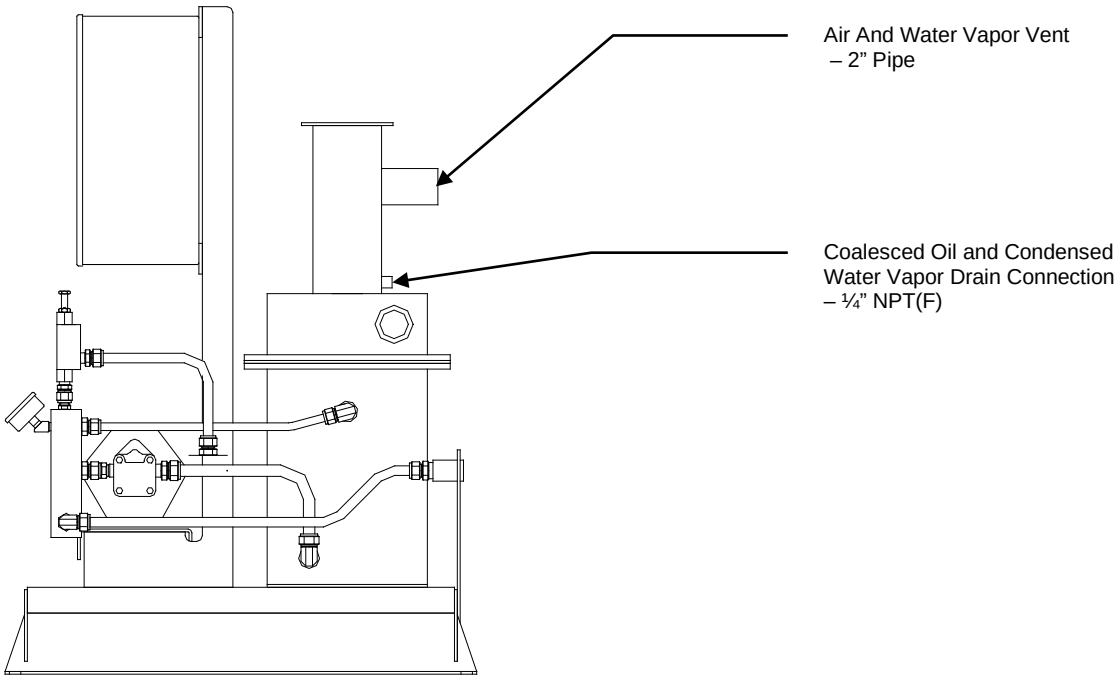
Normally, when the THERMOJet® is installed outdoors, venting the escaping air and water vapor to the atmosphere may not a pose a problem to personnel. However, where the THERMOJet® is installed in an indoor space or an occupied space that is confined and unventilated, the discharge must be routed to the outside away from personnel.

THE ESCAPING AIR IS NOT BREATHING QUALITY AIR, AND BREATHING THE EXCAPING AIR AND WATER VAPOR SHOULD BE AVOIDED.

WARNING:

AVOID BREATHING VENTED AIR AND WATER VAPOR THAT IS DISCHARGED FROM THE THERMOJet® OIL PURIFIER. WHEN INSTALLED IN A UNVENTALATED OR CONFIM\NED SPACE, THE VENTING AIR AND WATER VAPOR MUST BE VENTED TO AN OUTSIDE LOCATION AWAY FROM PERSONNEL.

Where required, connect the vent piping to the 2" pipe (unthreaded) vent connection located on the back of the THERMOJet®. The minimum recommended size for the vent piping is 2" pipe. A 2" dresser type coupling or suitable hose connection is required to connect the THERMOJet® to the vent pipe. All vent piping must be sloped so that all water vapor that condenses in the piping is drained away and does not hinder the air flow to atmosphere. Install no block valves in the vent piping.



Power Requirements

The THERMO*Jet*® 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. The power circuit requirements for the THERMOJet® Model N2000 are indicated in the table below.

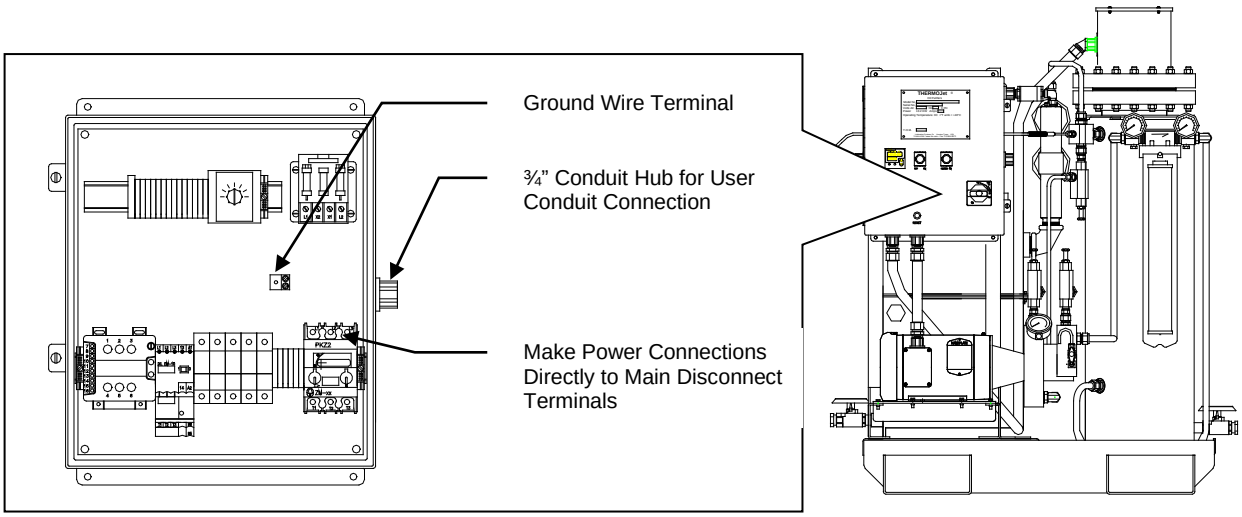
Line Voltage	Full Load Amps
380V 50HZ 3ϕ	21.4 A
415V 50HZ 3ϕ	19.7 A
460V 60HZ 3ϕ	17.6 A
575V 60HZ 3ϕ	13.9 A

IMPORTANT:

ELECTRICAL POWER SERVICE MUST HAVE ADEQUATE CIRCUIT PROTECTION. USE TABLE ABOVE FOR SELECTION OF USER PROVIDED INTERRUPT DEVICE.

Connecting Power

Power connection is made at the MAIN POWER DISCONNECT terminals located in the electrical panel box. A ¾" conduit hub is provided for user connection. Ensure that a suitable ground connection is connected to the grounding terminal.



IMPORTANT:

ALL ELECTRICAL CONNECTIONS SHOULD BE MADE BY A QUALIFIED ELECTRICIAN.

IMPORTANT:

ENSURE THAT ALL ELECTICAL SERVICE AND METHODS OF INSTALLATION ARE IN ACCORDANCE WITH ALL LOCAL CODES AND REQUIREMENTS..

System Start Up

Pre-Start Up Checks

Before starting the THERMOJet® Model N2000 Oil Purifier, perform a “walk-around” check and ensure that:

- The equipment is secured to the foundation it is placed on.
- All electrical power service has been properly installed according to all applicable codes and local requirements.
- The THERMOJet® is properly connected to an earth ground.
- Check inlet and return oil piping, ensuring that all connections are properly made and connections are tight.
- When required, ensure that vent and drain piping is installed and suitably routed for proper disposal of vapors and oily water.
- The oil filter element is installed in the filter housing and that the seals are in good condition.
- Check the Main Disconnect Switch and the ON-OFF Selector Switch on the front of the THERMOJet® electrical enclosure and ensure that both in the OFF position.
- Before attempting to start the THERMOJet®, locate the reservoir drain valve at the equipment being serviced and drain off any free water from the oil reservoir.
- Open any block valve installed in the piping supplying oil to the THERMOJet®.
- Ensure that any vales in the return oil piping between the THERMOJet® and the serviced reservoir are in the full open position.

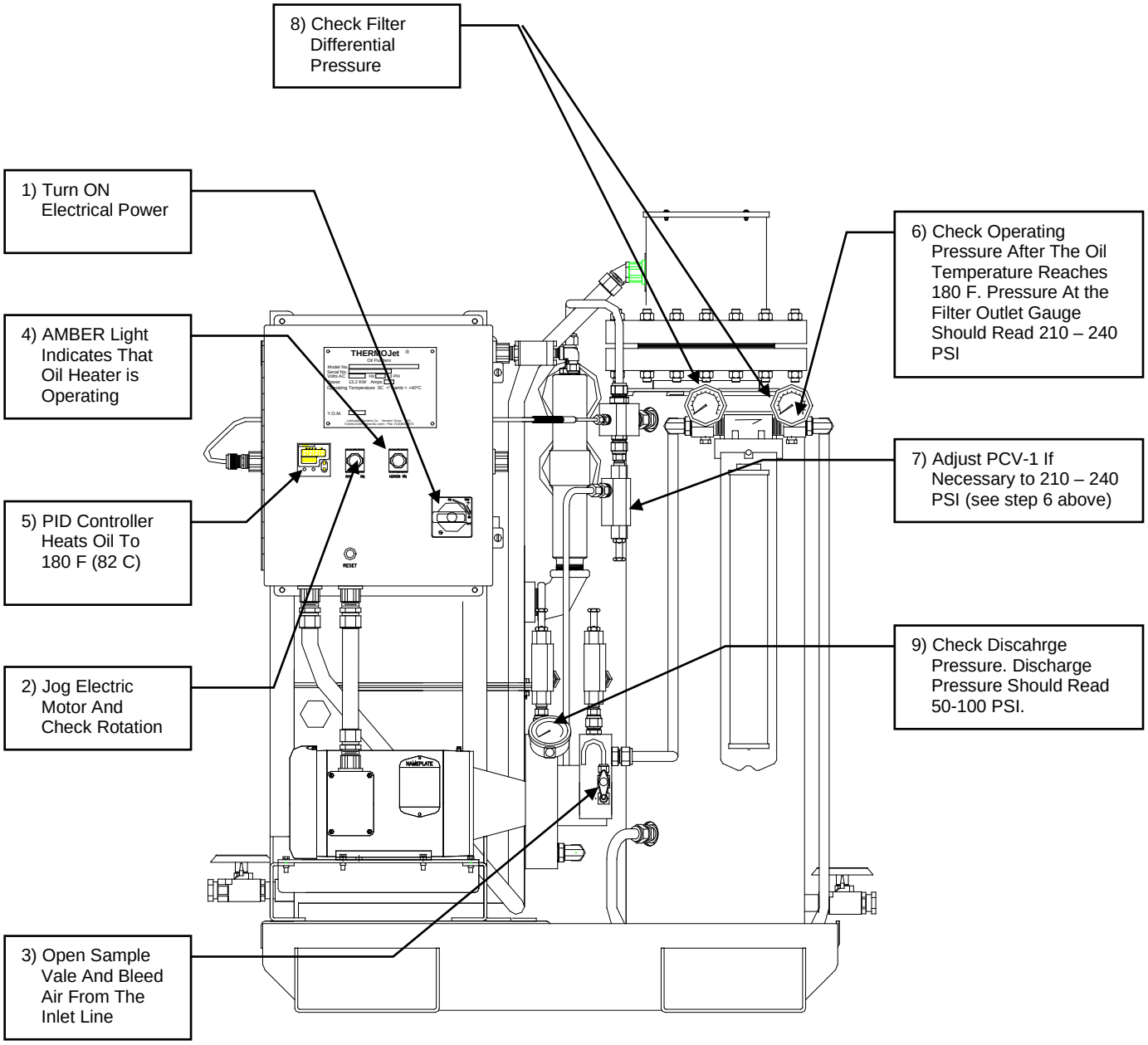
Starting The THERMOJet® Model N2000 Oil Purifier

To start the THERMOJet®;

1. Locate and energize the electrical power supply at its source. The supply circuit should be protected with a suitable current limiting device for the service. Turn the THERMOJet® main disconnect switch to the ON position.
2. Jog the electric motor to ensure proper motor rotation by switching the ON-OFF selector switch to the ON then OFF positions. 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.
3. Open the air bleed/sample valve at the inlet pump discharge so that air in the suction line can escape. Turn the ON-OFF selector switch to the ON position. The oil pump starts. 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 into the unit 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.
4. 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. System pressure is monitored at the filter outlet pressure gauge. The amber Heater ON / OFF pilot light monitors heater operation.
5. The temperature controller is factory set at 180^{o} F and is field adjustable. When the oil temperature reaches approximately 160^{o} 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.
6. The pressure control valve (PCV1) located downstream of the oil heater is factory set at 240 psig at the heater process temperature of 180^{o} F (82 C). Initially, the filter inlet and outlet pressures may vary due to cold start oil temperature. As the system heats up the oil viscosity will decrease and as the oil temperature approaches the normal operating range, the pressure will return to the normal 210-240 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 by turning the Main Disconnect Switch to the OFF position. Take any necessary steps to pre-heat the oil.

7. If pump discharge pressure is to low, adjust PCV1 by loosing the lock nut and turning adjustment screw until the desired pressure is achieved. The normal operating pressure is monitored at the filter discharge pressure gauge. The normal operating pressure setting should be between 210-240 PSI.
8. Check the filter differential pressure. The difference between the filter inlet and out pressure should not exceed 30 PSIG. If filter differential pressure range is too high, replace filter element.
9. Once the Inlet Oil Stream has pressurized and oil flow through the Jet Mixer is established, the separation tank will start to fill with oil. Check the oil level sight glass to see the oil level. As the oil level rises the level control valve will maintain and control the oil level in the tank. The outlet pressure will increase as the level rises. Once startup is complete, the outlet pump discharge pressure range should be 50-100 PSI.



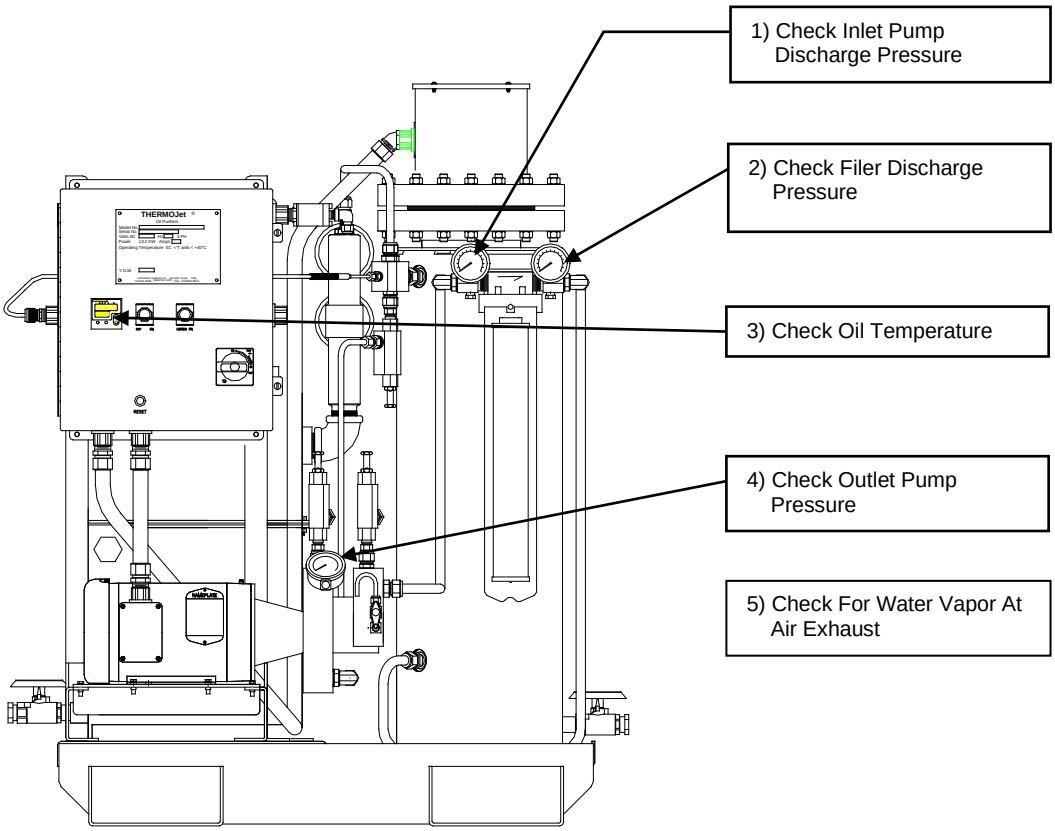
OPERATING GUIDE

Monitoring Normal Operation

Under normal operation, the following operational checks can be verified. System operation should be check daily.

1. The inlet pump discharge pressure gauge reading is 210-240 PSIG at operating temperature.
2. The filter discharge pressure gauge reading is between 210-240 PSIG.
3. The temperature gauge reading is relatively steady within 10 degrees F of the temperature controller set point on electric heated units. The process temperature is between 160-185 degrees F.
4. The outlet pump discharge pressure gauge reading is between 50 and 100 PSIG at operating temperature depending upon size/configuration of the oil return line.
5. 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 may be taken to verify the water content.



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 THERMO*Jet*® 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 dirty 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 THERMO*Jet*® 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 filter element and install a new filter. 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 THERMO*Jet*® and verify normal readings on the inlet pump discharge and filter discharge pressures. Pressure loss between the two readings should be zero.

3. 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.

Types Of Product Misapplication And Misuse Not Covered By Warranty Or Guarantees

Prolonged operation which causes pump capitation and/or relief valve chatter.

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 constant condition, request customer service on the feasibility of installing an automatic water drain valve.

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.

Excessive solids contamination with no pre-filter.

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.

Presence of contaminants which attack Viton seals.

High differential pressure on oil filter.

Operating without oil filter element or inlet Y-strainer element.

Operating with air filters plugged.

Incoming oil temperature too cold for heater capacity (except for small reservoir volumes).

Operating either above or below recommended operating pressures.

Discharging oil into reservoir below the oil level.

Operating on under-voltage, over-voltage or wrong voltage.

Inadequate power supply, i.e. amperage rating of breaker or fuses under-sized for load required.

Vent line not sloped downward.

Connection to pressurized reservoir without inlet pressure reducing valve or discharge boosting means.

Use of Dewatering Unit in Degassing Applications

TROUBLE SHOOTING

Troubleshooting Guide

No Flow in the Suction Line

1 Verify motor rotation is in the proper direction.

2 Verify that any valves between the oil supply tank and the THERMOJet® inlet are open.

3 Verify that there are no inlet line blockages other than closed valves.

4 Check that hoses are fully extended without kinks, or if hard-piped, that there are not elevated section to create air pockets.

5 Verify that inlet line sizes are correst.

6 Verify that suction lift does not exceed 8 feet (2.4 meters).

7 Verify that oil viscosity does not exceed 3,000 SSU.

8 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.

No Flow in the Discharge Line.

1 Ensure that there are no valves or other line-blocking devices or debris in the discharge line. If there are, remove them.

2 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.

3 If the pump is noisy, check for damage, wear, foreign objects, relief valve set too low or stuck open. .

No Vapor Discharge

1 Verify that no line-blocking devices are installed in the vapor/condensate discharge connections or the drain lines

2 Check oil condition. If there is little or no water present, no vapor or condensate will exhaust.

3 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.

Oil Spills from the Jet Mixer First-Stage Air Inlet Connection.

1 Verify that the pressure into the jet mixer is adequate as indicated on the gauges located downstream of the inlet pump and oil filter.

2 If not, re-adjust the inlet pump pressure control valve to 240 PSIG.

3 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.

Low Oil Temperature

1 Verify that the "heater on" light is illuminated.

2 Verify the unit is connected to the correct power supply.

3 Verify that the temperature controller is set at the desired operating temperature. If the temperature controller is set to the desired temperature, then the parameters of the PID temperature controller may have drifted and need to be readjusted

4 Verify that the temperature gauge is not damaged. Confirm its reading with a surface temperature probe.

5 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 THERMO*Jet*® 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.

6 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

1 Verify that oil is flowing normally through the inlet sight glass and that the pressures of the system are normal.

2 Verify that the temperature controller is set at the desired operating temperature. The parameters of the PID temperature controller may have drifted and need to be readjusted.

3 Verify that the heater contactor is neither stuck, nor has failed in the energized position. If so, replace the contactor.

Excessive Noise/Vibration

1 Ensure that the suction connection in the reservoir is not adjacent to or near to any oil return connection which could cause oil foaming

2 With a ¾" wrench, exercise the inlet and outlet pressure control valves. There may be a piece of trash stuck in one of these valves that is causing the valve to chatter. After exercising the valves 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 these two valves will change the pressure in which the unit is running.

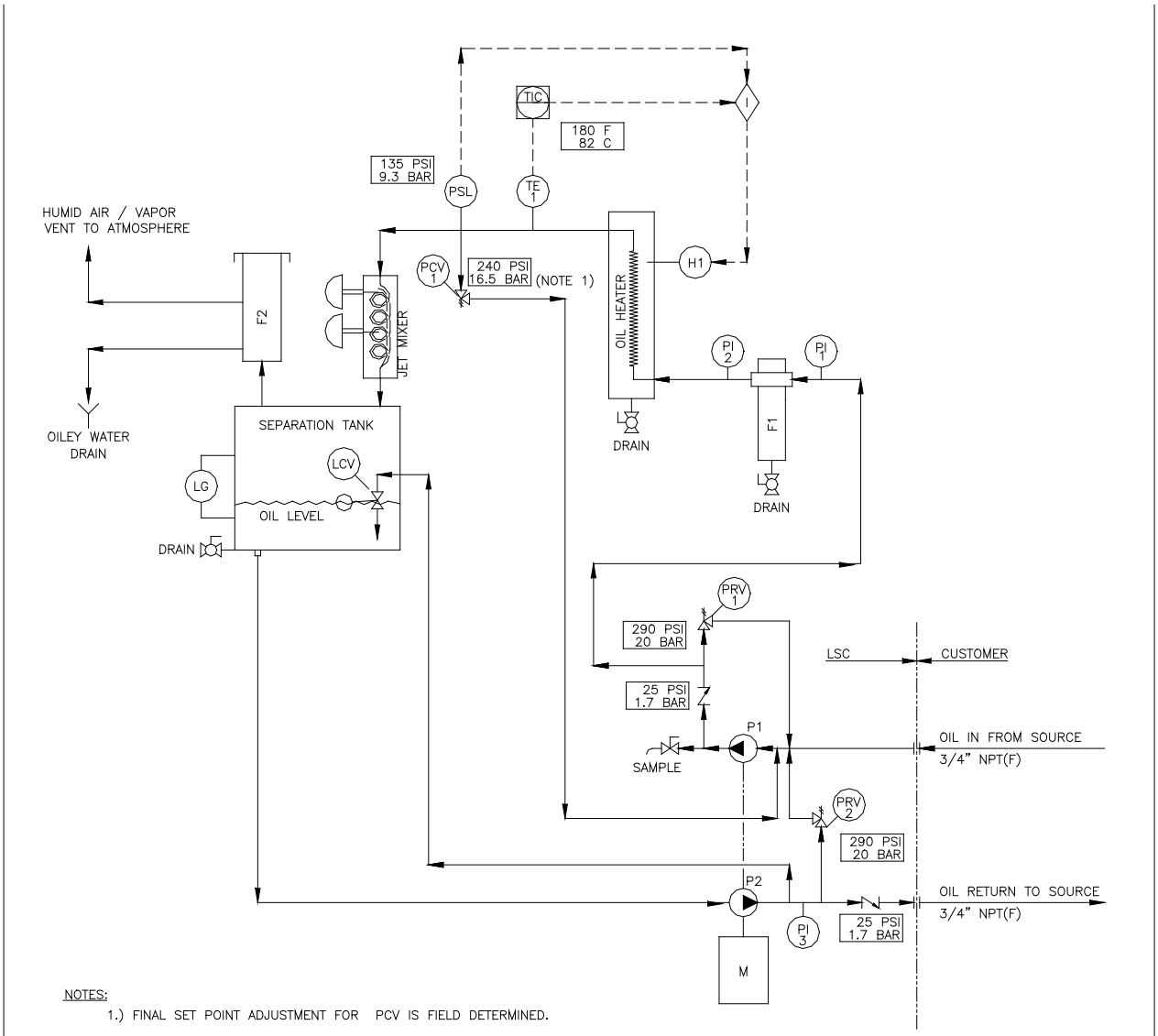
Trouble Shooting Quick Reference

DO **DON'T**

Drain free water from the bottom of reservoir	Operate with inadequate oil flow caused by suction line too small, elevated sections of suction piping, excessively high viscosity, excessive suction lift or suction line restrictions
Install oil filter element	Operate with air bubbles in sight glass
Change oil filter element at 30 PSID	Operate with excessive solids contamination. The filter element within the THERMO*Jet*® is not designed to clean up the solid particulate in oil reservoirs. The element is designed to protect critical systems within the THERMO*Jet*® and will load up with particulate very quickly and required frequent changes if a pre-filter package is not used. Contact manufacturer for technical assistance if frequent filter loading occurs.
Clean jet mixer's air filters	Operate with contaminants which attack Viton seals
Operate at recommended pressures and temperature	Connect to a pressurized reservoir without inlet pressure-reducing valve or discharge boosting means
Return oil above reservoir level	Expect satisfactory performance when rate of contaminant intrusion exceeds removal rate
Slope vent line downward	Adjust factory set (290PSI) pop-off relief valve
Operate at correct voltage and frequency	Reduce the inner diameter of the suction and discharge lines.
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 absorption media sock	

Drawings

Process& Instrument Diagram



NOTES:

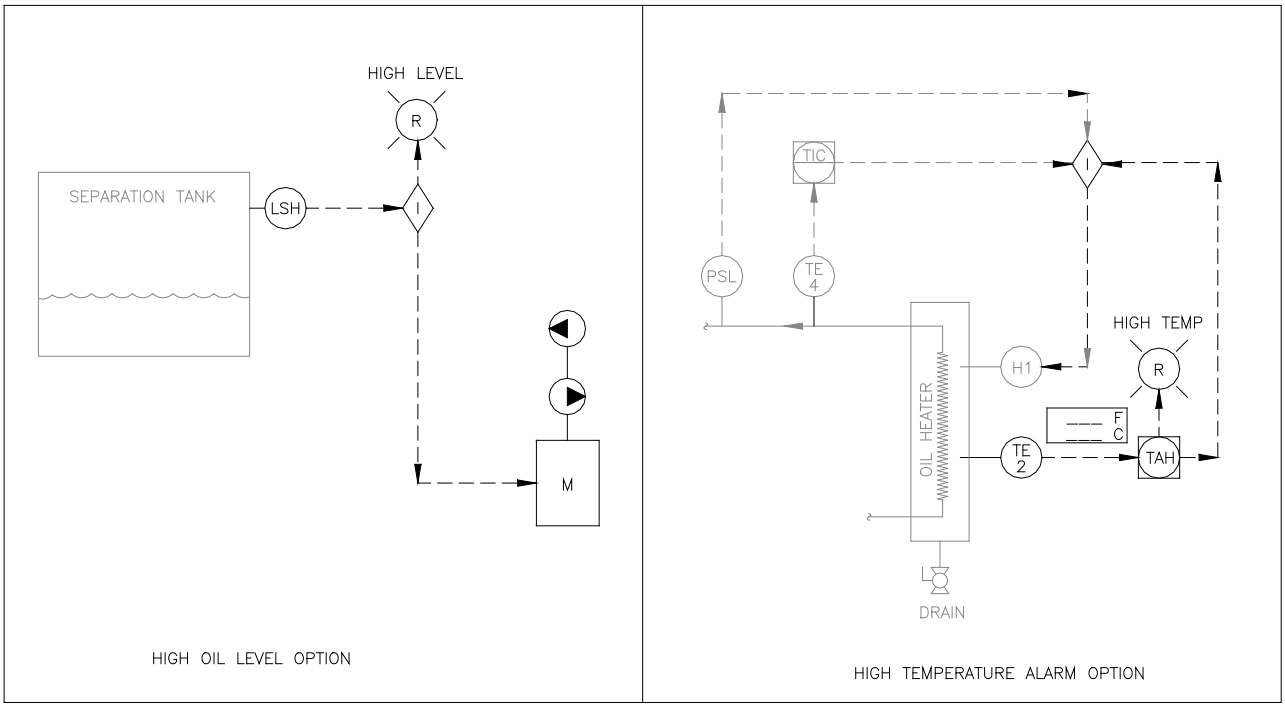
1.) FINAL SET POINT ADJUSTMENT FOR PCV IS FIELD DETERMINED.

TAG	ITEM DESCRIPTION
TE–2	TEMPERATURE SENSOR (T/C) HIGH TEMP ALARM, HEATER CUTOUT
TE–1	TEMPERATURE SENSOR (T/C) HEATER CONTROL
PSL	LOW OIL PRESSURE SWITCH
PRV–2	PRESSURE RELIEF VALVE (DISCHARGE PUMP)
PRV–1	PRESSURE RELIEF VALVE (INLET PUMP)
PCV–1	PRESSURE CONTROL VALVE (BACK PRESSURE)
PI–3	DISCHARGE PUMP PRESSURE GAUGE, 0–100 PSI
PI–2	FILTER OUTLET PRESSURE GAUGE, 0–300 PSI
PI–1	FILTER INLET PRESSURE GAUGE, 0–300 PSI
PI–1	RETUN OIL PUMP
P1	INLET OIL PUMP
M	ELECTRIC MOTOR – 1.5 HP
LSH	HIGH OIL LEVEL SWITCH
LG	LEVEL GAUGE
LCV	LEVEL CONTROL VALVE
H1	OIL HEATER – 1 KW
F2	COALESCING AIR FILTER (DEMISTING)
F1	OIL PARTICULATE FILTER

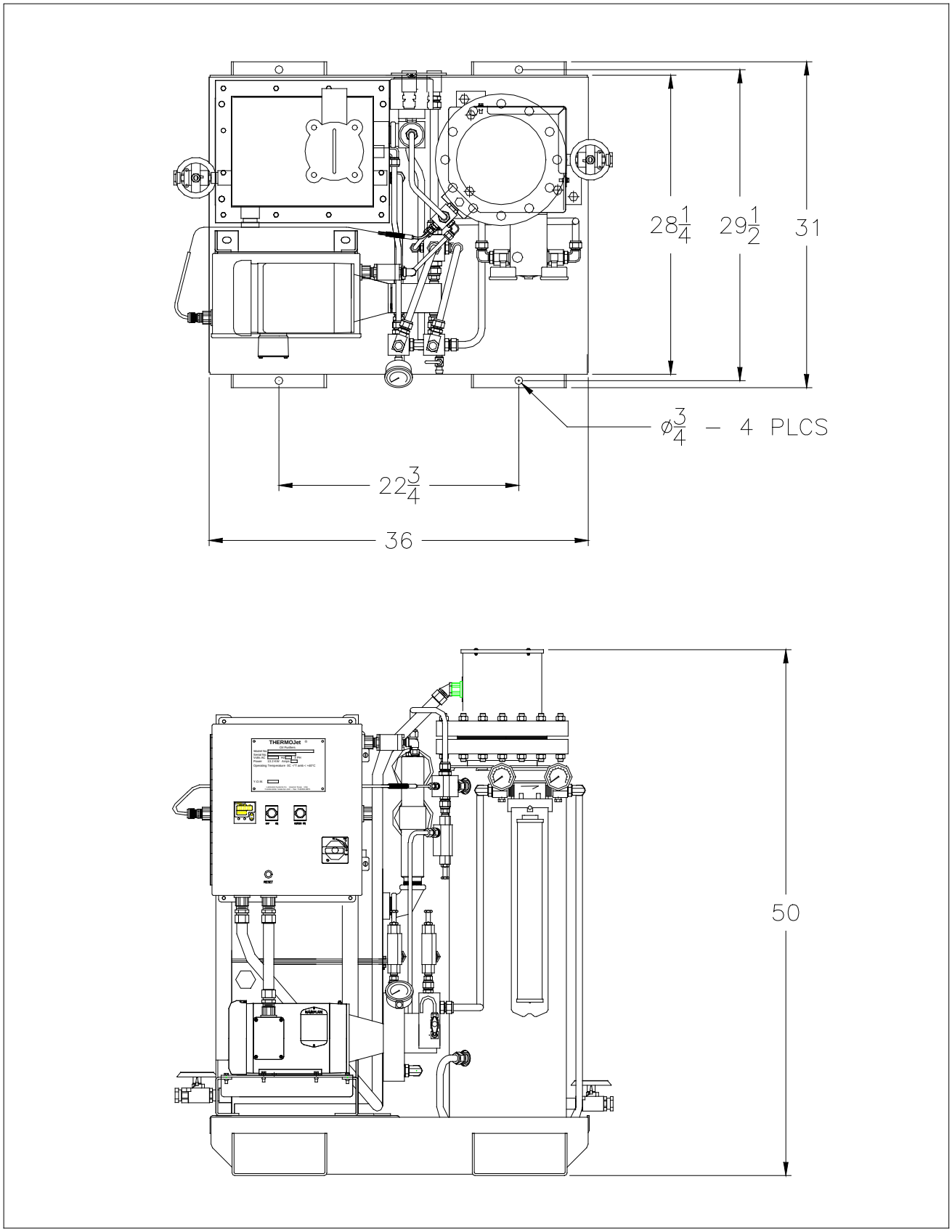
SYMBOL LEGEND

- SAMPLE VALVE
- FLOAT OPERATED LEVEL CONTROL VALVE
- BALL VALVE
- DIRECT ACTING PRESSURE RELIEF VALVE
- DISPLAY/CONTROL
- CONTROL/ALARM
- DISCRETE INSTRUMENT
- INTERLOCK
- LOCAL FAULT INDICATION (RED)
- CHECK VALVE
- DOUBLE SPUR GEAR PUMP

Process& Instrument Diagram (con't)



Dimensional Outline Drawing



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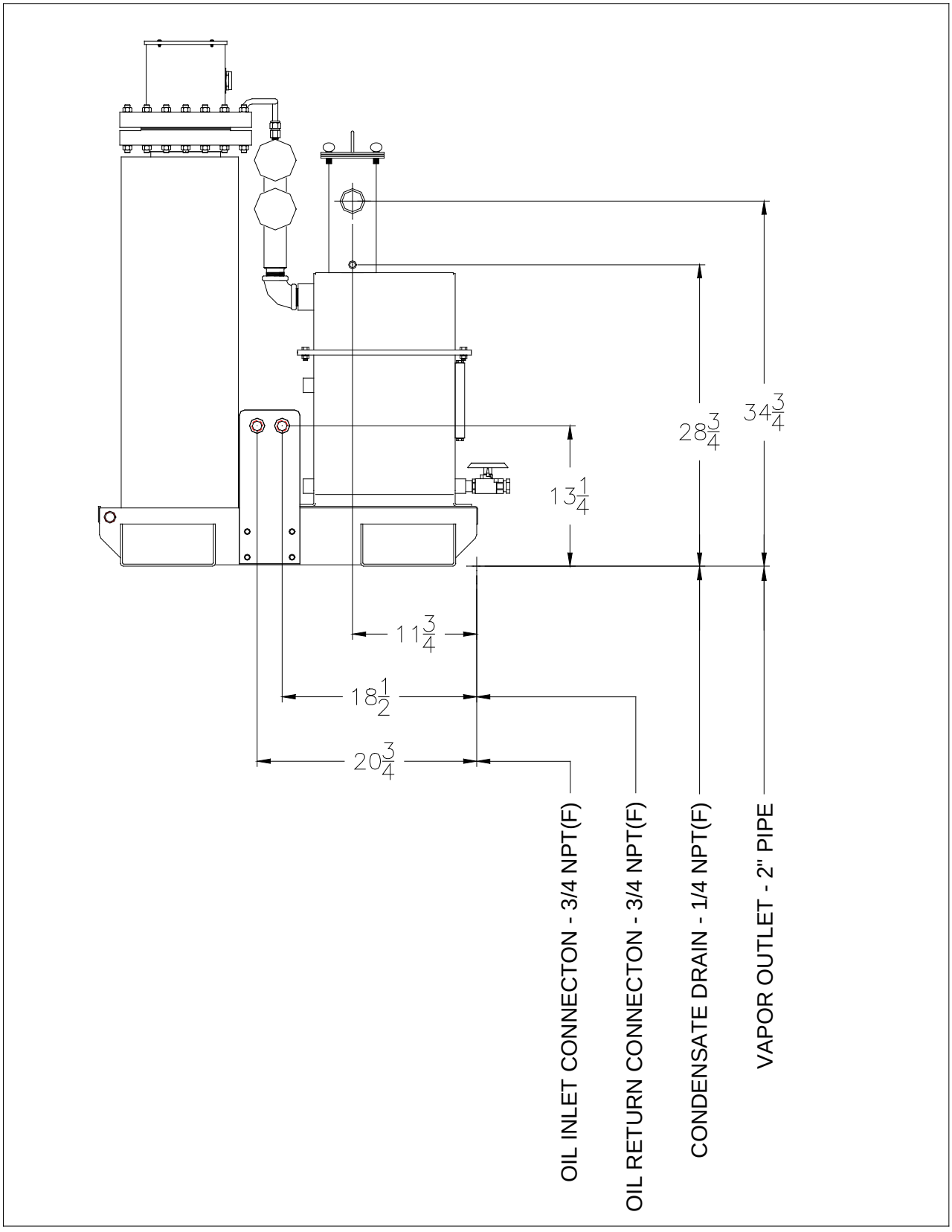
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$28\frac{3}{4}$
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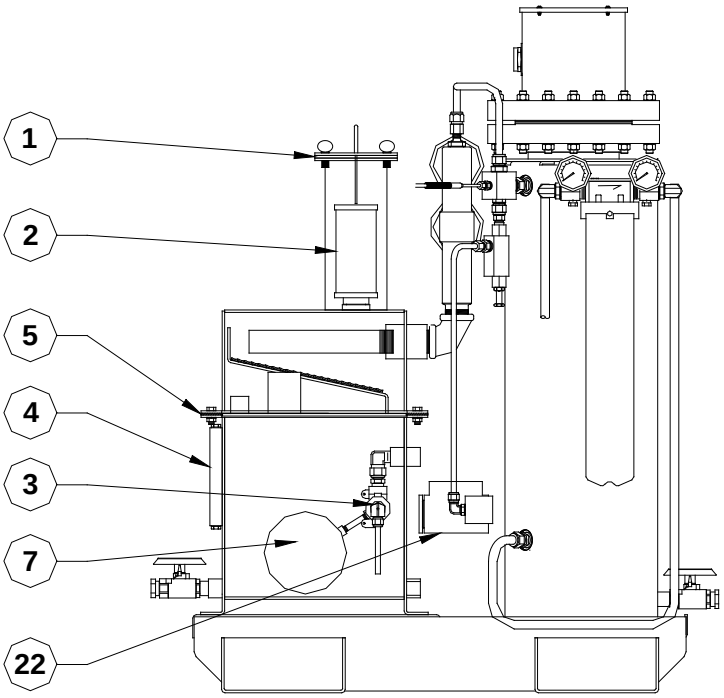
OIL INLET CONNECTON - 3/4 NPT(F)
OIL RETURN CONNECTON - 3/4 NPT(F)
CONDENSATE DRAIN - 1/4 NPT(F)
VAPOR OUTLET - 2" PIPE

Replacement Parts Lists & Drawings

Item	Part Number	Description
1	77700934	GASKET, FILTER CHAMBER
2	77750101	FILTER ELEMENT, DEMISTING
3	51850100	VALVE, LEVEL CONTROL 1/2" NPT
4	U10923B6	OIL LEVEL GAUGE
5	77780644	RESERVOIR GASKET
6	77780680	FUSE HOLDER
7	33000100	FLOAT, SS T316 6" DIA
8	77750215	FUSE, FERRULE 6A 13/32X1 FIBRE TUBE
9	77780671	CHECK VALVE, CARTRIDGE TYPE, 25 PSI
10	77600088	PRESSURE GAUGE, 0-100 PSIG
11	51001237	VALVE, POP-OFF 3/8"P SS SET@ 290
12	77780679	Fuse, Semiconductor type, Rated at 25A/600V
13	77500342	GAUGE, PRESS OIL SUPPLY 0-300 PSI
14	19000050	BREATHER, AIR 1/2"P
15	19000125	BREATHER, AIR 1-1/4"P
16	19103006	FILTER ELEMENT, OIL INLET 6 MICRON
17	77700941	THERMOCOUPLE, TYPE K 3/16"OD X 4"L
18	77750160	HEATER, 12KW-460V-6"FLG CSA/4
	77750174	HEATER, 12KW-380V-6"FLG CSA/4
	77700971	HEATER, 12KW-400V-6"FLG CSA/4
	77700970	HEATER, 12KW-415V-6"FLG CSA/4
	77750173	HEATER, 12KW-575V-6"FLG CSA/4
19	40500060	GASKET, 6" 300# FLEXITE SS T304
20	77700940	SWITCH, PRESSURE 120-170 SET @ 135
21	35500401	TEFC ELECTRIC MOTOR, 1-1/2HP 230 - 460V / 60Hz / 3Ph
	35500403	TEFC ELECTRIC MOTOR, 1-1/2HP 380-400-415V / 60Hz / 3Ph
	35500404	TEFC ELECTRIC MOTOR, 1-1/2HP 575V / 60Hz / 3Ph
22	02000001	PUMP, DOUBLE SPUR GEAR FOR 2000 SER
23	77780677	Single Channel PID Temperature Controller
24	77500322	PILOT LIGHT BULB, 120V
25	30120250	THERMAL MAGNETIC TRIP, 16-25 AMP (480V/60HZ)
26	30180020	FERRULE FUSE, 250V/2AMP
27	30180010	FERRULE FUSE, 600V/1AMP
28	30100601	CONTROL TRANSFORMER W/ FUSE BLOCK, 460V/120V
29	30110120	MAGNETIC MOTOR STARTER (120V/60HZ)
30	30140040	THERMAL OVERLOAD RELAY, 2.4-4 AMP, 460V/60HZ
31	77780678	SCR Power Controller
32	77750179	TIMER, MULTI 0-5 MIN. DELAY
33	77500053	SWITCH, LEVEL SIDE MTD OIL BRASS
34	77780683	Relay, DIN Rail Mounted - 120VAC - PLC-RSC-120UC 21-21
35	30130350	MOTOR STARTER, MAGNETIC 600V/35AMP
36	77780959	TEMPERATURE LIMIT CONTROL
37		HEATER, 12KW-460V-6"FLG CSA/4 w/ THERMOCOUPLE
		HEATER, 12KW-380V-6"FLG CSA/4 w/ THERMOCOUPLE
		HEATER, 12KW-400V-6"FLG CSA/4 w/ THERMOCOUPLE
		HEATER, 12KW-415V-6"FLG CSA/4 w/ THERMOCOUPLE
		HEATER, 12KW-575V-6"FLG CSA/4 w/ THERMOCOUPLE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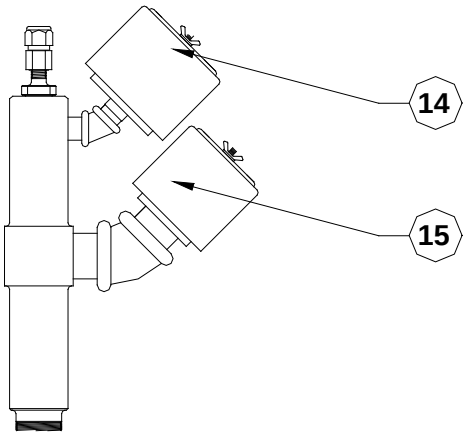
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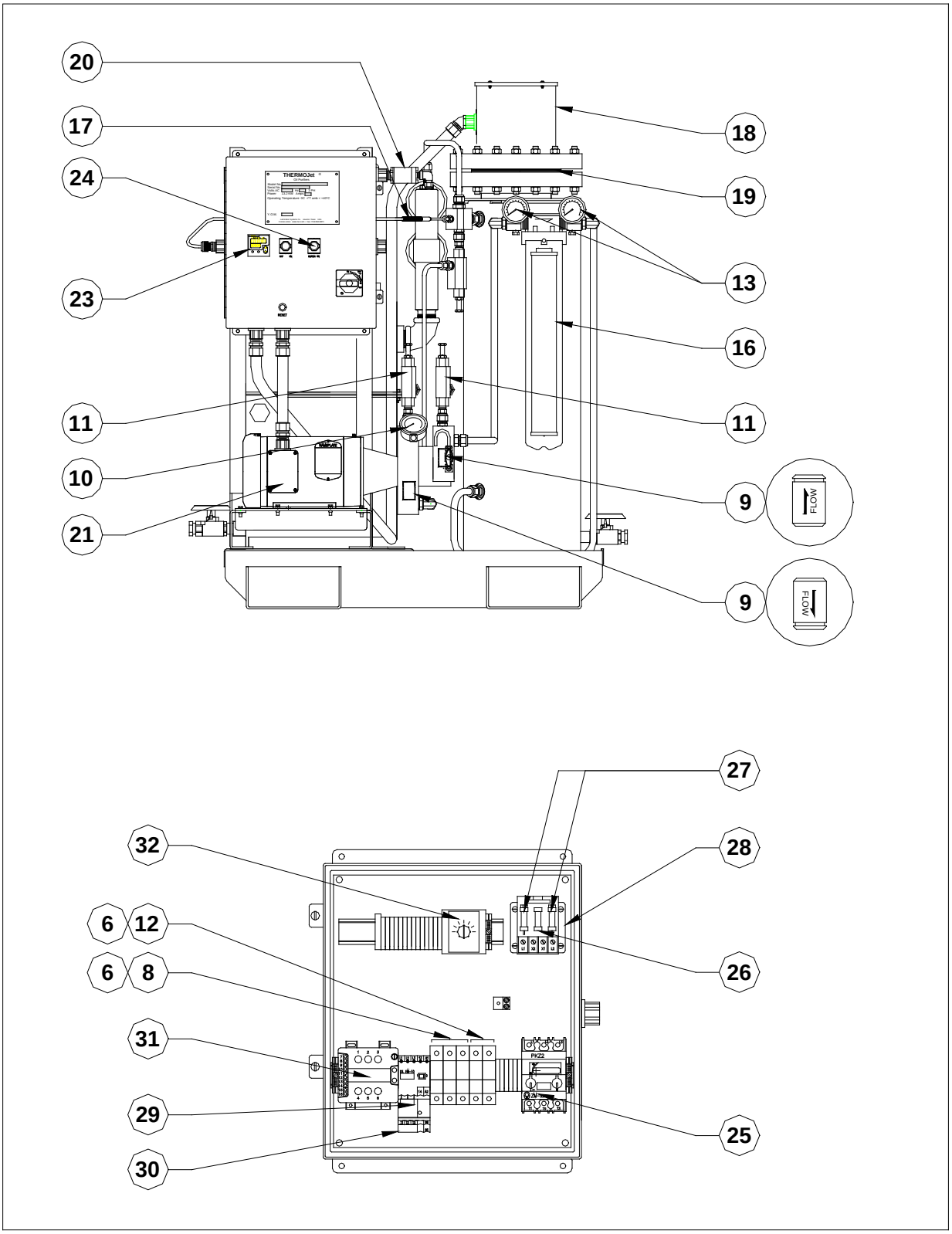
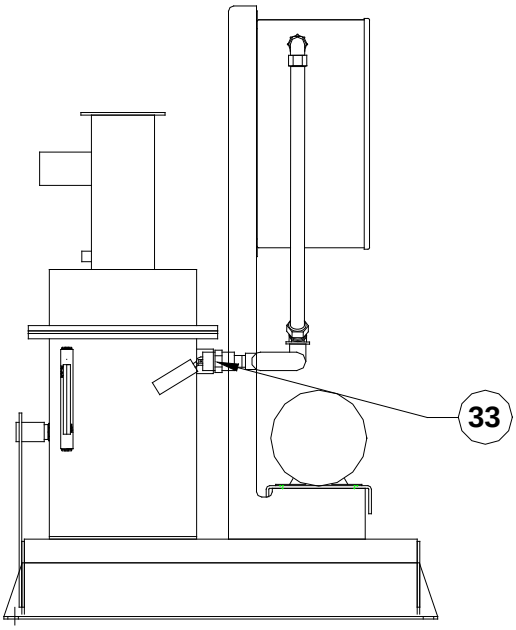
Replacement Parts Lists & Drawings (con't)

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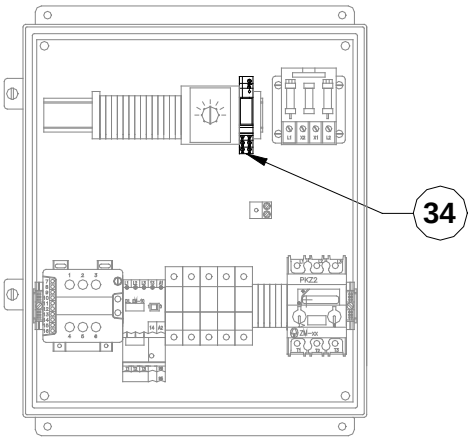
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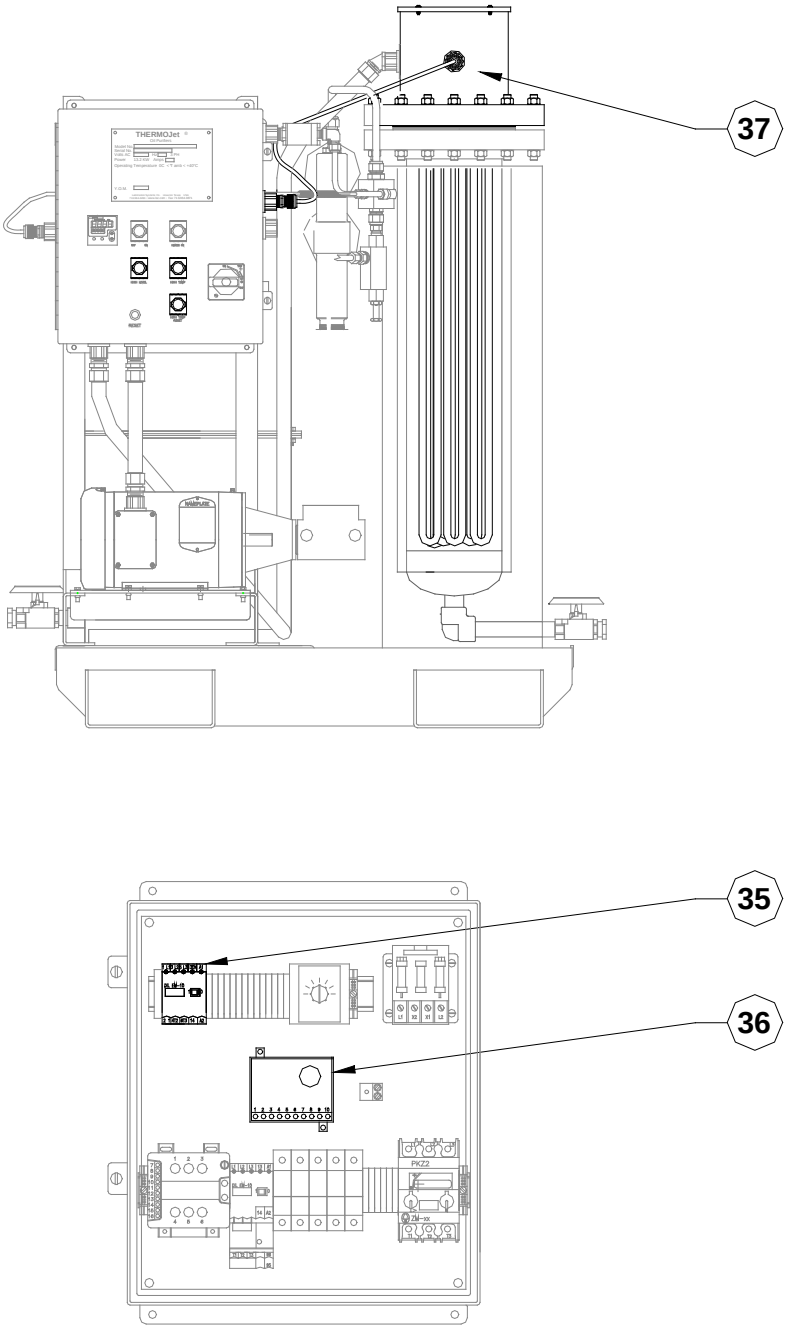
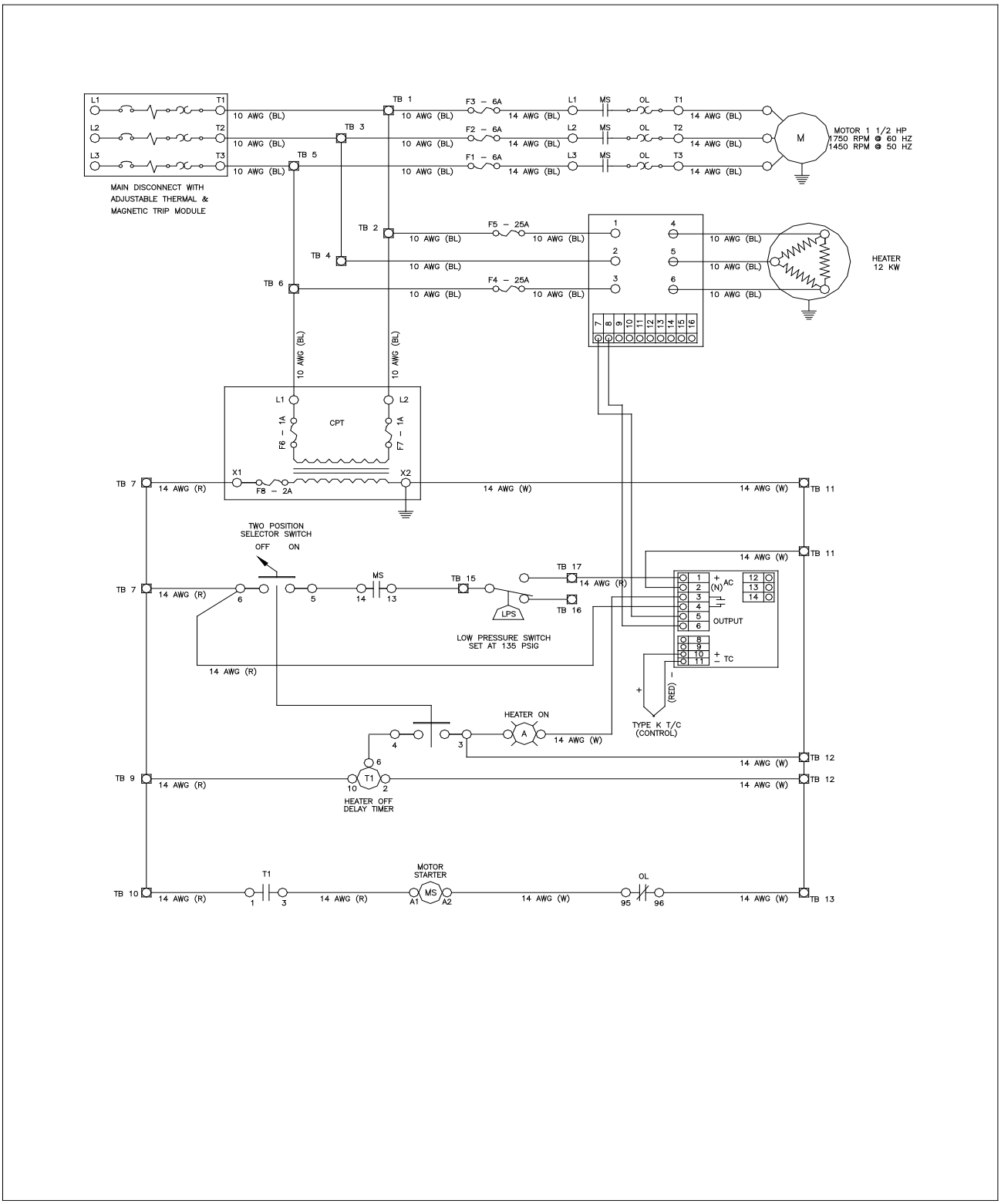
Replacement Parts Lists & Drawings (con't)
High Temperature Option.

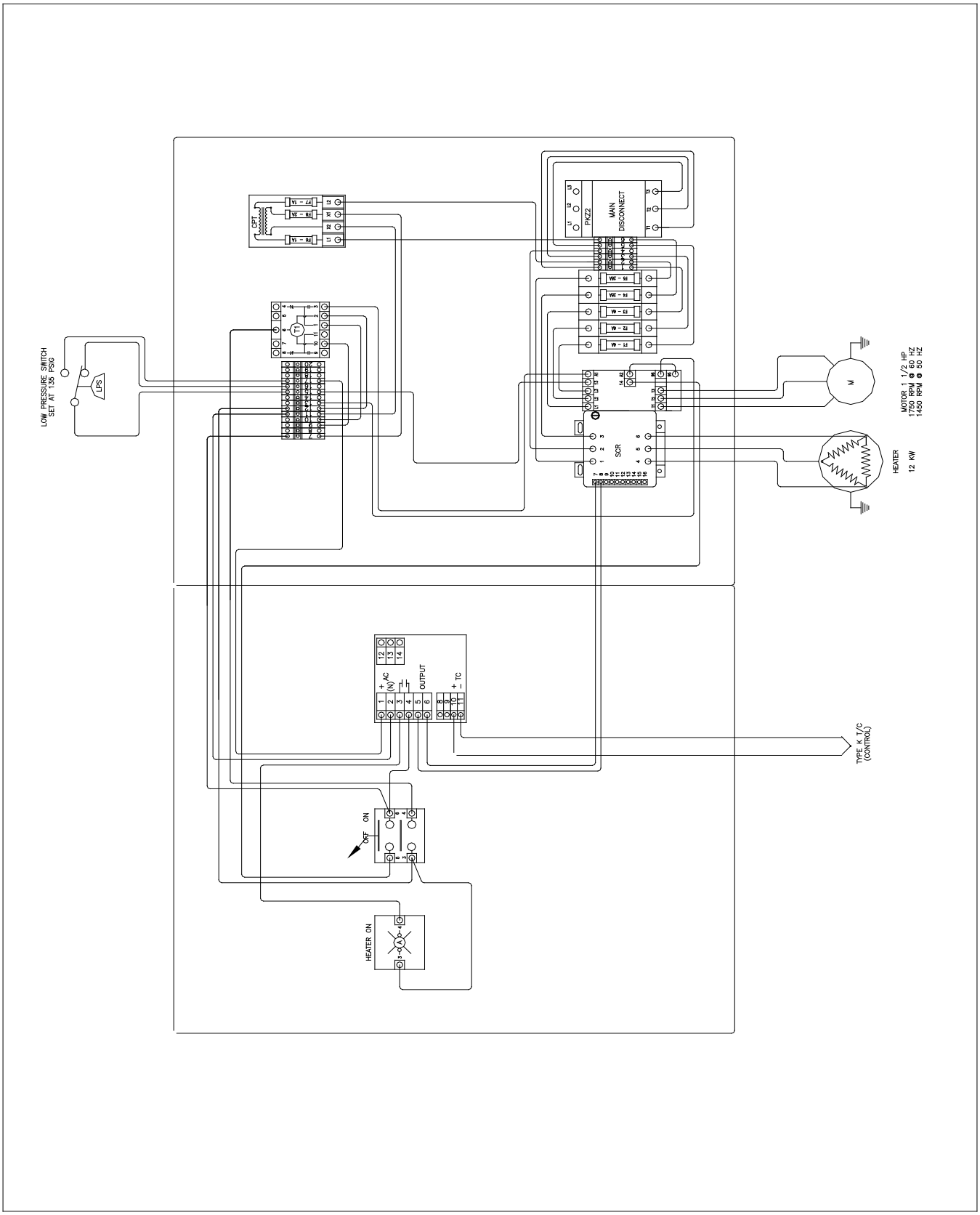


LATER

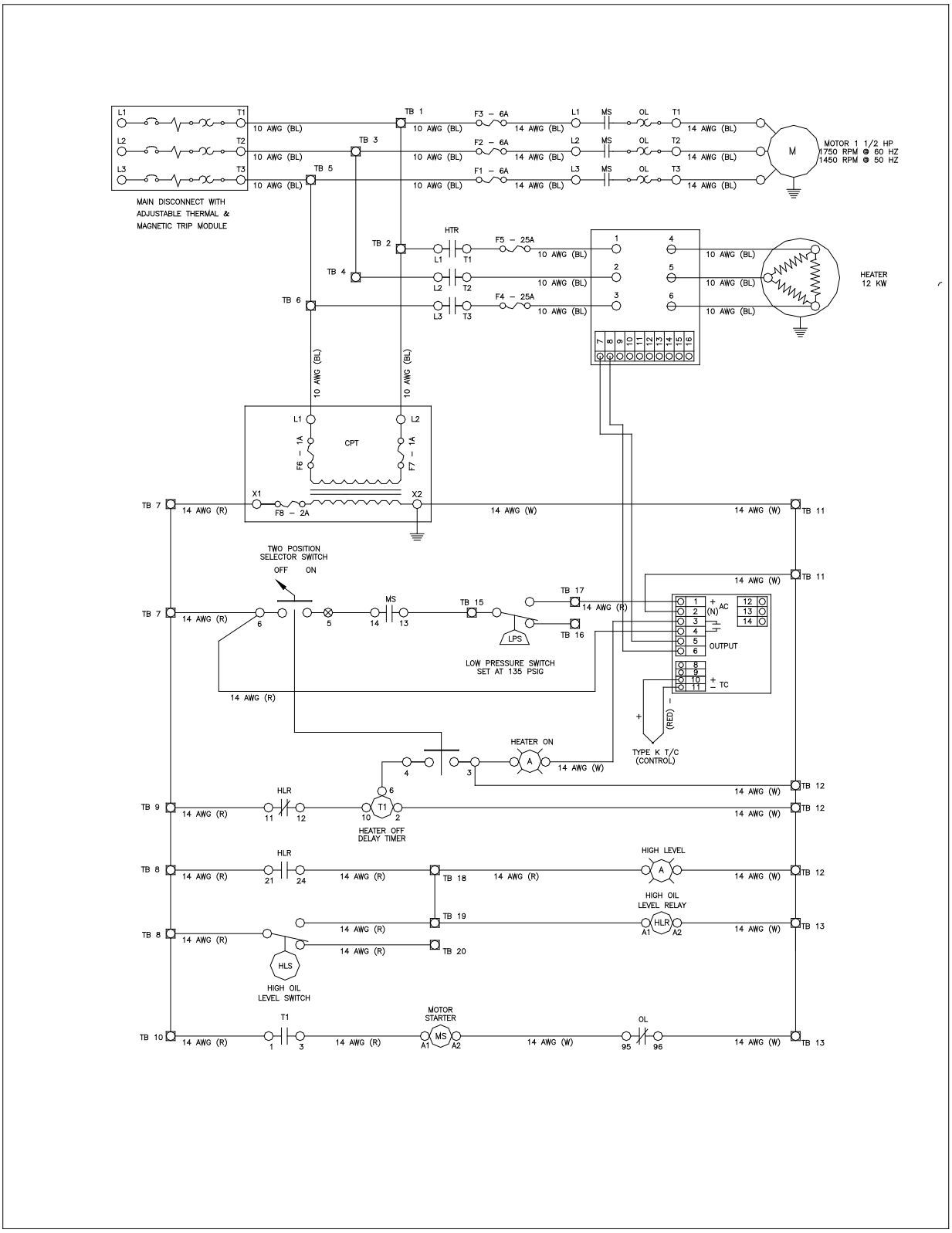
Wiring Schematic – Model N2000 E✳✳X (No Alarms)



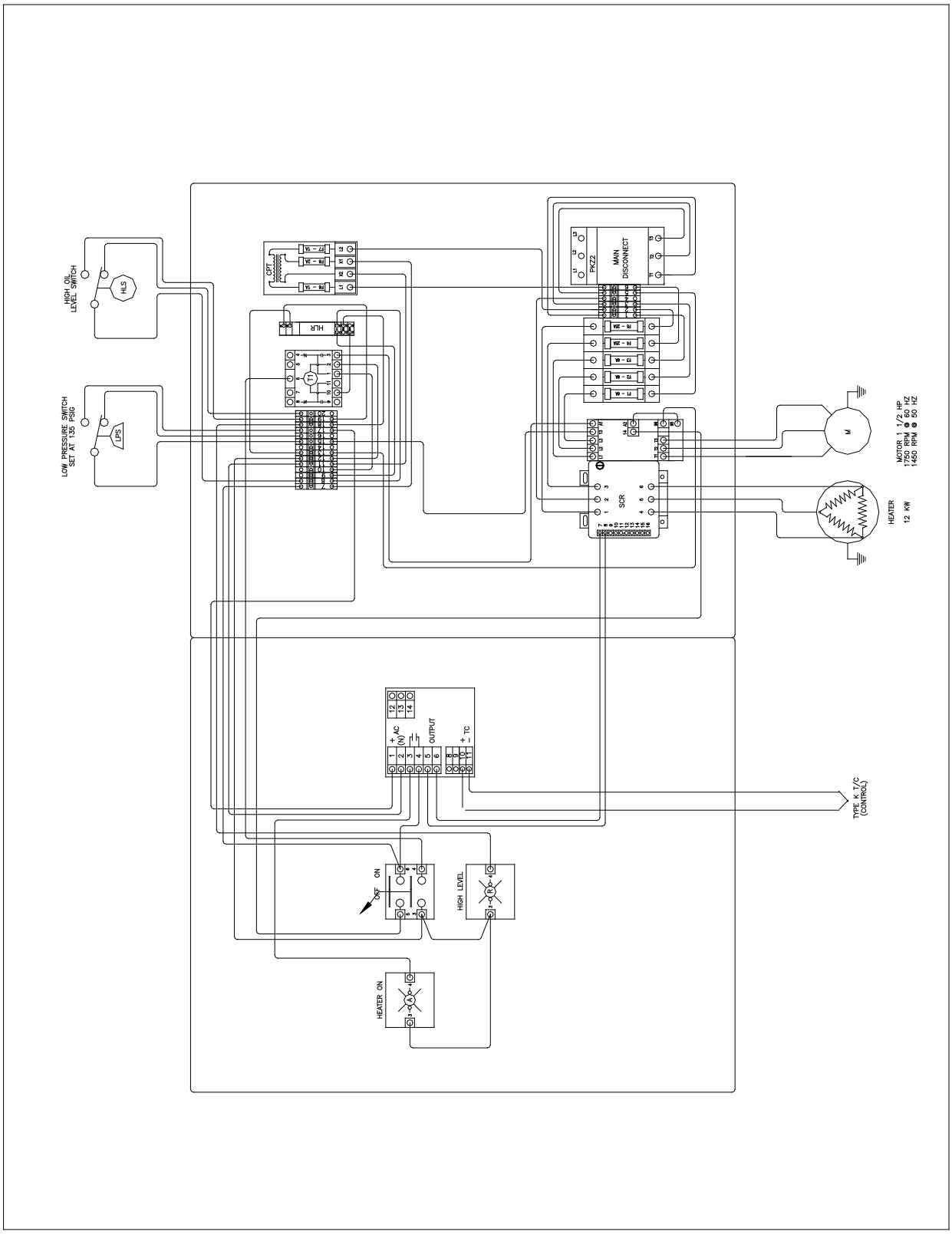
Wiring Diagram – Model N2000 E✳✳X (No Alarms)



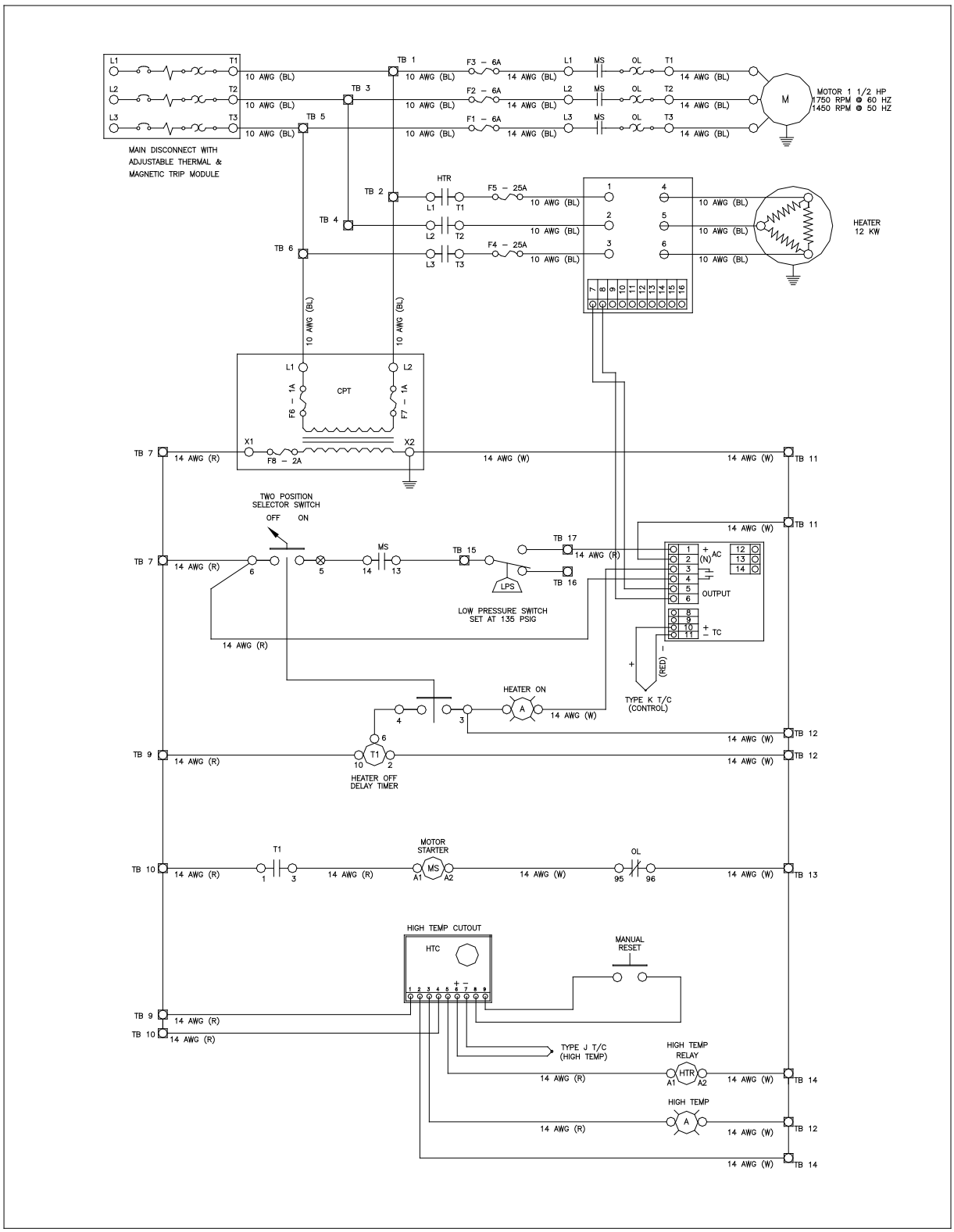
Wiring Schematic – Model N2000 E✳✳L (Low Level Alarm Option)



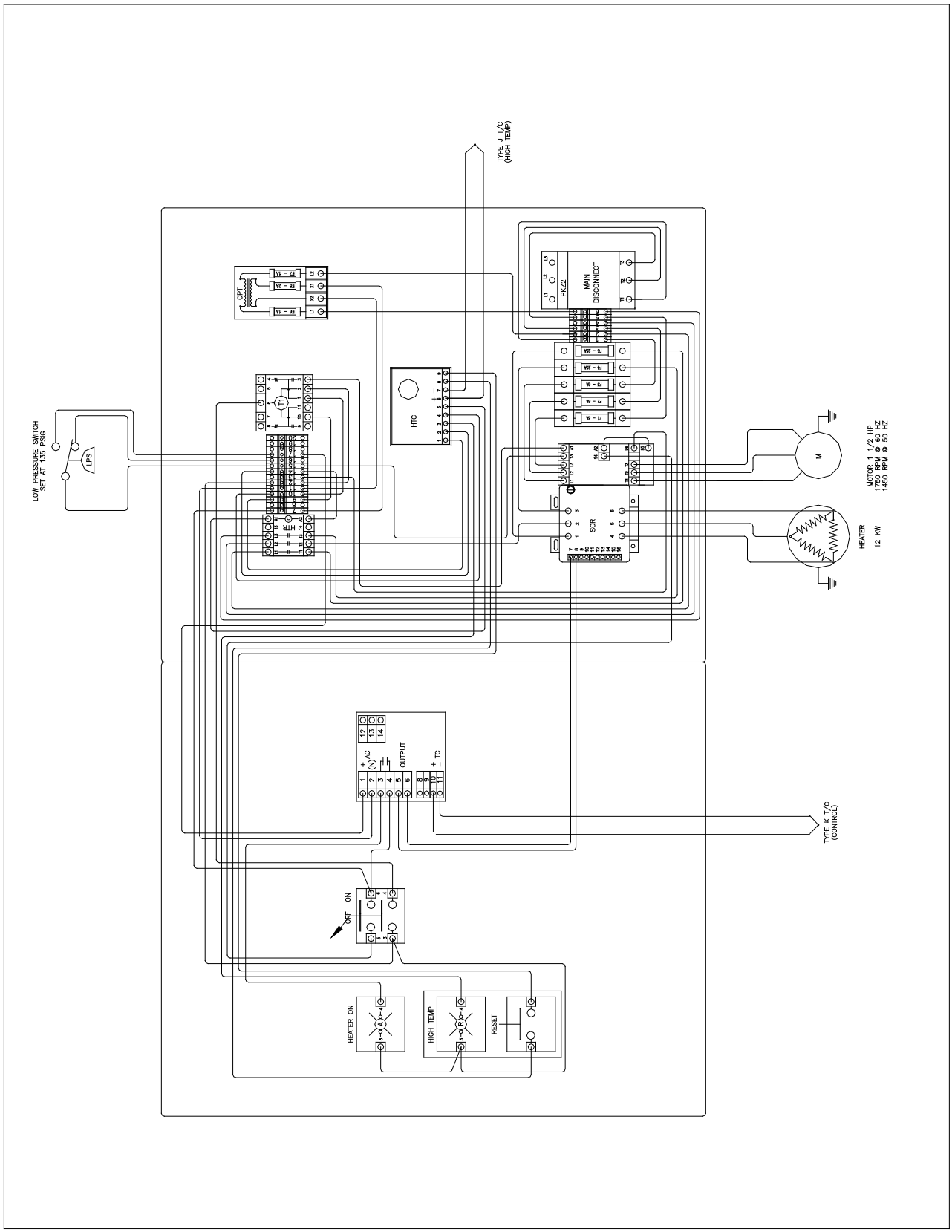
Wiring Diagram – Model N2000 E✳✳L (Low Level Alarm Option)



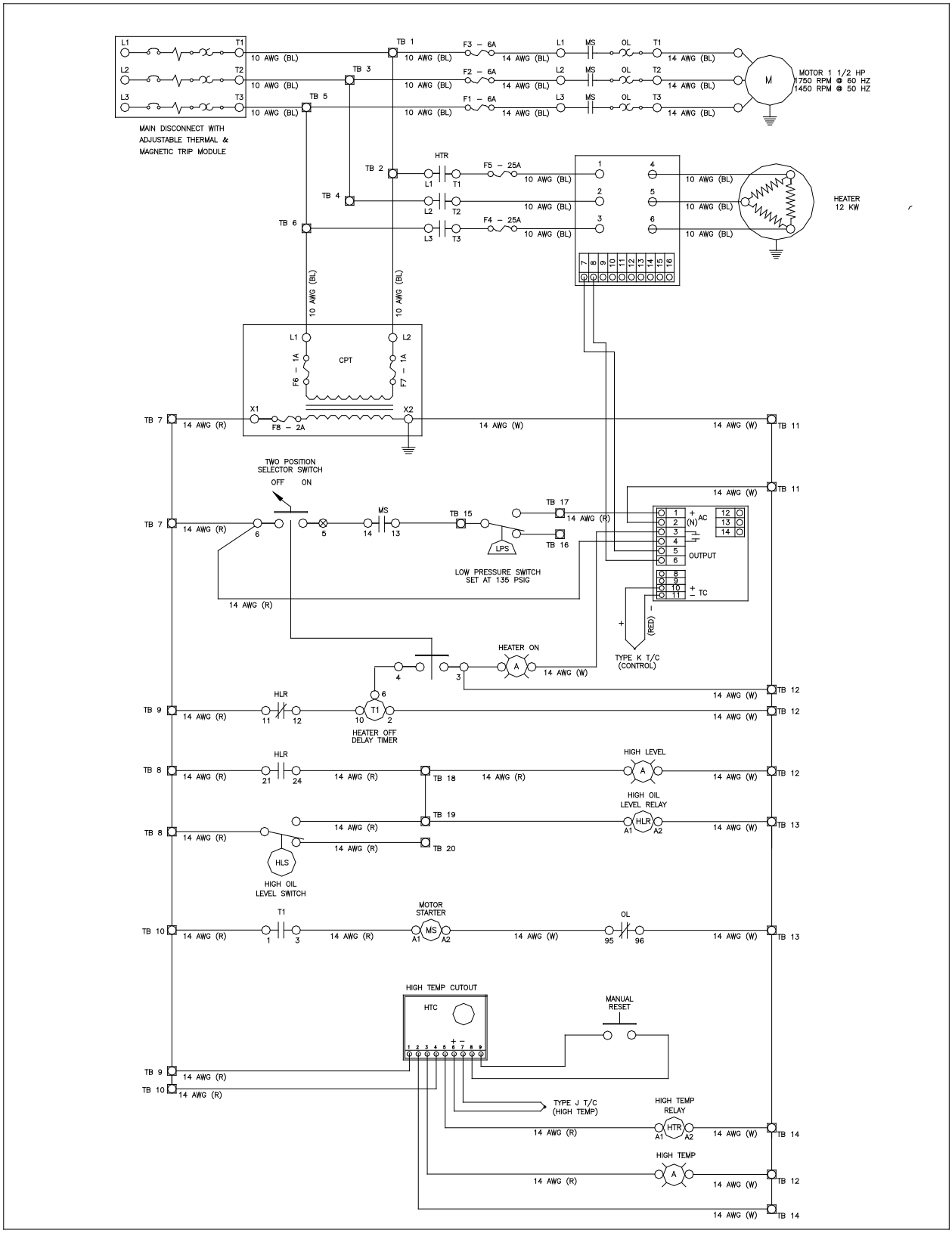
Wiring Schematic – Model N2000 E✳✳T (High Temperature Alarm Option)



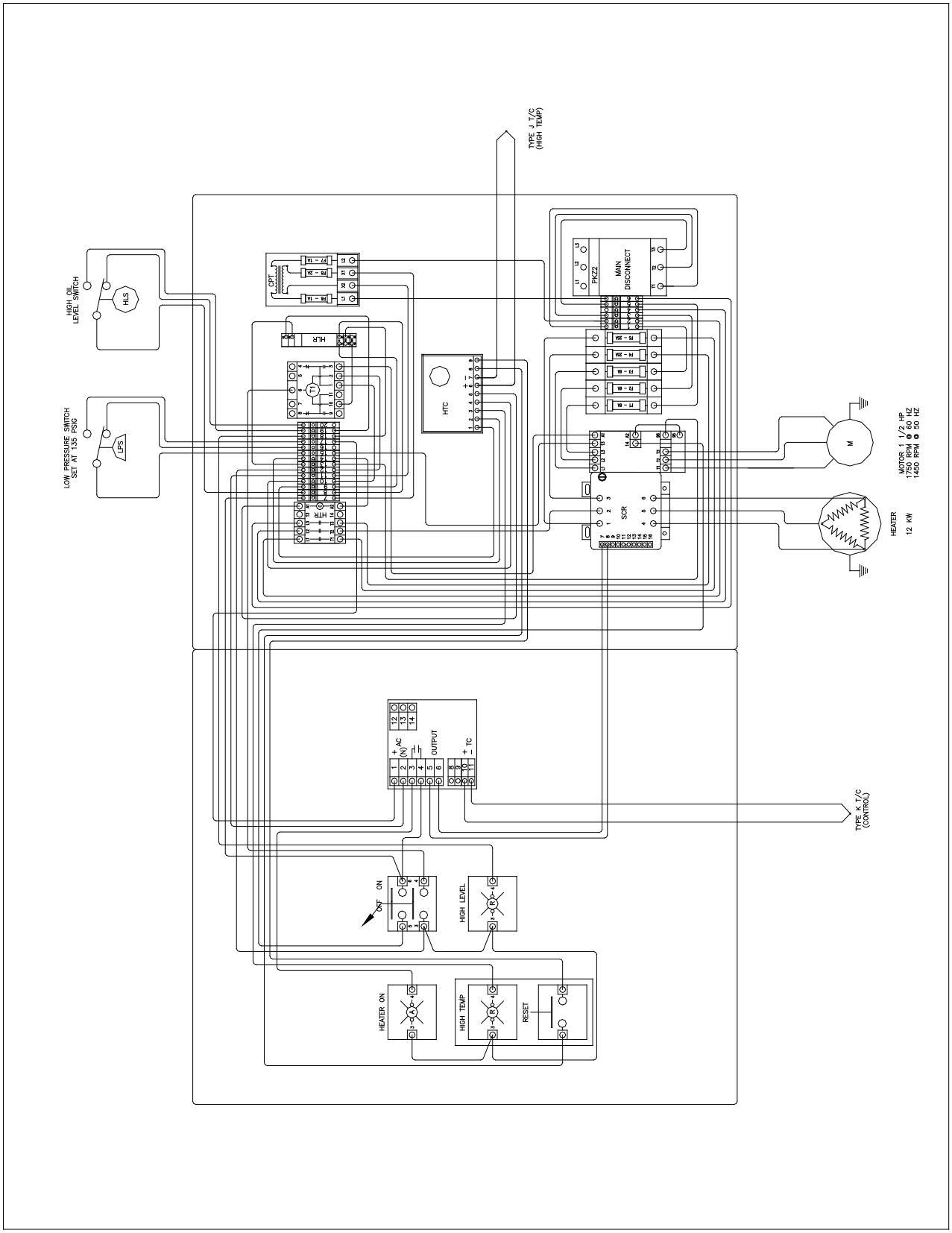
Wiring Diagram – Model N2000 E✳✳T (High Temperature Alarm Option)



Wiring Schematic – Model N2000 E✳✳Z (Low Level + High Temperature Alarm Options)



Wiring Diagram – Model N2000 E✱✱Z (Low Level + High Temperature Alarm Options)



NOTES: