

waukesha®



2ND GENERATION

LTC Oil Filtration Manual

LTC-OF-MANUAL – 3.9

Read and understand this manual prior to operating or servicing the products.



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GENERAL SYSTEM DESCRIPTION

Waukesha LTC Oil Filtration Systems have been designed to remove operating contaminants from the insulating oil of load tap changers. The removal of contaminants will help maintain the oil at the highest possible dielectric strength and minimize equipment failure and downtime. Filtering systems can be installed on existing transformers in the field or ordered on new transformers. Oil filtration systems can be configured with various pumps, filters and control box options. This instruction manual outlines the external mounting configuration, installation and operation of the various units.

CONSTRUCTION

The filtration system has the pump, motor, controls and filter cartridge all located on a common mounting frame. The oil pump is located in a sealed enclosure. Two types of filters are available, a quick change, integrated filter/canister and a replaceable cartridge type. The filter canister for replaceable cartridges is designed to accept most 7"x18" oil filtration cartridges on the market today. The system is also available with an installation kit that includes all hoses, entrance tube components and fittings necessary for the oil filtration system installation.

Standard Control Box Layout and Information

All systems include a microchip timer/control unit that is used to control the system. Indicator lights and power switch are mounted on the front of the control panel. Indicator lights provide status indication at a glance:

- Amber - On
- Red - Low Flow Alarm
- Red - High Pressure Alarm

High pressure and low flow alarm conditions are monitored by separate high pressure and low flow switches. The timer has built-in time delays on both the high pressure and low flow alarms to prevent false alarming at start-up. After start-up, the system automatically shuts down in the event of a high pressure or low flow condition.

The low flow alarm has a 15 second delay and will provide an indication if an insufficient volume of oil is flowing through the unit. Possible causes of this can be attributed to the following: motor failing to start, a break occurring in the oil supply line or oil level falling below the anti-siphon hole (this situation only applies if the customer has installed the stainless steel entrance tube kit as recommended by Waukesha).

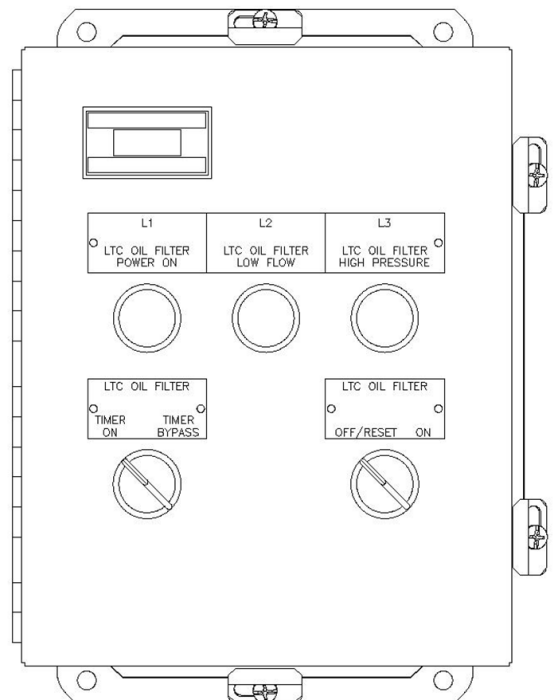


Figure 1 – Standard Control Box with Optional Bypass Switch and Motor Runtime Meter

Standard Control Box Layout and Information (continued)

The high-pressure alarm has a 5-minute delay, which provides time for warm oil to circulate through the filter during cold weather, reducing the chance of false alarms. The system will alarm on high pressure if the filter becomes clogged, a return line becomes blocked or if the filter cartridge quick connect fittings are not completely inserted.

Each of the alarm relays has spare form “c” contacts that can be wired into the customer’s SCADA system (see Figures 13–17, wiring schematics, on pages 16–20).

To reset the system after an alarm, turn the power switch to the OFF/RESET position and then back to ON. The alarms will reset, and the timer will reset initiating operation of the pump for the duration of the timer setting.

Control Box Options

Filtration systems are also available with options such as timer bypass, motor runtime meter and input relay pump shutdown:

- **Bypass Switch:** Positioning this switch in the “Timer Bypass” mode will allow for continuous operation (24/7) of the system without changing the programming of the timer. When operating in this mode, all alarm conditions are still monitored as described above.
- **Runtime Meter:** This meter is located on the front cover and records total number of hours the pump has run.
- **Optional Shutdown Relay:** This relay is used to shut down the system from a customer-supplied signal (i.e. oil level gauge).

Filter Housing

Two basic filter configurations are available for use with the Waukesha oil filtration systems. The small filter canister is designed for LTC tanks of 200 gallons or less, and the larger filter canister is designed for LTC tanks up to 1000 gallons. The small filter is designed to work with the 1/3 HP pump and motor; however, the larger 7x18 filter can be used with either size pump or motor.

- **Small tank filtration systems:** The filter element is permanently housed inside an easily changeable canister. The filter canister design allows for complete change-out of the canister by utilizing quick connect fittings which snap on and off and automatically seal when disconnected from the system.
- **Large tank filtration systems:** This system utilizes a common replaceable filter element that is housed within a canister that allows easy cartridge replacement without oil spills.

Pump and Motor

Waukesha oil filtration systems are available with flow rates of 1.8 to 4 GPM. Both systems feature a pump that is located inside an oil containment frame. The frame provides an extra level of protection from oil spills in the event of a leak at the pump. Continuous duty, thermally protected motors drive all pumps. Smaller systems use a 1/3 HP motor while larger systems use up to a 1/2 HP motor. In all pump housings, the motor is securely mounted with a flange utilizing an O-ring sealing design. The motor is mounted vertically behind the control box.

INSTALLATION

The filter assembly should be mounted on a transformer stiffener. Mounting holes are provided to accommodate four 1/2" mounting bolts. The filter assembly weighs approximately 180–200 pounds.

Electrical power should be brought into the bottom of the electrical box. A 1/2" electrical connector is provided to facilitate connection to standard conduit hardware. On most systems, power requirements are 120VAC; however, a single-phase transformer option for 240V input power is also available.

A complete flexible tube installation kit is recommended; however, the customer may also hard pipe the oil inlet and outlet from the oil filter system. The following guidelines should be followed when installing the supply and return piping (also see Figures 10–12 in Appendix C, pages 13–15):

- Plumbing from the LTC compartment to the filter should be 1/2" inside diameter or larger.
- Copper or stainless tubing is recommended. **Do not use galvanized pipe or fittings.**
- Do not exceed six (6) elbows on the supply piping or six (6) elbows on the return piping.
- If the total length of inlet plus outlet piping exceeds 75 feet, use 3/4" ID piping or larger. Inlet oil connection is 1/2" NPT female pipe thread.
- Outlet oil connection is 1/2" NPT male pipe thread.
- Suction and return tubes should be mounted as far away from each other as possible to induce cross-flow.
- Suction and return tubes should be mounted as close to side walls as possible.
- Return tube should terminate at the top of the LTC tank.
- Suction tube should draw oil from the bottom of the LTC tank and be installed so that the tube opening is 1/2" from the bottom of the tank.
- Anti-siphon hole needs to be drilled in the suction tube at 1/2" below the minimum oil level.
NOTE: The anti-siphon hole prevents the system from drawing additional oil out of the tap changer when the oil level reaches a minimum level.

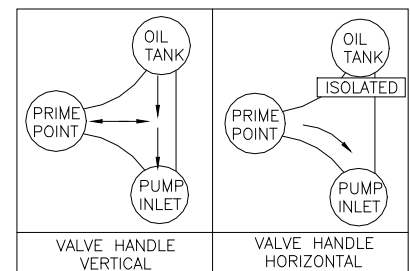
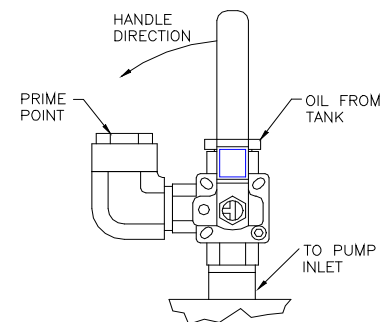
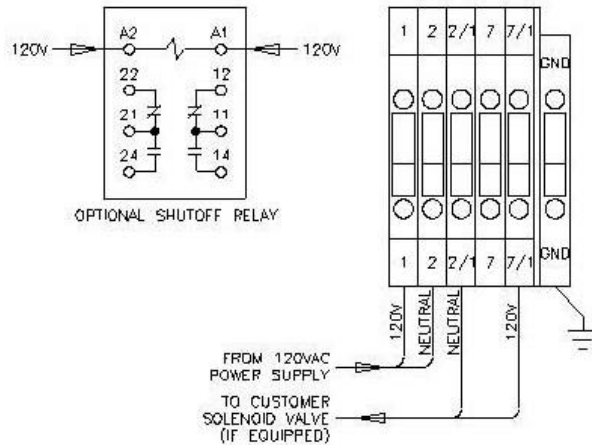


Figure 2 – Pump Priming and Three-Way Valve Operation

We recommend that the pump be primed prior to start-up. This can be achieved by adding load tap changer oil directly into the oil input line on the three-way valve (see Figure 2 above).

ELECTRICAL POWER CONNECTIONS

120V Input Connection



240VAC Input Connection

NOTE: For use with optional transformer.

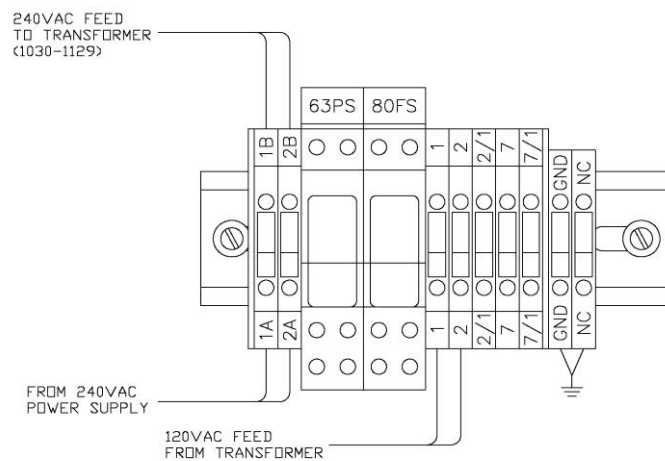


Figure 3 – Control Box Direct Input Connections

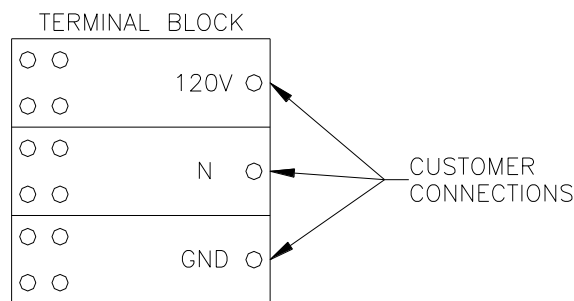


Figure 4 – Enclosed System Power Connections

NOTE: Solenoid valve connections made in control box as shown above.

OPERATION

System operates by circulating oil from the LTC switching compartment through the filter. The pump draws oil from the LTC oil compartment at a rate from 1.8 GPM (for the 1/3 HP motor) to 5.0 GPM (for the 1/2 HP motor). The oil is forced through the moisture absorbent filter element, which absorbs water and removes particulates suspended in oil.

Pump operation can be manually initiated by turning the power switch to the OFF position and then back to the ON position. *If equipped*, the bypass switch will manually operate the pump without the timer functions. **The safety functions of the system are always in effect and cannot be bypassed.**

The system will always alarm when a filter change is required. The filter should be changed when the pressure indicated on the pressure gauge reaches 60–65 PSI or as recommended by the filter cartridge manufacturer, whichever comes first (wait at least one minute before reading to allow the pressure to stabilize). The filter life will vary depending on the number of LTC operations, pump size used, filter size used, pump timer settings and the volume of oil in the LTC tank.

The high pressure switch monitors the pressure at the filter and will shut the system off when the filter requires replacement. The high pressure setting on the pressure switch is set at 68 PSI. The low flow switch will shut the system off if the flow drops below 0.9 GPM. For additional safety, the brass bypass manifold automatically bypasses the oil if the pressure exceeds 75 PSI.

The timer/controller located inside the control box controls timing operations of the filtering system. The timer can be accessed by removal of the front cover screws. The factory setting is all switches OFF.

Timer Programming

	DIP SWITCH #1	DIP SWITCH #2	RUN TIME
e. 2 Hours	OFF	OFF	2 HOURS
f. 4 Hours	OFF	ON	4 HOURS
g. 8 Hours	ON	OFF	8 HOURS
h. 24 Hours	ON	ON	CONTINUOUS (24/7)

	DIP SWITCH #3	DIP SWITCH #4	RESTART EVERY
a. Daily	OFF	OFF	1 DAY
b. Every other day	OFF	ON	2 DAYS
c. Weekly	ON	OFF	7 DAYS
d. Every other week	ON	ON	14 DAYS

**(SW #3 & #4 not active
In CONTINUOUS mode)**

MAINTENANCE

LTC filtration system requires minimal maintenance. The unit has been designed to shut down if problems occur. To reset the alarm lights and place the filter system back in service, turn the power switch OFF, then back ON.

Annual Inspection:

- 1) Check system for leaks.
- 2) Check LTC oil level.
- 3) Check operation by turning to OFF/RESET and back ON; this will initiate a pump cycle.
- 4) Check the pressure on the gauge when the pump is running. If the pressure is above 60 PSI, change the filter.
- 5) Check the service date of the filter cartridge. If the service date shows the filter being used beyond the manufacturers' recommended lifecycle, change the filter cartridge.

When changing the filter, the following procedures should be performed:

Large System Canister Replacement

- 1) Turn the power switch to the OFF/RESET position.
- 2) Open the air vent on the canister to release any pressure that may exist, close the vent.
- 3) Release the quick couplers from the canister inlet and outlet ports.
- 4) Unclamp securing bracket and remove canister.
- 5) Position new canister in the mounting rack and secure by locking down bracket. Attach the quick couplers to their correct positions on the inlet and outlet ports.

Large System Cartridge Replacement

- 1) Turn the power switch to the OFF/RESET position.
- 2) Open the air vent on the canister to release any pressure that may exist.
- 3) Release the quick coupler fittings from the inlet port to prevent free oil flow from the load tap changer tank.
- 4) Position a bucket in front of the canister drain valve. Drain approximately 2 gallons of oil from the unit then close the valve.
- 5) Unclamp the canister lid to access the cartridge. Remove cartridge by unscrewing wing bolt, washers and securing plate.
- 6) Insert new cartridge and center inside the canister. Position securing plate with legs on the inside diameter of filter. Install rubber washer and lock washer. Tighten wing bolt until lock washer is fully compressed.
- 7) Position canister lid and gasket, tighten clamp and close the air vent.
- 8) Attach inlet hose to the canister.
- 9) Operate the filtration system under personnel supervision for 10 minutes to ensure no leaking occurs.

MAINTENANCE (continued)

Small System Canister Replacement

- 1) Turn the power switch to the OFF/RESET position.
- 2) Release the quick couplers from the canister inlet and outlet ports.
- 3) Remove canister.
- 4) Position new canister in the mounting rack. Attach the quick couplers to their correct positions on the inlet and outlet ports.

TROUBLESHOOTING

Motor will not operate.

- 1) Check for 115VAC control power at terminals 2 and 7.
- 2) Check for voltage at the motor.

Low Pressure

- 1) Check motor power supply.
- 2) Check operation of pump.

High Pressure

- 1) Does filter need to be changed?
- 2) Check for blockage in the system.

General Oil Leaks

- 1) Check connections for tightness.
- 2) Check tubing for cracks. Replace, if necessary.
- 3) Check that connections are completely inserted and locked.

APPENDIX A: General Dimensions

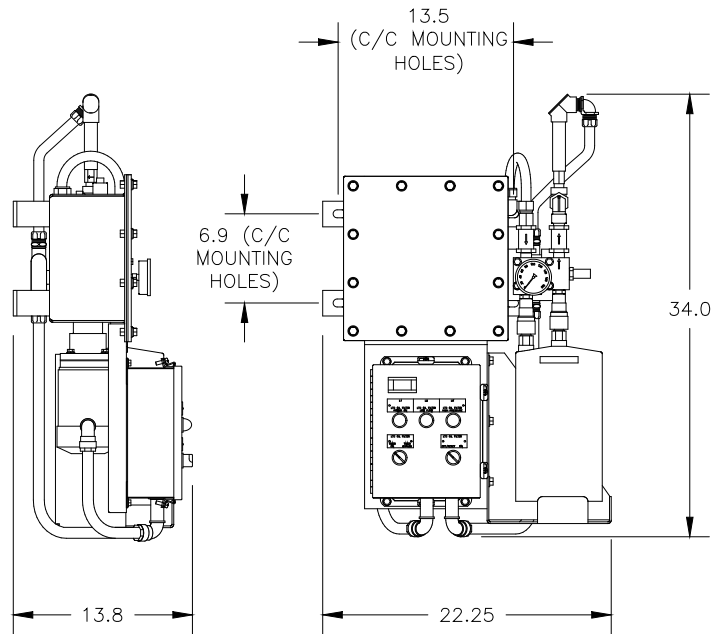


Figure 5 – 1/3 HP Pump and Small Filter

NOTE: 3 way valve not shown.

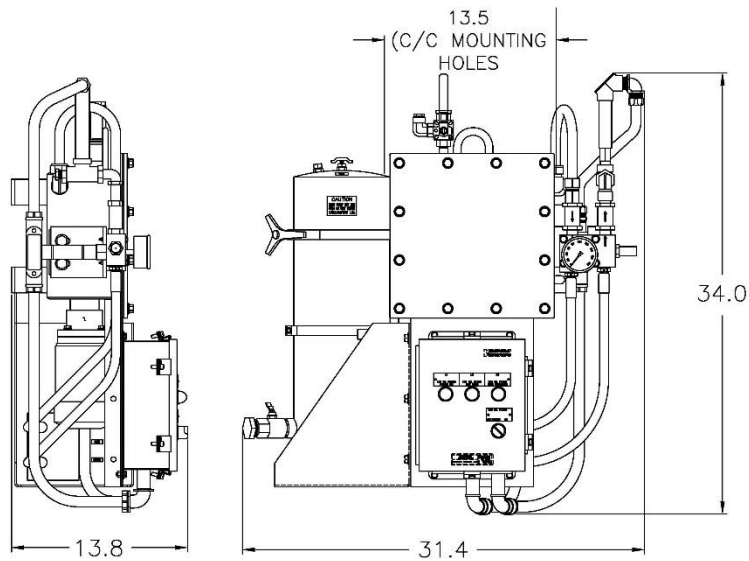


Figure 6 – 1/3 HP Pump and Large Filter

APPENDIX A: General Dimensions (continued)

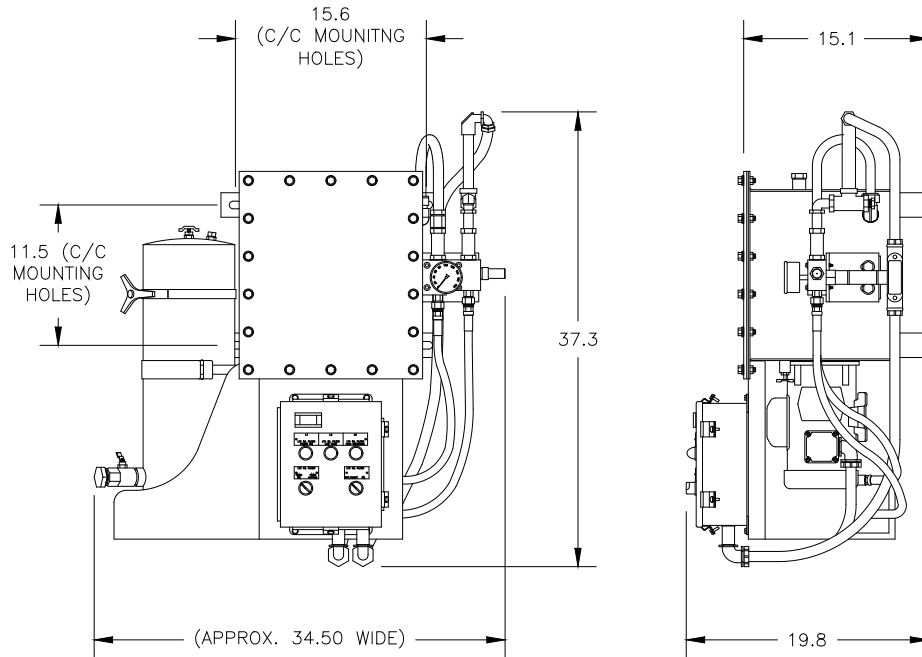


Figure 7 – 1/2 HP Pump and Large Filter

NOTE: 3 way valve not shown.

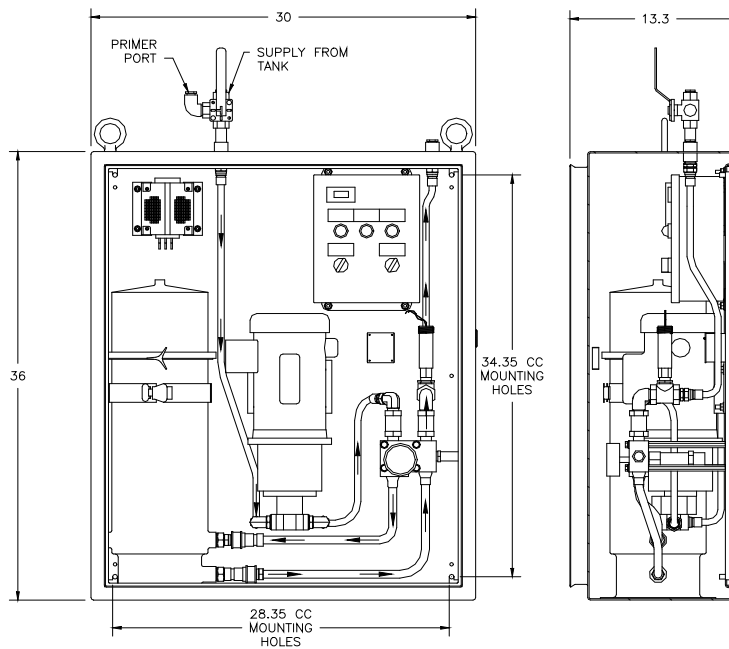


Figure 8 – 1/2 HP Pump and Large Filter in Enclosure

NOTE: Door not shown.

APPENDIX B: Pump Cover Replacement / Reinstallation

If the cover of the pump chamber is removed, the following reinstall procedure must be followed:

- 1) Carefully clean the gasket sealing surfaces.
- 2) Inspect the gasket for any wear, tears or other irregularities.
- 3) Replace the gasket if it is damaged in any manner.
- 4) The gasket is installed dry following the bolt tightening sequence as shown.

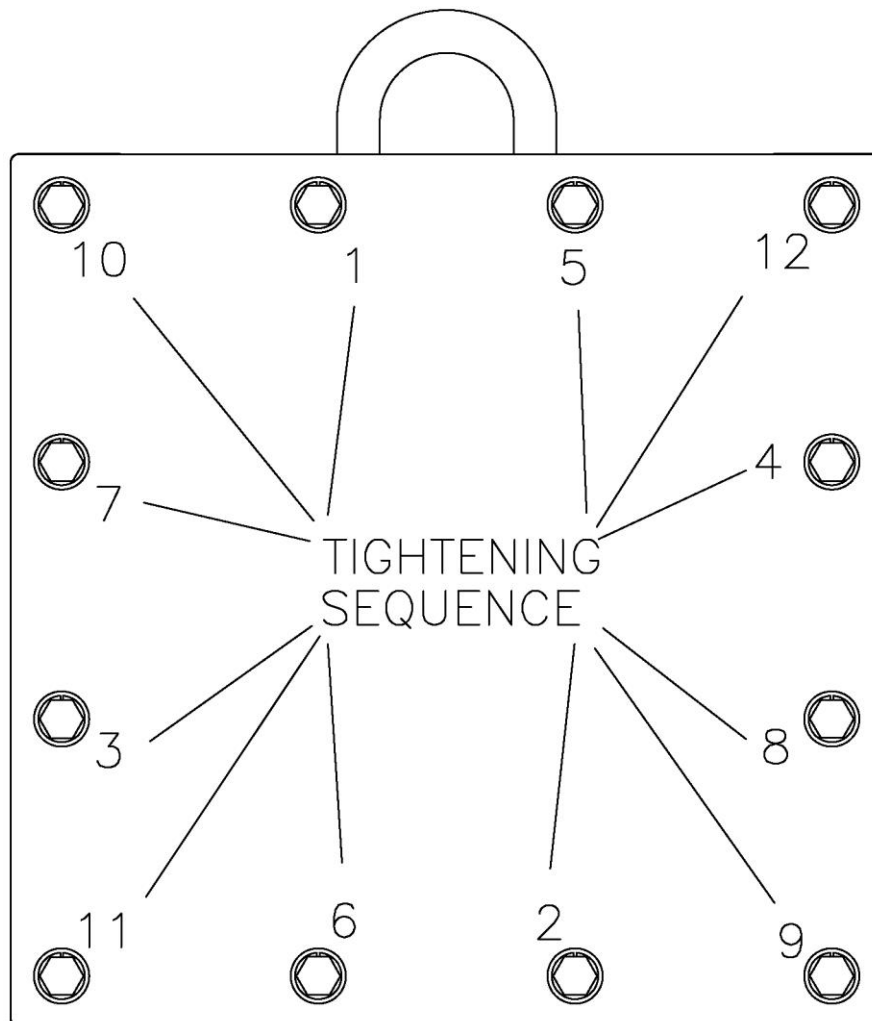


Figure 9 – Pump Cover Bolt Tightening Sequence

APPENDIX C: General Piping Diagrams

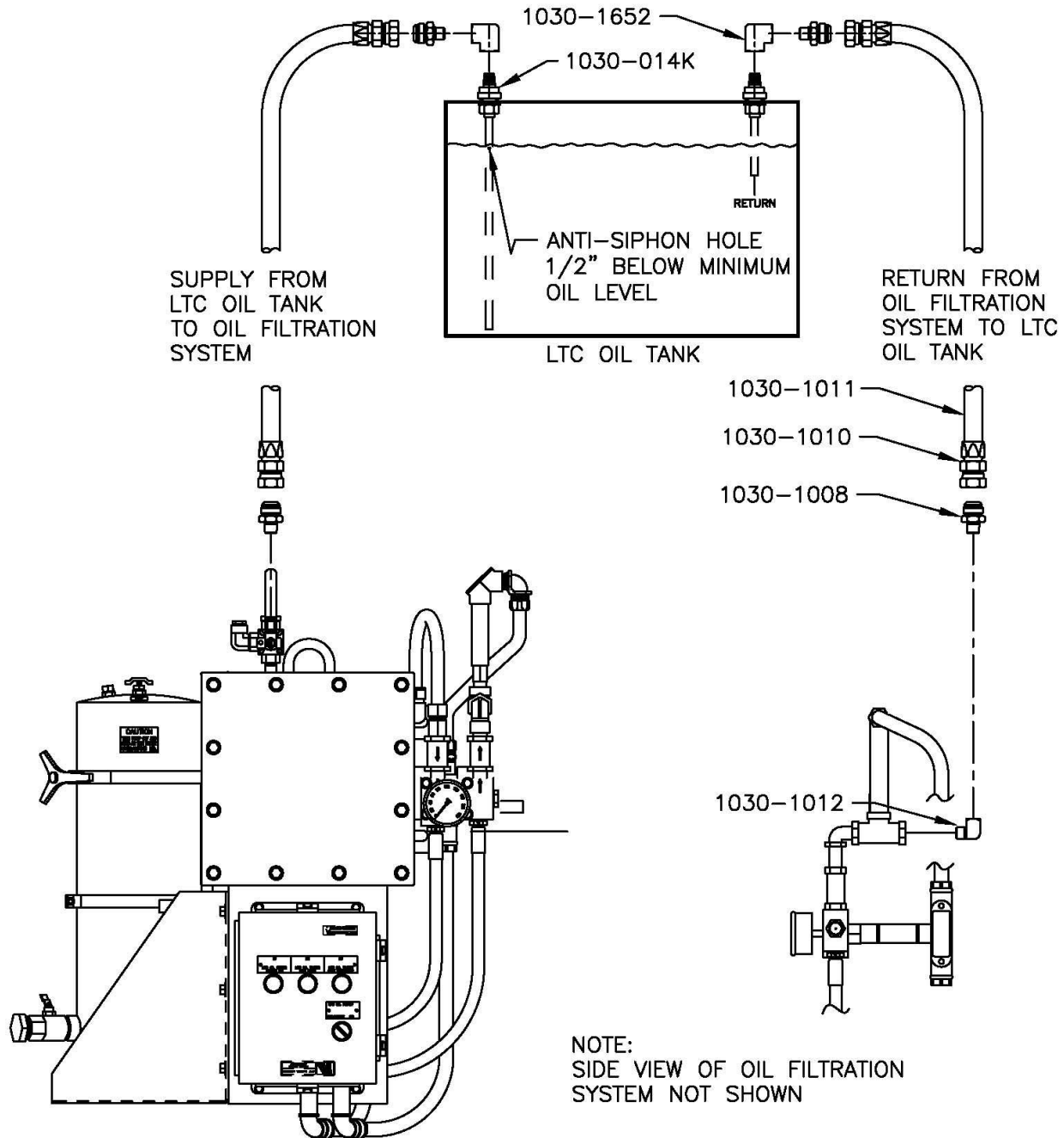


Figure 10 – Installation Using OPTIONAL Flexible Hose Kit

APPENDIX C: General Piping Diagrams (continued)

RECOMMENDED TUBING LENGTH							
7.5 PSI Friction Losses @ Min Flow Rate of 0.33 GPM and -20° Coil Temperature (400cST Viscosity)							
	0 ELBOWS	1 ELBOW	2 ELBOWS	3 ELBOWS	4 ELBOWS	5 ELBOWS	6 ELBOWS
1/2" I.D. Tubing (ft.)	14	11	9	7	5	N/A	N/A
3/4" I.D. Tubing (ft.)	70	67	64	62	59	56	53
1.0" I.D. Tubing (ft.)	220	217	214	212	209	206	203

FLEXIBLE HOSE KIT ASSEMBLY NOTES

- 1) Mark and cut hose to desired length using a fine tooth hacksaw or cutoff machine.
- 2) Remove nipple from socket and place nipple aside.
- 3) Place socket in vice and screw in hose counter-clockwise until the hose bottoms out (approx. 1.0"). Back hose out 1/2 turn. Mark hose with grease pencil or equivalent.
- 4) Oil inside of hose and nipple threads liberally w/ transformer oil. Do NOT oil the hose cover.
- 5) Screw the nipple assembly into the socket using a wrench on the nipple hex until the nipple hex shoulders against the socket.
- 6) Ensure the grease mark has not separated during the tightening of the assembly.

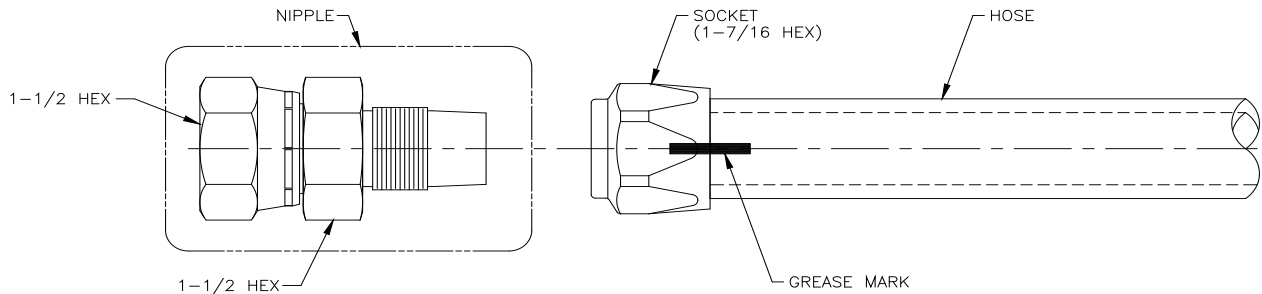
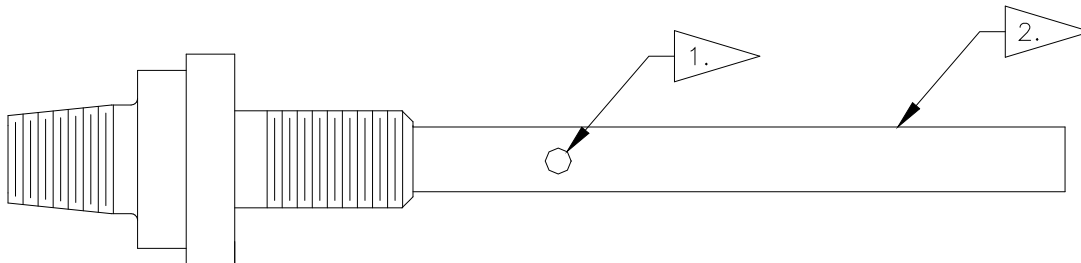


Figure 11 – Instructions for Installation of OPTIONAL Flexible Hose Kit

APPENDIX C: General Piping Diagrams (continued)



HOLE TO BE DRILLED IN THE FIELD 1/2" BELOW LOW ALARM OIL LEVEL
Ø.125 (3.175mm) HOLE THRU ONE SIDE



TUBE TO BE CUT TO LENGTH AFTER ASSEMBLY IN THE FIELD.

Figure 12 – Instructions for Anti-Siphon Hole on Suction Tube of Entrance Kit

APPENDIX D: Electrical Wiring Schematics

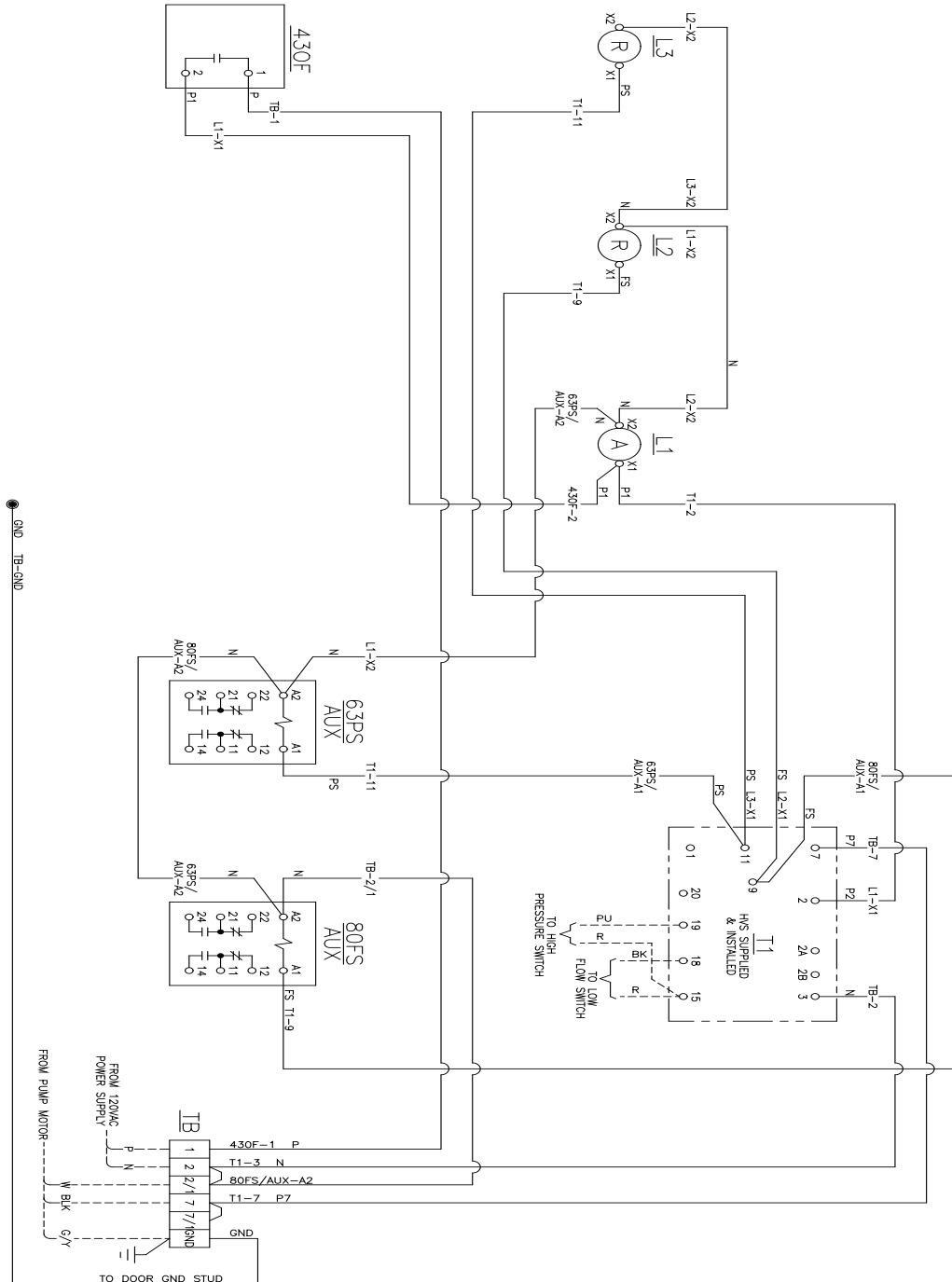


Figure 13 – Standard Control/Alarm Circuit

APPENDIX D: Electrical Wiring Schematics (continued)

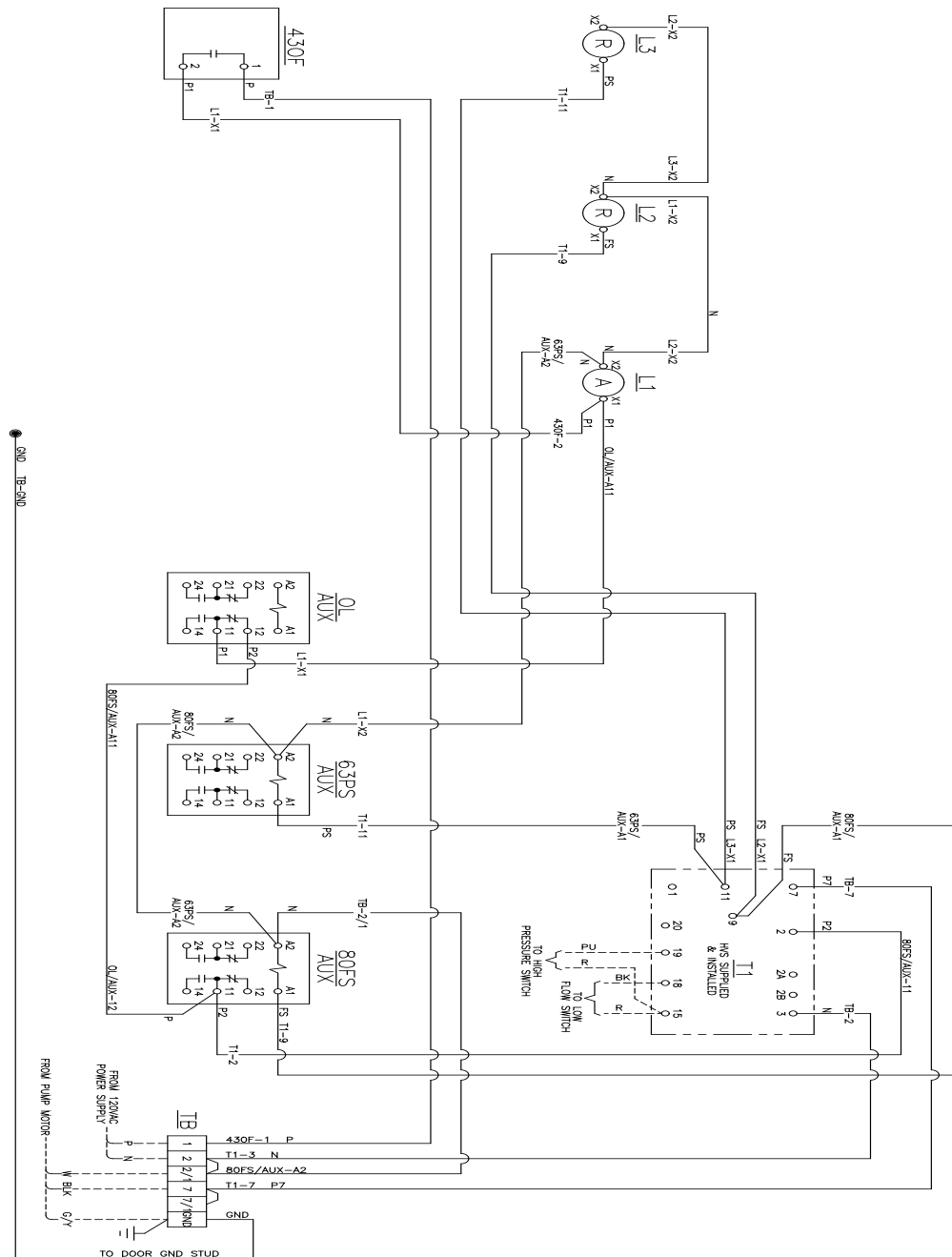


Figure 16 – Control/Alarm Circuit with Optional Shut-Down Relay

APPENDIX D: Electrical Wiring Schematics (continued)

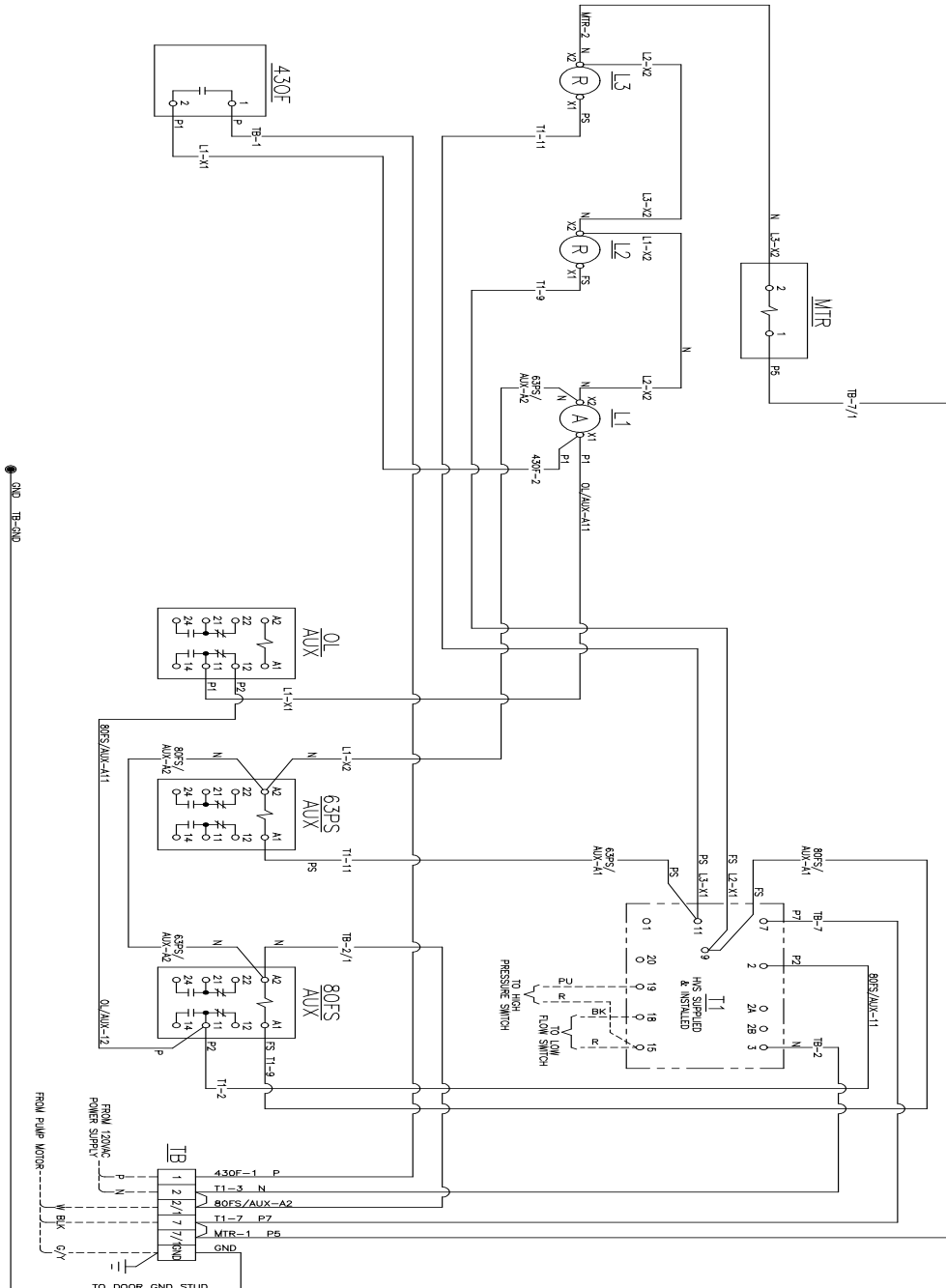


Figure 17 – Control/Alarm Circuit with Optional Shut-Down Relay and Runtime Meter

REPLACEMENT PARTS AND SERVICE

Please contact your local sales representative or authorized distributor for replacement parts and/or service, or visit us online at www.waukeshacomponents.com.

For technical support, call us at **800-338-5526**.