

TS-LLD

Electronic Line Leak Detector

Installation Guide



INCON[®]
INTELLIGENT CONTROLS

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Need Help ? Contact INCON at:

INTELLIGENT CONTROLS, INC.

PO Box 638

SACO ME 04072

Office Hours: 8 a.m. to 5 p.m. EST Monday through Friday

Sales

Phone: (800) 872-3455

Fax: (207) 283-0158

E-mail: sales@intelcon.com



24 hour Technical Service

Phone: (800) 984-6266

Fax: (207) 282-9002

E-mail: tech@intelcon.com

Visit our web site at: <http://www.intelcon.com>

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 Page Numbering and Layout Conventions
 Components Included with Each TS-LLD System
 Before You Begin

Graphic Symbol Conventions



NOTE Important information, tips, and hints are highlighted by the NOTE graphic.



CAUTION or **WARNING** messages are highlighted by the WARNING graphic and contain instructions that must be followed to avoid faulty equipment operation, or an explosion or shock hazards. If ignored, severe injury or death **may** result !



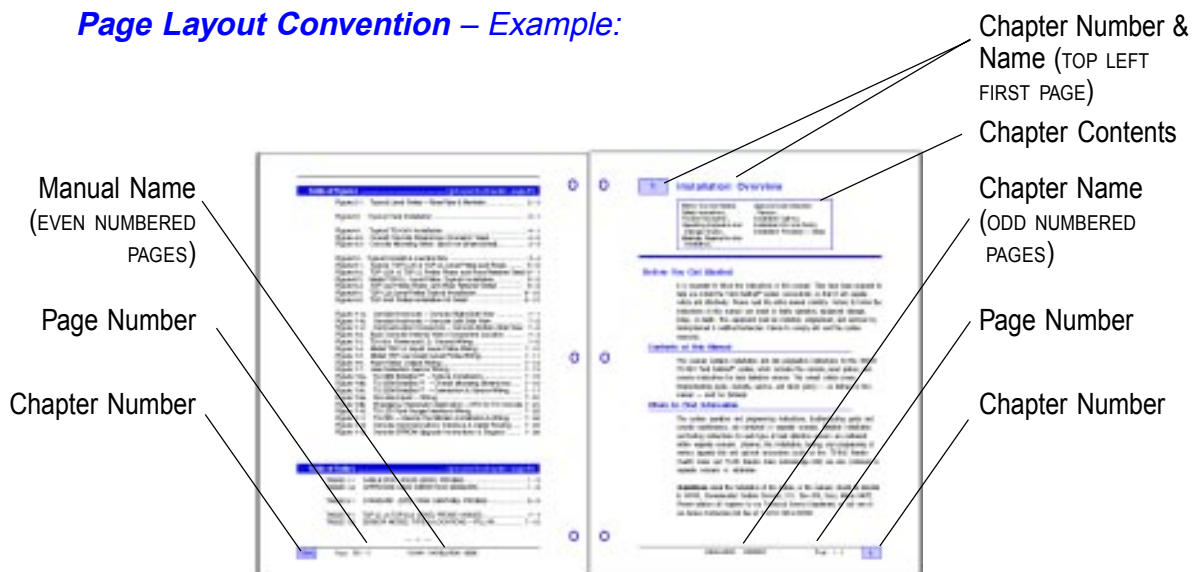
DANGER messages are highlighted by the DANGER graphic and contain instructions that **must be followed** to avoid an explosion or electrical shock hazard. If ignored, severe injury or death **will** result !

— ❖ — End of Chapter symbol

Page Numbering Convention – Example:

Page 4 – 1 = Chapter 4 page 1 and Page 6.1 – 2 = Chapter 6 . Section 1 – Page 2

Page Layout Convention – Example:



Components Included with Each TS-LLD System (TS-LLD Packing List)

- (1) CU – Control Unit enclosure assembly (with stick-on CU Serial No. label)
- (1) CU – Control Unit faceplate cover assembly
- * – (4) CU cover hold-down screws (4-40 x 1/4 inch)
- (1) Bundle of different colored wire (Wire Bundle)
- * – (1) Spare 1/2 Micro Amp Fuse (F1)
- * – (1) Line Filter Capacitor, 1 μ Farad (for pump relay / motor control box)
- (1) Sheet of (9) stick-on – **DANGER** labels
- (1) LSU – Leak Sensing Unit (with stick-on LSU Serial No. label)
- (1) Cable adapter (2 inch NPT) – (for Red Jacket Pumps)
- * – (1) Plug (1/4 inch NPT)
- * – (2) Wire Nuts (red) – (for connections at pump)
- (1) Warranty Registration Card (write / stick-on CU & LSU Serial No. labels)
- (1) TS-LLD Installation Guide Manual
- (1) Read Me First – Installation Guide (Supplement Sheet)
- (1) TS-LLD Quick Reference Guide (for the station owner / customer)
- * – Denotes parts in the supplied Hardware Kit (within plastic accessory bag)

Before you Begin

NOTES



Refer to all applicable Local and State codes before beginning this installation. If a conflict exists between the information presented in this manual, and the local codes, then follow the local codes.

Maintenance, Service, and Installation of the TS-LLD system is to be performed by Factory Trained and Certified personnel only.

Heed all **CAUTIONS** and **WARNINGS** ! See Chapter 2.1 about Safety, before attempting any installation, maintenance, or service work.

This manual is your reference guide for the INCON TS-LLD line leak detector. It includes typical installation details, which may vary depending on the actual equipment at the site. Reference the Submerged Turbine Pump (STP) or submersible pump, and pump relay (Motor Control) box — manufacturers' documentation — for the installation details and requirements of this equipment.



TS-LLD Electronic Line Leak Detector system – Overview

Contents:

- Overview and theory of Operation
- Leak Test Requirements and Length
- The LSU (Leak Sensing Unit)
- Communications
- The CU (Control Unit)
- Operator Interface

Overview and Theory of Operation

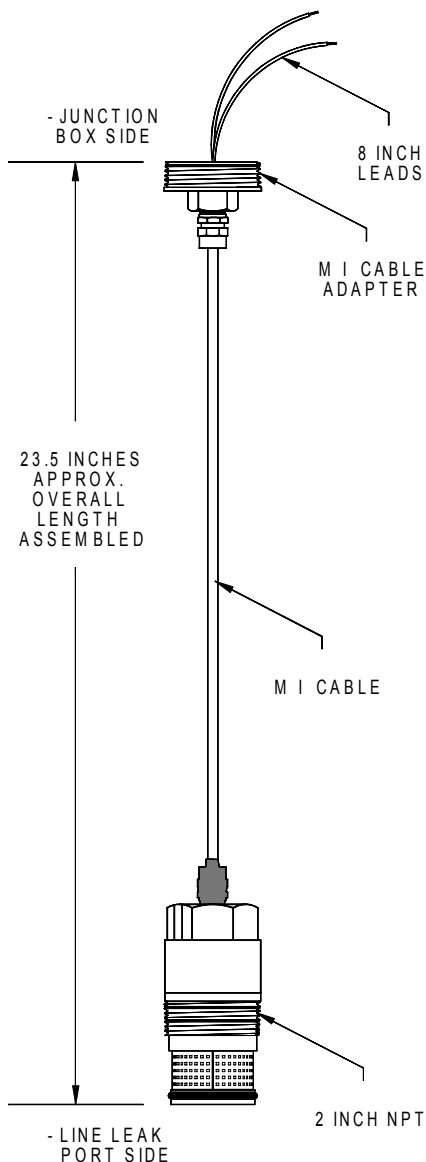


Figure 1.1 LSU Outline

The **INCON TS-LLD** is an electronic line leak detector system. It has two components: a Control Unit (or CU) and a Leak Sensing Unit (or LSU). The CU is mounted in the station near the pump control relay box, and the LSU is installed in the line leak detector port at the submersible pump housing. One system per pump is required to detect leaks from a pressurized fuel line.

The TS-LLD detects leaks in the pipeline leading from the submersible pump to the dispenser. To comply with current EPA regulations, three types tests are provided. These are: a 0.1 gph annual test, a 0.2 gph monthly test, and a 3.0 gph hourly test, which run at full line pressure.

Note: All Dimensions are in inches, and are approximate

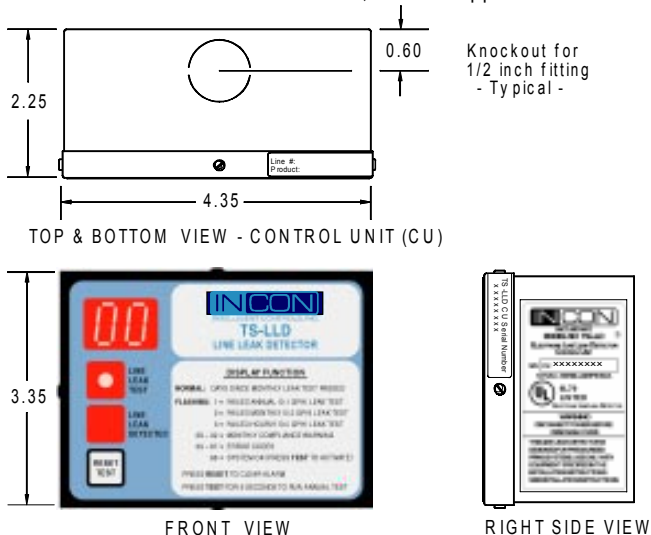


Figure 1.2 CU Outline Dimensions

Overview and Theory of Operation (Continued...)

The **0.1 gph annual test** is started manually from the control unit (also known as a **manual test**). On the other hand, the gross **3.0 gph hourly test** and the intermediate precision **0.2 gph monthly-compliance test** both start and run automatically. ***Quiet-times, where no dispensing occurs, are required to start and finish any line leak test.***

Leak Test Requirements and Length

The **3.0 gph hourly test** starts after every dispense and takes about 3 minutes of ***quiet-time*** to finish.

The **0.2 gph monthly-compliance test** automatically starts after a 3.0 gph test passes ***unless*** a previous 0.2 gph test has already passed within the last 24 hours. The monthly compliance test either runs, passes, and resets the day-count to 00, or, advances a day if no test has passed after 24 hours. Depending on conditions of the line and product, the **0.2 gph monthly-compliance test** needs 13 minutes to 4 hours of ***quiet-time*** to finish.

The manual **0.1 gph annual test** needs 4 hours of ***quiet-time*** before it's started, and takes about 13 minutes of ***quiet-time*** to finish after it starts.

The LSU (Leak Sensing Unit)

The LSU (Leak Sensing Unit) has an O-Ring sealed valve at its base, which forces all of the fuel flowing from the submersible pump through the LSU. A microprocessor based printed circuit board is contained in the LSU. It uses a proprietary technique to measure the actual product flow rate through a sensor tube within the LSU, which can indicate a leak.

In most cases, the only required field wiring connections are two wires that are connected in parallel to the existing Submersible Turbine Pump (STP) power-feed-lines. A special copper sheathed, Mineral Insulated Cable (**MI Cable**) connects the LSU to the electrical junction box at the pump discharge head.

Communications

The LSU not only receives power from the existing pump power-lines, but it transmits data (communicates) over these lines. One of the power lines is routed through a communications ***pickup coil*** inside the Control Unit (CU).

The CU (Control Unit)

The CU monitors data that it receives from the pickup coil. The control unit automatically turns on the pump when no one is dispensing product and calculates accurate liquid flow rates to determine if a line leak exists or not.

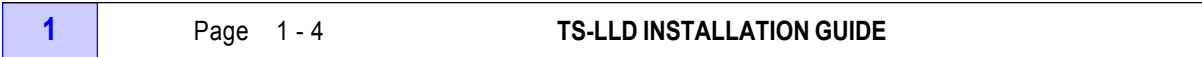
The dispense signal is also monitored to identify when a customer is about to dispense product. The CU is tied directly to the existing Pump Relay (Motor Control) Box that is inside the station. The control unit activates the pump relay, which turns the pump on and permits product dispensing when no line leak or errors exist. *When a leak or error is detected, the pump relay is deactivated, which keeps the pump turned off and prevents product dispensing.*

Operator Interface

Two lights, a 2 digit display, and a reset-test touch button are provided for operator interface. One light turns on when leak tests run, and the other flashes when a line leak is detected. The two digit display shows operational status codes / day counts (since the last monthly 0/2 gph line leak test passed), or flashes line leak alarms, warnings, and error codes when and if they occur.

Brief operating instructions, and a list of codes and display functions are printed on the control unit faceplate. **See Chapter 3 for complete details.**

— Your Notes —



TS-LLD Materials & Tools Required

Contents:

- Do a Site Survey Before Attempting the Installation
- Materials Required
- Tools Required

Do a Site Survey Before Attempting the Installation

Submersible Turbine Pumps:

What is the Motor Control / Pump Relay Box or Starter Type ? and

What is the Model Number, HP, Manufacturer, and age of all Turbine Pumps ?

Electrical Supply:

What is the Voltage and Phase (240 VAC – Single or Three Phase ?) of all Turbine Pumps ?

Materials Required

- ☐ **Petroleum absorbent / absorbing rags**
- ☐ **Pipe Dope** — Non-hardening (Soft-Set), UL Classified, gas/oil resistant — to seal the Leak Sensing Unit, and the 1/4 inch Tank Test Port plug at the pump
- ☐ **MI Cable Adapter** — for installation on the TS-LLD Leak Sensing Unit (LSU). The **TS-RJ** 2" NPT Cable Adapter for Red Jacket® submersible pumps is *(supplied with the TS-LLD)*, the adapter for FE Petro® STPs must be ordered separately...
Order INCON part number:
TS-FE 3" straight Cable Adapter for FE Petro® STPs *
- ☐ Stick-on **DANGER** labels (*INCON P/N 240-1175 – supplied with the TS-LLD*)
- ☐ **(1) 1/4 inch NPT pipe plug** for the tank test port at the pump head (*supplied with the TS-LLD*)
- ☐ **Red wire nuts** for LSU wiring at the pump head (*supplied with the TS-LLD*)
- ☐ **(1) 1μ Farad Line Filter capacitor** for the pump relay box (*INCON P/N 020-0028 – supplied with the TS-LLD*)
- ☐ **Wire:** 14 AWG, 3 feet (*supplied with the TS-LLD*)
- ☐ **(6) spade lugs for #8 studs** to connect the 14 AWG wire at the pump relay box

Materials Required (continued...)

- ☐ (1) **ring lug** for the 14 AWG earth ground connection at the pump relay box
- ☐ (1) **short 1/2 inch nipple** — 2-1/2 to 3 inches long, or 1/2 inch 90 degree, **and hardware fittings** to mount the CU to the relay box. (Or you may wall-mount the control unit with appropriate fasteners, and use 1/2 inch EMT and fittings.)
- ☐ * Steel stem **Replacement Check Valve Kit** (RedJacket P/N 144-184-5) to replace older all plastic check valves – for older RedJacket pumps only
- ☐ * Approved Pump Relay (Motor Control) Box – to comply with codes, retrofit system to add a motor control box inside of the station
 - * = **Occasionally Required**
- ☐ **this Installation Manual** – INCON P/N 000-1359 most current revision
- ☐ (1) **Completed Warranty Registration Card** – *(supplied with each TS-LLD)*
- ☐ **TS-LLD Quick Reference guide** – INCON P/N 000-1447 *(supplied with each TS-LLD)*. **Leave all TS-LLD Quick Reference guide(s) on-site for use by the station owner, shift managers / personnel !**
- ☐ **Also, for use by the station owner, shift managers / personnel, provide** the name(s), phone number(s) of the local inspection agency and other applicable information, instructions and regulations should a line leak be detected.
- ☐ **Regulations and documentation:** Applicable Local and State Codes, the Manufacturers' manuals and wiring diagrams of the — Dispenser, Submersible Pump, and Relay Box (including other equipment not listed here and the sites' electrical power distribution).

Tools Required

- ☐ Digital multimeter and test leads (high quality professional instrument)
- ☐ One each: wire strippers, cutters, and crimp splice tool
- ☐ Various sizes of flat and phillips bladed screwdrivers
- ☐ One 12 inch long adjustable wrench
- ☐ One 2 inch open end hex wrench
- ☐ Two 7/8 inch open end hex wrenches
- ☐ One socket set, extension, and square socket for a 1/4 inch NPT square headed hole plug



Contents:

- Important Safety Notes and Warnings...
Read and follow these DANGER, WARNING, and CAUTION messages before starting any installation or service.

**Important Safety Notes and Warnings**

DANGER Electrical Shock Hazard. Before installing, servicing, or working on this equipment, make sure you **turn off all** submersible pump power (240 VAC) and pump relay coil / dispenser power at the electrical panel. **Tag, secure / lockout** these circuit breakers in the off position to prevent accidental or unauthorized circuit breaker closure. **Failure to turn off power will result in severe injury or death !**

DANGER Verify that no voltage exists before working-on, or wiring-to a circuit – a lethal electrical-shock-hazard could exist, which would kill you. *Note: circuit breaker contact(s) can fail in the on position, even when the circuit breaker lever is turned off.*



DANGER The TS-LLD automatically starts the submersible pump to run leak-tests at full line pressure between periods of product dispensing (while the dispense switch is off). **BEFORE performing any installation or service (such as replacing fuel-filters) – turn off / lockout all electrical power sources to the submersible pump(s), and relieve fuel-line pressure.** Failure to turn off power, and relieve fuel-line pressure before work is started, may cause a pressurized fuel spill. *A pressurized fuel spill would create a fire or explosion hazard that could result in injury or death.*

NOTE

INCON Danger stickers (see above left) are supplied with the TS-LLD line leak detector. Apply these stickers on the pump relay box cover, in locations near dispenser fuel-line filters, plugs, emergency safety-shut-off valves, on the TS-LLD Leak Sensing Unit (at the submersible pump housing), and other serviceable components of a fuel line (where a spill would occur if the line became pressurized). The selected surfaces must be clean, dry, and in plain sight so that the warning can be read, and followed.

Safety Notes and Warnings (continued...)



DANGER Explosion Hazard — Flammable Vapor Area.

After any installation or service of the submersible pump or its housing, inspect the MI Cable at the LSU (Leak Sensing Unit) for damage, twists, kinks, or breaks... 240 VAC power flows through this cable to the LSU. ***DO NOT apply power if the MI Cable is damaged, twisted, kinked, or broken.*** Electrical sparks or fire in this area could cause an explosion, injury or death.



WARNING The fuel line from the submersible pump to the dispenser, may be under pressure. Turn off all pump power and relieve pipeline pressure (reference and follow the pump manufacturer's directions about how to do this). If the line leak detector/plug (or any other part of the submersible pump and fuel line) is removed without first relieving pressure, then a product leak will occur. This could cause an environmental, fire, or explosion hazard, and may result in injury or death.

WARNING Be careful not to cause sparks when working on fuel dispensing equipment (volatile fuel may be within the pump's leak detector port). Allow no source of combustion near the work area. Failure to follow these directions may cause an explosion hazard, which could result in property damage and death.



CAUTION Refer to all applicable Federal, State and local codes, the National Electric Code (NEC), and the Automotive and Marine Service Station Code (NFPA 30A) before installation or maintenance. *This installation is designed for submersible pumps which have a pump relay box in the station. If a pump relay box does not exist, then the system must be retrofitted to add a pump relay (motor control) box in the facility to comply with Codes.*

CAUTION Although the LSU is water resistant, INCON does not recommend operating the LSU while submerged for long periods of time (drain sump and manhole immediately).



2.2

TS-LLD LSU Installation

Contents:

- LSU Installation Steps (Typical in Pump Housing)
- Overall Site Installation Diagrams (typical Site, in Angle Check Valve, RedJacket "BigFlo," & FE PETRO STP / IST pumps)

LSU Installation Steps

Follow the steps (below) in the order that they appear:

- 1) **Install** the appropriate size MI Cable Adapter on the LSU. Use an adjustable wrench and a 7/8 inch wrench to tighten the MI cable adapter onto the TS-LLD as shown in **Figure 2.2-1**. NOTE: The cable adapter that you install must match the size of the junction box plug at the submersible pump housing (two different cable adapters are shown in **Figure 2.2-1**). The 3 inch straight **TS-FE** cable adapter must be ordered separately because the pump type and manufacturer varies.

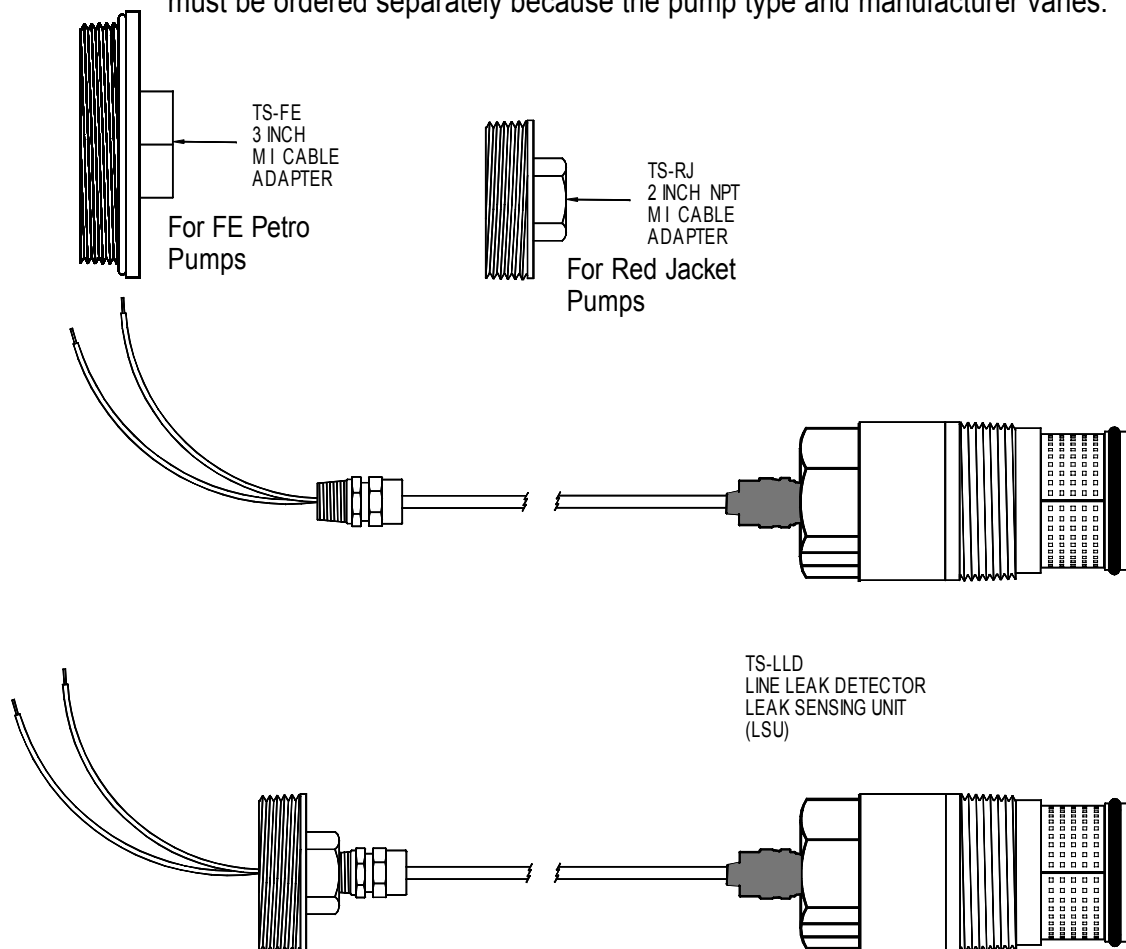


Figure 2.2-1 MI Cable Adapter Installation (before and after)



DANGER Fire, Explosion, & Electrical Shock Hazard. Before installing, servicing, or working on this equipment, make sure **all** submersible pump power and pump relay coil / dispenser **power is turned off & locked out** at the electrical panel. *Prevent automatic or unauthorized pump start-ups, spills from pressurized lines, and electrical shocks. See Chapter 2.1 follow all Safety advise.*

- 2) **Relieve pipe line pressure.** Reference the detailed instructions found in the submersible pump manufacturers' documentation about relieving pressure in the pipe line.



WARNING The pipe line is under pressure – **relieve line pressure**. If the line leak detector / plug is removed before the pipe line pressure is relieved, then a product leak will occur ! A explosion, fire, or environmental hazard may be created.

- 3) **Remove** the 2 or 3 inch junction box plug and the 2 inch line leak plug, or mechanical line leak detector (if present), from the pump housing per **Figure 2.2-2** or **2.2-3**. Use petroleum absorbent / absorbing rags to collect and contain spills if they occur (be sure to properly dispose of these afterwards). If a mechanical line leak detector was removed, then apply pipe dope on the threads of the supplied 1/4 NPT hole plug, and install this plug into the tank test port.

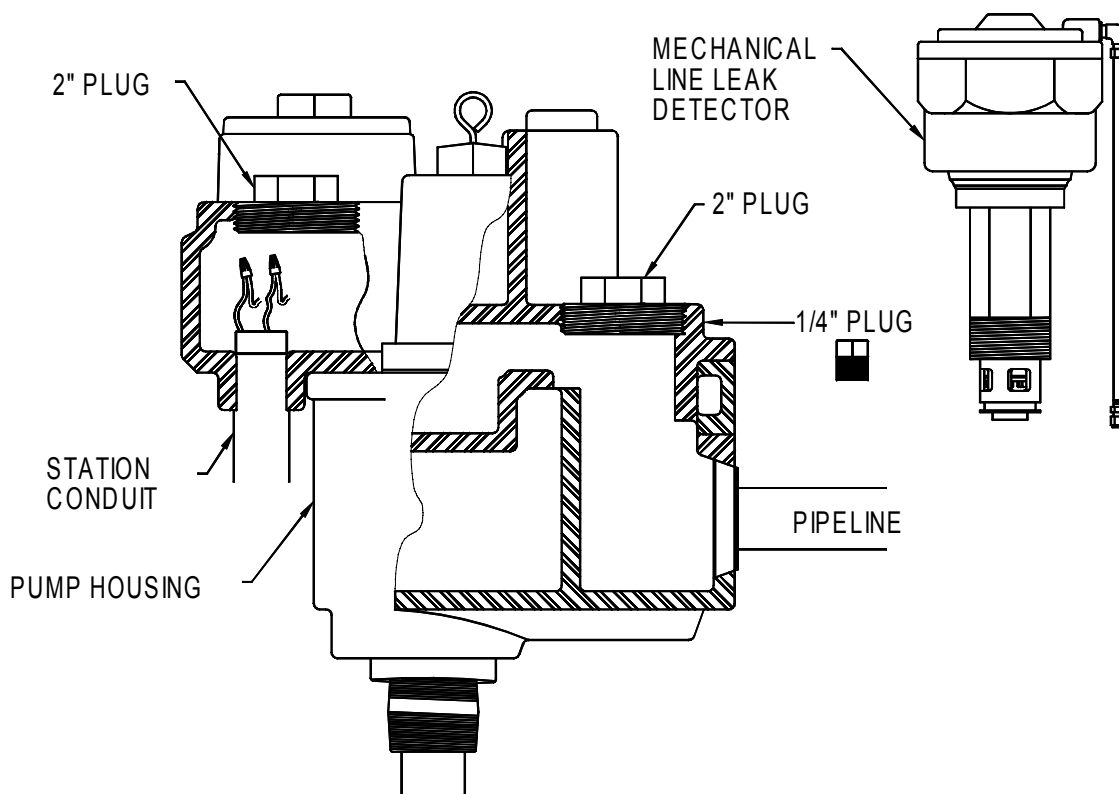


Figure 2.2-2 Plug Location – RedJacket® Submersible Pump Housing

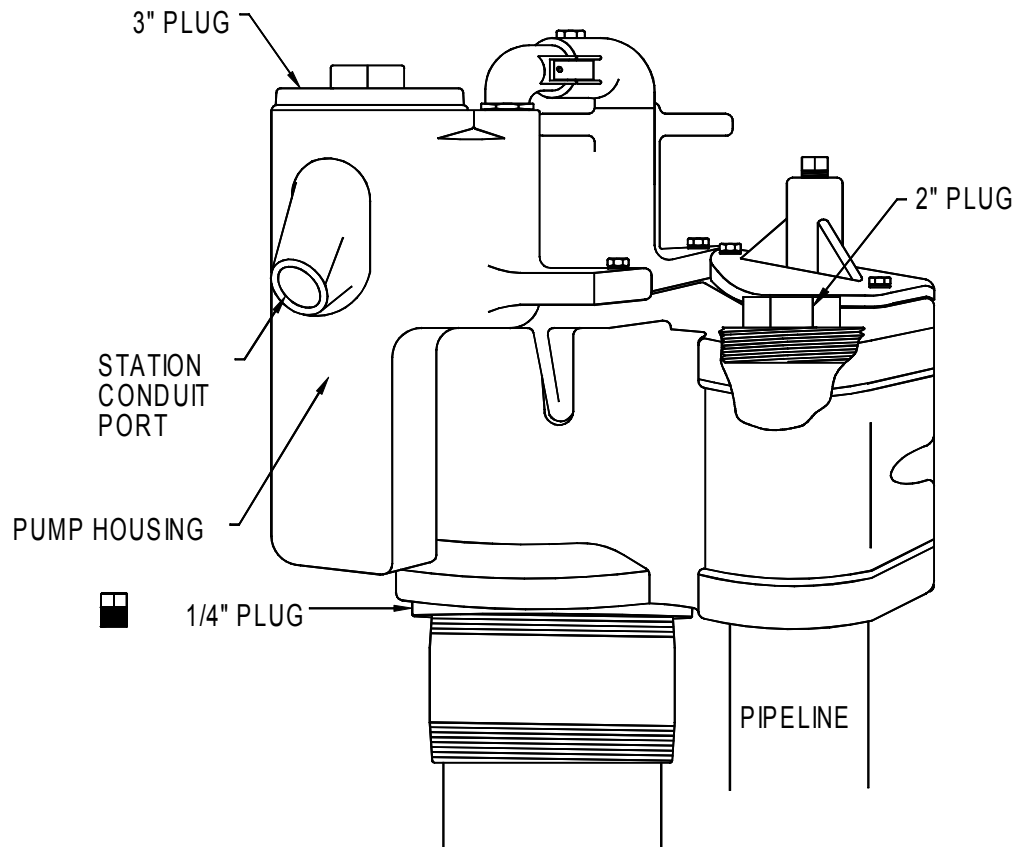


Figure 2.2-3 Plug Location – FE Petro Submersible Pump Housing

- 4) Apply Pipe dope to the line leak detector threads per **Figure 2.2-4**.

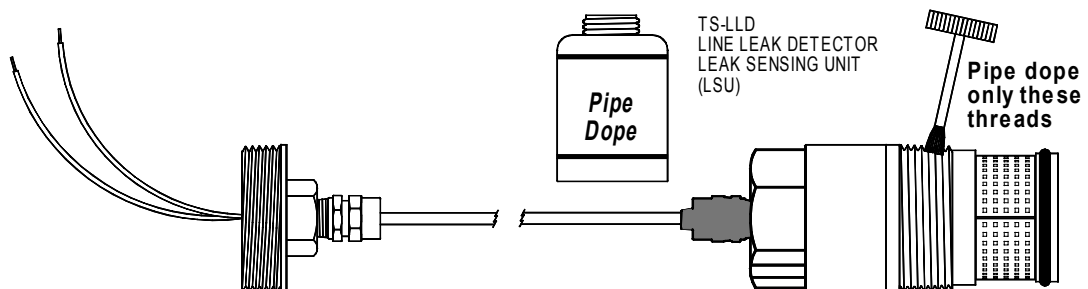


Figure 2.2-4 TS-LLD Leak Sensing Unit – Thread Doping

- 5) **Insert** the Leak Sensing Unit into the line leak port at the pump housing. See **Figure 2.2-5**, or **2.2-6**, and tighten the detector with a 2 inch hex – open end wrench (no larger than 12" long to prevent overtightening and possible pump housing damage or leaks). **DO NOT overtighten the LSU in the pump head !**

NOTE



The MI Cable should be straight, vertical and able to rotate freely with the LSU during the insertion or removal process.

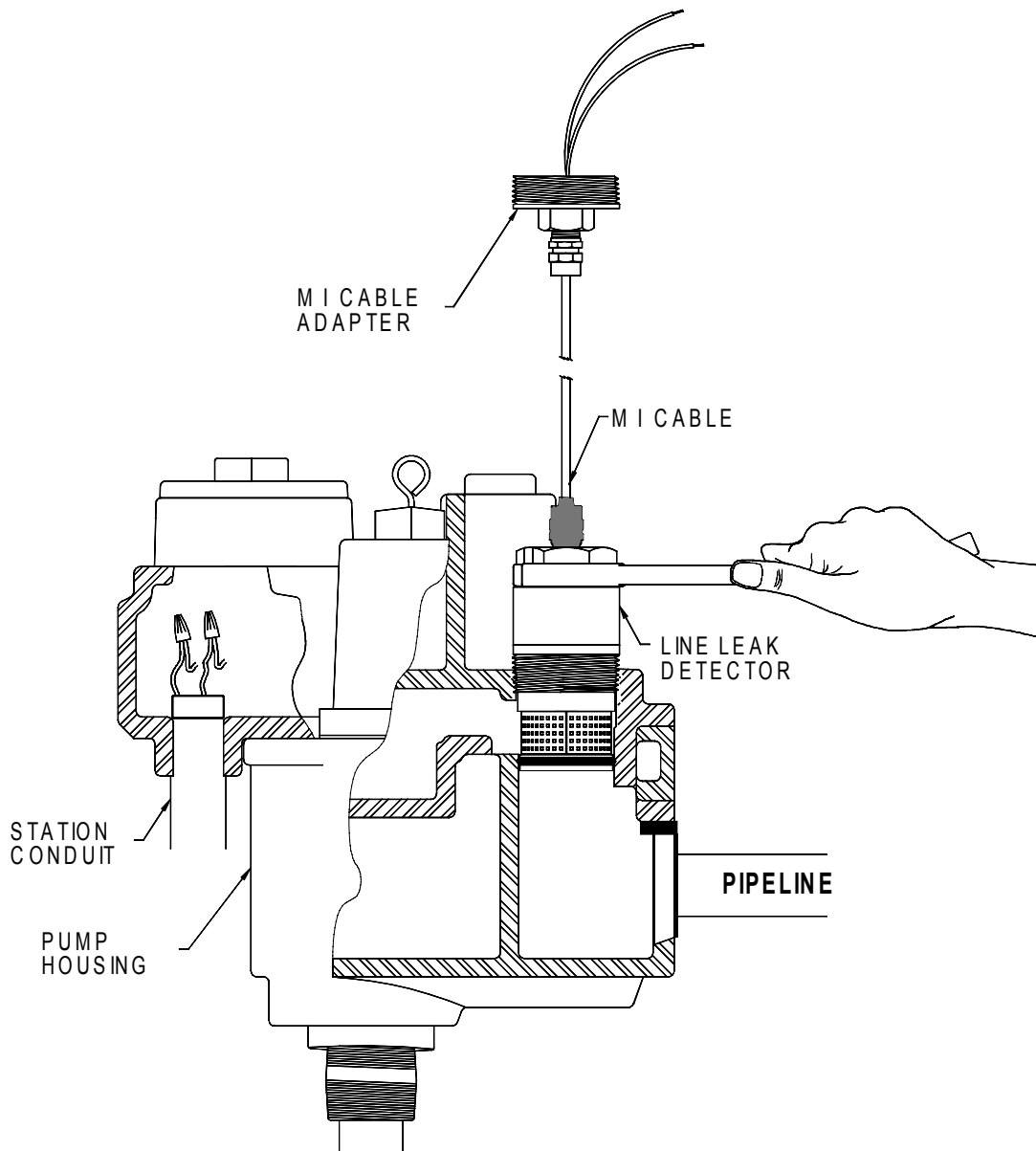


Figure 2.2-5 Line Leak Detector Installation – RedJacket® Pump Housing

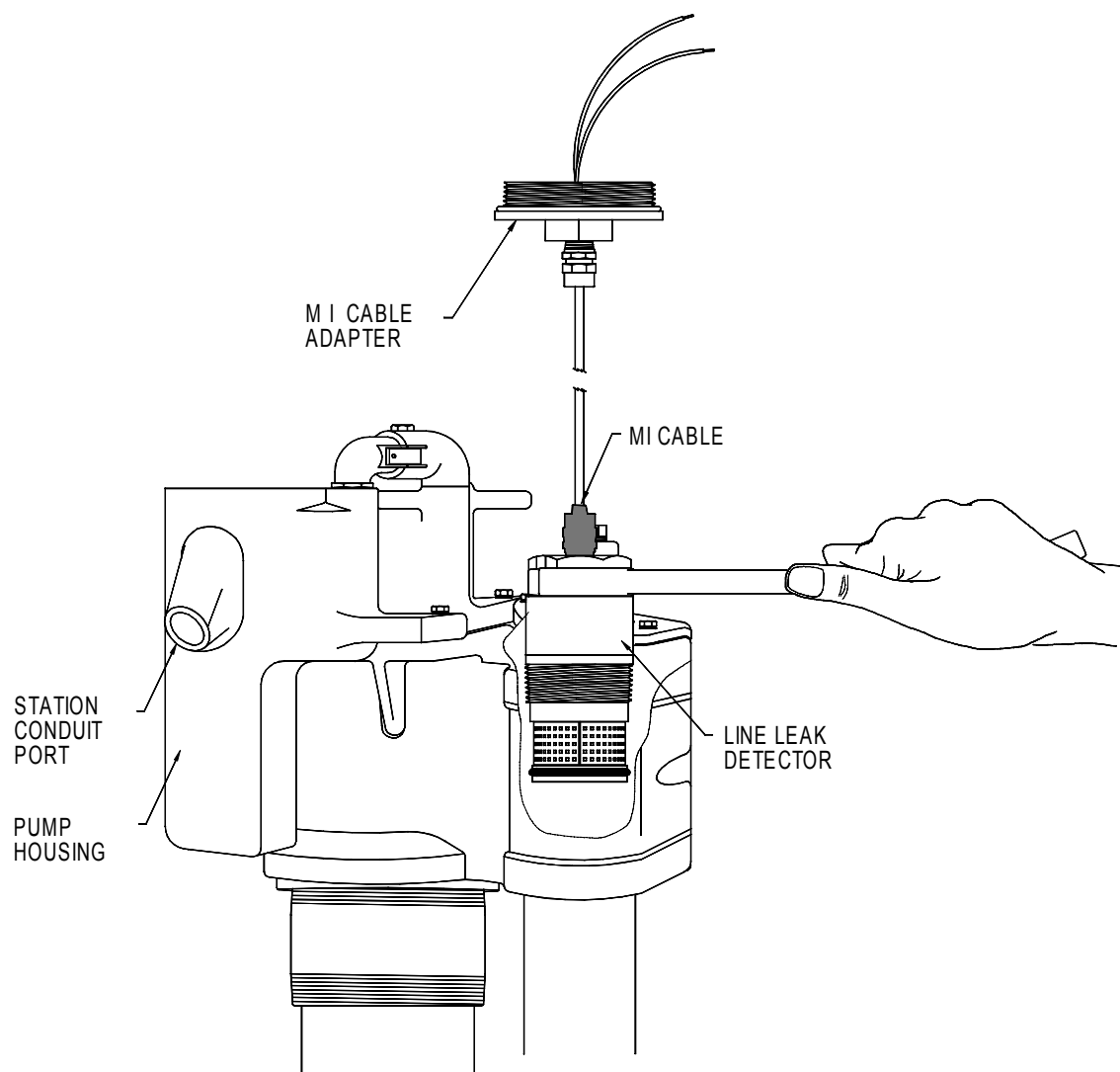


Figure 2.2-6 Line Leak Detector Installation – FE Petro Pump Housing

- 6) **Carefully bend the thin-wall MI cable by hand** and align the 2 or 3 inch cable adapter fitting with the *junction box* plug opening. Support the MI cable with both hands when bending to fit. DO NOT force or bend the MI cable against the compression fittings. Be sure you leave enough room to work (as shown in **Figure 2.2-7**, or **2.2-8**).



Avoid breaking the MI cable — DO NOT bend the MI cable too close to the fittings. An LSU that has a damaged MI Cable is unusable and must be replaced before power is applied.

- 7) **Carefully remove each wirenut**, one at a time and check each for the absence of power (see **Figure 2.2-7**, or **2.2-8**).

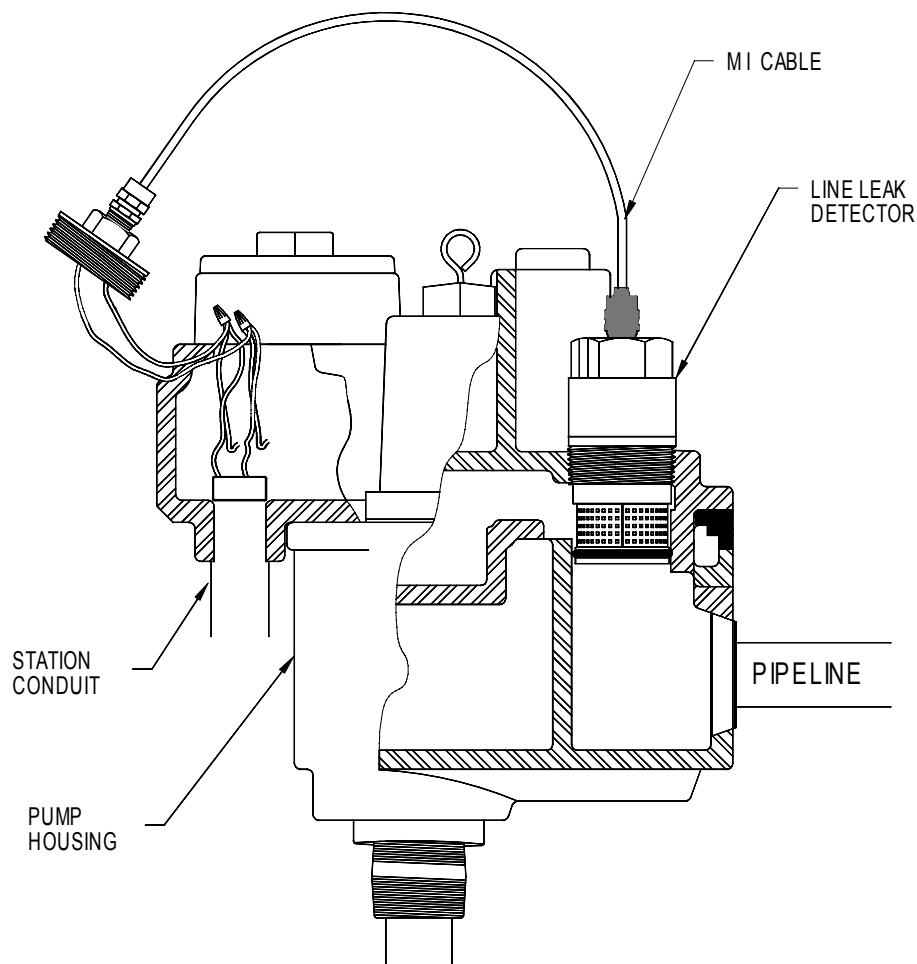


Figure 2.2-7 Line Leak Detector Wiring – RedJacket® Pump Housing



DANGER Make sure you check these wires for the absence of power before proceeding. All pump power (240 VAC) and pump relay / dispenser power must be off before this installation is started, otherwise a lethal hazard will be created which could kill you or others. **Note:** A circuit breaker contact(s) can stick closed even when the circuit breaker is in the off position.

- 8) **Leak Sensing Unit Wiring** – Reference **Figure 2.2-7**, or **2.2-8**.
- a) Use one of the supplied red wire nuts, and twist one wire lead from pump together with one of the black wire leads from the LSU.
 - b) Again use a red wire nut, and twist the remaining lead from pump together with the remaining black wire lead from the LSU.
 - c) **For Canadian TS-LLD leak sensing units only:** connect the green (ground) wire from the pump to the green LSU wire.

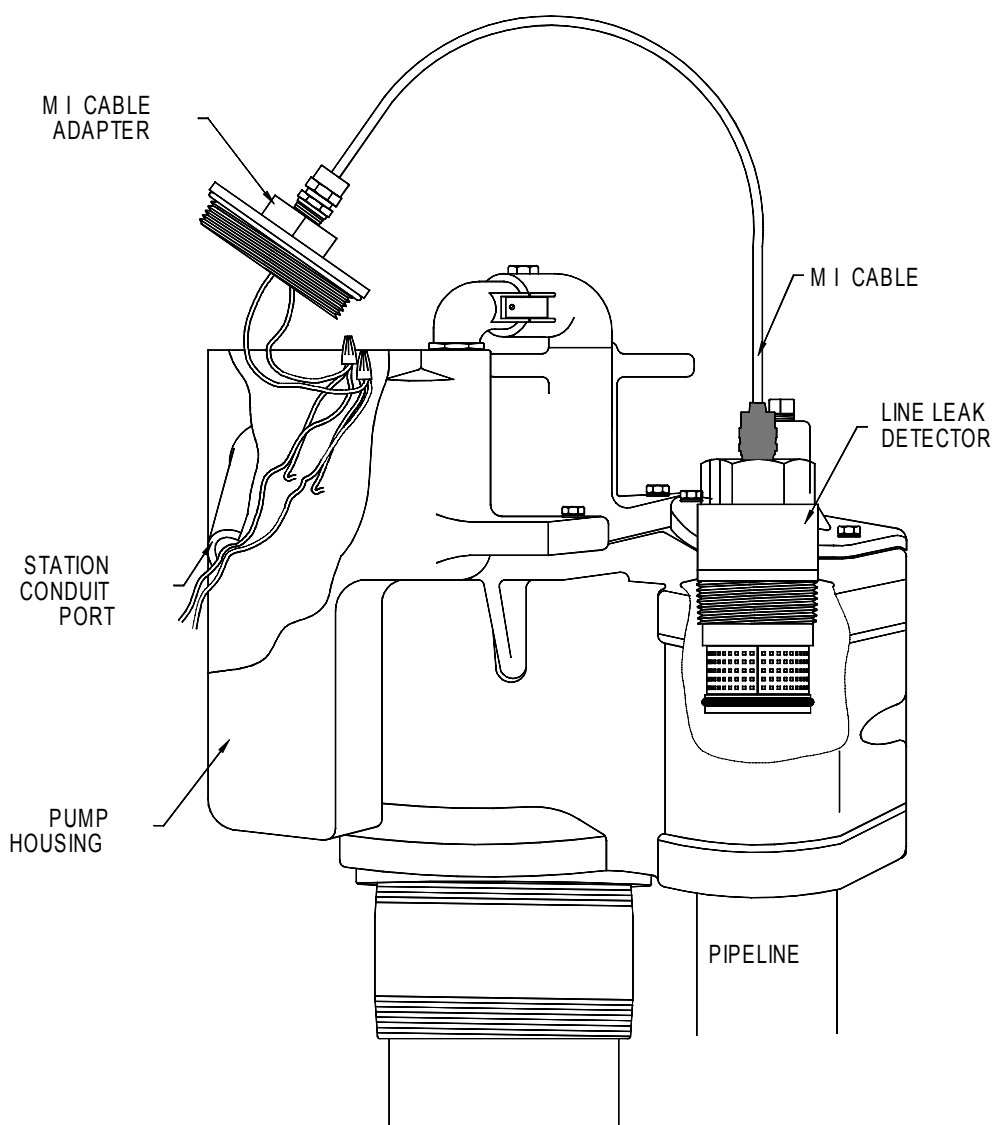


Figure 2.2-8 Line Leak Detector Wiring – FE Petro Pump Housing

-
- 9) **Stuff the wires back into the pump housing** and carefully finish bending the MI cable so that the cable adapter engages the threaded opening of the junction box. *Make sure to push the wires down enough to avoid pinching, or cutting through the wire insulation from the cable adapter when it is tightened down.* Reference **Figure 2.2-9**, or **2.2-10**.
- 10) **Tighten the MI cable adapter** (new junction box cover) **after making sure that compression fitting is loose and is able to rotate freely — to prevent bending and twisting damage to the MI Cable.** Apply electrically conductive pipe dope to the cover or the junction box. Use a 12 inch adjustable wrench. Reference **Figure 2.2-9**, or **2.2-10**.

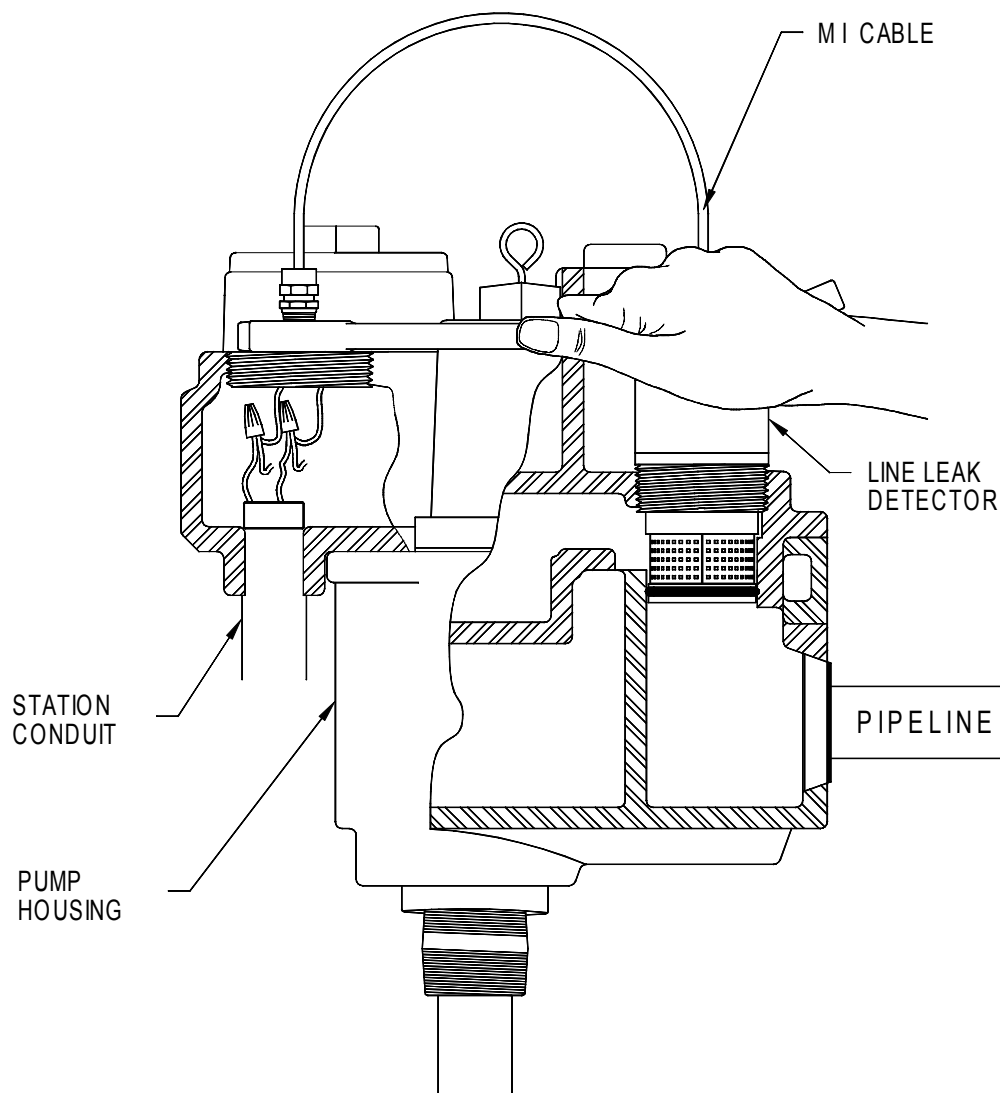


Figure 2.2-9 MI Cable Adapter Installation – RedJacket® Pump Housing

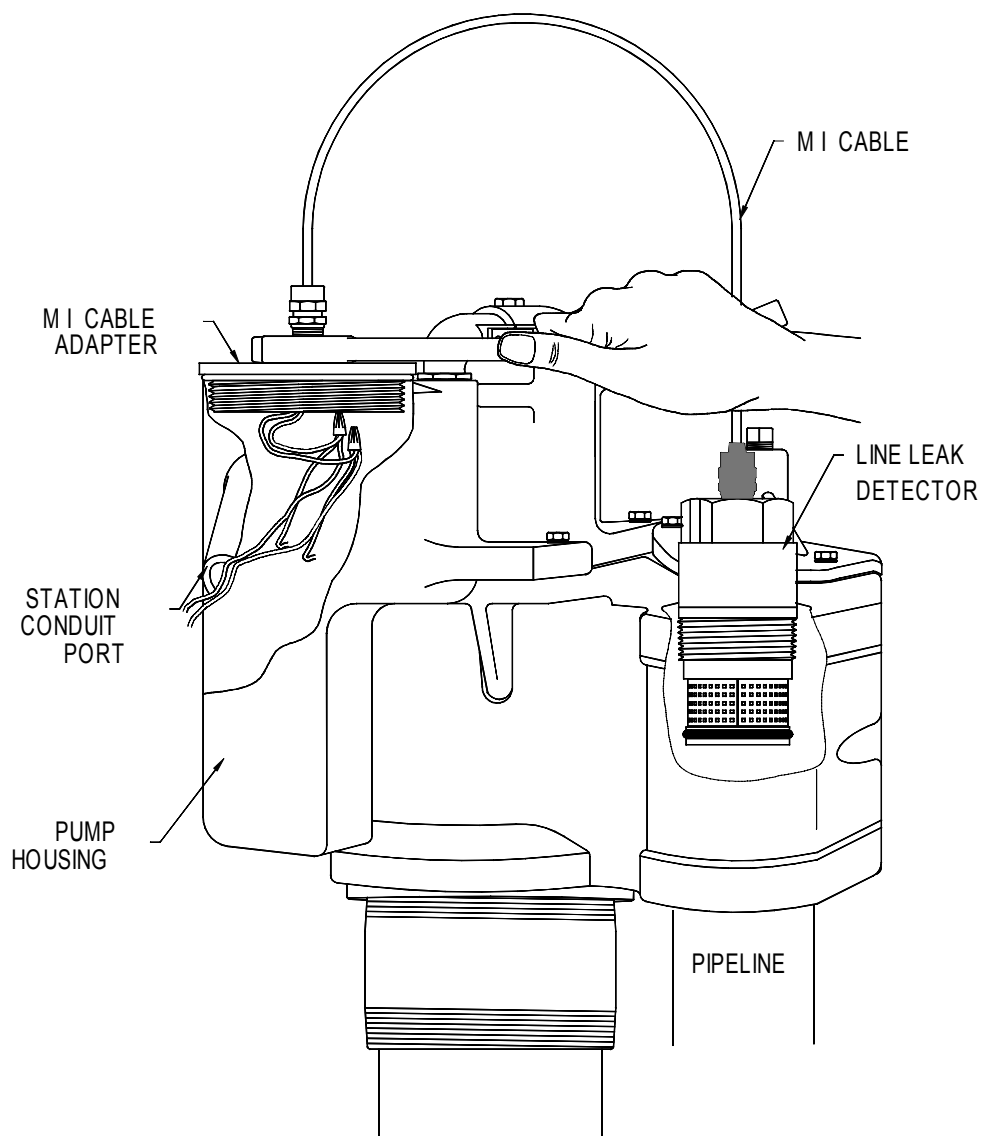


Figure 2.2-10 MI Cable Adapter Installation – FE Petro Pump Housing

- 11) **Tighten the MI cable compression fitting with a 7/8 inch wrench.** Be careful not to overtighten the compression fitting – *avoid MI cable twisting / bending damage and failures* – torque to 25 lbs/ft. Reference **Figure 2.2-11**, or **2.2-12**.
- 12) Recommended for Red Jacket installations: **inspect and replace the check valve** under the functional element – IF – it doesn't have a stainless steel stem. **Use Red Jacket replacement part number: 144-184-5.**
- 13) Finally, inspect the MI Cable at the LSU (Leak Sensing Unit) for damage, twists, kinks, or breaks — *a LSU that has a damaged MI Cable is unusable and must be replaced before power is applied. Install a new LSU if the MI Cable is damaged.*

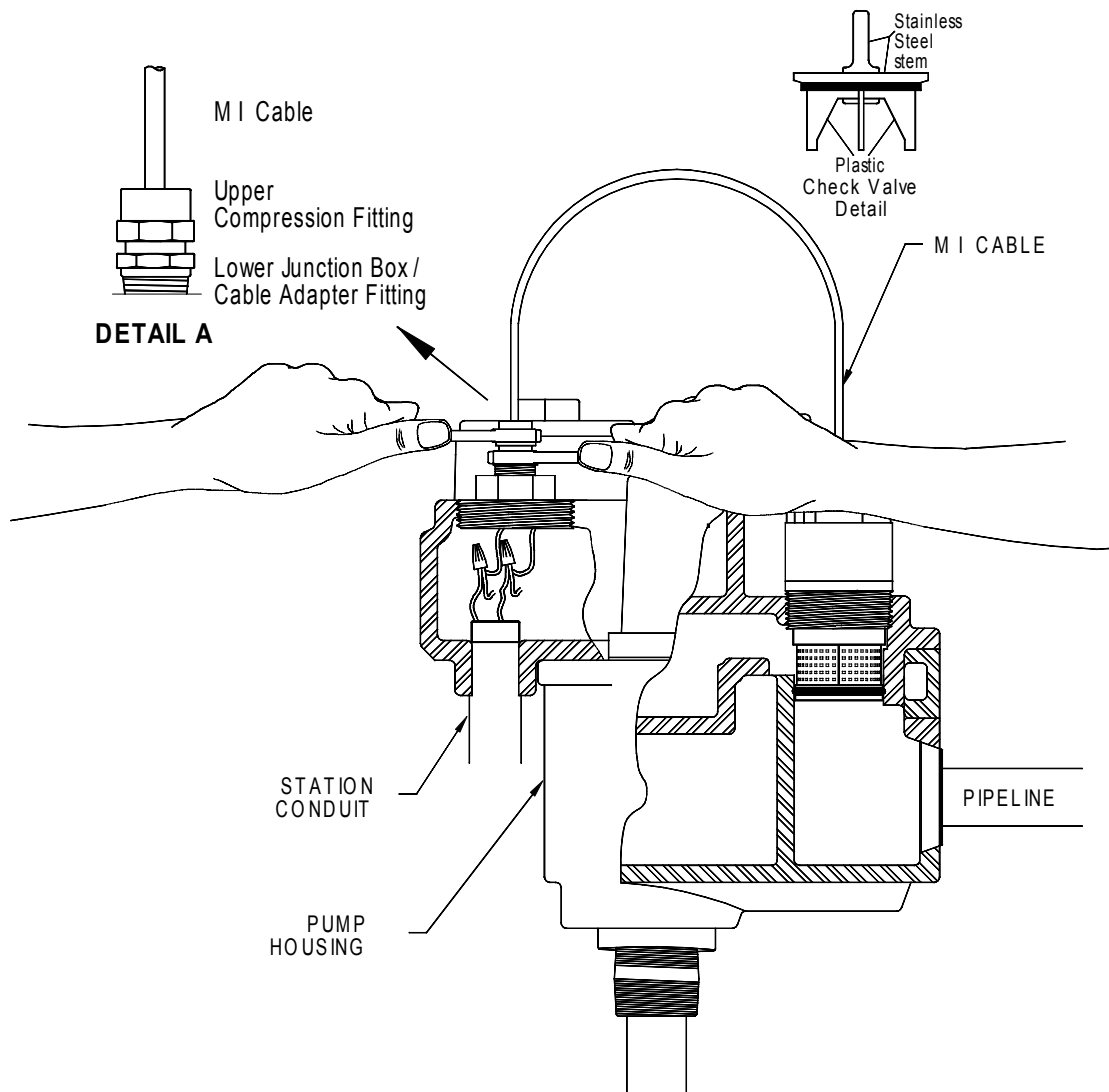


Figure 2.2-11 Tightening MI Cable Adapter Compression Fitting – RedJacket® Pump



DANGER Explosion Hazard — Flammable Vapor Area.

After any installation or service of the submersible pump or its housing, inspect the MI Cable at the LSU (Leak Sensing Unit) for damage, twists, kinks, or breaks... 240 VAC power flows through this cable to the LSU. **DO NOT apply power if the MI Cable is damaged, twisted, kinked, or broken.** Electrical sparks or fire in this area could cause an explosion, injury or death.

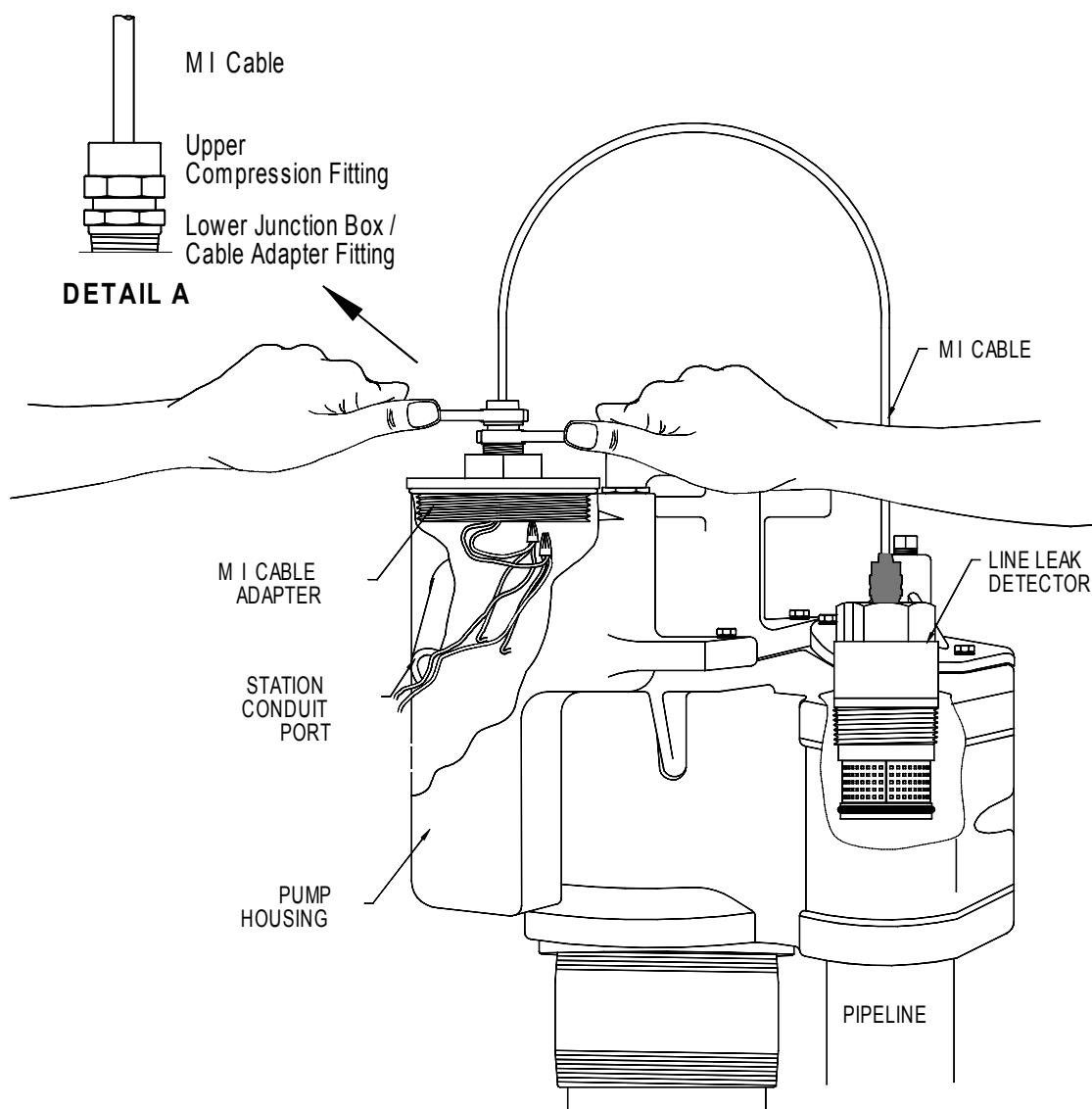
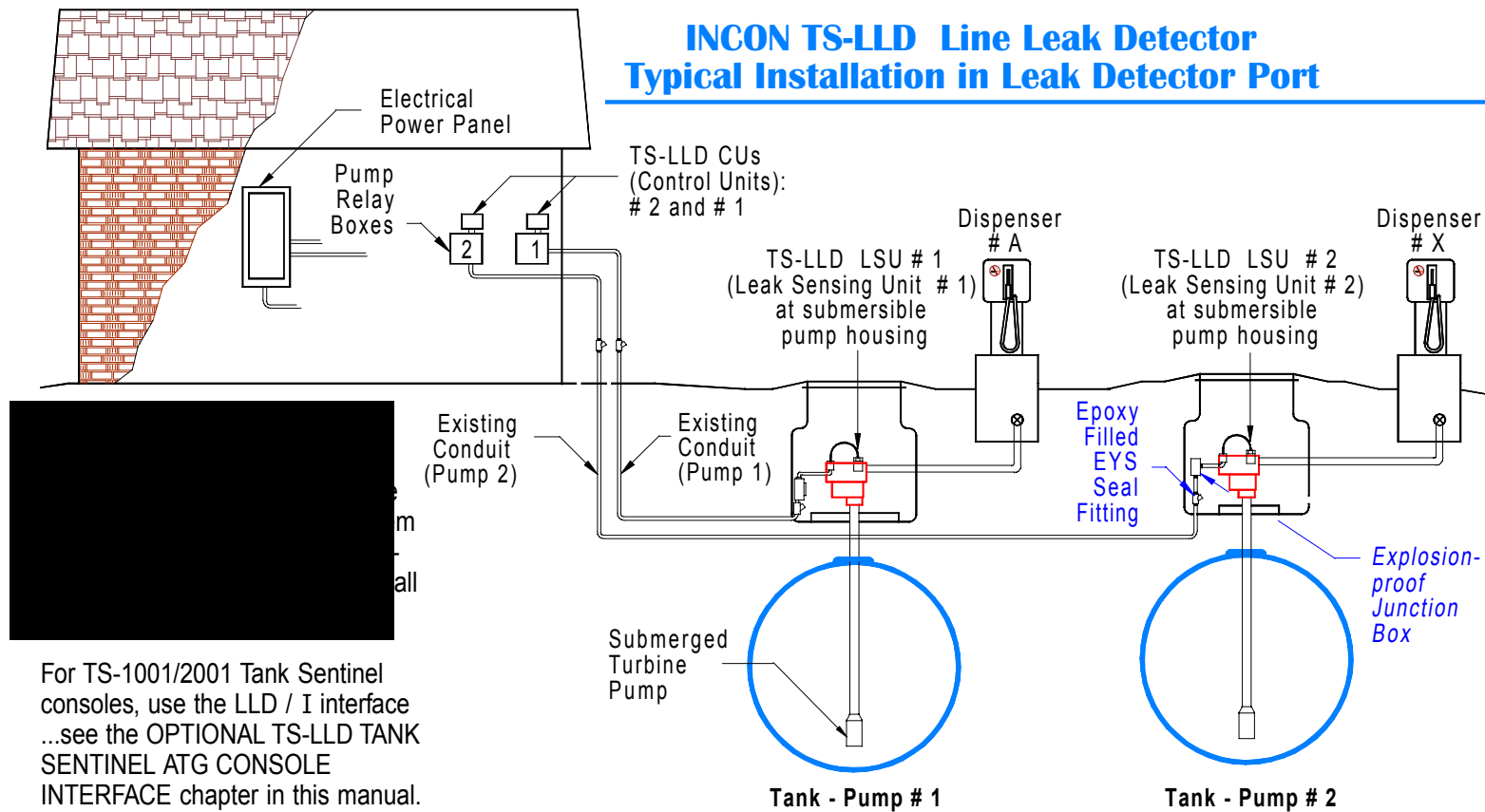
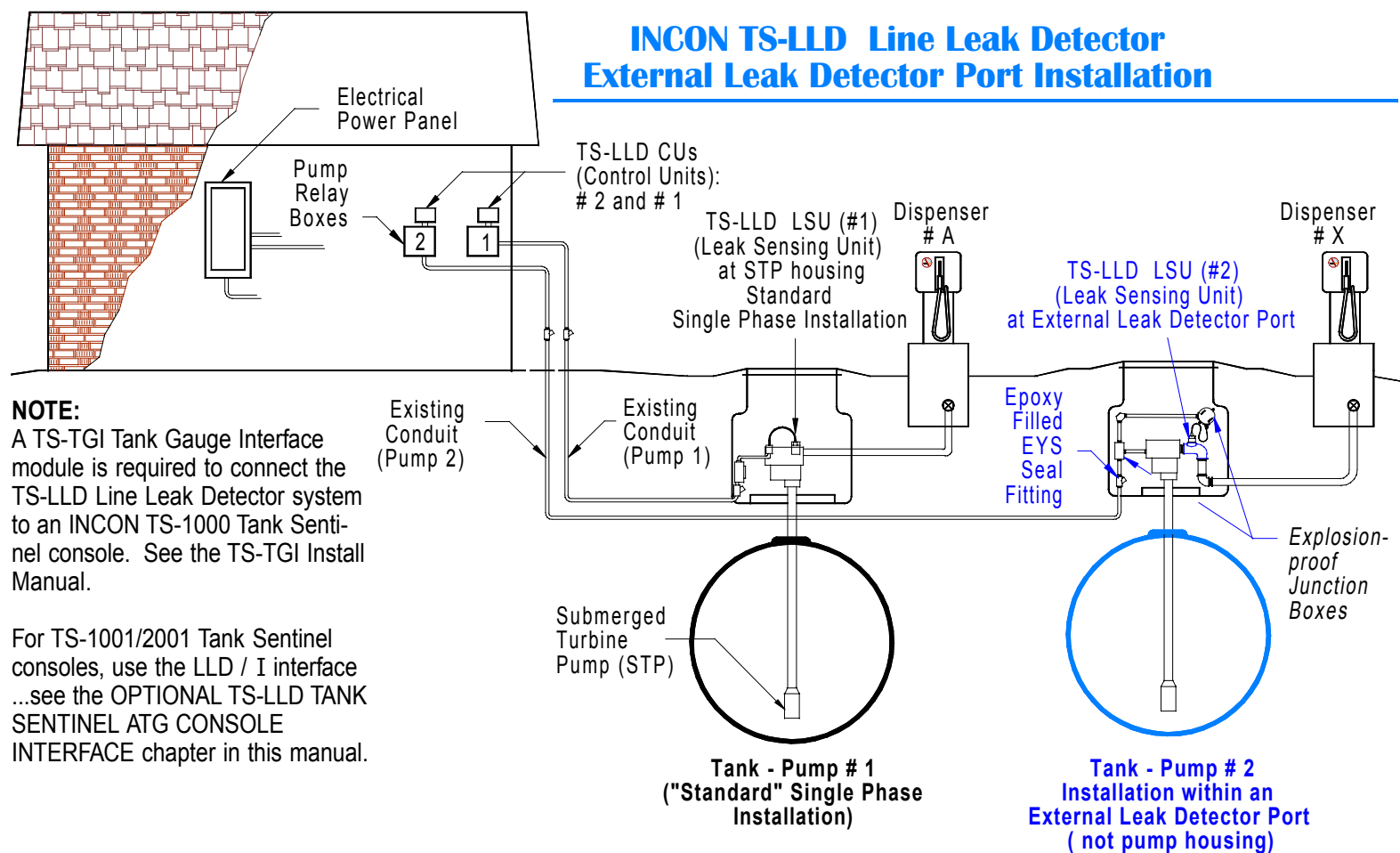
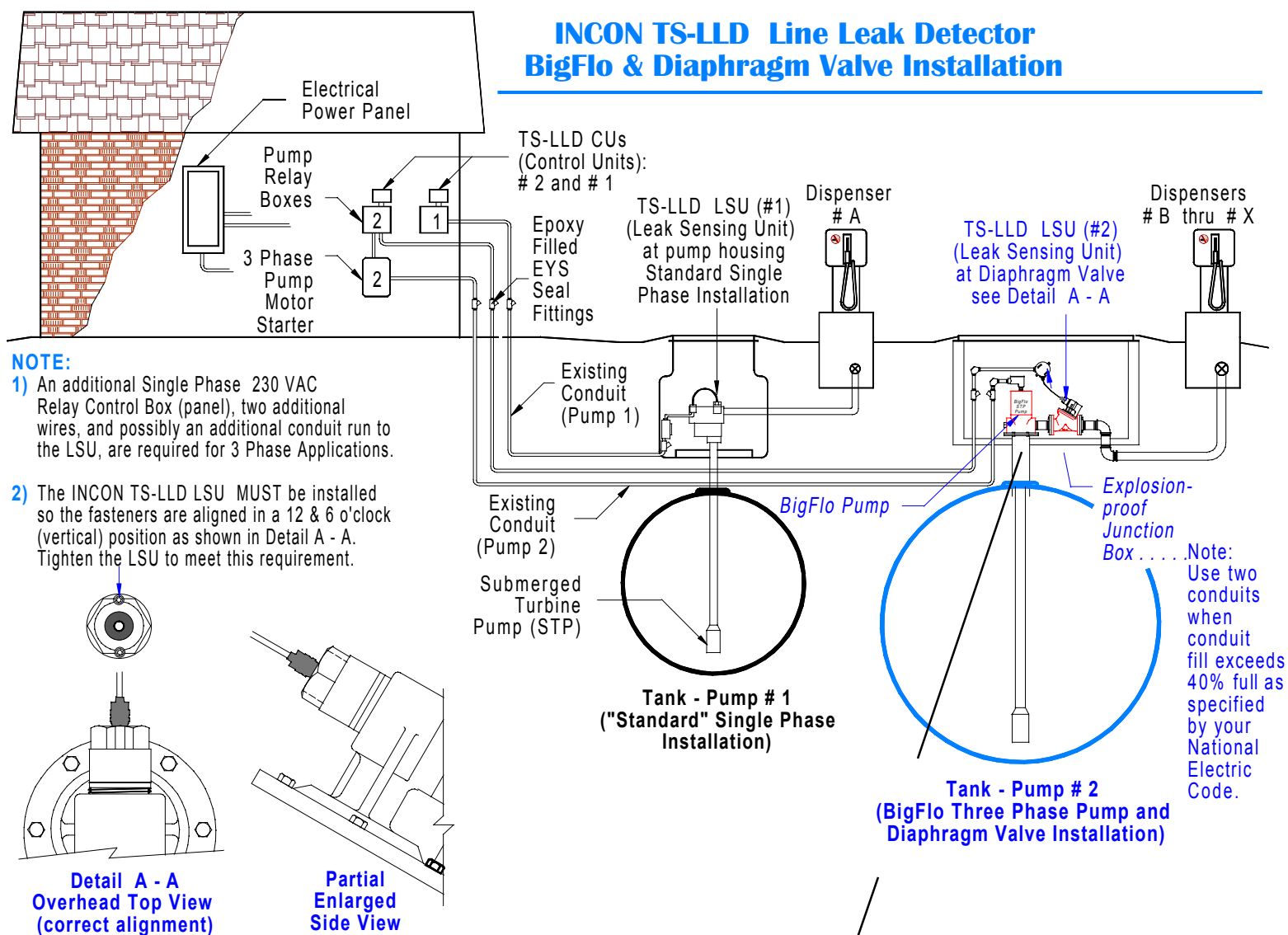


Figure 2.2-12 Tightening MI Cable Adapter Compression Fitting – FE Petro Pump

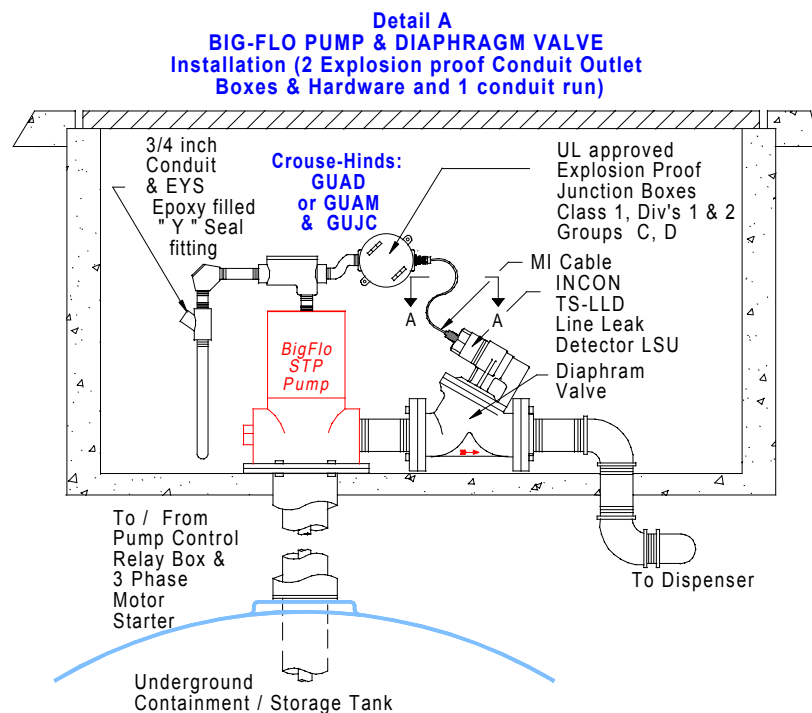
Reference Schematic **Figure 2.3 - 8***Figure 2.2-13 Typical Installation INCON TS-LLD Line Leak Detector*

Reference Schematic **Figure 2.3 - 8****Figure 2.2-14 INCON TS-LLD Installation at External Leak Detector Port**

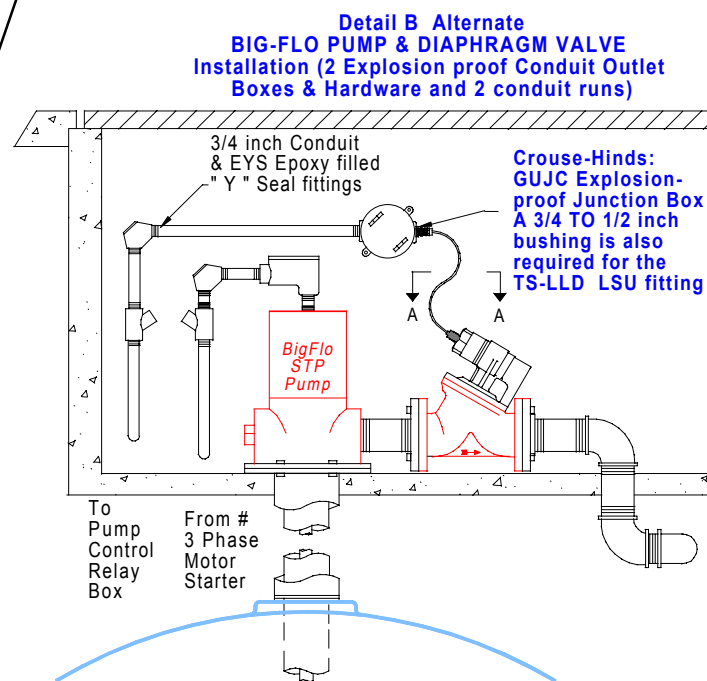
INCON TS-LLD Line Leak Detector BigFlo & Diaphragm Valve Installation



Reference Schematic Figures 2.3 - 9 & 10



or



Note: Use two conduits when conduit fill exceeds 40% full as specified by your National Electric Code.

Use recommended components or equivalent

Figure 2.2-15 INCON TS-LLD Installation at BigFlo Diaphragm Valve

Reference Schematic Figures 2.3 - 11 & -12

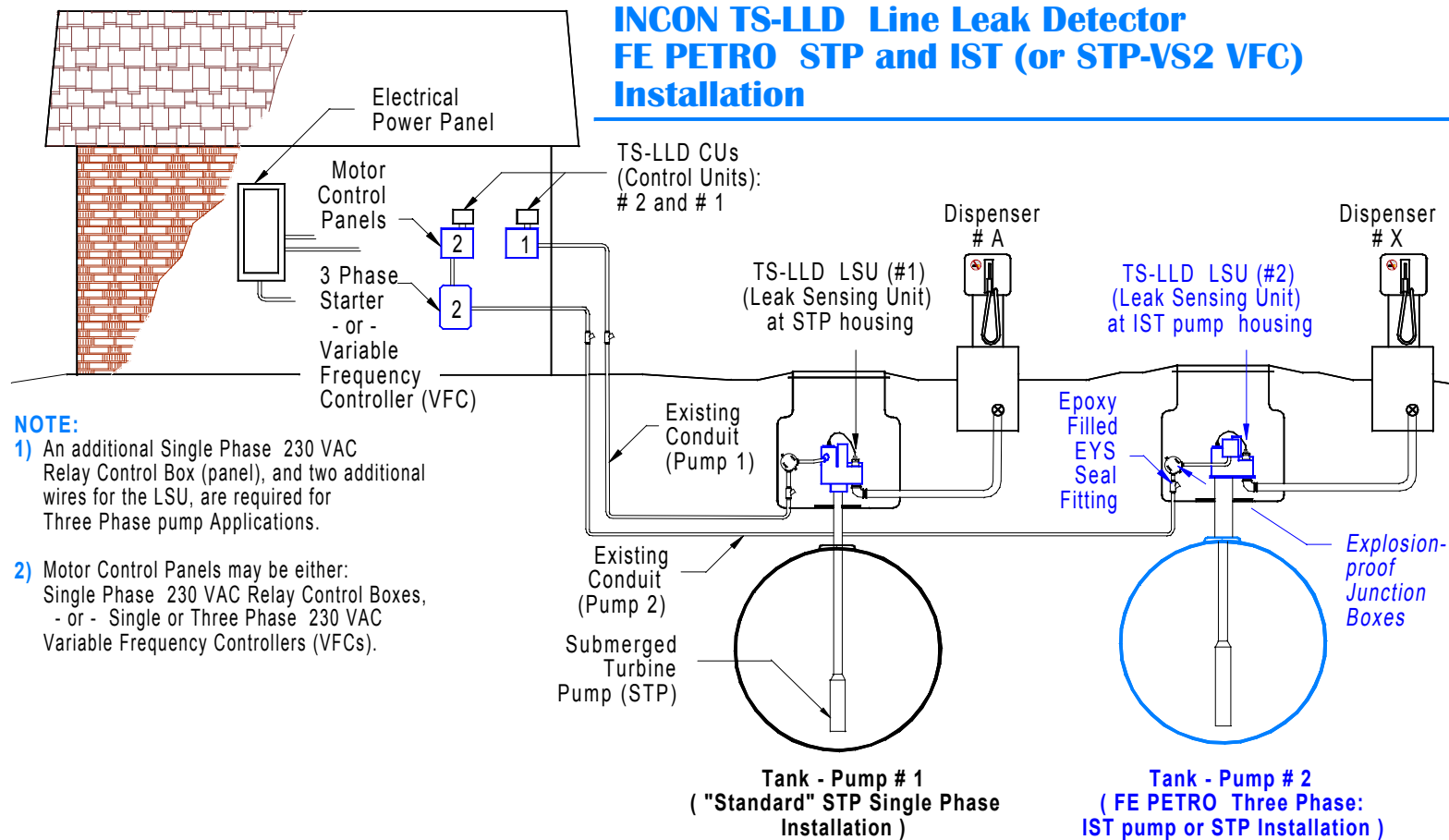


**Figure 2.2-16 INCON TS-LLD Installation at FE PETRO STP or IST pumps
Single or Three Phase 240 VAC Applications**

2.3

TS-LLD CU Installation & Wiring

Contents:

- Control Unit Installation Steps (Location, Product Configuration, TS-2000 Configuration, Mounting the Control Unit, Relay Box & Control Unit Wiring TABLE 2.3-1)
- Wiring Diagrams & Schematics (Pump Control Relay Box, Single Phase 240 VAC, 3 Phase 240 VAC, 3 Phase RedJacket BigFlo, 3 Phase 240 VAC - FE Petro - STP & IST applications)
- Final Installation Steps

Control Unit (CU) Installation Steps

Follow the installation steps (below) and in the order that they appear:



DANGER Electrical Shock Hazard. BEFORE installing, servicing or working on this equipment, **turn off all** submersible pump power (240 VAC) and pump relay coil / dispenser power at the electrical panel. **Tag, secure / lockout** these circuit breakers in the off position to prevent accidental or unauthorized circuit breaker closure. **Failure to turn off power will result in severe injury or death !** Check all wiring terminals for the absence of power before proceeding. *Note: Circuit breaker contact(s) can stick closed even when the circuit breaker lever is in the off position.*



NOTE *You must know the dispense line number, product dispensed, and which pump relay box (motor control box) is associated with this line.*

- 1) Select an accessible mounting location for the control unit (see **Figures 2.3-1 & 2.3-3**), and **remove** the appropriate conduit knockouts. The CU is usually mounted above the pump relay box (shown here)... other locations are possible.

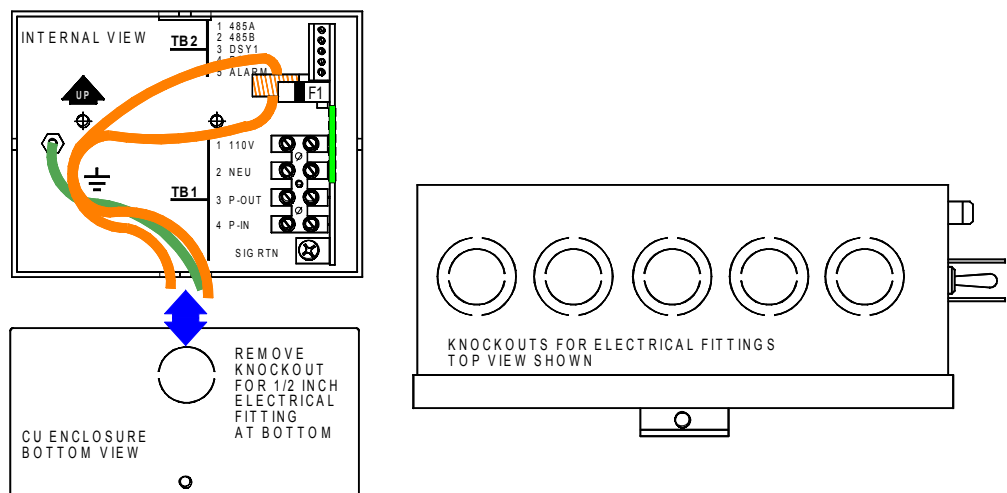


Figure 2.3-1 CU Internal & Bottom Views, and Relay Box Top View

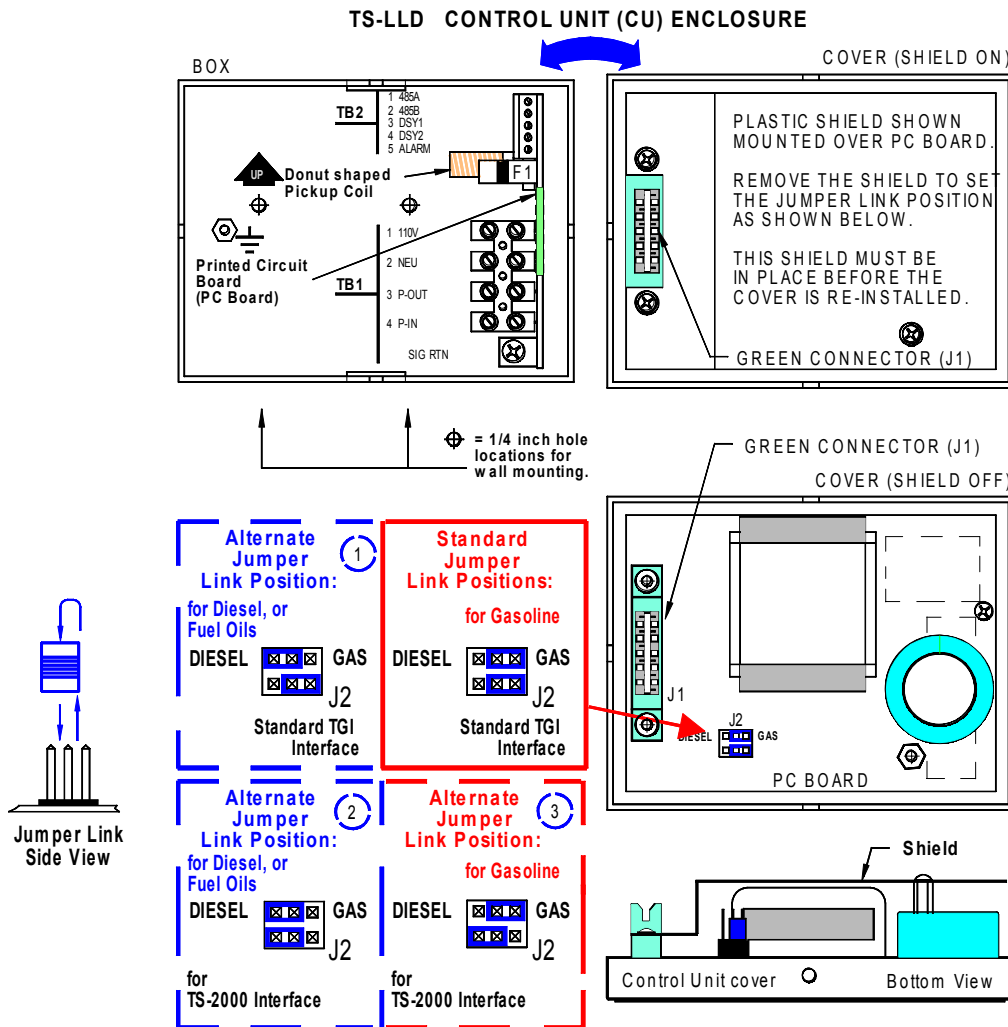
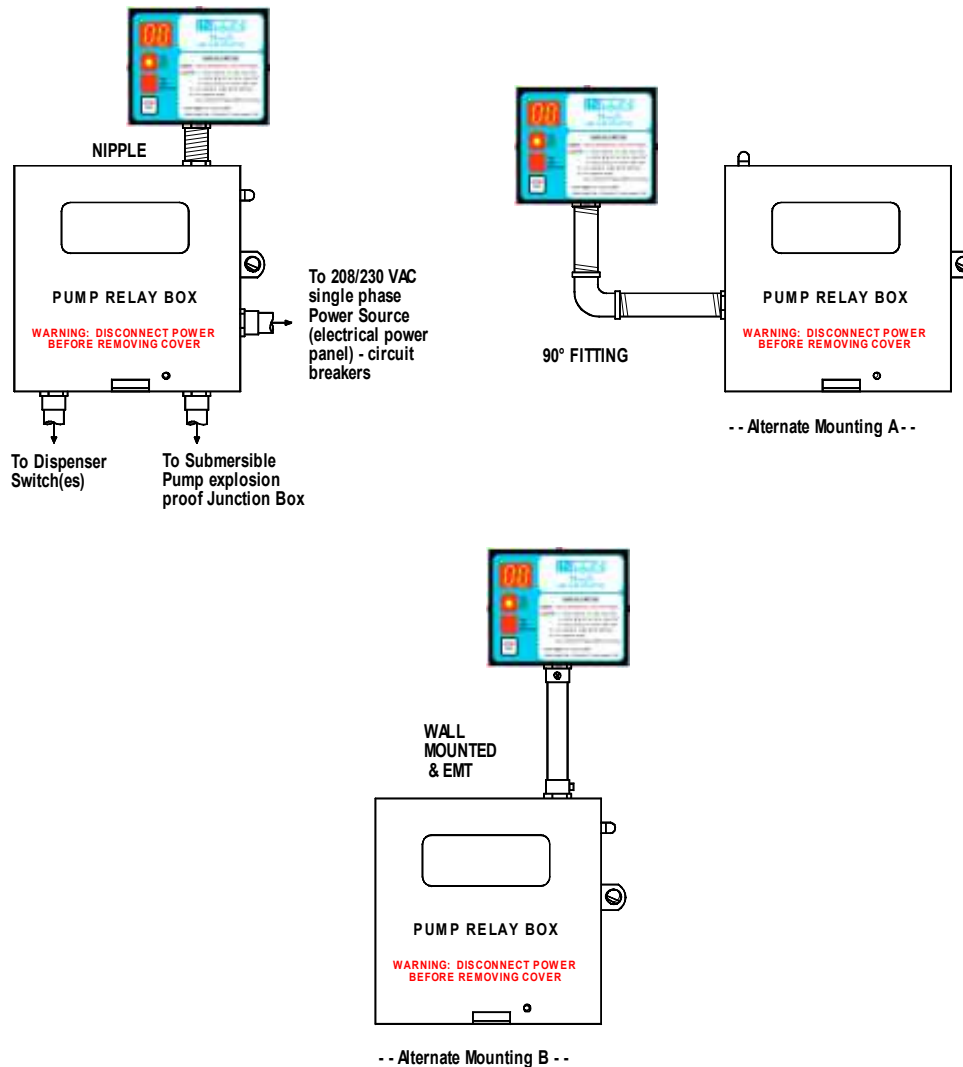


Figure 2.3-2 CU Component Location - Internal View

Control Unit Installation Steps (continued...)

- 2) **Product Configuration (Top Jumper Link)** — required only for Diesel, Fuel Oil, or Kerosene — skip this step if gasoline will be monitored. Remove the plastic shield in back of the control unit cover. Pull up and reposition the top blue jumper-link at J2, so that it is installed over the left two pins. See **Figure 2.3-2** and reinstall the plastic shield when done.
- 3) **INCON TS-2000 Configuration (Bottom Jumper Link)** — this step is required only when the TS-LLD will be wired to or interfaced to an INCON model TS-2000 ATG console. Remove the plastic shield from the control unit cover. At J2, pull up and reposition the bottom jumper-link so that its installed over the left two pins. See **Figure 2.3-2** and the applicable **INCON Application Note about wiring to a TS-2000**. Reinstall the plastic shield when done.



WARNING Avoid electrical shock hazards. Disconnect all electrical power sources **BEFORE** removing any enclosure cover !

NOTE: Ground equipment as required by your local and National Electric Codes.

Figure 2.3-3 TS-LLD CU Typical Mounting and Conduit Routing

- NOTE** 4)  **Mount the CU to the pump relay box** (see **Figure 2.3-3** above for typical mounting methods). You may mount the control unit to a wall through the two 1/4 inch mounting holes — use fasteners that are appropriate for the wall construction. The centers of these holes are shown on the inside label of the control unit. In addition, make sure that the UP arrow is pointing up as shown in **Figure 2.3-2**.

Control Unit Installation Steps (continued...)

5) Wiring at the Pump Control Relay Box:

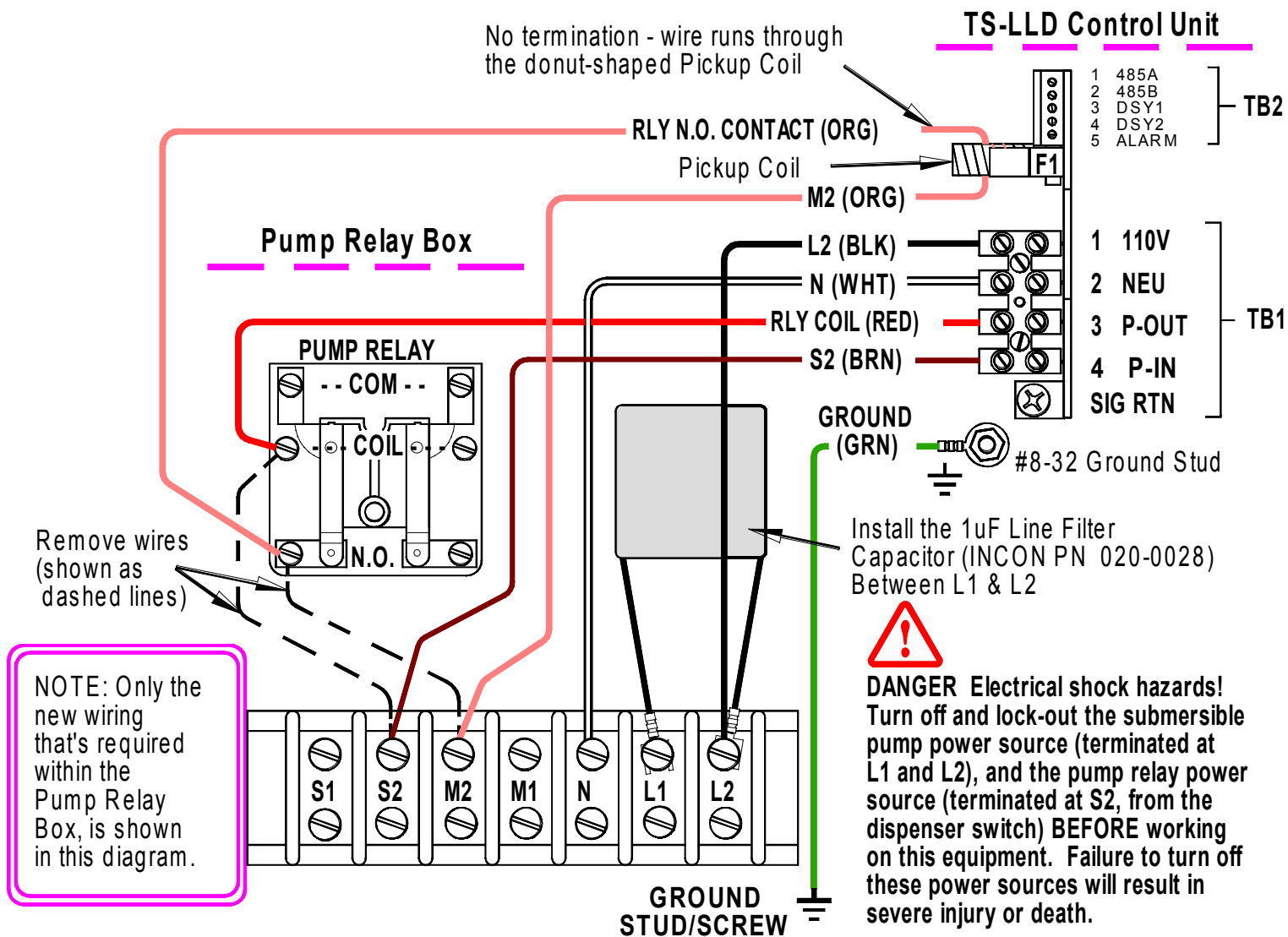
- Remove the wire from S2 to the relay coil
- Remove the wire from M2 to the relay N.O. contact
- Install the 1 μ Farad “Line Filter” capacitor (INCON P/N 020-0028) between terminals L1 and L2
- Wire the CU to the pump relay box as described below TABLE 2.3-1 and as shown in **Figures 2.3-4 & 2.3-5**. Strip 1/4 inch of insulation off each end (for termination at the control unit and for the spade crimp connectors at the pump relay box). Use connectors sized for 14 AWG wire.

NOTE  *Other pump relay boxes may have different terminations, and/or may be wired differently than what is shown in this manual.*

Typical Single Phase Wire Connection List TABLE 2.3 -1 PUMP RELAY BOX — to — TS-LLD CONTROL UNIT (CU)				
From	Wire Color	Wire Gauge	Circuit (Description)	To
L2	BLK	14 AWG (supplied)	110 V (AC Line Power input)	TB1 - 1
N	WHT	14 AWG (supplied)	Neu (Line Power Neutral)	TB1 - 2
Relay Coil	RED	14 AWG (supplied)	P-OUT (Pump On - output signal, 110 V AC, to Pump Relay Coil)	TB1 - 3
S2	BRN	14 AWG (supplied)	P-IN (Pump On - input signal,	TB1 - 4
M2				
	ORG	14 AWG (supplied)	240 VAC (Pump Motor Power)	{ see below }
Relay N.O.				
		NOTE -	{ Pump Motor Power - the 14 gauge orange wire is pre-routed through the pick-up coil at the Control Unit. At the relay box , wire one end to the M2 terminal, & wire the other end to the pump relay N.O. contact (Figure 2.3-4)... no wiring/connection at CU	- NOTE
Ground Stud	GRN	14 AWG (supplied)	GND (Equipment Ground)	Ground Stud
		NOTE -	{ Ground according to your Local and National Electric Codes. }	- NOTE

NOTE  **Electricians:** All AC wiring at the control unit (**TB1-1 110V** and **TB1-4 P-IN**) must be in-phase and read 0 VAC in respect to each other and must read from 110 to 130 VAC in respect to ground. Reference **Figures 2.3-4 thru 2.3-10**. These are “typical” diagrams and may not represent the actual wiring. A **0 VAC** potential must exist from **TB1-1** to the hot side of dispenser on switch **S1** (or to **S2**) with the dispense switch on. Take voltage readings at the pump relay box. Use the leg that is in-phase with **S1** (**L1** or **L2** that reads 0 VAC) and wire it to **TB1-1** (110V). **For 3 phase applications — DO NOT use any leg that reads more than 130 VAC to Ground !**

Figure 2.3-4 Typical Single Phase 240 VAC Pump Relay Box & Control Unit Wiring Diagram



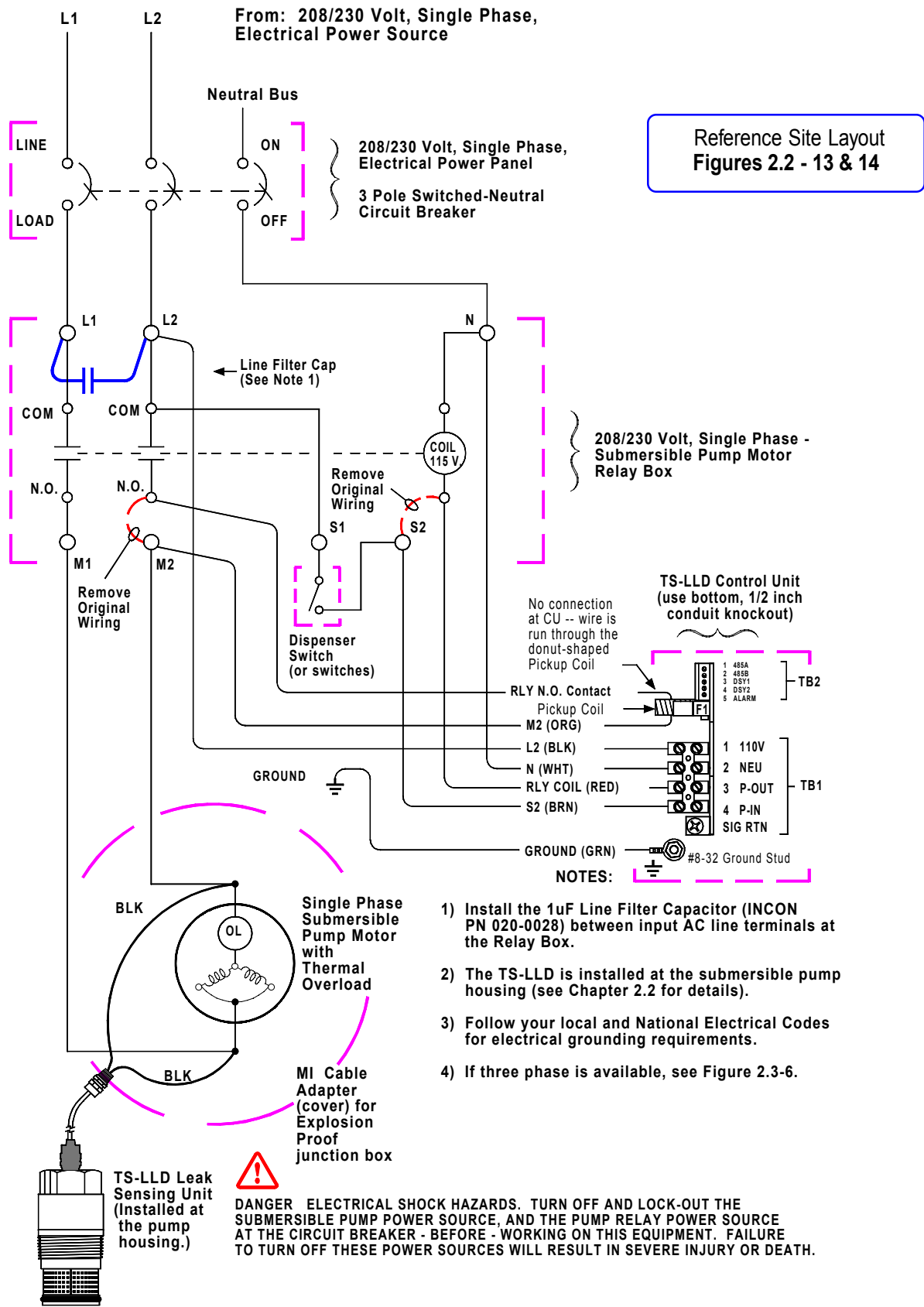


Figure 2.3-5 Typical Single Phase 240 VAC Pump & Control Unit Interface Schematic

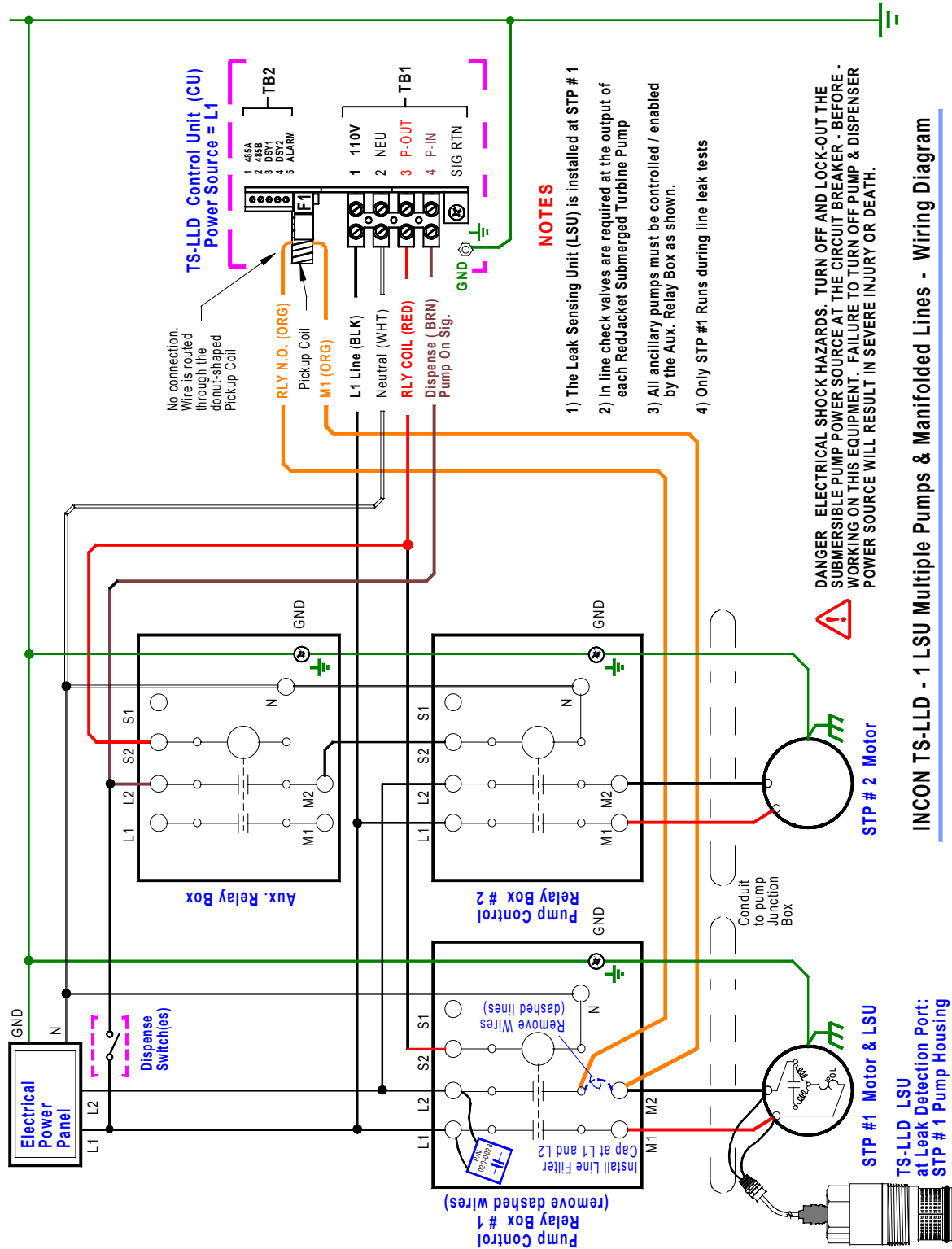


Figure 2.3-6 Single Phase 240 VAC Multiple Pump & Manifolder Line with Single LSU & CU Interface Schematic

TS-LLD Line Leak Detector — Mechanical Blender Interface

When connecting a TS-LLD line leak detector to systems with mechanical blenders, tie the: premium, all mid-grades, and regular dispenser switch signals together (electric blenders can be wired normally). Wire both premium and regular TS-LLD Control Units at TB1-4 (P-IN). See the typical (partial) wiring diagram below. Because the mid-grades are blended mixtures of the premium and regular octanes, any product dispense will abort leak tests at the premium and regular Control Units.



CAUTION The **dispense on** signals must be *in phase* to avoid electrical shorts and damage. Verify that all dispenser switch signals are in phase before you tie them together (in phase = 0 Volts AC in respect to each other and 120 Volts AC in respect to Neutral or ground). Note that both pumps will be active on any dispense.

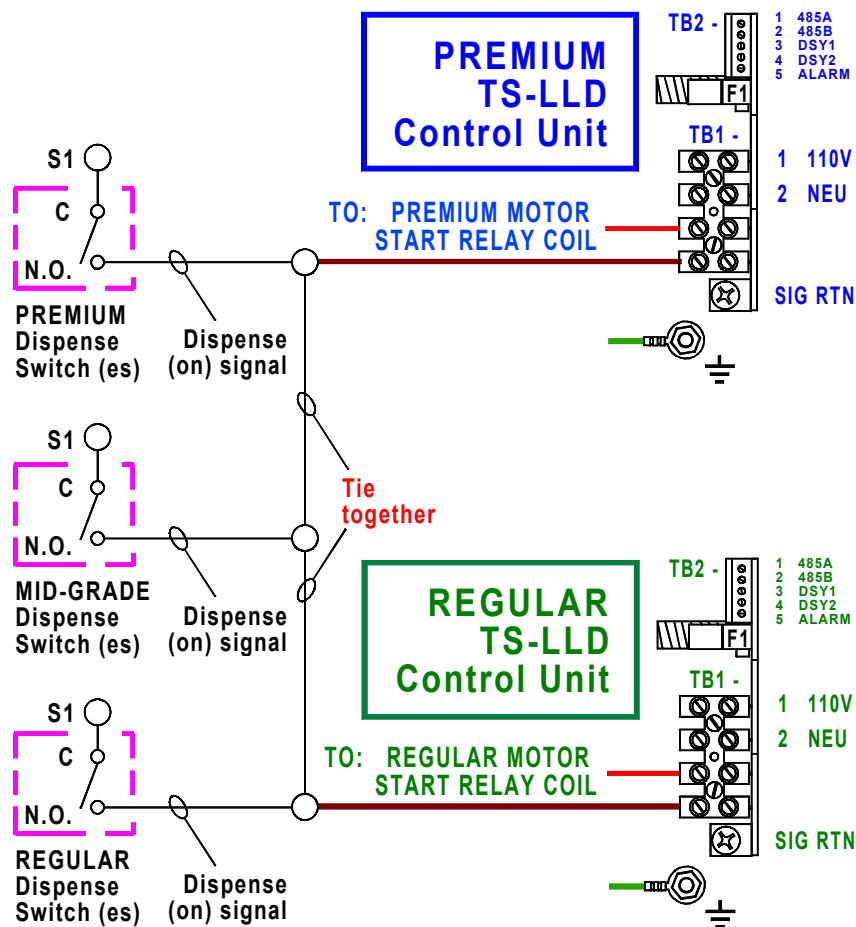


Figure 2.3-7 Blended Dispensers to TS-LLD Control Unit – Interface Schematic

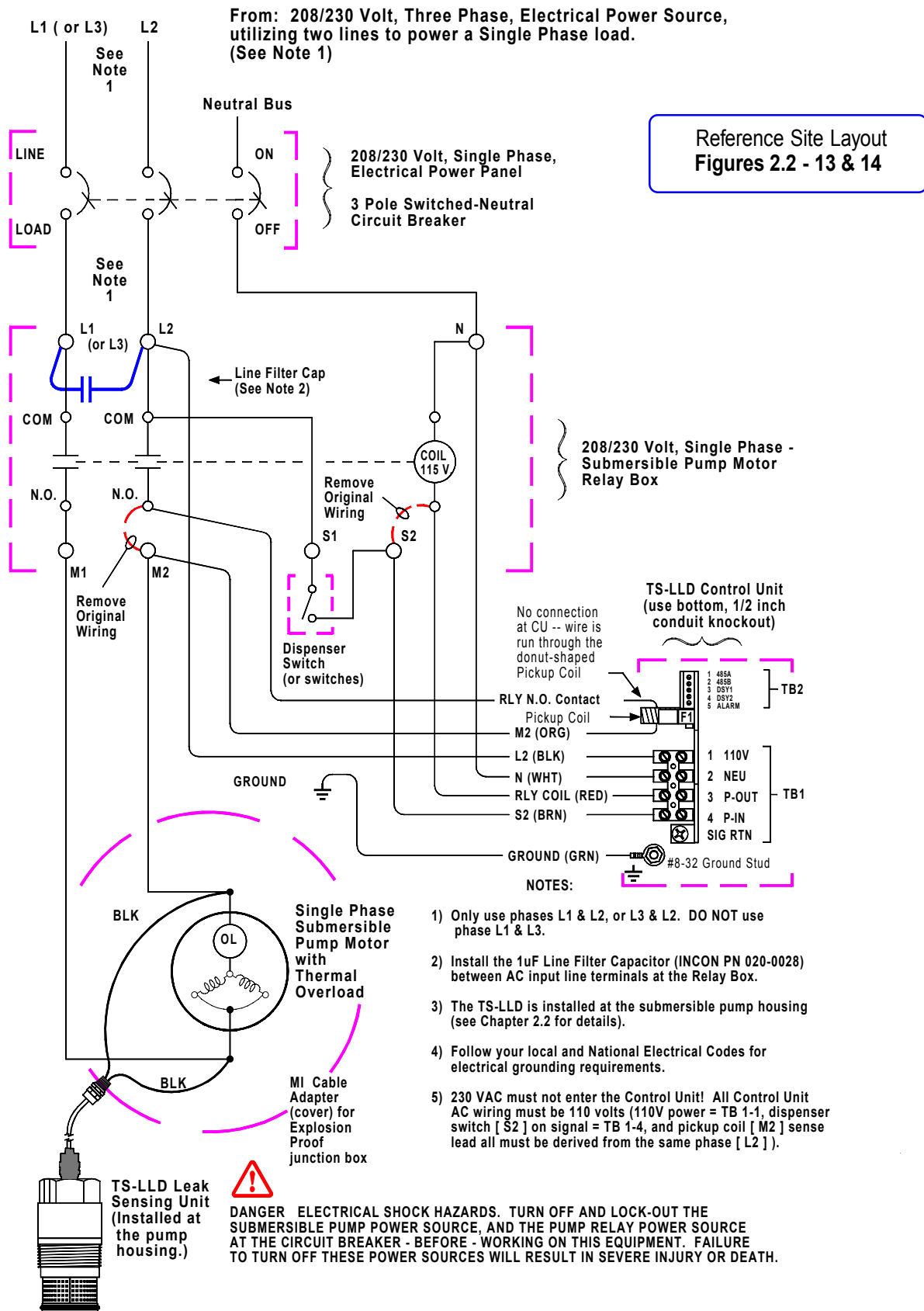


Figure 2.3-8 Three Phase 240 VAC Supply – Single Phase 240 VAC Pump & Control Unit Interface Schematic

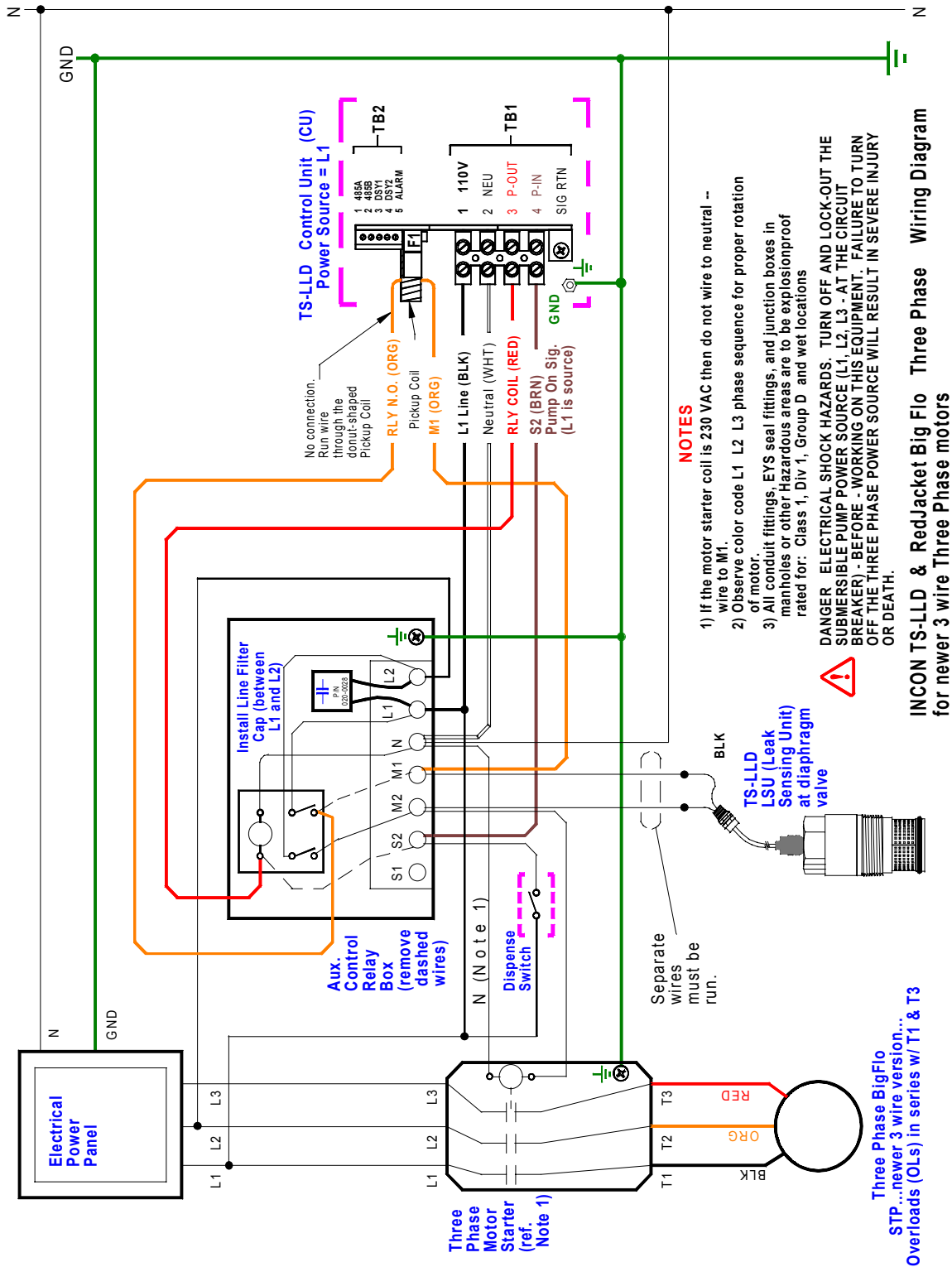


Figure 2.3-9 Three Phase 240 VAC Supply – Starter – Motor Control Box – and BigFlo Pump (3 wire) Interface Schematic to TS-LLD

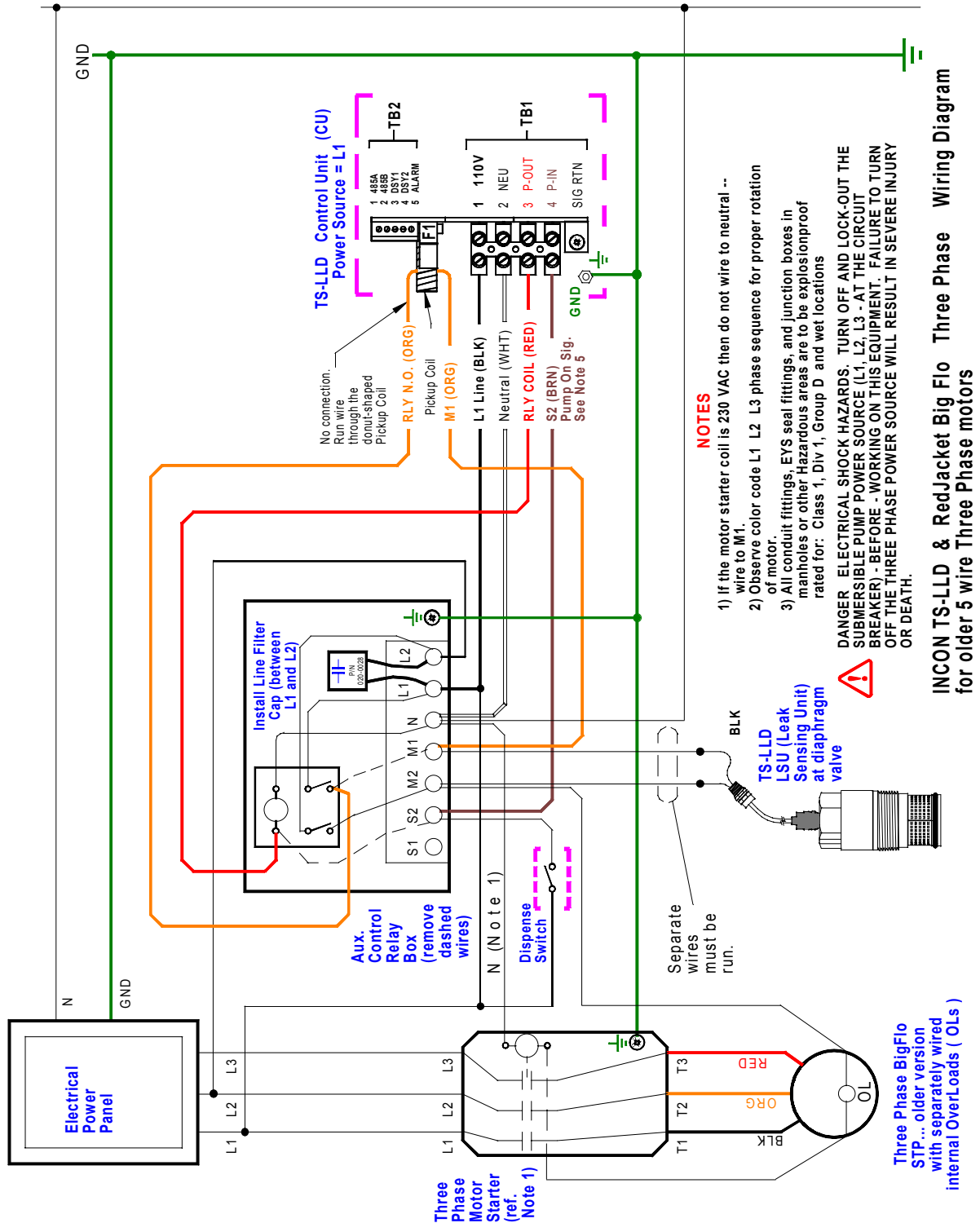


Figure 2.3-10 Three Phase 240 VAC Supply – Starter – Motor Control Box – and BigFlo Pump (5 wire) Interface Schematic to TS-LLD

Reference Site Layout **Figure 2.2 - 16**

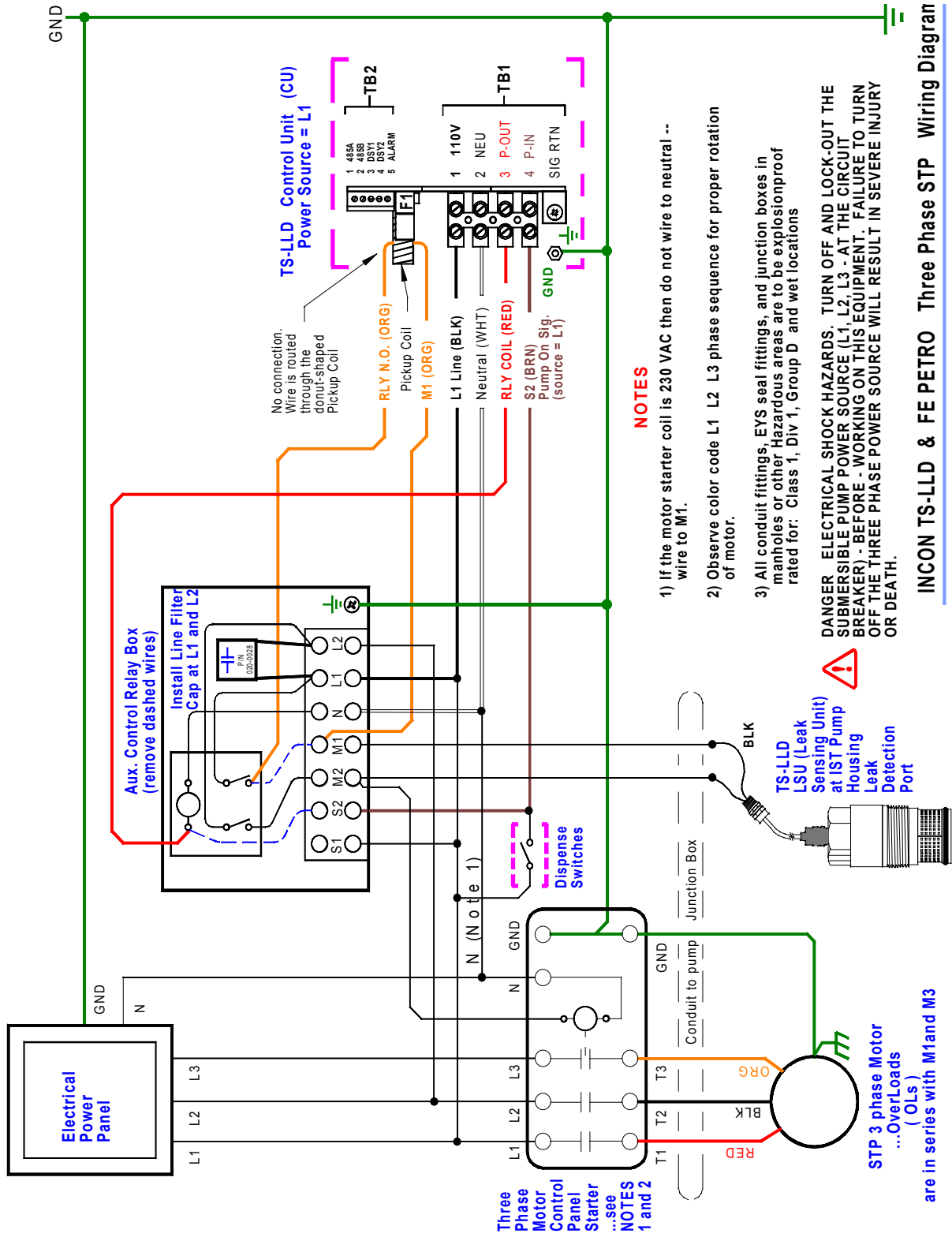


Figure 2.3-11 Three Phase 240 VAC Supply – Starter – and Motor Control Box Standard Interface Schematic to TS-LLD

Reference Site Layout Figure 2.2 - 16

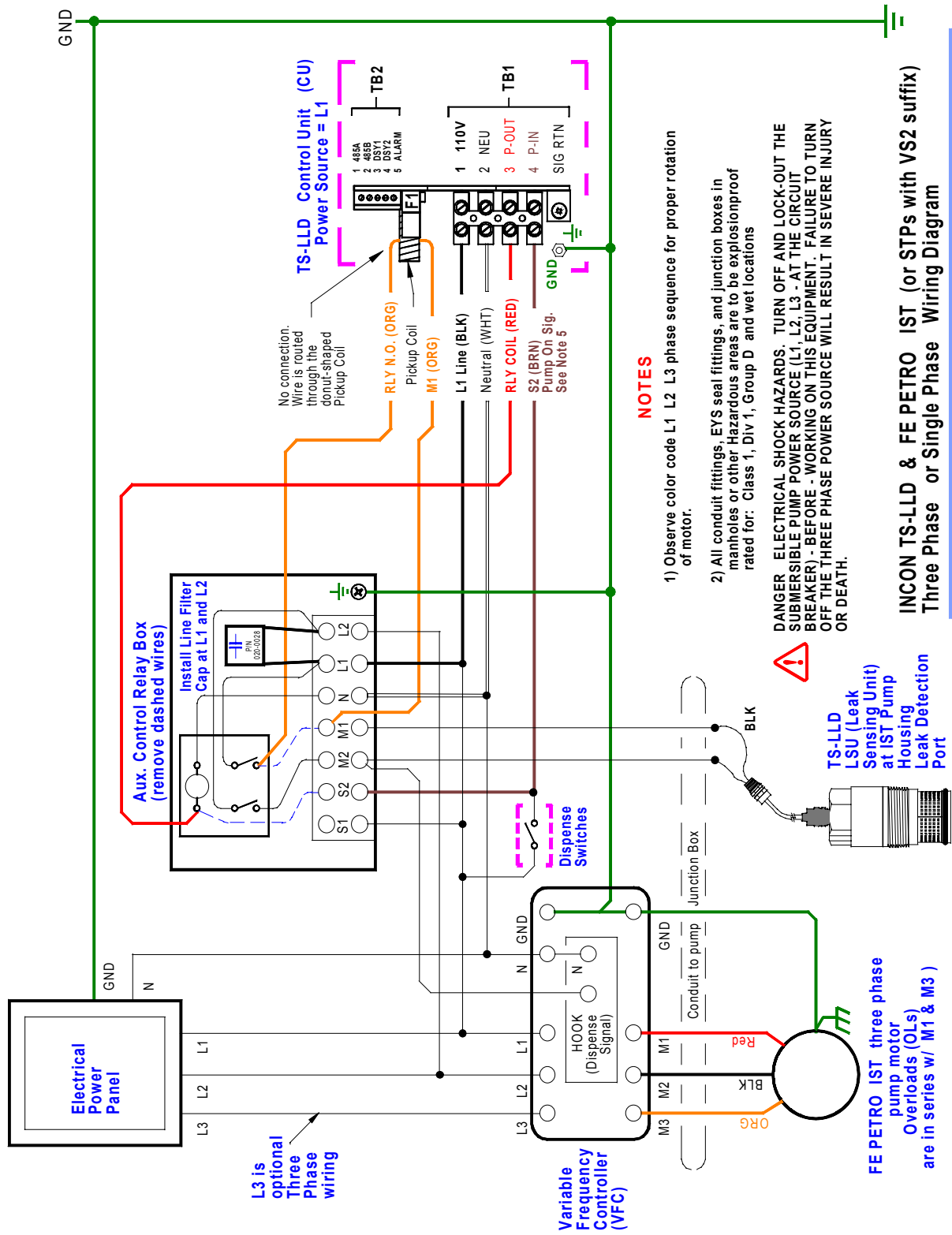
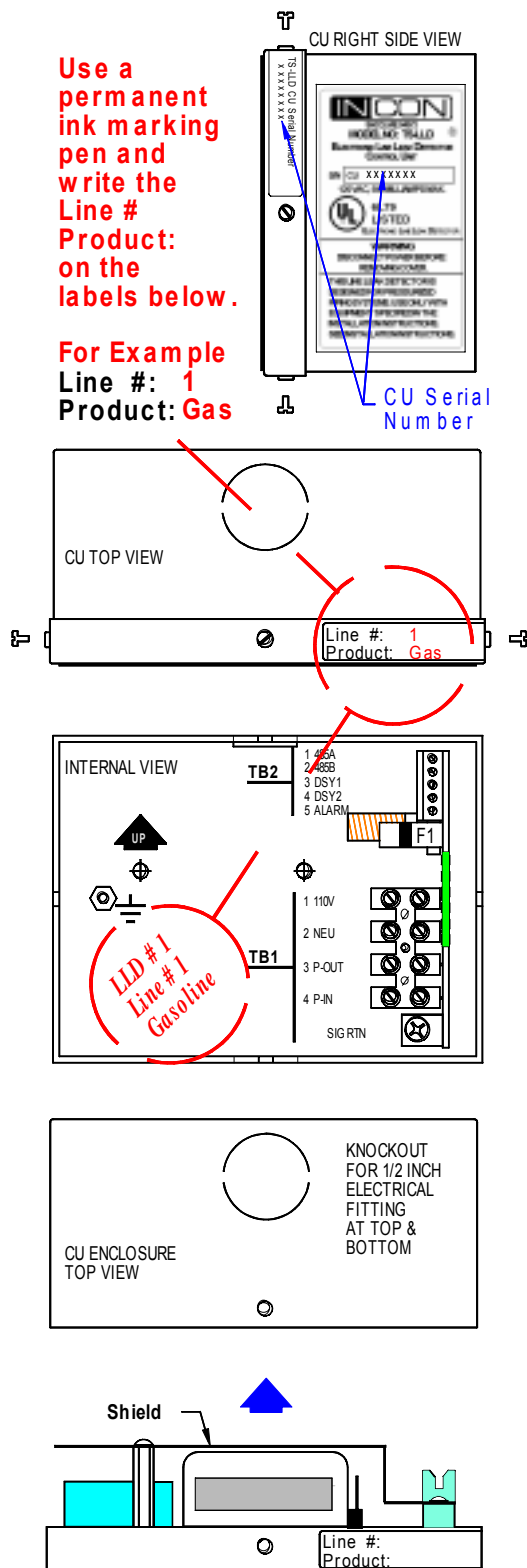


Figure 2.3-12 Three Phase 240 VAC Supply – FE PETRO Variable Frequency Controller, Motor Control Box – and IST Pump Interface Schematic to TS-LLD

Final Installation Steps



- 6) **Recheck your wiring.** Make sure all terminations are correct and tight.
- 7) Use a permanent ink marking pen to: **write the Line # and the Product** being monitored on two CU labels — The label inside of the control unit, and the label located on the top right of the cover label (so the box and cover can be reinstalled as a matched-set). See **Figure 2.3-6** to the left.
- 8) **Reinstall the correct CU cover on the box** – as a matched-set. See **Figure 2.3-6** to the left.
- 9) **Reinstall the pump relay box cover.** See **Figures 2.3-1 & 2.3-3.**
- 10) Nine **INCON** Danger stickers are supplied with each line leak detector (P/N 240-1175). **Apply one sticker:** on the pump relay box cover, in locations near dispenser fuel-line filters, plugs, emergency safety-shut-off valves, on the TS-LLD Leak Sensing Unit, and onto other serviceable components of a fuel line (where a spill would occur if the line became pressurized). The selected surfaces must be clean, dry, and in plain sight so that the warning can be read and followed.

Finally, see the next few Sections of this Chapter about Optional Tank Gauge Console Interface and the After Installation Steps / Testing.

Figure 2.3-13 Control Unit Final Assembly

2.4

Optional TS-LLD – Tank Sentinel ATG Console Interface

Contents:

- TS-1000 TS-TGI Interface
- TS-2000 Interface
- TS-1001 / TS-2001 LLDI Interface

TS-1000 Tank Gauge Interface

The TS-LLD can be interfaced to an INCON TS-1000 console with the addition of a TS-TGI module. The TGI module (Tank Gauge Interface module) can interface up to 4 TS-LLD systems with the TS-1000. **NOTE – The devices and installation methods covered in this Section have not been evaluated by Underwriters Laboratories and are not considered part of this Listing.**

For Installation, Programming, and Testing issues of the TS-LLD & TS-1000 tank gauge console see the INCON, TS-TGI Installation Guide, manual P/N 000-1051.

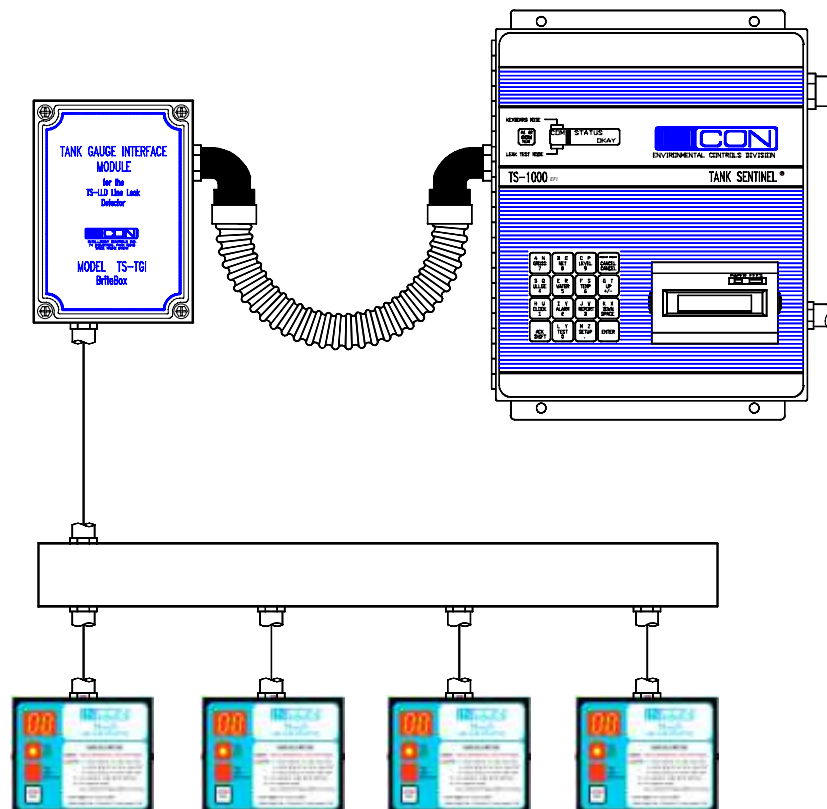


Figure 2.4-1 TS-1000 & TS-TGI Hardware Layout (Motor Control Boxes not shown)

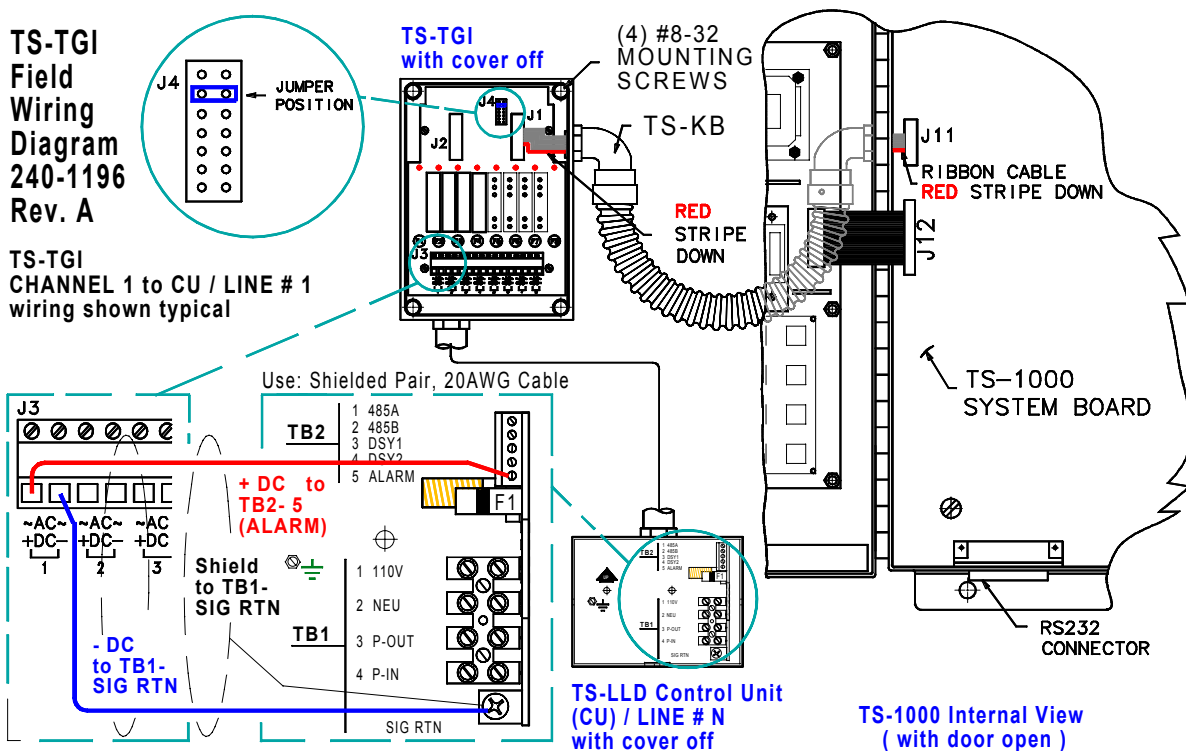


Figure 2.4-2 TS-1000 – TS-TGI Module – TS-LLD Control Unit Wiring Diagram

Example TS-1000 & TS-2000 ATG Reports:

INCON ENVIRONMENTAL
74 INDUSTRIAL PARK RD
SACO ME
SITE # 00001

4 line report header (standard)

6/23/1999 09:45 AM
ALARM REPORT

6/23/1999 09:45 AM
3 GPH LINE LEAK
LINE NO. 1

4 line report header (standard)

6/23/1999 10:08 AM
ACTIVE ALARM REPORT
(Not with TS-2000)

LOW BRI 6
ACTIVE

3 GPH LINE LEAK
LINE NO. 1

4 line report header (standard)

6/31/1999 11:01 AM
ALARM HISTORY REPORT

6/19/1999 03:45 PM
POWER UP

6/23/1999 09:45 AM
3 GPH LINE LEAK
LINE NO. 1

6/29/1999 10:14 AM
.2 GPH LINE LEAK
LINE NO. 4

4 line report header (standard)

6/20/1999 09:05 AM
LINE TEST REPORT

LINE 1

TEST TIME 04:32 PM
TEST DATE 6/19/1999
TEST RESULT PASSED

4 line report header (standard)

6/23/1999 10:12 AM
LINE TEST HISTORY

LINE 1

TEST TIME 04:32 PM
TEST DATE 6/19/1999
TEST RESULT PASSED

TEST TIME 08:19 PM
TEST DATE 6/20/1999
TEST RESULT PASSED

TEST TIME 09:45 AM
TEST DATE 6/23/1999
TEST RESULT FAILED

TS-2000 Tank Gauge Interface

Remove the TS-LLD control unit cover & plastic shield, and reposition the blue jumper links as shown in the diagram below. Do this when wiring to the discrete input terminals of an **INCON** model TS-2000 ATG.

NOTE



TS-LLD Alarm Output ratings (from TB2-5) are:

+ 5 VDC, 60 milliAmps max. (resistive loads) — *the output is from an Open Collector transistor with a 270 ohm resistor tied to an internal + 5 V DC supply.*

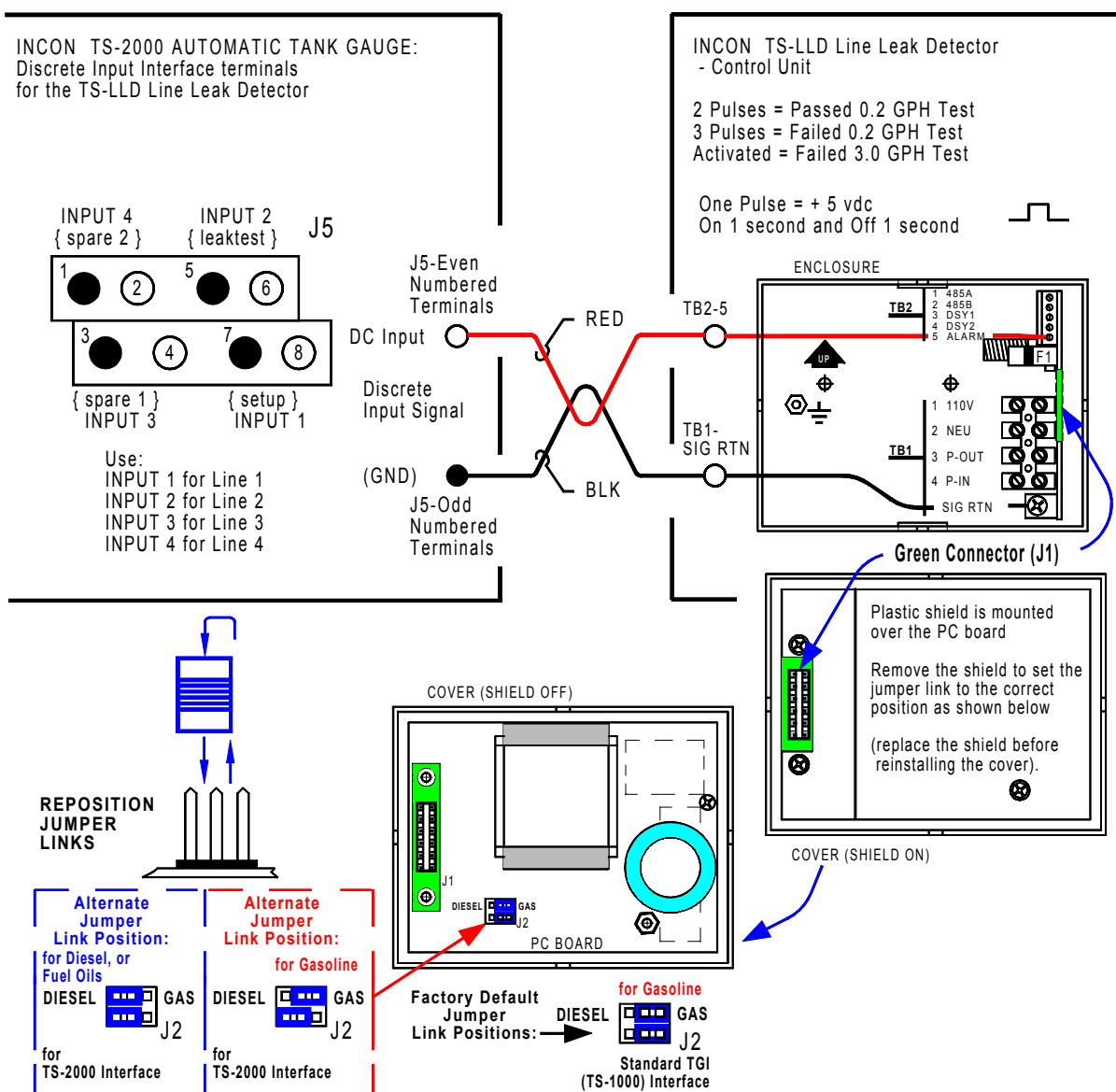


Figure 2.4-3 TS-2000 – TS-LLD Line Leak Detector Interface

Programming the TS-2000

Alarm Relays

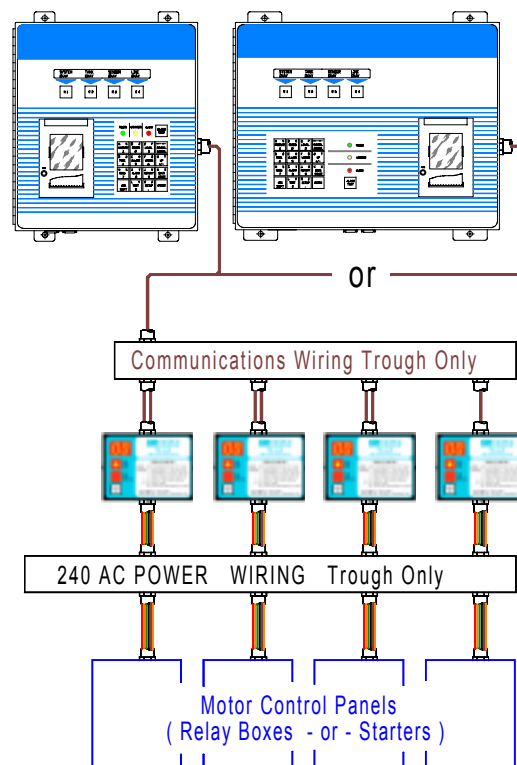
From ALARM RELAYS setup menu, select YES for LN LEAK RY1 to activate the audible alarm inside of the console should a line leak occur. Select YES for LN LEAK RY2 to control an external device that is wired to these contacts.

Alarm Reports

From SYSTEM setup menu, enable Report Alarms to have alarm reports printout automatically at the console report printer. As with the TS-1000, Line Test Reports and Line Test History Reports can be printed using the report key (see previous page for examples).

TS-1001 / TS-2001 LLDI Interface

The Line Leak Detector Interface to these console uses a 4 conductor, 22 AWG, communications grade cable for the RS-485 protocol. See **Figures 2.4-4** and **2.4-5** for additional details.



See the TS-1001 / TS-2001 Setup Programming Guide (P/N 000-1053) for programming details and available reports.

Many line-related reports can be printed at the console by using the report key. See the TS-1001 / TS-2001 Sample Reports Document (P/N 000-1394) for Line – Test, Diagnostic, and History Reports. Also, in the sample reports document, see Line Alarm Reports for active line alarms, cleared line alarms, or line alarm history reports.

Figure 2.4-4 TS-1001 / TS-2001 LLDI Typical Connecting Hardware Layout

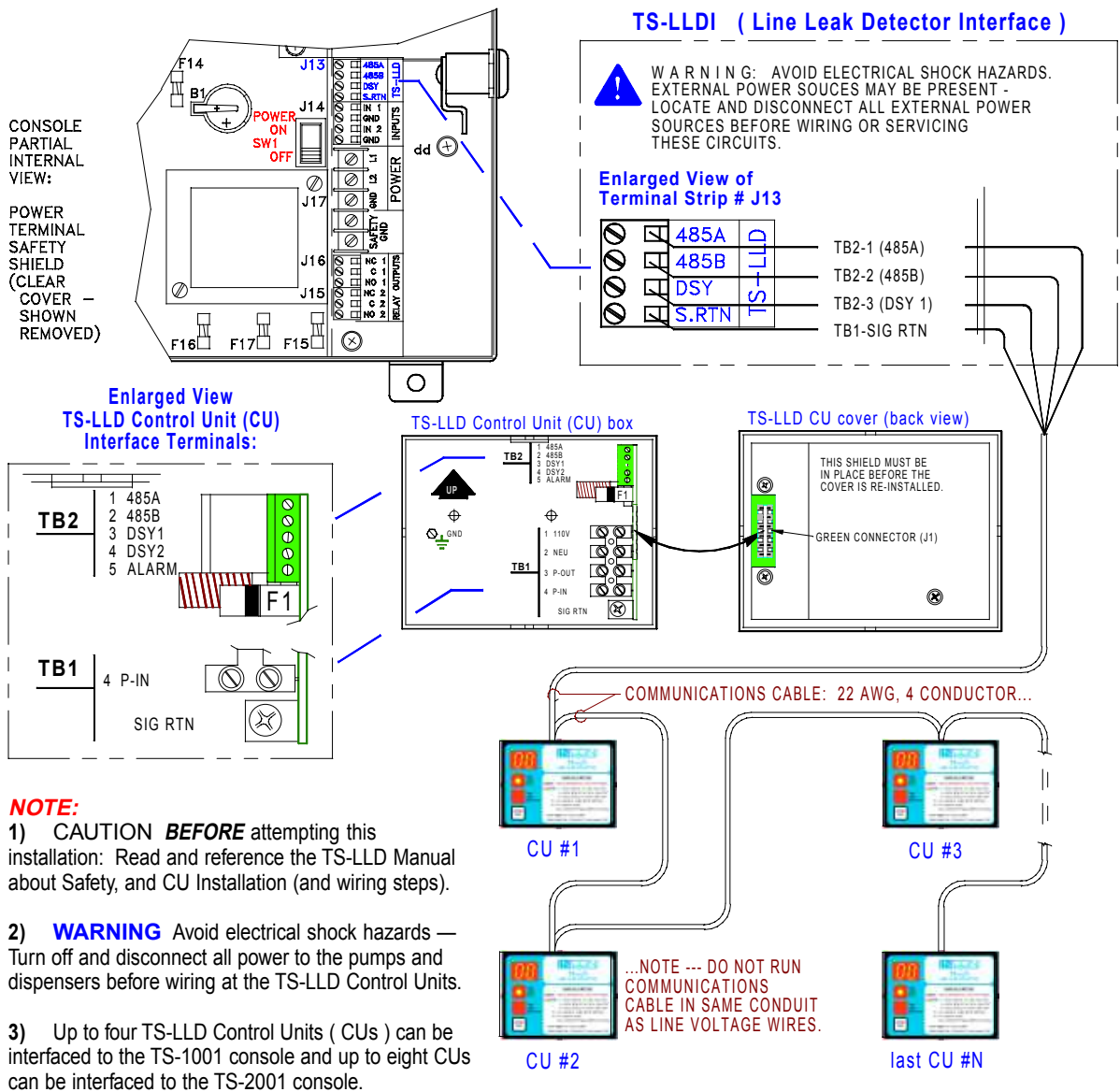
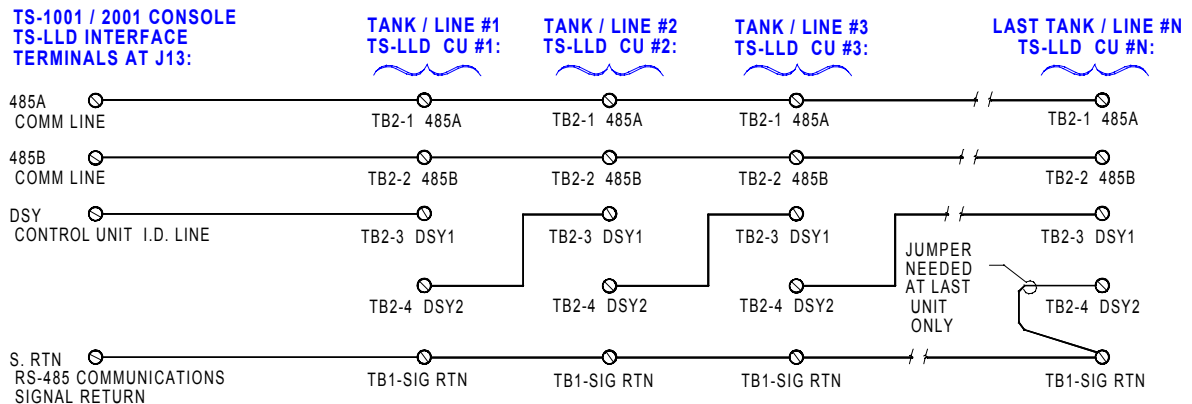
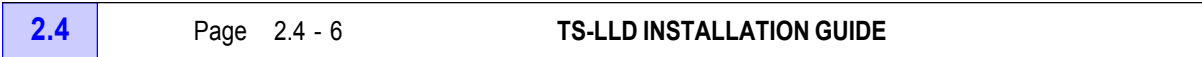


Figure 2.4-5 TS-1001 / TS-2001 LLDI Wiring Diagram

This image shows a full-page view of a blank sheet of white paper designed for taking notes. At the top center, there is a header section defined by two short horizontal black lines, one above and one below the text "— Your Notes —". Below this header, the rest of the page is filled with evenly spaced, horizontal blue lines, providing ample space for writing.



After Installation – Steps & Testing

Contents:

- After Installation Steps / Testing
- Important Warranty Information
- Important Customer Documentation

After Installation Steps & Testing (follow steps in order):

- 1) Make sure that all wiring is checked – completed – and correct, that all electrical box covers are reinstalled, and that all personnel are clear. Surround the LSU and 1/4 inch pipe plug fittings with absorbent. Remove safety tags and lockouts from the submersible pump circuit breakers at the electrical panel and then reapply power (turn the circuit breakers on).
- 2) **Immediately after a power-up**, the control unit will display several numbers for a few seconds. **Verify that the following is displayed:**
 - nn (2 digit software version number [**Ver #**] of the CU ...after any power-up),
 - NN (2 digit **Ver #** of the LSU ...after second and subsequent power-ups),
 - DD (the total number of days since the last 0.2 monthly leak test passed. This will show the current day count or a 00 for new installations).
- 3) **Verify that the Line Leak Test light is on.** The system should automatically start a 0.2 gph line leak test after power-up, or whenever the day count changes at the display. *The submersible pump is turned on at various times during a test to keep the line pressurized.* See Chapter 3 for operation and testing.
- 4) **Verify that the Line Leak Detector, and the 1/4 inch NPT pipe plug** (at the Tank Test port) **are not leaking product** around these threads. If there is a leak, then:
 - a) Power down (turn off and lockout all power again) — see Chapter 2.1
 - b) Clean the pump housing with absorbent rags
 - c) Retighten the pipe plug / the line leak detector again. Follow the installation steps and diagrams shown in Chapter 2.2 in reverse (from Step # 11 to Step # 5), and then forward again (from Step # 5).
 - d) Repeat steps 1) through 4 c) above until the pump housing is free of leaks. Remove the absorbent and properly dispose of these materials.



CAUTION Avoid damaging the MI Cable – loosen the compression fitting, disconnect and straighten the MI Cable before tightening/loosening the LSU.

After Installation Steps (continued...)

- 5) Push the control unit RESET - TEST button momentarily to test the system operation. **Verify that the:**
 - a) Line Leak Test light goes out when the RESET - TEST button is pushed
 - b) An 88 is displayed while the button is held down (indicating that the system is okay, and that all display segments are okay).

Do not hold the TEST push-button down longer than four seconds, otherwise a 0.1 gph manual (annual precision) line leak test will start.
- 6) **Recommended** – dispense a small amount of product (a gallon or so) from each dispenser to remove air that may be trapped in line during installation or service.
Note that air trapped in the line may initially cause false alarms.
- 7) **Verify that leak tests run and finish** (Line Leak Test light turns on about 30 seconds after a dispense and indicates that automatic 3 gph and 0.2 gph line leak tests are running). The Line Leak Test light will go out when these tests finish (15 minutes to 4 hours later if dispensing is prevented.. 1 hour is typical). Note: the light will also go out when a test is aborted (by pushing RESET-TEST), or when a dispense occurs.
- 8) **Follow-up** with the Customer within 30 days and ask for a display reading. If the days are counting up instruct them to leave the pump breakers on 24 hours a day (so tests can finish during quiet times / after normal business hours).

Important — Warranty Registration

After installation, completely fill-out the postage-paid Warranty Registration Card. Have the customer / owner / manager sign this card give a copy to him. Finally, fax a copy or mail the original card back to INCON. Please make certain that you fill out the CU & LSU serial numbers.

Important — Customer Documentation

- ☐ **Leave** a copy of the completed Warranty Registration card with the customer.
- ☐ **Leave** copies of the **TS-LLD Quick Reference Guide** with the customer (**INCON** P/N 000-1447 — latest revision). *One is supplied with each TS-LLD system.*
- ☐ **Provide** the name(s), phone number(s) of the local Inspection Agency and other applicable information, instructions and regulations should a line leak be detected.
- ☐ **Provide** the name(s) and phone number(s) of the local Distributor and Service provider for the future use and reference by the customer.



Contents:

- System Operation
- Normal Displays (Day Counts, Diagnostic Codes)
- Fault displays (Test fails, Monthly Compliance Warnings)
- Indicator lights, RESET-TEST button USE
- Starting a 0.1 Manual Precision Leak Test
- Normal Operation (Sequence of Events)
- Out of Compliance (Dispensing Disabled)
- Frequently Asked Questions
- What to do: When a Leak Test Fails ? (Leak is Detected)

System Operation

The TS-LLD system can perform three different **pressurized line leak tests**, two of which run automatically. The automatic line leak tests are: a *gross 3.0 gph* hourly test, and a *standard 0.2 gph* monthly-compliance test. The third test is a *precision 0.1 gph* annual test that must be started manually at the control unit... the 0.1 annual test is also known as a *manual test*.

A **Quick Reference Guide** is provided with every TS-LLD system. It was designed specifically for use by your customer at his station. Inform your customer to keep a log of all alarm and error codes. This log could be FAXed to you and would prove to be very useful diagnostic tool. **Distributors and Installers:** you may order more guides by contacting **INCON** and asking for part number 000-1447 or for 000-1482, which is a color-laminated version. Certain restrictions may apply.



Need Help ?

Call INCON Technical Service @ 1-800-984-6266 (or FAX: 1-207-282-9002) for help with leak alarms, or diagnostic codes. Also, please call if alarms, warnings, or error codes occur frequently or repeatedly.



DANGER This line leak detector may start the pump at any time during a line leak test to maintain fuel line pressurize. **Avoid Fire, Explosion hazards, and Electrical shock hazards...** make sure that all dispenser and submersible pump power is turned off / locked out before attempting any service (such as: replacing fuel line filters). **Inspect the copper Mineral Insulated Cable (MI Cable)** at the Leak Sensing Unit for damage, kinks, or breakage. Make sure to do this after any installation or service is done in the containment sump / pump head and **BEFORE** power is applied. See Chapter. Section 2.2 in this manual about installation and inspection. **Never apply power if the MI Cable is damaged !**

CU Component Location & Function

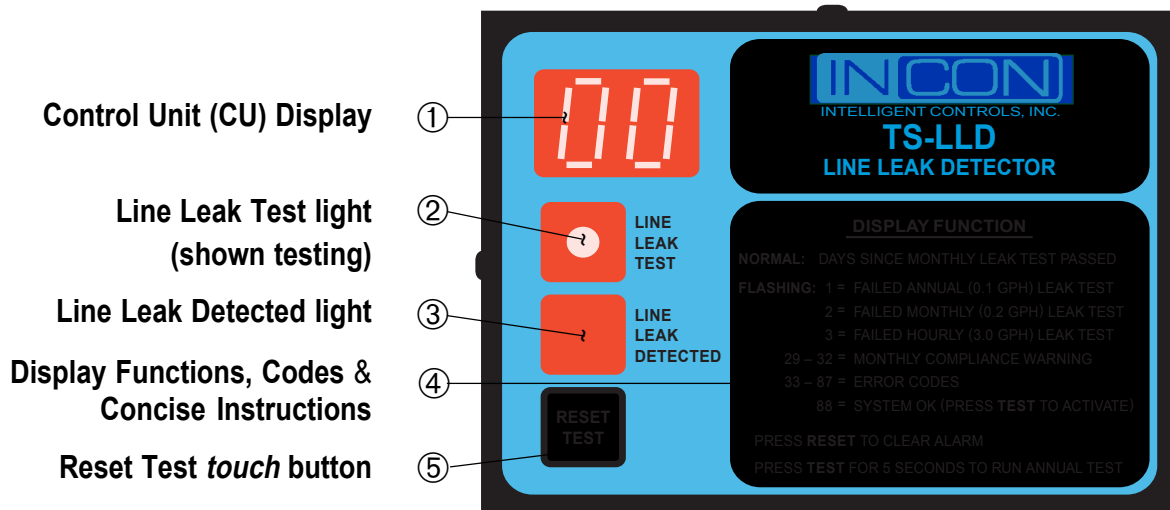


Figure 3-1: Control Unit Cover – Component Location

Control Unit Display ①

The 2-digit, 7 segment LED will display: day-counts, RESET-TEST touch-button diagnostic codes, and *possibly Diagnostic Codes Between 0.2 Gph Test-cycles* when the system is operating normally. The display will also rapidly flash: line leak detected / test-fail alarm codes, monthly-compliance warning codes, or error codes when faults occur.

Normal Displays (on steady / solid)

Day Counts

Ordinarily, the display shows **the total number of days since the last 0.2 gph monthly-compliance test passed**. The *day count* is on steady (not flashing) and advances one day for every 24 hours that a monthly test does not finish with a passed result. The normal display range is from 00 (zero days) to 28 days, i.e.

00 = zero days (a 0.2 gph test has passed within the last 24 hours), up to
28 = twenty eight days have elapsed since the last monthly-compliance test passed (also see Monthly-Compliance Warning which begins on Day # 29)

Fault Displays (rapidly Flashing – twice per second)

Alarms, Warnings, and Error codes, ranging from 80 to 85, are displayed when the following conditions occur. *See Chapter 6.1 & 6.2 about Error Codes*

a. Line Leak Test Failure – Flashing Leak Alarm Codes

Identifies the minimum leak rate detected (in gallons per hour)

- 1** 0.1 gph line leak was detected (annual precision test failed)
- 2** 0.2 gph line leak was detected (monthly compliance test failed)
- 3** 3 gph line leak was detected (hourly gross leak test failed)

When a Leak Test Fails / Line Leak is Detected:

- 1) The display flashes one of the single-digit Line Leak test-fail Alarm Codes
- 2) Dispensing is disabled for that line / product, pump is turned off (can be reset)
- 3) The Line Leak Detected light flashes continuously and keeps flashing until another test of equal or greater precision passes... this light cannot be reset or turned-off
- 4) The leak test fail / line leak alarm can be printed out or faxed **if** the LLD has been *optionally* interfaced with an INCON ATG

b. Monthly-Compliance Warning – Flashing Day Codes

A 0.2 gph monthly-compliance test still hasn't passed. Up to four flashing warning codes can be displayed when the line is nearly out of compliance with State and Local regulations (a 0.2 gph test must pass each month).

- 29** produced on Day number 29 (first monthly-compliance warning)
- 30** produced on Day number 30 (second warning)
- 31** produced on Day number 31 (third warning)
- 32** produced on Day number 32 (**fourth and last warning**)

On day 33 a Flashing 84 Error-Code is produced, which causes a hard shutdown that can't be overridden by a reset... no further dispensing is allowed until a 0.2 gph test passes (see **Out of Compliance** later in this Chapter).

Indications:

- 1) A flashing **Monthly-Compliance Day Code Warning** is displayed (see b. above)
- 2) Dispensing stops but can resume if the Reset Test button is pushed (permits up to 24 hours of additional dispensing or until the day-count changes to the next day)

Recommendation:

Prevent dispensing and let the test finish. The monthly compliance warning may indicate a malfunction within the system and may require a service call to the site.

c. Flashing Display Error Codes

The following error codes may occur... see Chapter 6.1 & 6.2 for more details.

- 80** A dispense occurred during a manual Annual Leak Test
- 81** A component failed within the LSU
- 82** A leak test pass or fail could not be determined (result = indeterminate)
- 83** The LSU is not communicating with the CU
- 84** The line is out of compliance (a monthly compliance test has not passed in the last 33 days)... no dispensing is allowed until a monthly test passes.
- 85** LSU screen / flow tube is blocked and requires cleaning

CU Component Location & Function (Continued...)

Line Leak Test light ②

Turns on when any line leak test starts and stays on during the entire test. The light only turns off when:

- 1) a test finishes
- 2) a dispense occurs
- 3) the Reset Test button is pushed

Line Leak Detected light ③

Flashes on and off continuously when a line leak test fails. This light will continue to flash until another test – of equal or greater precision – finally passes.

Display Functions, Codes & Concise Instructions ④

RESET TEST touch button ⑤... press to:

- **Abort, Stop, or Cancel any line leak test** (the Line Leak Test light ② will also turn off when the RESET TEST is pushed)
- **Clear any flashing Error codes and Enable product dispensing** (except the Flashing 83 or 84 Error codes)... error codes will reappear if the problem remains
- **Reset and restart automatic line leak testing** (the leak detected light ③ cannot be reset if a leak was detected)... *Automatic Line Leak Tests resume after product is dispensed.*
- **Perform a Self-Test** (one push displays an **88**) see Chapter - Section 6.1
- **Display diagnostic codes** (see Chapter - Section 6.1)
- **Start a manual, 0.1 gph annual precision line leak test**

NOTE



Display Diagnostic Test Codes:

See Chapter - Section 6.1 for directions about Diagnostic Display Test Codes

Starting a Manual 0.1 gph Precision Leak Test

Requirements:

NOTE



Prevent dispensing / bag dispenser during this time. The manual test needs 4 hours of **quiet-time** **BEFORE** it is started, and takes about 13 minutes to finish.

Definition: **quiet-time** is the inactive period –**between**– product dispensing



A Flashing 80 Error code will be produced, and dispensing inhibited, if a dispense is attempted when an annual test is running. This error can be cleared by pushing the RESET-TEST touch button.

How to Start a Manual Test

Press and hold the RESET-TEST touch button down more than 5 seconds until the Line Leak Test light ② turns on. Do not hold the reset-test button down longer than 4 seconds unless a manual test is desired.

Normal Operation – Sequence of Events / Steps

1.) *Product Dispense – Begin (dispenser: nozzle out / lever up / switch on)*

- a) Aborts / Cancels / Stops any line leak test that is running, and turns off the Line Leak Test light ② — or —
- b) Perform a functional self-check and allow product dispensing IF okay — or —
- c) Prevent dispensing (turn the pump off) IF an error or fault was detected

2.) *Product Dispense – End (dispenser: nozzle in / lever down / switch off)*

After a short delay the 3.0 gph line leak test starts.

3.) *The 3.0 gph Gross Hourly Test*

Starts automatically — **after** every dispense and **before** a 0.2 gph test, or **before** a 0.1 gph test.

- a) The 3.0 gph hourly test takes about 3 minutes of quiet-time to finish
- b) The Line Leak Test light ② stays on throughout this test
- c) The process will begin again from **Step 1.) when Product is Dispensed**

4.) *The 0.2 gph Monthly-Compliance Test*

- a) Requires from 13 minutes – to – 4 hours of uninterrupted **quiet-time** to finish



The total time required to complete the monthly test depends on the specific conditions at the site and within the line. Tests finish rather quickly when an obvious pass or fail condition exists. Tests times are lengthened when a more detailed analysis is required.

- b) The 0.2 gph test is made up of one or more, 13-minute test-cycles.)
- c) The Line Leak Test light ② stays on throughout the entire test

Normal Operation – Sequence of Events / Steps (Continued...)

A 0.2 gph Test Automatically Starts:

- 1) when the system is powered up (as is the case in new installations, the CU attempts 0.2 gph leak tests until one finally passes).
- 2) when a 3 gph leak test passes (after a dispense) **unless** another 0.2 gph test has passed within the last 24 hours (when this happens: the day-count is reset and displays a 00, and the Line Leak Test light only turns on for about 3 minutes — during 3 gph leak tests)
- 3) when the display advances to the next day (the CU waits 24 hours before starting another monthly-compliance test)
- 4) when a line is **Out-of-Compliance**

Out of Compliance

If a 0.2 gph Monthly-Compliance line leak test does not pass by day 33, then the line will be **Out of Compliance**. Three things happen when a line is Out of Compliance. These are:

- 1) a Flashing 84 error code is displayed,
- 2) the Line Leak Test light turns on because a 0.2 gph monthly compliance test is automatically started, and
- 3) product dispensing is disabled (stopped / shutdown).

None of these events can be stopped, reversed, or reset. The monthly leak test must pass (and be in Compliance) before product can be dispensed again. This test should finish in about 1 hour and reset the day count to 00 and turn the Line Leak Test light off. See the Troubleshooting Guide in Chapter 6.2 of this manual about flashing 84 alarm error codes if this test does not finish.

Frequently Asked Questions

Why do Days Count Up ?

A monthly-compliance test has not passed. This can be caused by very frequent dispensing (the **quiet-time** between product dispensing is too short for the test to finish). This may happen in very busy stations or when the pump power is turned off after business hours. Also see Chapter 6.2 in this manual.

Why do Error Codes 29, 30, 31, or 32 Appear ?

See Monthly Compliance Warnings and Why Days Count Up earlier in this Chapter.

How do I Display the Last Alarm or Error Code ?

See how to **Display Diagnostic Test Codes in Chapter 6.1** by using the RESET TEST touch button

How do I Reset Flashing Error Codes ?

How do I Allow Dispensing ?

How do I Clear Flashing Codes ?

First find out what the Flashing Code represents (Leak Alarm, Error, or Warning). The display ① will rapidly Flash an Alarm or Error Code twice per second when either line leak or error is detected, but only the Line Leak Detected light ③ will rapidly Flash when a line leak alarm occurs. In this Chapter see: How to Verify a Leak — when a leak Alarm is produced, or see using the RESET TEST touch button and its operation.

Why can't I Reset and Dispense ?

See Chapter 6.2, for Alarms, Errors, and Warnings that disable dispensing. *An Error Code 84 cannot be reset because the line is Out of Compliance.* See the **Out of Compliance** discussion earlier in this Chapter.

How do I Verify a Leak ? Does it Exist ? or was it a False Alarm ?

See Chapter 4 about Line Leak Detection, and this Chapter about using the RESET TEST button. Remember that the Line Leak Detected Light ③ will continue to flash on and off until another test, of equal or greater precision finally does pass.

Visually inspect the sump and dispenser areas whenever the TS-LLD reports a leak !

Continued next page...

Frequently Asked Questions (Continued...)

How do I Start a Manual Test ?

See this Chapter about using the RESET-TEST button to Start a 0.1 gph Annual Precision Leak Test (also see the test Requirements before you start it).

How Often Should the Manual Test be Run ?

See Chapter 4 about Line Leak Detection and INCONs recommended frequency (the manual test cannot be started when a flashing 84 error code is displayed).

What Should I Do:

When a 3 gph Leak Test Fails / Gross Leak is Detected ?

The display shows a flashing **3** Alarm code — ***immediately follow the instructions in Chapter 4 !***

When a 0.2 gph Leak Test Fails / Leak is Detected ?

The display shows a flashing **2** Alarm code — ***follow the instructions in Chapter 4***

When a 0.1 gph Annual Precision Leak Test Fails / Leak is Detected ?

The display shows a flashing **1** Alarm code — ***follow the instructions in Chapter 4***

Visually inspect the sump and dispenser areas whenever the TS-LLD reports a leak !



Contents:

- When a Line Leak is Detected
- Steps to take When a Line Leak is Detected
- How Often Should a Manual 0.1 gph Test be Run ?
- Need Help (with line test failures) ?

When a Line Leak is Detected

The TS-LLD line leak detection system: disables the Submerged Turbine Pump, flashes the Line Leak Detected light, and displays a flashing test-fail Alarm code when a line leak test fails.



CAUTION DO NOT excavate and repair a fuel-line solely on the basis of a single alarm. Confirm the presence of a leak before attempting any repairs !

**NOTE**

Leak tests occasionally fail when no leaks actually exist because of: product line instability, thermal contractions within the line, or pump / vapor recovery system malfunction. Air trapped within the line may also cause false leak alarms (this is especially true after new installations / maintenance / service). See Chapter 2.4... has product been dispensed after installation or service ? When was the last maintenance / service done ?

Steps to take When a Line Leak is Detected:

- 1) **Identify what type of leak was detected... Flashing** test-failed Alarm codes:
3 = 3 gph leak = hourly test failed (gross / large leak)
2 = 0.2 gph leak = monthly-compliance test failed
1 = precision 0.1 gph leak = annual / manual test failed
- 2) **Stop / Prevent dispensing** (*bag or tape poly over dispenser and dispense lever*).
- 3) **Inspect** the piping system, dispenser, fittings, and hoses **for obvious leaks**. Open the dispenser enclosure, and inspect the fittings and fuel filter for leaks (*especially if maintenance or service was done recently*).
- 4) **If no leaks are found** during inspection, then **start another leak test to verify the previous failure** (*The Line Leak Detected light will keep flashing and will not turn off until another test of equal or greater precision passes*).

Start another test (*same type that originally failed as identified in step one*)... See Chapter 3 about the requirements of and how to start a 0.1 manual test – **or** – to start automatic 3 gph and 0.2 gph line leak tests: push the Reset Test button to clear a failed test and **simulate a dispense** (see the next page about this).

Step 4 (continued...)

Simulate a dispense by – move the dispense lever up and wait a few seconds after the pump has turned on, and then move the dispense lever down.

- 5) **Prevent dispensing while this test is running** (bag or tape poly over the dispenser and dispense lever)
- 6) **If a leak is found, or if the second line leak test also fails, then:**
 - a) Shut off all power to the affected pump and dispenser & contact INCON Technical service
 - b) Take corrective action in accordance with local, State, and Federal regulations
 - c) **Contact the local inspection agency**, and follow all procedures and instructions as required by State Laws and Regulations.



WARNING When a line leak is detected, it is the station owner's obligation to contact his local inspection agency and comply with the reporting and procedure requirements of local / State / Federal Laws and Regulations. These must be followed explicitly. Serious legal, health and safety hazards could result from not taking the proper action. Where the codes and regulations conflict with this manual, follow the regulations.



NOTE *The site* (station owner, shift manager(s), and personnel) must have access to the **Important — Customer Documentation** as listed in Chapter. Section # 2.4. This data is required for their reference (our valued customer). **TIP** Also keep a copy of this documentation for your future reference.

How Often Should a Manual 0.1 gph Test be Run ?

State and local regulations will dictate the need for and frequency of the 0.1 gph annual test and inspections. Make sure you and **the site** are aware of the issues and requirements for compliance testing and inspections.

Need help ?



Contact **INCON** Technical Service at 1-800-984-6266 (FAX #: 207-282-9002) for help with: a Line Leak Test failure, repeated Line Leak Test failures, or multiple Line Leak Test failures. Also see Chapter 3, for additional information about System Operation & Testing, and Chapter 6.1 & 6.2 for information about Alarm – Error Codes, & Troubleshooting.



Contents:

- Cleaning the Control Unit
- Control Unit Replacement Parts
- Rump Relay Control Box Replacement Parts
- Leak Sensing Unit Replacement Parts
- LSU Removal for Service / Inspection and Cleaning
- After Maintenance or Service D0

NOTE

This chapter contains instructions ranging from routine cleaning to maintenance inspections, replacement instructions, and *maintenance frequency*... **A/R means as required**. Replacement part numbers are shown here as well.

Cleaning the Control Unit

Clean the Control Unit (CU) exterior with a soft sponge or cloth that is **slightly dampened** with a solution of water and mild detergent – *A/R by Customer*



DANGER Fire, Explosion, & Electrical Shock Hazard. Before installing, servicing, or working on this equipment, make sure all submersible pump power and pump relay coil / dispenser power is turned off & locked out at the electrical panel. Prevent automatic or unauthorized pump start-ups, spills from pressurized lines, and electrical shocks. See Chapter 2.1 and follow all Safety advise.

Control Unit Replacement Parts

Items	Frequency = A/R	Replacement Part Numbers
a) Fuse F1		P/N = 430-0010
b) Terminal Board		P/N = 010-0072
c) Replacement cover faceplate (with new Software)		P/N = TS-FPU
d) Entire Control Unit	US.....	P/N = TS-CU
	Canadian	P/N = TS-CU/C

*Are the CU box label and cover label correctly marked with the product and line #?
Are the jumper links behind the cover (at J2) correctly configured ? Reference Chapter 2.3 for product & jumper link configuration(s).*

Pump Relay Control Box Replacement Parts

Items	Frequency = A/R	Replacement Part Numbers
Line Filter Capacitor @ Pump Relay (Motor Control) Box		P/N = 020-0028

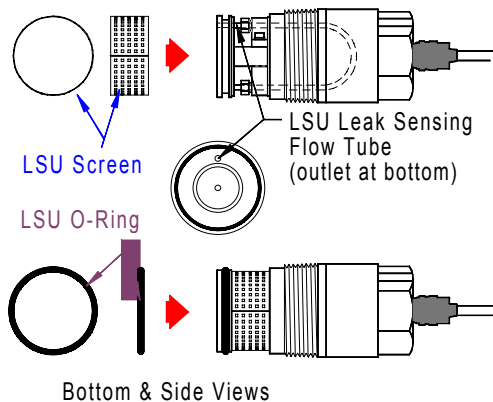
Leak Sensing Unit (LSU) Adapters & Replacement Parts

Items	Frequency = A/R	Replacement Part Numbers
a) M I Cable Adapter 2 inch NPT		P/N = TS-RJ
b) M I Cable Adapter 3 inch Straight Thread		P/N = TS-FE
c) Leak Sensing Unit USA		P/N = TS-LSU
d) Leak Sensing Unit Canadian		P/N = TS-LSU/C
e) Leak Sensing Unit Screen		P/N = 270-0002
f) Leak Sensing Unit O-Ring		P/N = 250-0048

LSU Removal for Service / Inspection and Cleaning

The LSU is removed or replaced whenever the following service steps are done.
Review Chapters 2.0 through 2.2 before removing or replacing a LSU.

- 1) With all pump power off and line-pressure relieved: follow the installation steps & diagrams shown in Chapter 2.2 **in reverse order** to remove the LSU.
- 2) Carefully straighten the M I Cable enough to provide clearance from other components while the LSU is being unscrewed (removed) from the pump.



- 3) Clean the LSU **Screen** and Flow Tubewhen a flashing 85 Error Code is displayed at the CU – replace the **Screen** as required
- 4) Inspect LSU O-Ringwhen the LSU screen is cleaned – replace **O-Ring** as required. *The LSU **O-Rings** are made from a special material that are UL rated – use no substitutes. Install only genuine INCON LSU **O-Rings**. (Also see Appendix A about Applicable Liquid Products.)*
- 5) Reinstall / Install the Leak Sensing Unit per steps shown in Chapter 2.2

- 6) Inspect the M I Cable at the LSU for damage, kinks, sharp bends, and breaks **before reapplying power**whenver the containment sump has been accessedand **after** all maintenance or service of the Submerged Turbine Pump or other related components (such as the piping system).
- 7) Replace the LSU per Chapter 2.2 – **before power-up**whenver the M I Cable has been damaged, or when the LSU has malfunctioned / become inoperable.

After Maintenance or Service DO –

Make sure that the system is operating properly ! See Chapters 2.4 and 3 for information about System Operation and Testing, and Chapters 6.1 & 6.2 for about Error Codes & Troubleshooting.



Contents:

- Where to Find Help
- Service
- Factory Support
- Phone & Fax numbers
- INCON Office Hours:
- Before calling INCON:
- Return Shipments
- Warranty Registration Card (blank... can be copied, filled-in the copy and FAX back to INCON)

Where to Find Help

Chapter 6 is divided into four problem solving sections for your reference. These are:

Service and Factory Support	Section 6.0
Alarms and Error Codes	Section 6.1
Trouble Shooting Guide	Section 6.2
Warranty	Section 6.3

Refer to the Table of Contents and Figures in this manual to find where other helpful information is located.

A **Quick Reference Guide** is provided with every TS-LLD system. It was specifically designed for use by your customer at his station. He has been instructed to keep a log of all alarm and error codes. This log could be FAXed to you and would prove to be very useful diagnostic tool. **Distributors and Installers:** you may order more guides by contacting **INCON** and asking for part number 000-1447. Certain restrictions may apply.

Service

NOTE

Only authorized service technicians / organizations are permitted to install and work on this equipment. Contact INCON for authorized service technicians in your area.

Continued next page...

Factory Support



Need Help ? Call INCON Technical Service for help with leak alarms, or diagnostic codes. Also, please call if alarms, warnings, or error codes occur frequently or repeatedly.

Phone & Fax numbers:

Sales

Phone: (800) 872-3455

Fax: (207) 283-0158

E-mail:

sales@intelcon.com

Technical Service

**** Phone: (800) 984-6266**

Fax: (207) 282-9002

tech@intelcon.com

**** Technical Service Help is available 24 hours a day**

INCON Office Hours:

8 a.m. to 5 p.m. EST Monday through Friday

Before calling INCON:

- Have the CU or LSU Serial Numbers on hand for units you're having trouble with.
- The TS-LLD Warranty Registration Card should have this information (it should have been filled-out completely and mailed or FAXed back to INCON after installation). **NOTE:** The example Warranty Registration card on the next page can be copied and used for FAX in registration.

Return Shipments

If it should become necessary to return the LSU or CU to INCON please use the original packaging materials if possible. Return shipping damage due to inadequate or inappropriate packaging is your responsibility. Make sure the return-goods *shipment* is insured.

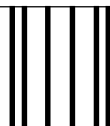
Before returning anything to INCON, you must first obtain a Return Material Authorization (RMA) number. Shipments of returned equipment, which have not been authorized, will be returned freight collect.

Call **INCON** Technical Service Department from the site for RMA numbers. Our personnel will give you the correct shipping address, and provide other details and instructions that you will need when you call for the RMA number.

FRONT SIDE



ENVIRONMENTAL CONTROLS DIV.
SACO MAINE USA



NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL

FIRST-CLASS PERMIT NO. 12 SACO ME

POSTAGE WILL BE PAID BY THE ADDRESSEE

ATTN: TECHNICAL SERVICE
INTELLIGENT CONTROLS INC
PO BOX 638
SACO ME 04072-9962



Warranty Registration Form: (copy, fill-in, & FAX Registration Form back to INCON)

BACK SIDE



INTELLIGENT CONTROLS, INC.

TS-LLD Warranty Registration Form

Telephone No. 1-800-984-6266 ♦ FAX No. 1-207-282-9002 000-1480 REV. C

— Please print, or type —

TS-LLD

Installation Date: _____

Purchased From: _____

Installers Name & Certificate Number: _____

Site Information:

Company Name: _____

Mgr. / Contact Name: _____

Street Address: _____

CU Serial No. _____

Write in, or tape-on
Serial No. labels
◀ here ▶

LSU Serial No. _____

Line # _____ of _____

Dispenser / Manufacturer Type: _____

Functional Element / age: _____

Telephone No. _____

Reg. hours of Operation _____

☐ Are blenders used ? Yes No

Is this an **IST** application ? Yes No

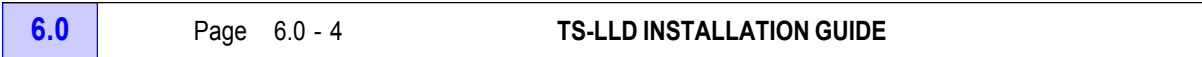
Is this a Big Flo® pump ? Yes No

☐ Product	Turbine Pump Type & HP	Pipe Type	Size	Length
Reg. UL Mid. UL Prem. UL	Red Jacket® _____	Steel	_____	_____
Diesel #2 Fuel Oil Kerosine	FE Petro™ _____	Fiberglass	_____	_____
Other	Other _____	Flexible (& below)	_____	_____
		...manufacturer:		

TS-LLD

Registration activates your warranty — mail, or Fax in today !

This image shows a full-page view of a blank sheet of white paper designed for taking notes. At the top center, there is a header section defined by two short horizontal black lines, one above and one below the text "— Your Notes —". Below this header, the rest of the page is filled with evenly spaced, horizontal blue lines, providing ample space for writing.



6.1

Test Fail Alarms, Warnings & Error Codes

Contents:

- Normal Display Codes (on steady – not flashing)
- Flashing Alarm, Warning, and Error Display Codes
- Diagnostic Display Codes

Display Codes

The following Normal, Alarms, Warnings, and Error Codes are displayed at the control unit at this publication date.

Normal Display Codes (on steady – not flashing)

DISPLAY CODE	DESCRIPTION
00 to 28	Number of Days since a 0.2 gph monthly-compliance leak test passed (00 = zero days, 09 = nine days). The display counts up (advances a day) for every 24 hours that the test has not finished with a passed result.
88	System OK... the control unit electronics and all segments of the 2 digit display are working correctly.

Flashing Display Codes (Alarms, Warnings, and Error Codes)

Flashing Error Codes can occur in range from 80 to 85 only !

DISPLAY CODE	DESCRIPTION
1	Alarm 0.1 gph Annual (manual) Leak Test Failed
2	Alarm 0.2 gph Monthly-Compliance leak test Failed
3	Alarm 3 gph Hourly – gross – leak test Failed
29 – 32	Warning ! <i>the line is almost out of compliance !</i> It has been nn days (represented by the flashing number) since the last 0.2 gph Monthly-Compliance test passed. <i>Also see 84 Error Code.</i>
80	Error Manually started, 0.1 gph Annual precision leak test was aborted... a dispense was attempted while the test was running
81	Error A component failed within the Leak Sensing Unit
82	Error Indeterminate 0.2 gph leak test result — the line was not thermally stable. This error will not disable dispensing and can be viewed when RESET-TEST is pushed 4 times.

Flashing Error Codes (continued...)

Flashing Error Codes can occur in range from 80 to 85 only !

DISPLAY CODE	DESCRIPTION
83	Error Leak Sensing Unit is not communicating with the Control Unit
84	Error The line is Out of Compliance (it has been at least 33 days since the last 0.2 gph Monthly-Compliance test has passed.
85	Error Leak Sensing Unit requires service

Diagnostic Display Codes

*These are obtained by repeatedly pressing the RESET button... **DO NOT** hold the TEST button down longer than 4 seconds, otherwise a manual leak test will start.*

First press:

88	System OK... all 7 segments of the 2 digit display are on and are working correctly when 88 is displayed (88 is solid/not flashing).
----	---

Second press:

XX	Solid or flashing number which represents the average temperature differential of the last 0.2 gph leak test. Record this number for assistance from INCON.
----	--

Third press:

XX	Solid or flashing number for the accumulated power reading of the last 0.2 gph leak test (00 - 99 solid ...solid 99 represents a number from 99 to 149 and flashing 99 represents a number from 150 and above). Record this number for assistance from INCON.
----	--

Fourth press:

XX	Flashing number which represents the last flashing Leak Detected Alarm code or Error code . Record this number for assistance from INCON.
----	--

— Your Notes —

Contents:

- Problem
- Description / Symptoms
- Probable Cause (and Action to Take)

Display Codes

This chapter contains a current listing of Warnings, Alarms, and Error Codes that may be displayed at the control unit. Before attempting any service, maintenance or troubleshooting work on this system, be sure to review and follow all instructions, and heed all cautions and warnings in this manual... see Chapter 5. Also, review all appropriate manufacturers' documentation, and applicable codes.



WARNING Disconnect power sources before troubleshooting and before removing any enclosure cover. Failure to turn power off will create an electrical shock hazard which may cause injury or death !

Abbreviations used in this Chapter:

STP = Submerged Turbine Pumps / Submersible Pumps
 LSU = Leak Sensing Unit
 CU = Control Unit

Problem	Description/Symptom	Probable Cause (Action to take)
No Display	No LED lights on Can't Dispense	Power is off (Check STP Circuit Breakers... are they on ?) CU fuse F1 is open/blown (See Chapter 5 about replacing F1) CU box was wired incorrectly. See Chapter 2.3).
Can't Dispense	Flashing 29, 30, 31 or 32	Monthly-Compliance Warning ! (Push RESET TEST to permit pumping for another day (up to 24 hours)...see Chapter 3.) Days may keep counting up in busy stations where there isn't enough quiet-time between dispensing to finish a monthly test. (Are the turbines turned off after hours ?) (Ask the station to keep the circuit breakers / turbine(s) on so the monthly tests can finish after hours.)

Problem	Description/Symptom	<i>Probable Cause (Action to take)</i>
Can't Dispense False Leak Alarms Multiple Nuisance Alarms	Flashing: 3, 2, or 1 & Leak Detected Light ON	<i>RedJacket Functional Element – bad</i> (check / replace) <i>Vapor Recovery system malfunction</i> (check / repair) <i>Check Valve leaking</i> (check / replace) <i>Air in lines</i> (dispense product after installation to remove air from the lines)
Can't Dispense	Flashing: 3 & Leak Detected Light ON	<i>3 gph (or greater) GROSS Line Leak !... Test Failed</i> (see Chapter 4 about the Steps to take When a Line Leak is detected)
Can't Dispense	Flashing: 2 & Leak Detected Light ON	<i>Monthly 0.2 gph Line Leak / Test Failed</i> (see Chapter 4 about the Steps to take When a Line Leak is detected)
Can't Dispense	Flashing: 1 & Leak Detected Light ON	<i>Annual 0.1 gph Manual Leak Test Failed</i> (see Chapter 4 about the Steps to take When a Line Leak is detected)

NOTE



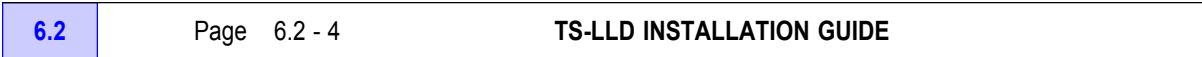
Flashing Alarm Error Codes are limited to a range of 80 to 85 ONLY !

Can't Dispense	Flashing 80 Error Code	<i>A manual 0.1 Annual leak test was aborted by an attempted dispense.</i> (Push RESET to permit pumping when an annual test was unintentionally started – or – Do not hold the RESET TEST button down longer than 4 seconds unless a manual test is intended. Bag the dispenser / prevent dispensing during the test and for 4 hours before starting a Annual leak test ...also see Chapter. 3)
Can't Dispense	Flashing 81 Error Code	<i>LSU internal component failure</i> (Push TEST-RESET to permit dispensing once again. Schedule service at this site.)
Counting Days	Diagnostic Error Code 82 Flashing (when viewed)	<i>A 0.2 monthly leak test aborted because the line was not thermally stable</i> (A test will abort when the test result is indeterminate after 18 cycles... neither a pass or fail result can be determined. The monthly test will start again after another dispense. Call INCON when days count up and when this Diagnostic Error Code is consistently displayed.)

Problem	Description/Symptom	<i>Probable Cause (Action to take)</i>
Can't Dispense	Flashing 83 Error Code	<p><i>No communications between LSU and CU</i></p> <p>(New installations: Check for loose wiring, or wiring errors, or omissions)</p> <p>Previously functioning systems — Press RESET to allow dispensing for another 4 hours and call INCON Tech Service)</p>
Can't Dispense	Flashing 84 Error Code	<p><i>The line is Out-of-Compliance because a Monthly Compliance Test has not passed in the last 33 days)</i></p> <p>(This Error Code cannot be reset by pressing the RESET TEST button — product dispensing is not allowed when Out of Compliance. A new 0.2 gph test automatically starts when this Error is displayed. Prevent dispensing and give the test time to finish { from 13 minutes to 4 hours later }. This may happen in extremely busy stations. Are the turbines turned-off after hours ? Ask the station to keep the circuit breakers / turbines on so tests can finish after hours. Call INCON if the Leak Test does not finish. A valve seat may have failed at the LSU which would cause indeterminate test result (neither pass or fail), and will cause the days to count up.)</p>
Can't Dispense	Flashing 85 Error Code	<p><i>The LSU requires service.</i></p> <p>(Press RESET to allow dispensing for another 4 hours. Schedule service when this error occurs repeatedly.</p> <p>See Chapters about Safety, Installation, Maintenance and Testing and call INCON)</p>

Please call our service department for tips and solutions to other problems not addressed at the time of this publication. Also, call INCON technical service when warnings, alarms, or error codes happen often or repeat often. Also, see Chapter 6.0 before calling INCON.

This image shows a full-page view of a notebook or worksheet. At the top center, there is a header area containing the text "— Your Notes —". Below this header, the page is filled with numerous horizontal blue lines, providing space for writing notes.



Contents:

- TS-LLD Warranty (Terms)
- Warranty Disclaimer and Limitation of Liability
- For Further Information, Contact INCON



Warranty Disclaimer and Limitation of Liability

There are no warranties which extend beyond those expressly set forth in this document. **INCON** disclaims and excludes all implied warranties including without limitation those pertaining to merchantability and fitness for a particular purpose.

INCON expressly disclaims and excludes any liability for consequential or incidental damages for breach of any expressed or implied warranty arising in connection with this product or this manual, including without limitation, purchaser's loss of stored liquids, or damage to the ground, underground or environment, whether arising under theories of tort, negligence, strict liability, contract or otherwise.

After installation, make sure to sign and return the completed Warranty Registration card to INCON. This form validates the express warranty stated here ! (See page 6.0 - 3 for a blank Warranty Registration card that you can copy, fill-in, and FAX-back to INCON.)

Some states do not allow the exclusion or limitation of incidental or consequential damages or a limitation on the duration of implied warranties, so the limitation or exclusion may not apply to you. This warranty gives you specific legal rights. You may also have other rights which vary from state to state.

Technical Service Department at:

INCON
PO BOX 638
SACO MAINE 04072 USA

Voice: 1-800-984-6266
Fax: 1-207-282-9002
E-mail: tech@intelcon.com

— Your Notes —

Appendix A

TS-LLD Technical Specifications

Abbreviations: LSU = Leak Sensing Unit, CU = Control Unit, STP = Submerged Turbine Pump

Operating Specifications

Application

Leak detection monitoring of pressurized underground fuel lines

Applicable Liquid Products

Gasoline

Gasoline / Alcohol Blends (10 % Max.
Ethanol or Methanol),
Gasoline / MTBE Blends (20 % Max. MTBE),
Kerosene, Diesel Fuel, or Fuel Oil

Leak Detection Tests

3 gph and 0.2 gph (automatic tests), and
0.1 gph (manual test)

Safety and Mounting Location (LSUs)

Explosion Proof brass housing for installation in Class I, Division 1, Group D hazardous locations. LSU is mounted at the STP housing (above Underground Storage Tank)

Operating Pressure (LSU)

50 psig maximum running pressure

Allowable Pipe Type and Length

(Per 3rd Party Test Qualifications):

Type	Max. Volume	Max. Length
2 inch Flex	49.6 (gallons)	540 (feet)
2 " ID Steel or Fib	163	1000
3 " ID Steel or Fib	163	443
3 3/8 " ID Steel or Fib	163	350

Electrical Specifications

Power Supply (Frequency: 60 Hz)

120 VAC (CU) – from pump control relay box
208 to 240 VAC (LSU) – single phase from
STP power lines

Power Consumption

40 Watts maximum (both CU and LSU)

Current Overload Protection

500 Milliamps at: 100 VAC & 120 VAC (CU)
2 Amps at: 240 VAC (LSU)

Alarm Output: Open Collector (TB2-5)

Voltage Rating

+5 VDC (internal 270 ohm resistor tied
to internal +5 VDC supply)

Current Rating

60 Milliampères (resistive loads)

Communications Distance

1000 feet maximum distance (between the
Control Unit and the Leak Sensing Unit).

RS 485 Communications Protocol

(TB2: terminals 1-4)

22 – 28 AWG, 4 wire communications cable,
1000 feet maximum distance (between a
Control Unit and a Tank Sentinel console).



NOTE	ID	=	Internal Diameter
	Flex	=	Flexible pipe
	Steel	=	Rigid pipe
	Fib	=	Fiberglass

Appendix A

TS-LLD Technical Specifications

Abbreviations: LSU = Leak Sensing Unit, CU = Control Unit, STP = Submerged Turbine Pump

Environmental Specifications

Operating Temperature

32° to 121° F (0° to 40° C) CU
0° to 121° F (-17° to 40° C) LSU

Storage Temperature

- 40° to 150° F (- 40° to 65° C)

Operating Humidity (CU)

0 to 95% non-condensing

Splash Resistance (CU)

Not to be exposed to direct spray, splash,
or drips.

Cleaning — See Chapter 5

Mounting Location (CU)

Dry indoor location (near the pump relay /
motor control box)



WARNING The TS-LLD control unit must be mounted indoors where explosive or flammable vapors are not present, otherwise, an explosion hazard will be created which can result in property damage, injury, or death.

Mechanical Specifications

Display — Type:

Alphanumeric LED (Light Emitting Diode)

— Size:

1 Line, 2 Digit, 7 Segment (0.54 inches high)

Dimensions (overall in inches)

3.35 x 4.35 x 2.25 (H x W x D [Depth]) CU
23.5 x 2.4 (H x D [Diameter]) LSU

Safety Approvals and Listings

Model TS-LLD USA



6L79
LISTED
Electronic Line Leak
Detector

Model TS-LLD/C Canada



6L79
LISTED
Electronic Line Leak
Detector



Listed
Leak Detection
Equipment
Precision Level 2 and Level 3
ULC/ORD-C107.12



NOTE See Serial Number labels for the Model and Serial numbers



***We'll listen – we promise !
Please complete and return
this form ...Mail or FAX to ►***

Technical Publications Manager
INTELLIGENT CONTROLS INC
74 INDUSTRIAL PARK ROAD
SACO ME 04072 USA

FAX #: 207-286-8414

Your ideas and opinions are important to us ! Please help us improve our products, our service, and our organization... use black ink and print clearly.

Your Name (and Position): _____

Company Name and Street Address: _____

(please – no PO Box numbers) _____

Documentation Provided: _____

Document & Manual Names: _____

Document & Manual Part Numbers: _____

Product: Model and Serial Numbers: _____

Documentation and Manual rating: Installation Date: _____ Today's Date: _____

Please circle (1 = no / poor, 2 = fair, 3 = okay, 4 = good, 5 = yes / excellent, N = don't know)

The documentation is easy to use	1	2	3	4	5	N
Information is easy to find	1	2	3	4	5	N
The Table of Contents is useful to find data	1	2	3	4	5	N
Information is well organized	1	2	3	4	5	N
Information is clear and easy to understand	1	2	3	4	5	N
Information is complete and accurate	1	2	3	4	5	N
The illustrations are clear and easy to follow	1	2	3	4	5	N
The number of illustrations are adequate	1	2	3	4	5	N

Comments & Suggestions ? (please be specific) _____

Sale / Supply Orders:

Please circle (1 = no / poor, 2 = fair, 3 = okay, 4 = good, 5 = yes / excellent, N = don't know)

Your order was processed quickly 1 2 3 4 5 N

You were treated professionally & with respect 1 2 3 4 5 N

You got what you wanted quickly / on time 1 2 3 4 5 N

Sales Suggestions _____

Technical Service / Support

Please circle (1 = no / poor, 2 = fair, 3 = okay, 4 = good, 5 = yes / excellent, N = don't know)

Your call was processed quickly 1 2 3 4 5 N

Help and advice was professional & accurate 1 2 3 4 5 N

You were not kept on hold (for a long time) 1 2 3 4 5 N

Service / Support Suggestions _____

The **INCON** system or product:

Please circle (1 = no / poor, 2 = fair, 3 = okay, 4 = good, 5 = yes / excellent, N = don't know)

Was easy to install / service / expand / update 1 2 3 4 5 N

Was easy to program / setup 1 2 3 4 5 N

Operates well and as expected 1 2 3 4 5 N

Product Comments & Suggestions _____



INTELLIGENT CONTROLS

PO BOX 638 SACO ME 04072

TS-LLD Installation Guide