

GENERAL DESCRIPTION

The High Voltage Supply 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. The 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

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

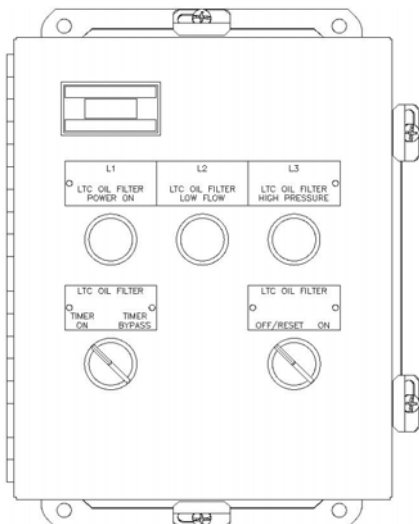


Figure 1 – Standard Control Box with Optional Bypass Switch and Motor Runtime Meter

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 indication if an insufficient volume of oil is flowing through the unit. Possible causes of this can be attributed to motor failing to start, a break 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 High Voltage Supply).

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 attached wiring schematics).

To reset the system after an alarm, turn the power switch to the OFF/RESET position and back to ON. The alarms will reset and the timer will also 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 HVS 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 1/5 hp pump and motor; however, the larger 7"x18" 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 that snap on and off and automatically seal when disconnected from the system.

Large tank filtration systems: The system utilizes a common replaceable filter element that is housed within a canister that allows easy cartridge replacement without oil spills.

Pump and Motor

HVS 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. All pumps are driven by continuous duty, thermally protected motors. Smaller systems use a 1/5 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 weights approximately 180 lbs.

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 120V AC; 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:

- The plumbing from the LTC compartment to the filter should be 1/2" inside diameter or larger.
- Do not use galvanized pipe or fittings. Copper or stainless tubing is recommended.
- Do not exceed 6 elbows on the supply piping or 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.
- The return tube should terminate at the top of the LTC tank.
- The suction tube should draw oil from the bottom of the LTC tank and should be installed so that the tube opening is 1/2" from the bottom of the tank.
- It is necessary to drill an anti-siphon hole in the suction tube at 1/2" below the minimum oil level. The anti-siphon hole prevents the system from drawing additional oil out of the tap changer when the oil level reaches a minimum level.

It is recommended 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.

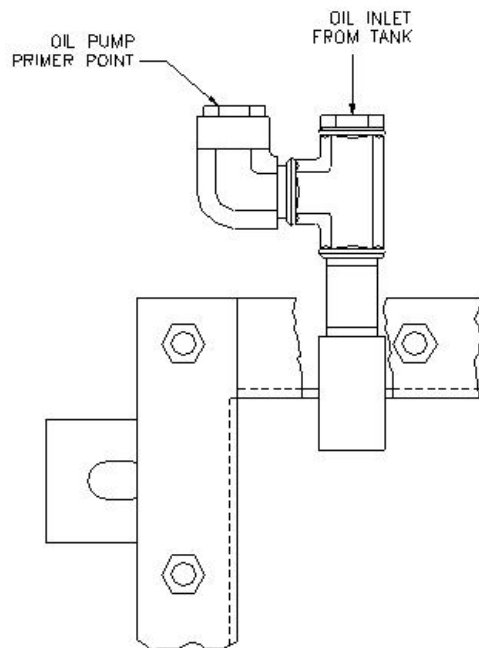


Figure 2 – Oil Primer Fitting on All Oil Filtration Systems

Electrical Connections

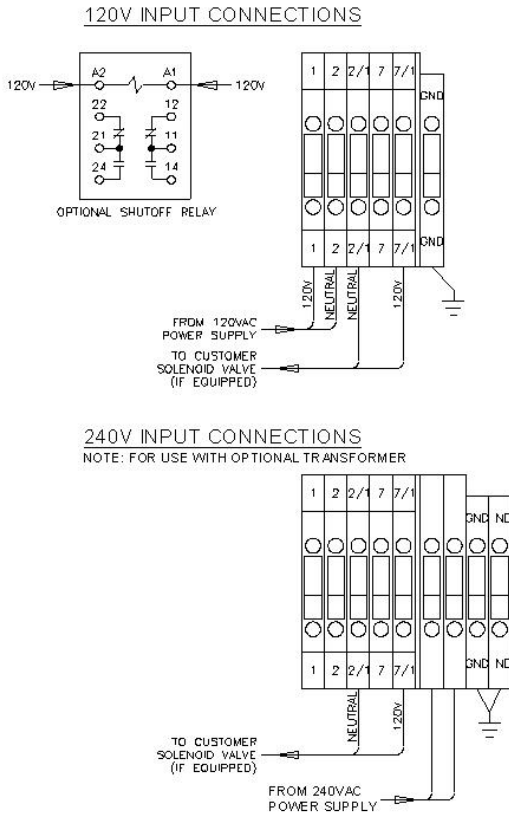


Figure 3 – Required Input Connections

OPERATION

The 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 1/5 hp motor) to 4.0 GPM (for the 1/2 hp pump). The oil is forced through the moisture absorbent filter element, which will absorb water and remove particulates suspended in oil.

Pump operation can be manually initiated by turning the power switch to the OFF position and back ON. 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 and the volume of oil in the LTC tank. The high-pressure switch monitors 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.

Timing operations of the filtering system is controlled by the timer/controller located inside of the control box. The timer can be accessed by removal of the front cover screws.

Timer Programming

The timer is preset at the factory to have the filter operate for two hours every other week. However, the timer does offer the flexibility of being configured with any combination of the following:

1. Frequency of operation
 - a. Daily
 - b. Every other day
 - c. Weekly
 - d. Every other week
2. Duration of operation
 - a. 2 Hours
 - b. 4 Hours
 - c. 8 Hours
 - d. 24 Hours

To select the frequency and duration of operation, change the dipswitches on the timer according to the following tables:

Dip Switch Number 1	Dip Switch Number 2	Run Time
OFF	OFF	2 Hrs
OFF	ON	4 Hrs
ON	OFF	8 Hrs
ON	ON	23 Hrs

Dip Switch Number 3	Dip Switch Number 4	Restart Every
OFF	OFF	1 Day
OFF	ON	2 Days
ON	OFF	7 Days
ON	ON	14 Days



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MAINTENANCE

The 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 and if it is beyond the manufacturer's recommended life cycle, change the filter cartridge.

The following procedures should be followed when filter change-out is 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 then 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 the inlet hose to the canister.
9. Operate the filtration system under personnel supervision for 10 minutes to ensure no leaking occurs.

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

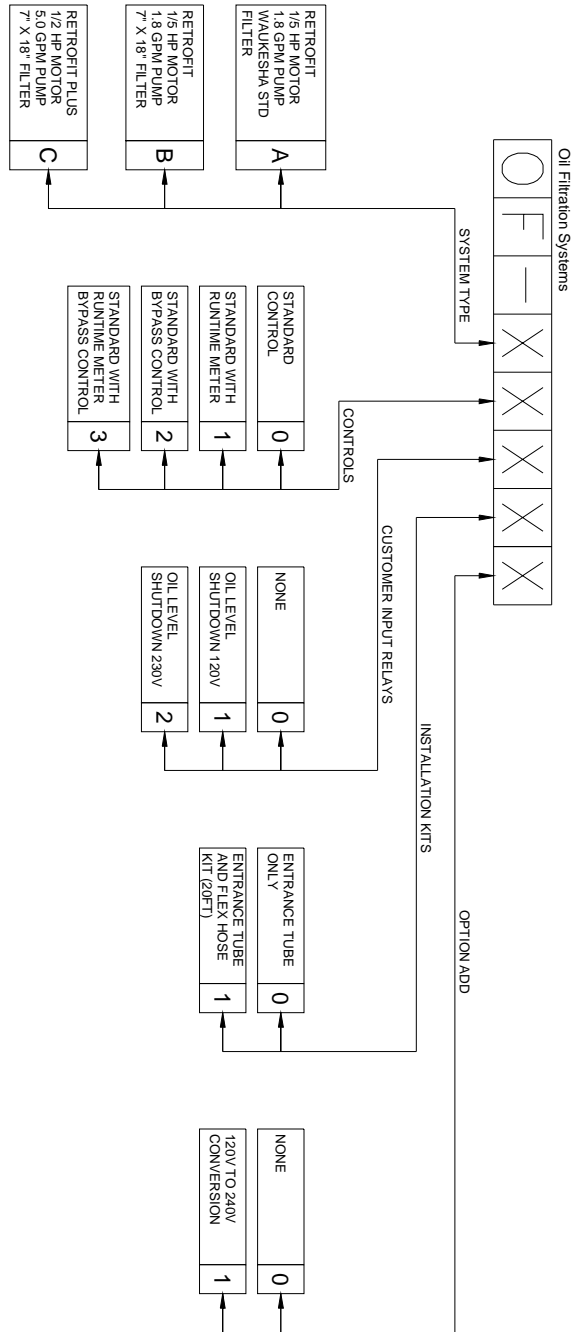
- 1) Motor will not operate
 - a) Check for 115 V AC control power at terminals 2 and 7
 - b) Check for voltage at the motor.
- 2) Low Pressure
 - a) Check motor power supply
 - b) Check operation of pump.
- 3) High Pressure
 - a) Check to confirm the filter connections are completely inserted and locked.
 - b) Check for blockage in the system.
 - c) Does filter need to be changed
- 4) General oil leaks
 - a) Check connections for tightness
 - b) Check tubing for cracks. Replace if necessary.

REPLACEMENT PARTS AND SERVICE

Please contact High Voltage Supply at 800-338-5526 for replacement parts and/or service.



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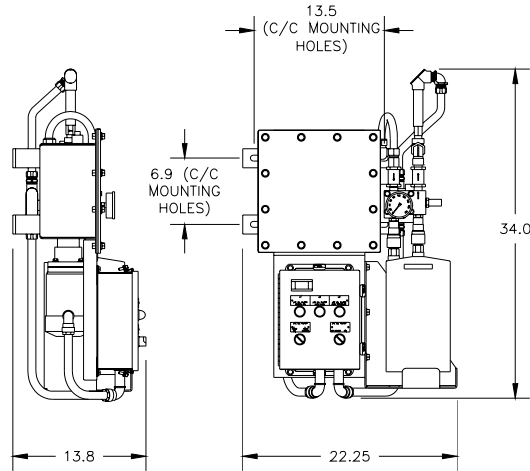


Figure 4 – 1/5 hp Pump and Small Filter

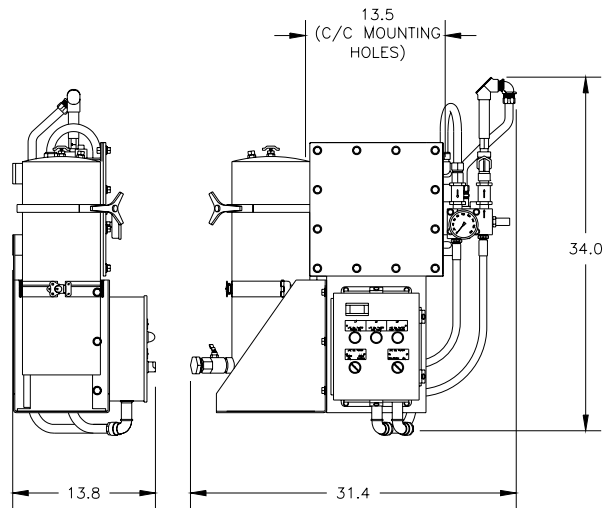


Figure 5 – 1/5 hp Pump and Large Filter

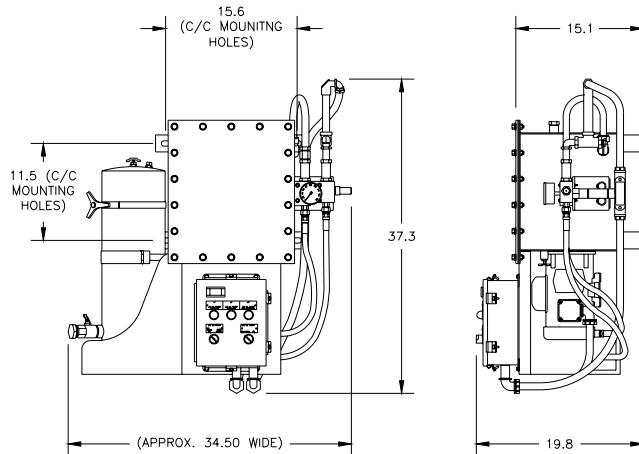


Figure 6 – 1/2 hp Pump and Large Filter

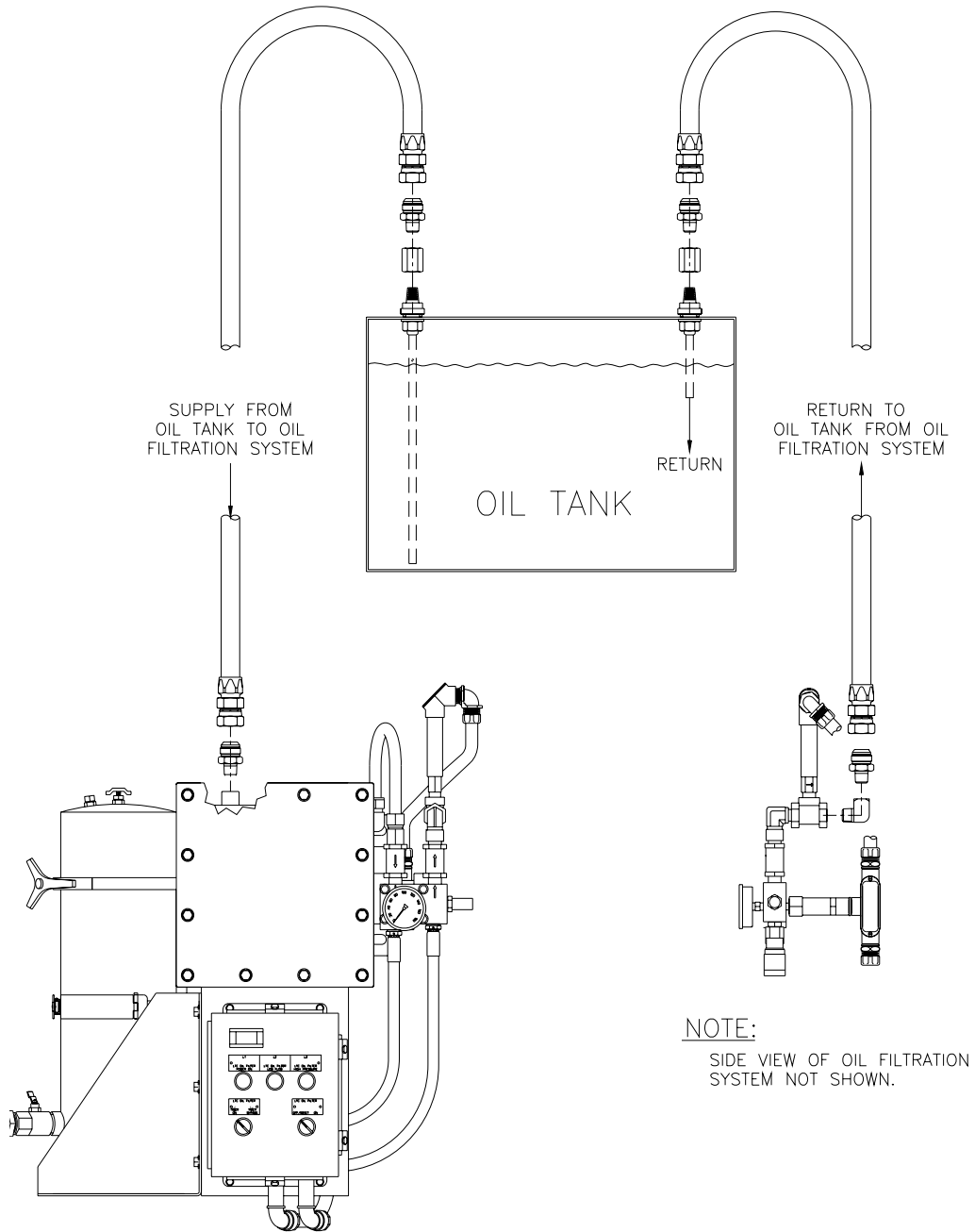
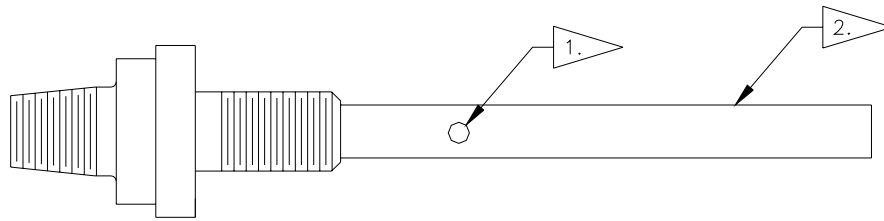


Figure 7 – Typical Installation of the Entrance Tube Kit and Flexible Tube Piping Kit (optional)



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

Figure 8 – Instructions for Anti-Siphon Hole on Suction Tube of Entrance Kit

ASSEMBLY NOTES:

1. MARK AND CUT HOSE TO DESIRED LENGTH USING FINE TOOTH HACKSAW OR A CUTOFF MACHINE.
2. REMOVE NIPPLE FROM SOCKET AND PLACE NIPPLE ASIDE.
3. PLACE SOCKET IN VICE AND SCREW IN HOSE COUNTER-CLOCKWISE UNTIL HOSE BOTTOMS OUT (APPROX.1"). BACK HOSE OUT 1/2 TURN. MARK HOSE WITH GREASE PENCIL OR EQUAL.
4. OIL INSIDE OF HOSE AND NIPPLE THREADS LIBERALLY WITH TRANSFORMER OIL. DO NOT OIL HOSE COVER.
5. SCREW NIPPLE ASSEMBLY INTO SOCKET USING A WRENCH ON THE NIPPLE HEX UNTIL THE NIPPLE HEX SHOULDERS AGAINST THE SOCKET.
6. ENSURE GREASE MARK HAS NOT SEPARATED DURING TIGHTENING OF ASSEMBLY.

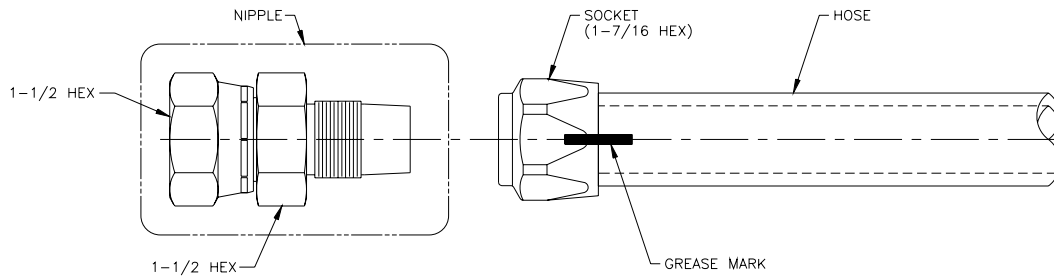


Figure 9 – Instructions for Installation of Flexible Hose Kit (optional)

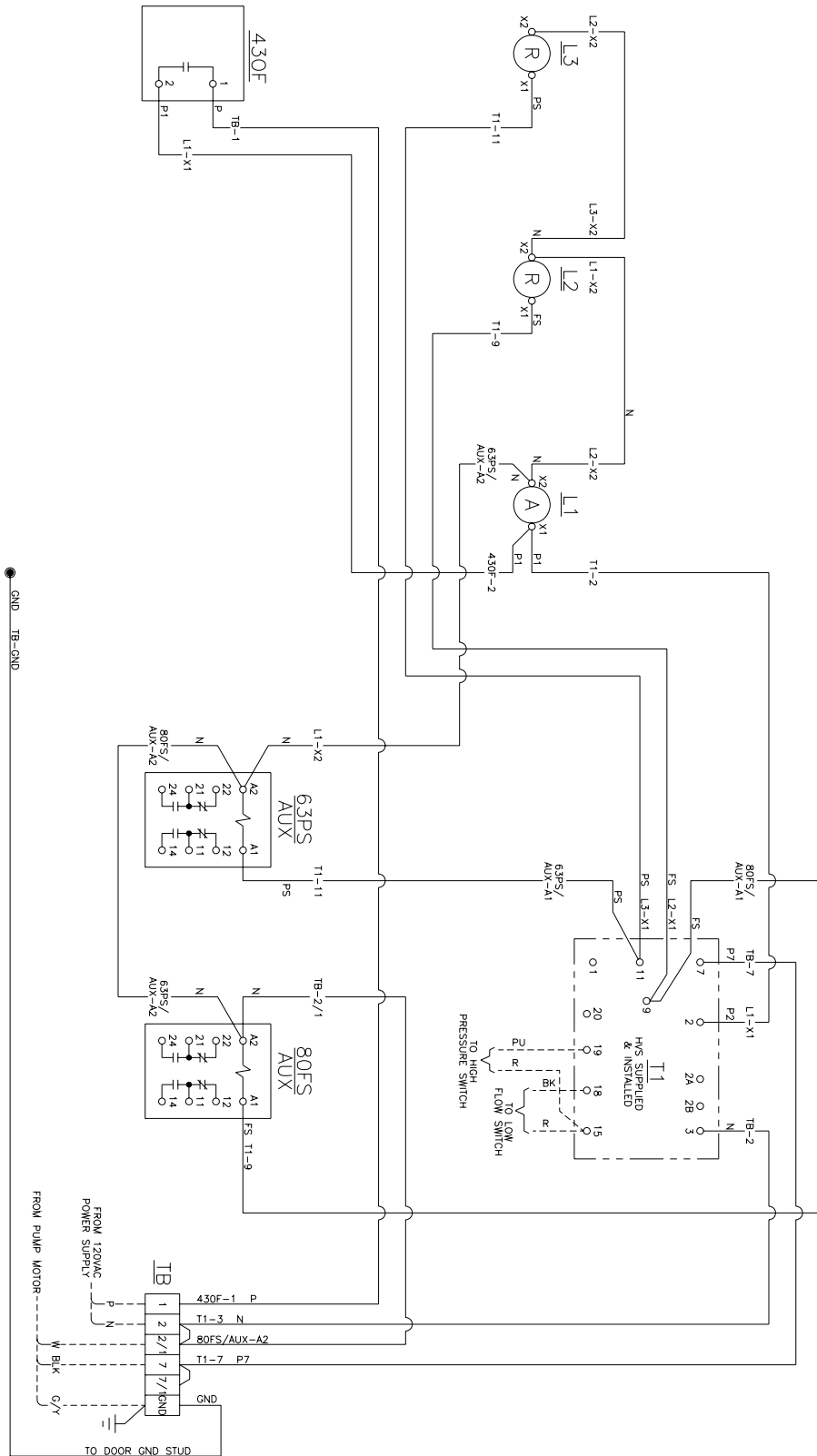


Figure 10 – Standard Control Schematic

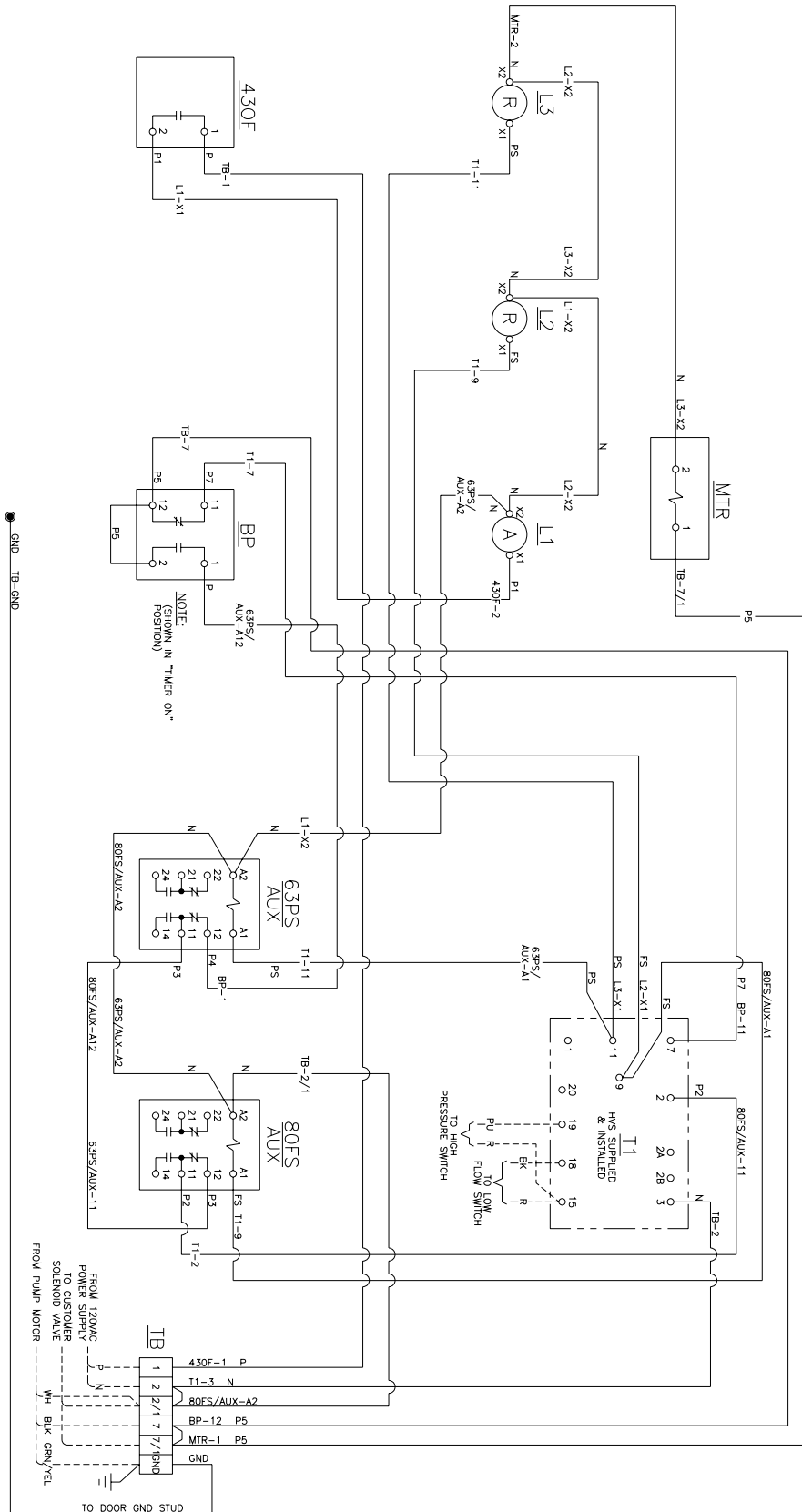


Figure 12 – Standard Control with Addition of Runtime Meter and Timer Bypass Switch