



Franklin Electric
FUELING SYSTEMS

DIGITAL INVENTORY & LEAK DETECTION PROBES

INSTALL GUIDE

409723001 r6

LEAK DETECTION PROBES

FMP-LL3-XX

FMP-LL3-XXX

INVENTORY PROBES

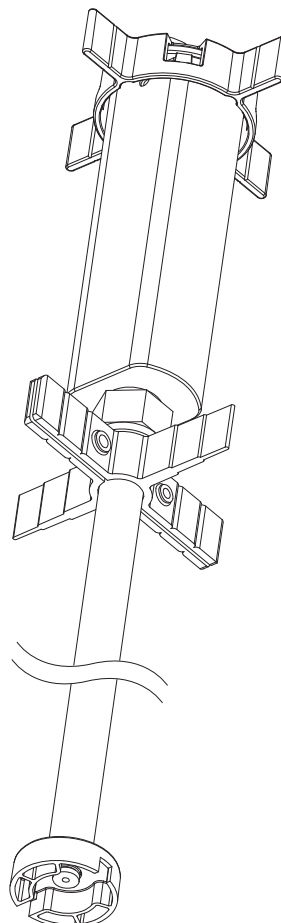
FMP-LL3-XX-I

FMP-LL3-XXX-I

CORROSION CONTROL™

WATER SEPARATOR PROBE KIT

FMP-LL3-18-WS



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Conventions used in this document

This document includes safety precautions and other important information presented in the following format:

NOTE: This provides helpful supplementary information.

IMPORTANT: This provides important supplementary information and instructions to avoid damaging hardware or a potential hazard.

▲ CAUTION: This indicates a potentially hazardous situation that could result in minor or moderate injury if not avoided. This may also be used to alert against unsafe practices.

▲ WARNING: This indicates a potentially hazardous situation that could result in severe injury or death if not avoided.

▲ DANGER: This indicates an imminently hazardous situation that will result in death if not avoided.

Operating precautions

Franklin Electric equipment is designed to be installed in areas where volatile liquids such as gasoline and diesel fuel are present. Working in such a hazardous environment presents a risk of severe injury or death if you do not follow standard industry practices and the instructions in this document. Before working with or installing the equipment covered in this document, or any related equipment, read this entire document, particularly the following precautions:

IMPORTANT: To help prevent spillage from an underground storage tank, make sure the delivery equipment is well-maintained, that there is a proper connection, and that the fill adaptor is tight. Delivery personnel should inspect delivery elbows and hoses for damage and missing parts.

▲ CAUTION: Use only original Franklin Electric parts. Substituting non-Franklin Electric parts could cause the device to fail, which could create a hazardous condition and/or harm the environment.

▲ WARNING: Follow all codes that govern the installation and service of this product and the entire system. Always lock out and tag electrical circuit breakers while installing or servicing this equipment and related equipment. A potentially lethal electrical shock hazard and the possibility of an explosion or fire from a spark can result if the electrical circuit breakers are accidentally turned on while installing or servicing this product. Refer to this document (and documentation for related equipment) for complete installation and safety information.

▲ WARNING: Before entering a containment sump, check for the presence of hydrocarbon vapors. Inhaling these vapors may cause dizziness/unconsciousness, and if ignited, can explode causing serious injury or death. Containment sumps are designed to trap hazardous liquid spills and prevent environmental contamination, so they can accumulate dangerous amounts of hydrocarbon vapors. Check the atmosphere in the sump regularly while work is in process. If vapors reach unsafe levels, exit the sump and ventilate it with fresh air before resuming work. Always have another person standing by for assistance.

▲ WARNING: Follow all federal, state, and local laws governing the installation of this product and its associated systems. When no other regulations apply, follow NFPA codes 30, 30A, and 70 from the National Fire Protection Association. Failure to follow these codes could result in severe injury, death, serious property damage, and/or environmental contamination.

▲ WARNING: Always secure the work area from moving vehicles. The equipment in this document is usually mounted underground, so reduced visibility puts service personnel working on it in danger from moving vehicles that enter the work area. To help prevent this safety hazard, secure the area by using a service truck or other vehicle to block access to the work area.

▲ DANGER: Inspect the installation location for potential ignition sources such as flames, sparks, radio waves, ionizing radiation, and ultrasound sonic waves. If any potential ignition sources are identified, implement proper safety measures.

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1 Introduction

INCON® Digital Inventory & Leak Detection Probes are advanced instruments that use magnetostrictive position measurement technology to accurately report inventory levels in storage tanks. The probes are designed to rest on the bottom of underground storage tanks (USTs) and above ground storage tanks (ASTs) and are supplied with hardware to support this installation.

1.1 Documentation

- This document is intended for qualified and certified installation persons.
- Instructions of this document are in English. All other language versions are translations of this original document.
- Illustrations in this document show a typical setup and are for instruction and description purposes only.
- Information given in this document is given as a guide only. It is the installer's responsibility to ensure that correct and safe procedures are followed at all times.
- This document and related documents are available online from Franklin Electric at www.franklinfueling.com.

1.1.1 Symbol Legend



Wear Protective Headwear



Wear Eye Protection



Wear Protective Clothing



Wear High-Visibility Clothing



Wear Protective Gloves



Wear Safety Footwear



Refer to instruction guide



Ventilate Before & During Entering



Ensure Continuous Ventilation



Connect an earth terminal to the ground



Lockout/Tagout Electrical Equipment



Disconnect main plug from electrical outlet



Disconnect before carrying out maintenance or repair



General Warning



Warning: Electricity



Warning: Flammable Material



No open flame; Fire, open ignition source and smoking prohibited

2 Safety/Security

2.1 General Safety Information

- Only perform procedures in this document that you are qualified and certified to perform.
- Personnel working on or with energized equipment must be authorized by relevant regulatory bodies to carry out such work and must have the appropriate training. Check with your employer and relevant regulatory body's rules for working with energized equipment.
- Obey all local laws, rules, regulations, and instructions in this document. In case of inconsistency or contradiction between information contained in this document and any laws, rules and regulations, obey the stricter of the two.
- Keep unqualified personnel at a safe distance during installation.
- If it is necessary to remove safety/security devices, immediately reinstall the safety/security devices after completing the work.

2.2 Hazard Assessment

Prior to beginning work and prior to recommencing work after leaving and returning to the worksite, a worksite, *pre-job hazard assessment* must be performed to identify safety and environmental needs. At a minimum, this hazard assessment should:

- Identify possible hazards and risks.
- Identify the safety needs of the job.
- Identify the correct procedures, practices and equipment.
- Eliminate unsafe conditions and actions from the worksite.
- Identify the need for personal protective equipment.
- Inspect equipment before use.
- Confirm sheaths of all cables are secured and undamaged.
- Confirm plugs and connectors are properly connected and serviceable.
- Perform ongoing risk assessment during the project.

2.3 Required Personal Protective Equipment (PPEs)

These PPEs are required during all phases of installation.



Wear Protective Clothing



Wear Eye Protection



Wear High-Visibility Clothing



Wear Protective Gloves



Wear Protective Headwear



Wear Safety Footwear

3 Probe Overview

3.1 Types of Probes

- Leak Detection.
- Inventory Control.

3.2 Understanding Probe Specifications

- The probe model number indicates its length.
- The model numbers are in the form FMP-LL3-XXX, where XXX = the tank diameter in inches plus 5".
 - For example, the FMP-LL3-101 is for 8' (2.4 m) tanks as determined by the equation $96" + 5" = 101"$.
- FMP-LL3-XXX, Leak Detection and Inventory probes are available in lengths that are compatible with 2' – 12' (0.6 m – 3.7 m) diameter tanks.
- FMP-LL3-XXX-I, Inventory Specific probes are available in lengths that are compatible with 2' – 12' (0.6 m – 3.7 m) diameter tanks.

3.2.1 Understanding Probe Specifications for DEF

- Reference Table 3.1 and Figure “A”, in determining if a probe is appropriate for the application.
- The model numbers of the probe are in the form FMP-LL3-XXX.
 - XXX = length E (*which is equal to D (D = C + 4") or the next size larger*).
 - Check to see if $(B + 10") + (E - C) < A$.
 - If it is not, the probe is not appropriate for the application and should not be used.
 - For this circumstance, custom length probes may be ordered. Contact Franklin Electric Customer Services for support.

TABLE 3.1

Part Number	Description
FMP-LL3-29-I	2' digital inventory control probe
FMP-LL3-41-I	3' digital inventory control probe
FMP-LL3-53-I	4' digital inventory control probe
FMP-LL3-65-I	5' digital inventory control probe
FMP-LL3-69-I	5' 4" digital inventory control probe
FMP-LL3-77-I	6' digital inventory control probe
FMP-LL3-81-I	6' 4" digital inventory control probe
FMP-LL3-89-I	7' digital inventory control probe
FMP-LL3-101-I	8' digital inventory control probe
FMP-LL3-113-I	9' digital inventory control probe
FMP-LL3-118-I	9' 5" digital inventory control probe
FMP-LL3-120-I	9' 7" digital inventory control probe
FMP-LL3-125-I	10' digital inventory control probe
FMP-LL3-131-I	10' 6" digital inventory control probe
FMP-LL3-137-I	11' digital inventory control probe
FMP-LL3-149-I	12' digital inventory control probe

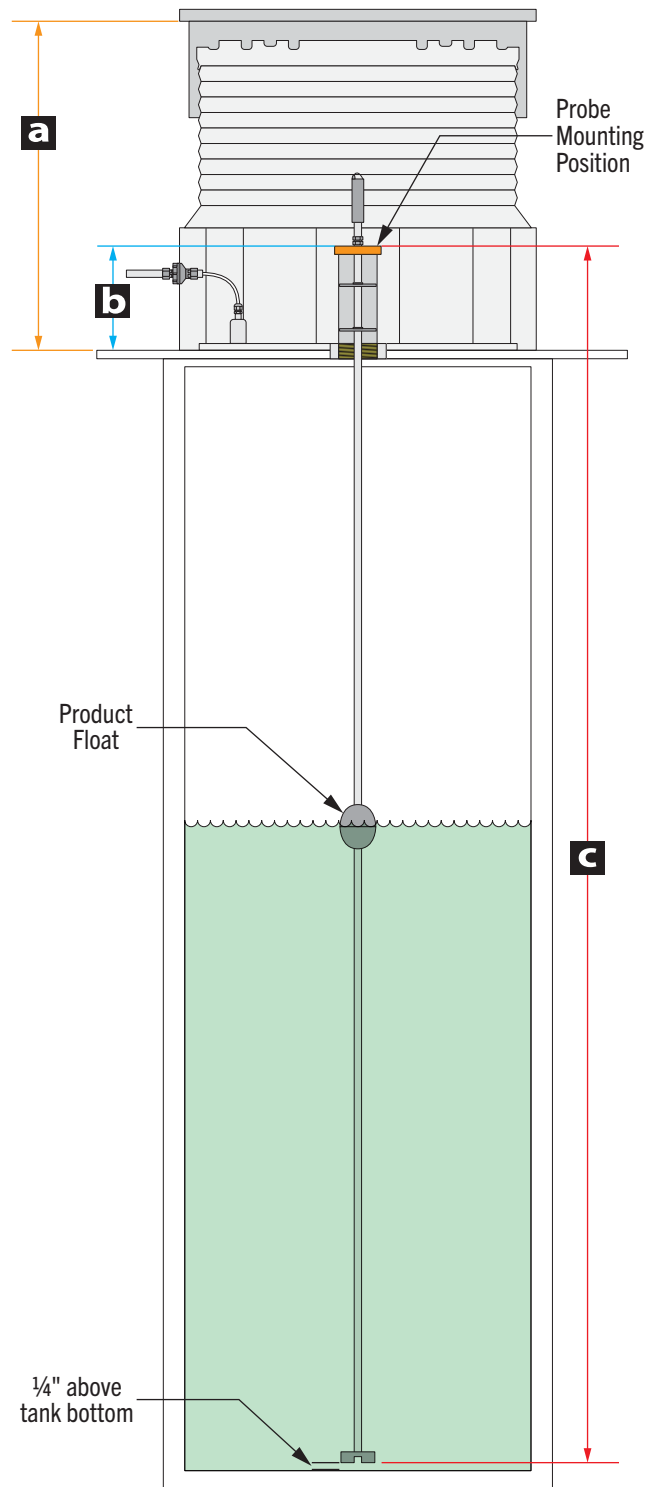


Figure A – DEF Probe Dimensional Variables

3.3 Install & Float Kits

Most float kits include a product and water float. Order one float set for each digital inventory and leak detection probe.

- Product floats are white (clear).
- Gasoline water floats are red.
- Diesel water floats are blue.

TABLE 3.2 – Float Kits

Part Number	Description
FMP-IDF4E	4" (102 mm) low level water float for diesel tanks.
TSP-IDF2	2" (51 mm) float set for diesel tanks.
TSP-IGF2	2" (51 mm) float set for gasoline tanks.
TSP-IDF4	4" (102 mm) float set for diesel tanks.
TSP-IGF4	4" (102 mm) float set for gasoline tanks.
TSP-LPGF	2" (51 mm) float for LPG tanks, with or without isolation sleeve. See document, p/n 000-0251 for more information.
TSP-SSP	2-1/16" (52.4 mm) OD, #316 stainless steel float for chemical applications only.

TABLE 3.3 – Density Float Kits

Part Number	Description and Density range
TSP-IDF4D3	Standard Diesel / fuel oil density float kit 790-900 kg/m ³ .
TSP-IGF4D3	Standard Gasoline density float kit 690-800 kg/m ³ .

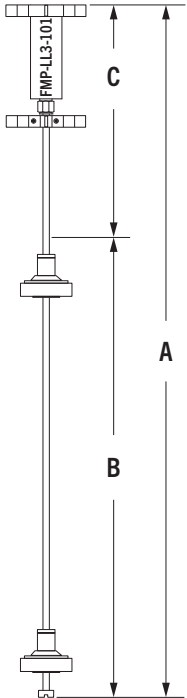
NOTE: Density floats are two-part floats. The inner and outer float are calibrated at manufacture and must be used together. Refer to document, p/n **000-0527** Density Measurement Option Installation Guide, for more information about density float installation.

TABLE 3.4 – Probe Caps and Adapters

Part Number	Description and Density range
TSP-C2A	Inventory Probe 2" Riser Cap and Adaptor.
TSP-C2B	Inventory Probe 2" Riser Cap and Adaptor with BSP threads.
TSP-C4A	Inventory Probe 4" Riser Cap and Adaptor.
TSP-C4B	Inventory Probe 4" Riser Cap and Adaptor with BSP threads.
TSP-K4AS	#316 stainless steel mag probe install kit for 4" riser pipes.

NOTE: A locally supplied riser cap should meet all applicable codes and approvals. The cord grip must be for use with a cable diameter of 0.19 inches (4.8 mm) and must also be compatible with the liquid installed in the tank.

TABLE 3.5 – Example for determining riser pipe length.

	92" (2.3 m) Tank	96" (2.4 m) Tank	Drawing Example
Probe Overall Length (A) (FMP-LL3-101)	+111" (2.8 m)	+111" (2.8 m)	
Tank Diameter (B)	-92" (2.3 m)	-96" (2.4 m)	
Minimum Riser Length (C)	19" (483 mm)	15" (381 mm)	

4

Installation



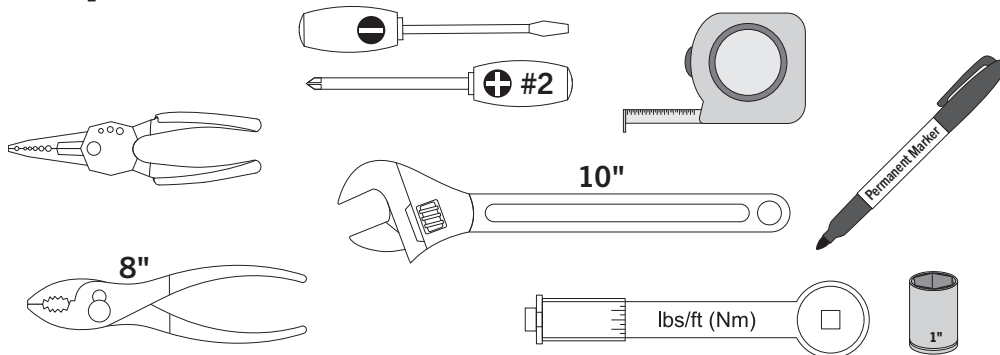
NOTE: When the installation is complete, make sure this guide is left with the service station owner or operator.

4.1 Pre-Installation Inspection

Upon Receipt of Item(s)

- Verify all items are in accordance with the order.
- Check all items for damage.
- If any item shows damage or is not in accordance with the order, inform Franklin Electric *immediately*.
- Remove the packaging material.
 - Follow all local laws, rules and regulations regarding disposal of discarded parts, packaging material or items and any subsequent components.

4.2 Required Tools



4.3 Float Install Instructions

Float(s) need to be installed on the probe for Digital Inventory & Leak Detection Probes.

1. Use a small flat bladed screwdriver to pry-off/remove the snap ring from the bottom of the probe shaft, then remove the stainless steel float retainer washer (Figure 3b).
2. Install the floats per Figure 2 and 3a. Product float first (magnet end up) and then the water float (magnet end up).

NOTE: Floats may or may not contain internal metal discs as ballasts for proper weighting and sizing.

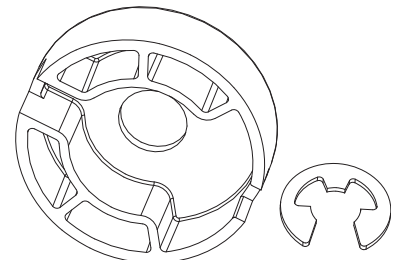


Figure 1 – Bottom-Mount Fitting and Probe E-Clip

3. Install the Bottom-Mount Fitting at the bottom of the probe shaft. Slide the snap ring into the groove below the Bottom-Mount Foot (Figures 3c and 3d).
4. Install a 2" or 3" isolation bushing (if required by local/state codes for steel tanks), 2" or 3" tank riser (length = As Required), 2" or 3" to 4" bell reducer fitting, 4" riser (length = As Required), and the riser cap adapter.
5. Install, wire, and test the LL3 (liquid level probe).

NOTE: Reference Section 6.1 for additional documentation.

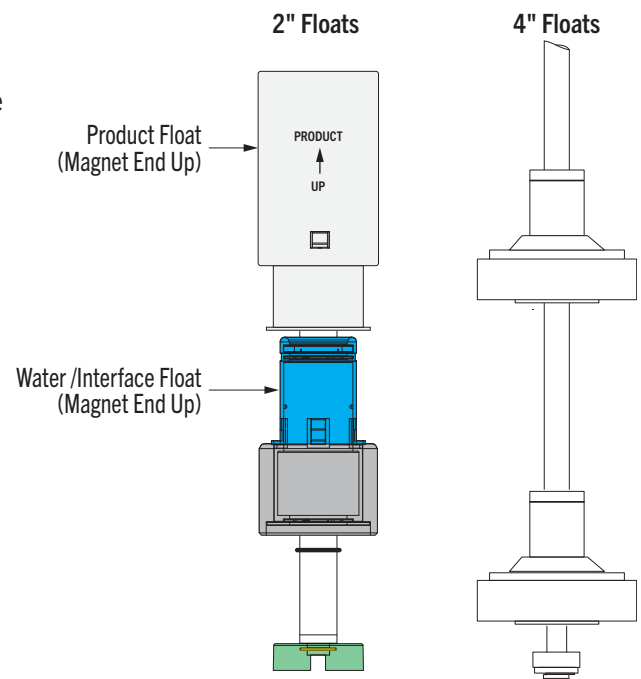
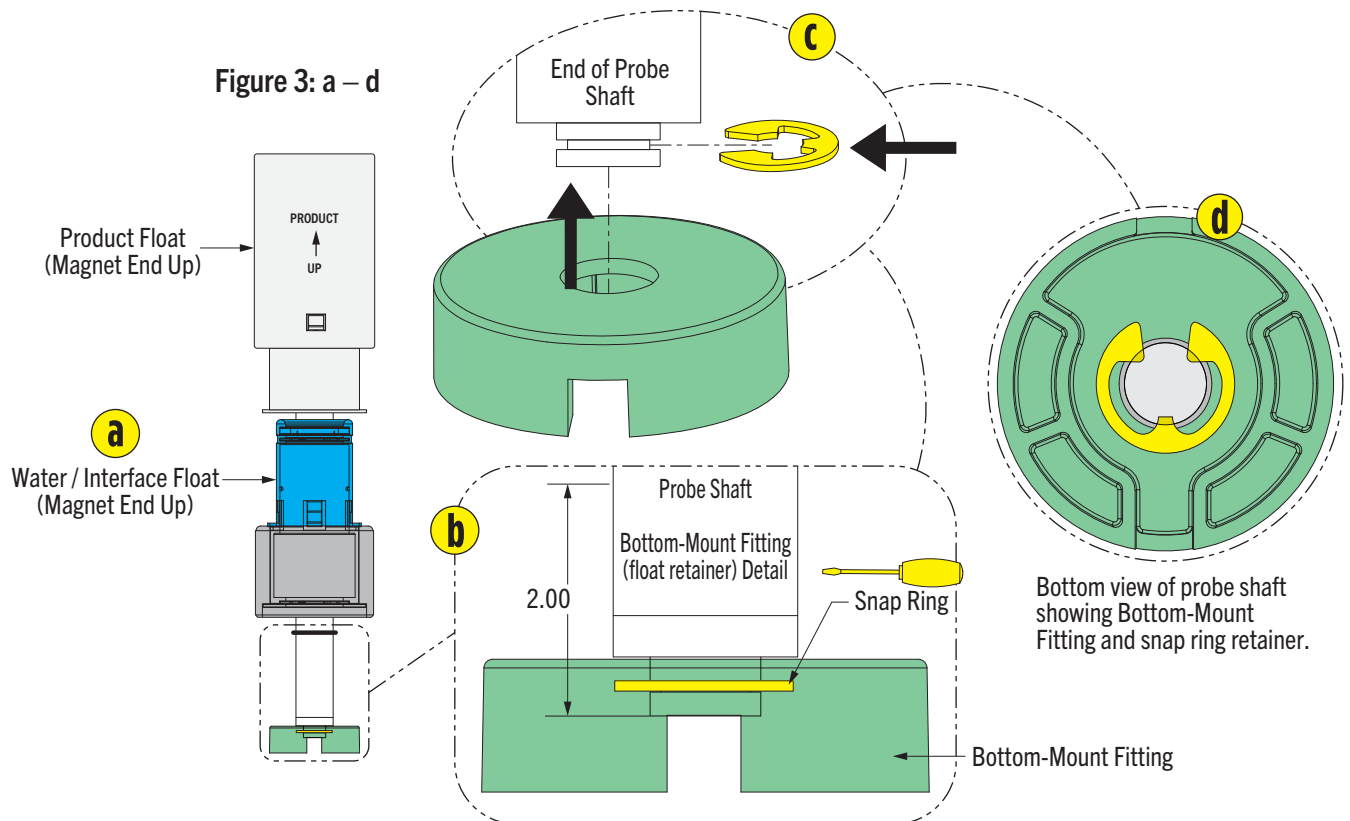


Figure 2 – Float Orientation



4.4 Probe Install Instructions

Digital Inventory & Leak Detection Probes must be installed resting on the bottom of the tank.

Bottom-mount assembly components:

- Top spacer above the probe head for use with 3" or 4" risers.
- Bottom spacer below the probe head.
- Probe foot mounts at the bottom of the probe shaft.

When using a 2" riser, remove the top spacer and replace the bottom spacer with the 2" spacer included with the 2" floats. When using a 3" riser, break off the tabs on the top spacer and replace the bottom spacer. No modifications are needed with 4" risers.

Single Thermistor Probe

The FMP-LL3-XXX-I inventory control probe will have one RTD near the bottom of the probe shaft. The Net Volume will be based on the one temperature reading vs. the average of the five RTDs in FMP-LL3-XXX leak detection probes.

NOTE: The FMP-LL3-XXX-I inventory control probes MUST NOT be used for leak detection or with Density Float Kits.

A sticker on the head of the inventory probe indicates that it is for inventory use only. Installers must be aware of the probe types at sites that have a combination of inventory-specific and leak detection probes.

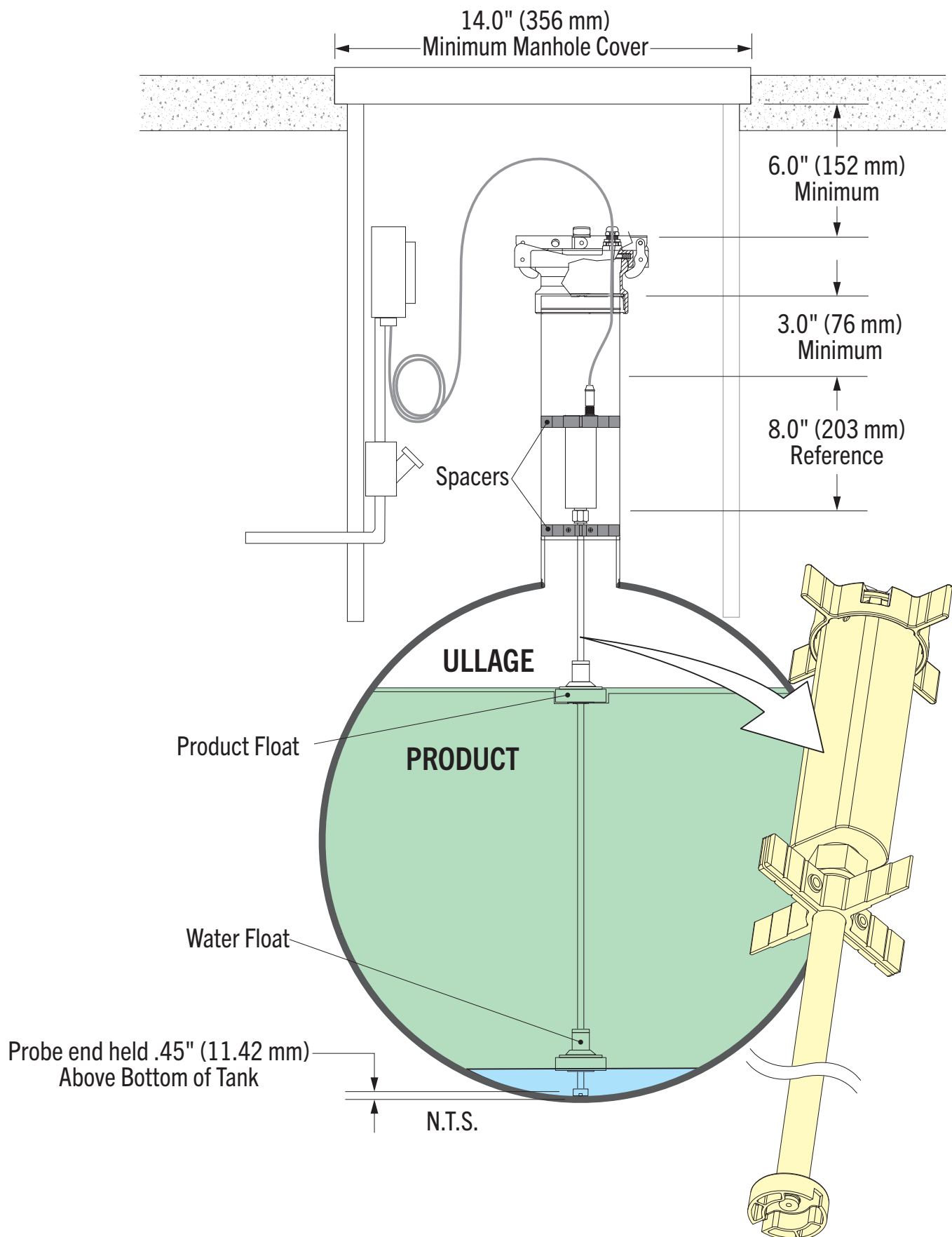


Figure 4a – Bottom-Mount Installed

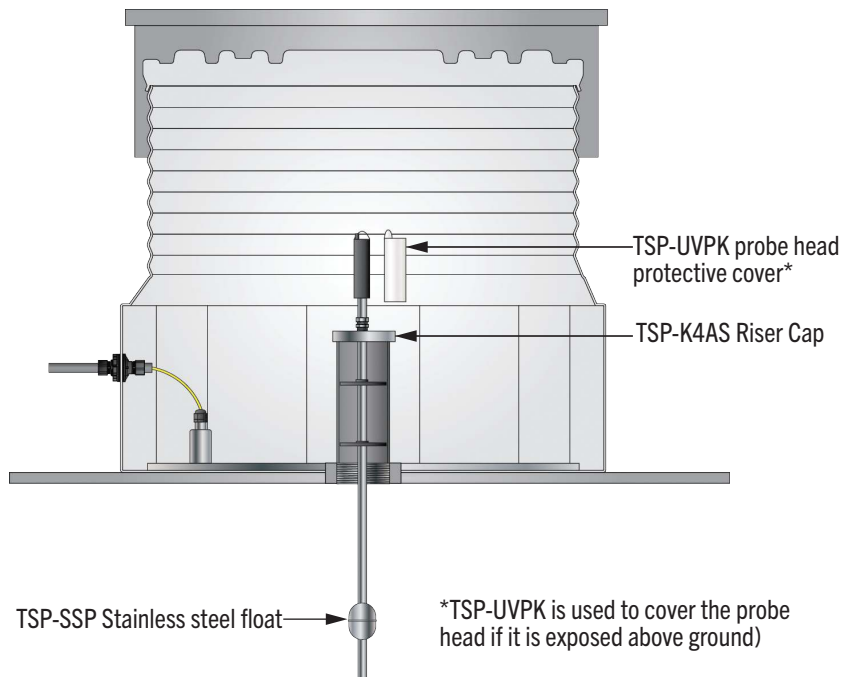


Figure 4b – Probe Installation Overview

4.4.1 Probe Install Instructions for DEF

1. Remove both spacers on the probe.
2. Use a small flat bladed screwdriver to pry-off/remove the snap ring from the bottom of the probe shaft, then remove the stainless steel float retainer washer (Figure 3b).
3. Install the compression fitting in the top of TSP-K4AS metal cap labeled 4SC. Use a DEF/AdBlue™ compatible thread compound to seal the lower threads of the compression fitting.
4. Install the end of the probe through the fitting.
5. Install the TSP-SSP float.
6. Install the Bottom-Mount Fitting at the bottom of the probe shaft. Slide the snap ring into the groove below the Bottom-Mount Foot (Figures 3c and 3d).
7. Screw the metal cap labeled 4SC onto the top of the riser pipe and torque to 20–25 ft lbs (27– 34 Nm).

NOTE: Do not use thread sealant when installing the cap. The cap has a washer that will seal against the riser.

8. While the probe is installed and sitting on the bottom of the tank, use a marker to mark the top of the compression fitting.
9. Lift the probe so that the mark is ¼" (6.4 mm) from the compression fitting. This ensures that the end of the probe is ¼" (6.4 mm) off the bottom of the tank.
10. Tighten the compression fitting.

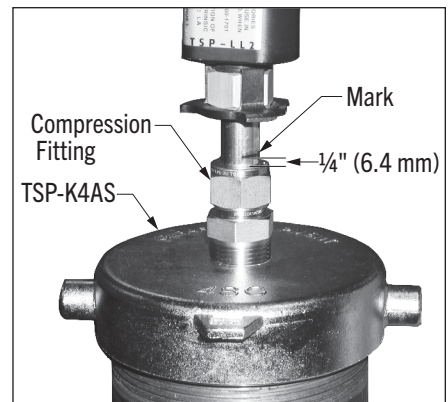


Figure 5a – Probe Installed

4.4.2 Above Riser Probes

For above-riser probes or ASTs, install the stainless steel TSP-K4AS riser adapter by tightening the lower swage lock fitting (Figure 5b).

Slide the floats onto the probe shaft after the probe has been inserted through the cap. Refer to document, p/n **000-0113**, TSP-K4AS with TSP-UVPK Installation Instructions for more information about mounting probes above the riser cap.

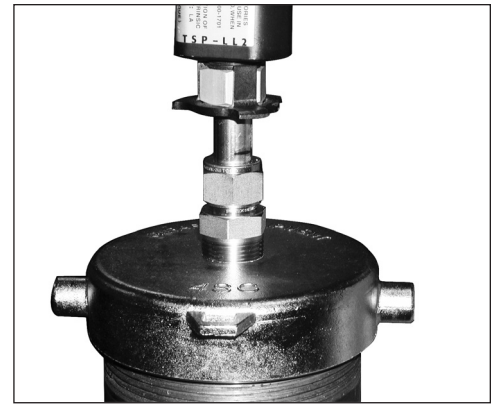


Figure 5b – TSP-K4AS cap with Swage-Lock Fitting

4.4.3 Probe Operation Modes

Digital Inventory & Leak Detection Probes have two modes of operation:

- LL3 Mode uses Universal Device Protocol to communicate digitally and provide enhanced functionality. This mode may be used with any EVO™ 200, 400, 600, & 6000 and any EVO™ 550/5000 system with a firmware version greater than 2.6.0.
- LL2 Emulation Mode allows for communication using the LL2 protocol. This mode may be used with the EVO™ Series, T5 Series, Colibri™, TS-1001/2001, TS-504/508, and TS-750.

4.4.4 Record Probe Information

NOTE: Probe information is needed only when using LL2 Emulation Mode. LL3 Mode will transmit the information digitally, eliminating the need to record the information.

Find the information label included in the probe splice kit and record which tank the probe is installed in. Provide this to the person programming the tank gauge.

4.4.5 Probe Wiring

The Liquid Level Probe Splice Kit includes three electrical connectors that are to be installed inside the manhole junction box.

4.4.5.1 LL3 Mode Splice Wiring

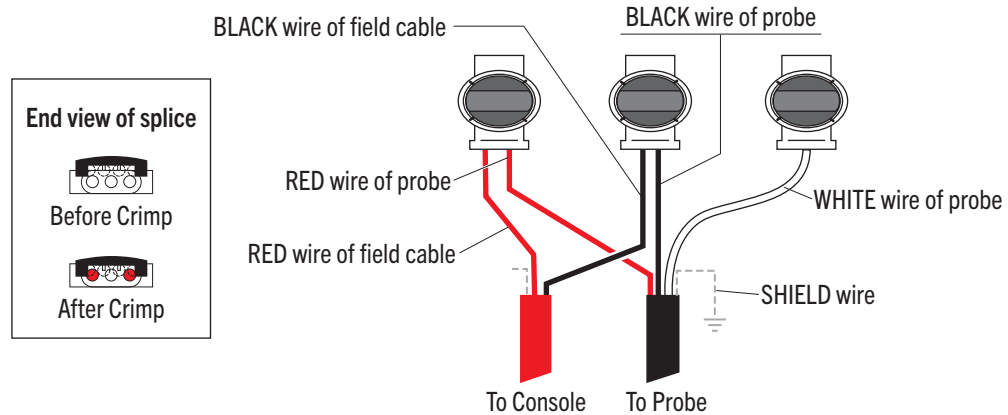


Figure 7 – LL3 Mode Splice Wiring

1. Insert two RED unstripped wires into two separate openings of the first connector.
2. Insert two BLACK unstripped wires into two separate openings of the second connector.
3. Insert the WHITE wire from the probe cable into one of the openings of the third connector.

IMPORTANT: Make sure the WHITE wire is isolated. DO NOT CUT IT. Connect it to a separate sealed connector.

4. Squeeze each connector together using 8" slip-joint pliers.
5. Connect the shield from the probe cable to Ground.

NOTE: Reference Table 6.1 for additional documentation.

4.4.5.2 LL2 Emulation Mode Splice Wiring

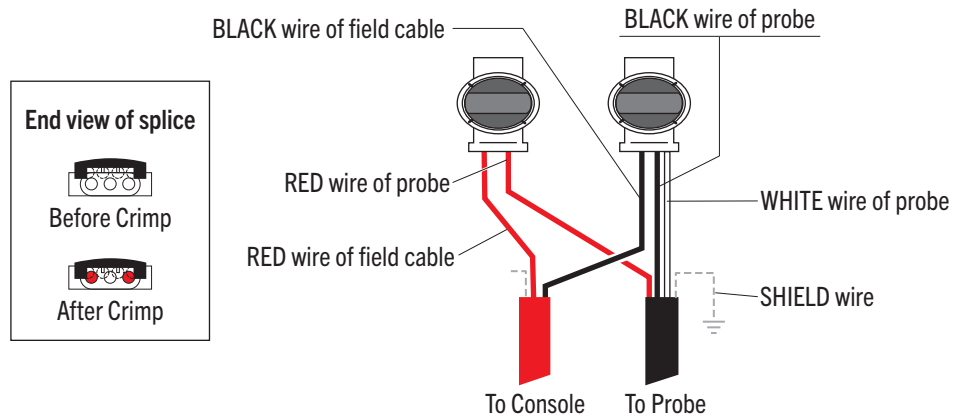


Figure 8 – LL2 Emulation Mode Splice Wiring

1. Insert two RED unstripped wires into two separate openings of the first connector.
2. Insert two BLACK unstripped wires into two separate openings of the second connector.
3. Insert the WHITE wire from the probe cable into the remaining opening of the second connector.
4. Squeeze each connector together using 8" slip-joint pliers.
5. Connect the shield from the probe cable to Ground.

NOTE: The Belden™ cable 89182 (for runs longer than 400 feet) has a YELLOW positive wire that must be connected to the RED positive probe terminal inside the console.

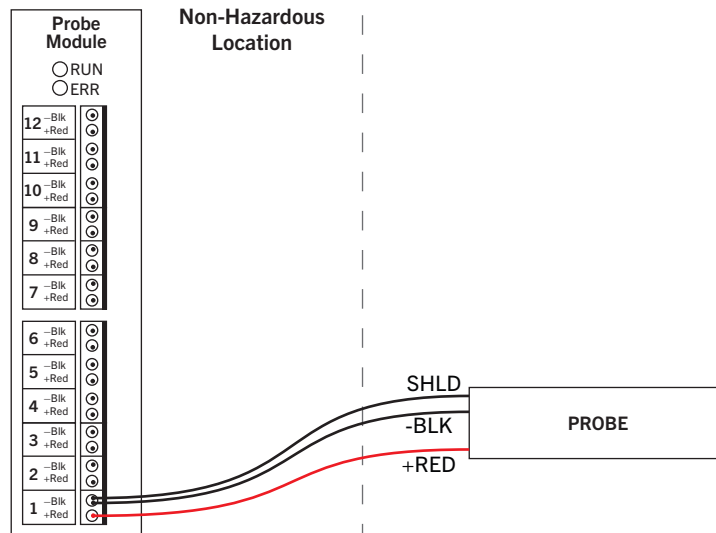


Figure 9 – Probe Module Wiring

NOTE: Reference Table 6.1 for additional documentation.

4.5 Tank Tilt / Offset Calculations

If the data to calculate tank tilt is not known, or if the tank is not seriously tilted, then use +/- offsets to adjust the probe readings to match the stick readings at fill.

Figure 10 shows the tank tilt formula to use when the fill tube and probe are on opposite sides of the tank center-line. Figure 11 shows the formula to use when the fill tube and probe are on the same side of the tank center-line.

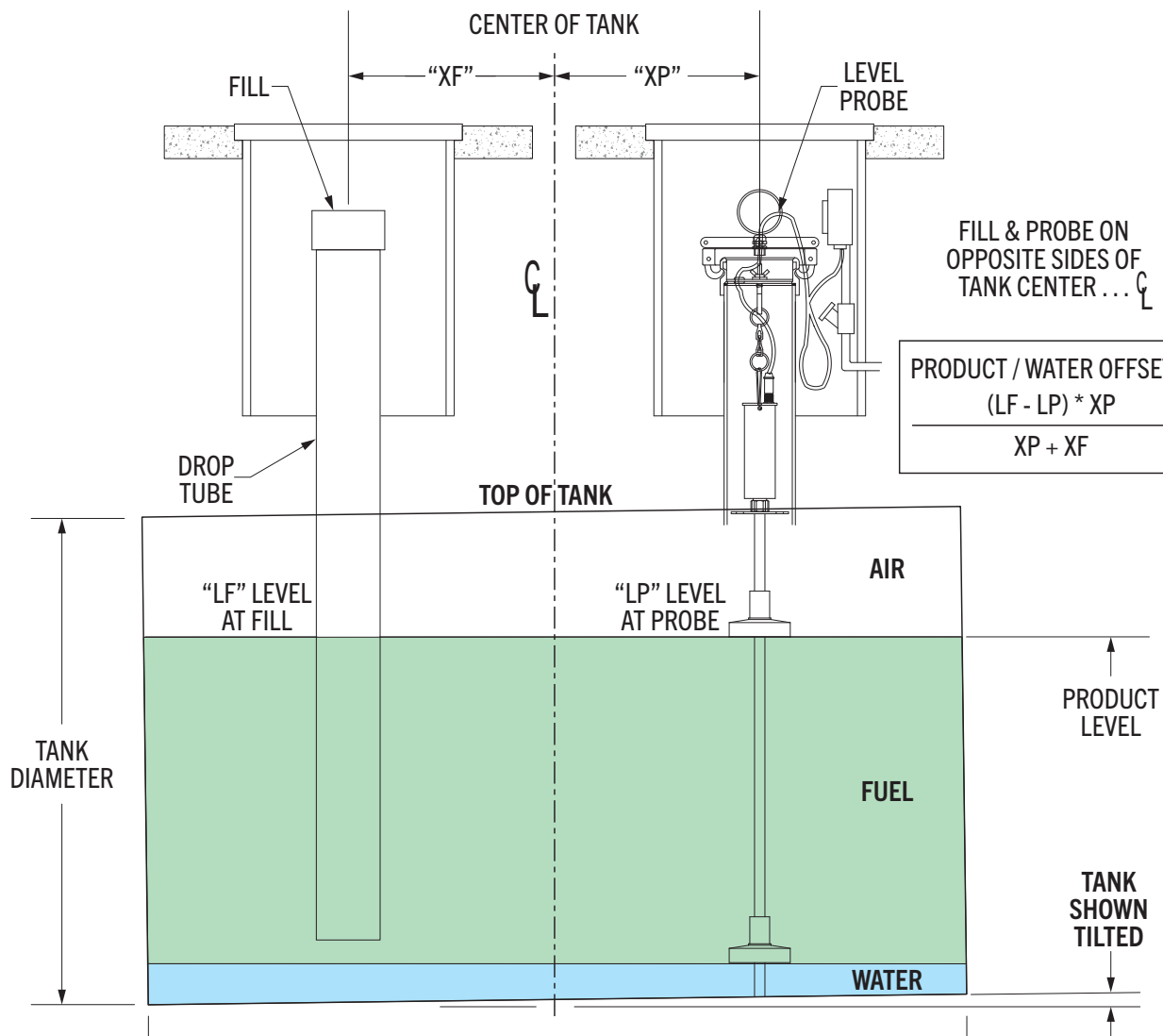


Figure 10 – Tank Tilt Calculation
Probe and Fill on Opposite Sides

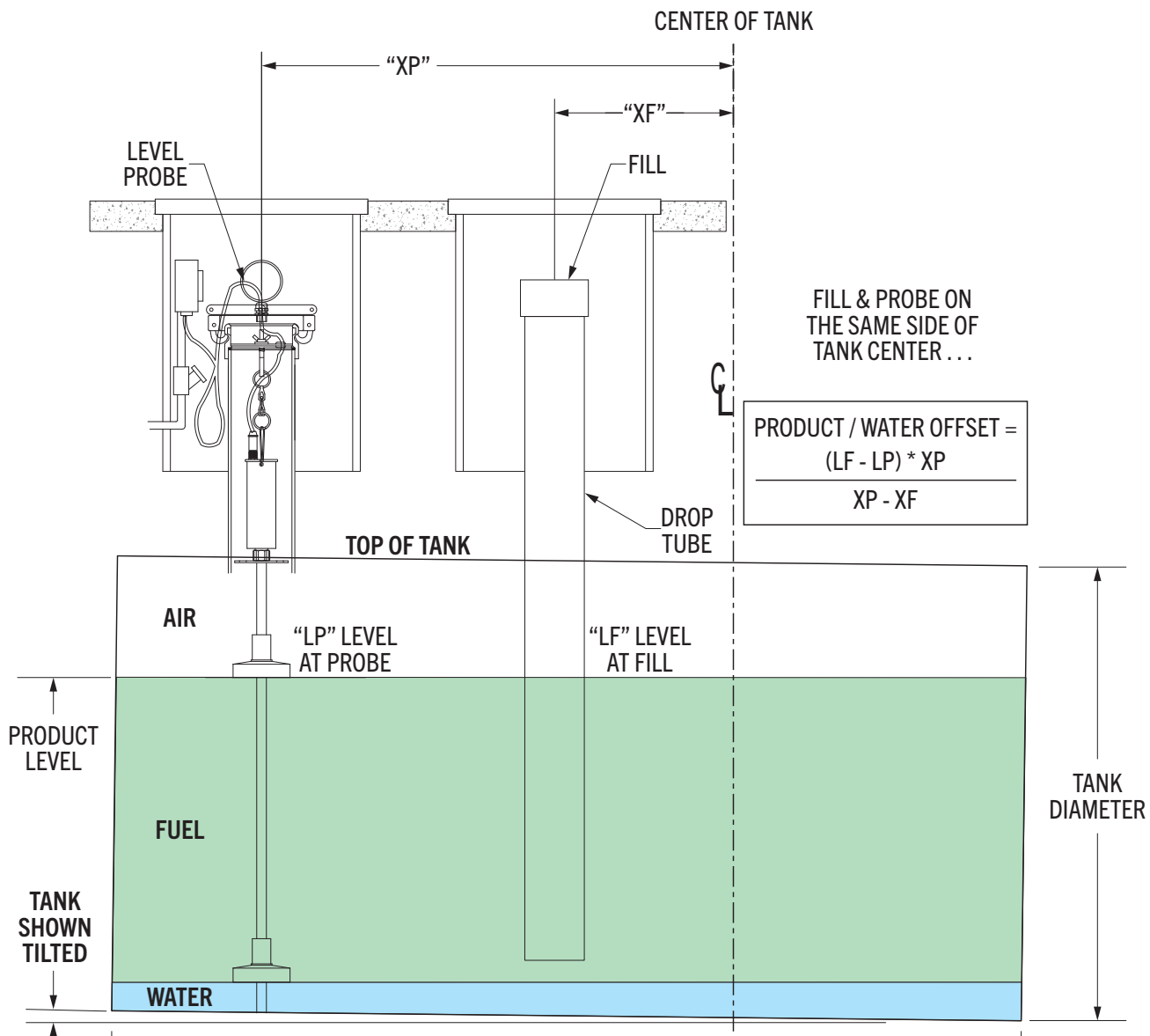


Figure 11 – Tank Tilt Calculation
Probe and Fill on Same Side

5 Troubleshooting

When troubleshooting, it is important not to presume any particular cause. Follow the steps listed below to properly and quickly troubleshoot probes.

NOTE: Do not start troubleshooting by swapping probes, it may cause confusion in the process of identifying the problem.

5.1 Probe Removal Instructions

1. Carefully remove the probe dust cap.

NOTE: Tanks are typically under pressure or vacuum and once the cap is removed, a rush of air will likely be present to equalize tank pressure.

2. Slowly raise the probe by carefully pulling on the yellow quick disconnect cable.

NOTE: While removing the probe, carefully guide floats through riser to avoid damage and prevent the probe from catching on the riser.

3. Once the probe and floats have cleared the riser, hold the probe by the shaft and disconnect the yellow quick disconnect cable.

4. Hold the probe with two hands along the shaft and carefully lower it to lay flat on the forecourt surface.

IMPORTANT: DO NOT allow probe to roll.

IMPORTANT: DO NOT place probe in an area of foot or vehicle traffic.

5. Once required maintenance or other procedures for the probe have been completed, reinstall the probe per the probe's installation guide. Confirm the probe is reading measurements correctly and that no alarms are present on the connecting console.

5.2 Float Missing

1. Check programming of probe for correct number of floats.
2. Confirm tank is programmed correctly and its diameter matches the probe size.
3. Look for active High Water or Float Missing alarms in the run status at the Automatic Tank Gauge (ATG).
4. If possible, have the technician “stick” the tank and compare the measurement with the level reported by the ATG.
5. Is the level correct?
 - If not, is the ATG measuring in reverse (the lower the actual product level the higher it reads on the ATG)?
 - If so, verify the Probe Ratio is programmed correctly. If programming is an issue, it may be a probe issue. Continue with next steps.
6. Check the water level. Does the ATG list it as Float Missing?
 - If it is listed as missing, this could be a probe issue, but *continue to troubleshoot*.

7. Try to cycle power.
 - If previously noted, check to see if the High Water alarm or Float Missing alarm have cleared.
 - If they clear, this could be a probe issue, but *acknowledge and continue to troubleshoot*.
8. Inspect floats for damaged or missing magnets.
9. After completing the above steps, replace the probe.

5.3 No Probe, Probe Sync and Unstable Probe

New Install or Replacement Probe

1. Check Wiring. Ensure that the Red, Black and Shield wires are connected to the correct terminals on the ATG. There should be two connections in the junction box, (refer to figure 9).

(Probe Alarms on Multiple Channels or Only One Probe Connected)

2. Check Main Board Power Supply. There should be approximately 21 VDC loaded (probe connected) and 24 VDC unloaded across the Red and Black terminals of the probe channel in the ATG.
3. Check Field Wiring. Ensure that the voltage is getting to the probe by checking at the junction box splice or quick disconnect pigtail. With the pigtail end facing you, keyslot up, there should be 24 VDC across the two bottom pins. Test field wiring for a short or open.
4. Remake Splice. Cutback and remake the splice connection in the junction box using the approved seal pack and connectors.

(Quick Disconnect Pigtail)

5. Try a New Pigtail. If this probe has a quick disconnect pigtail, try replacing it.
6. Try another Probe Channel. Once the field wiring has been checked and the junction box connection remade, try moving the field wiring to another channel.
7. Connect the probe directly to the ATG. If possible, bring the probe inside and wire directly to the ATG. (If this probe has a quick disconnect pigtail then the white wire should be connected to shield or ground).

5.3.1 Additional Steps for Troubleshooting the Probe

For Float Missing or Incorrect Level problems, consider the following actions:

1. Confirm tank is programmed correctly and correction points are accurate (Incorrect Level problems).
2. Confirm tank diameter matches the probe size (Float Missing).
3. Pull probe from tank and manually raise and lower floats.
 - a. Does the ATG accurately report the change in level?
4. Are the right number of floats installed on the probe?
 - a. Verify number of floats programming.
5. Is float too close to the end of the probe?
 - a. Was tank overfilled or is the float stuck in riser?
 - i. If float is too close to the probe head, a Float Missing alarm will occur.
6. Is there debris on the magnets?
 - a. If so, clean debris from magnet and check operation of ATG.
7. Are the magnets cracked or broken?
 - a. If so, replace float.
8. Does the magnet display acceptable magnetic performance (magnetism) when a small magnetic piece of metal (paper clip) is brought near?
 - a. If not, replace.
9. Are the floats installed correctly?
Product float on top, closest to the probe head.
 - a. Product floats have white collars.
 - b. Water floats have colored collars.
 - i. Red = gasoline.
 - ii. Blue = diesel.
10. Float Height Error?
 - a. Water float type in conflict with product selected?
 - b. 4" Gas float with Diesel as Product type?
11. Is the probe shaft dirty?
 - a. If so, use an abrasive pad to clean the probe shaft.
12. Check that wire connections from probe cable to field wiring are secure, in good condition and dry.
13. Are the floats compatible with the probe?
 - a. LL and LL2 / LL3 floats are NOT interchangeable.

6 Appendix

6.1 Related Documents

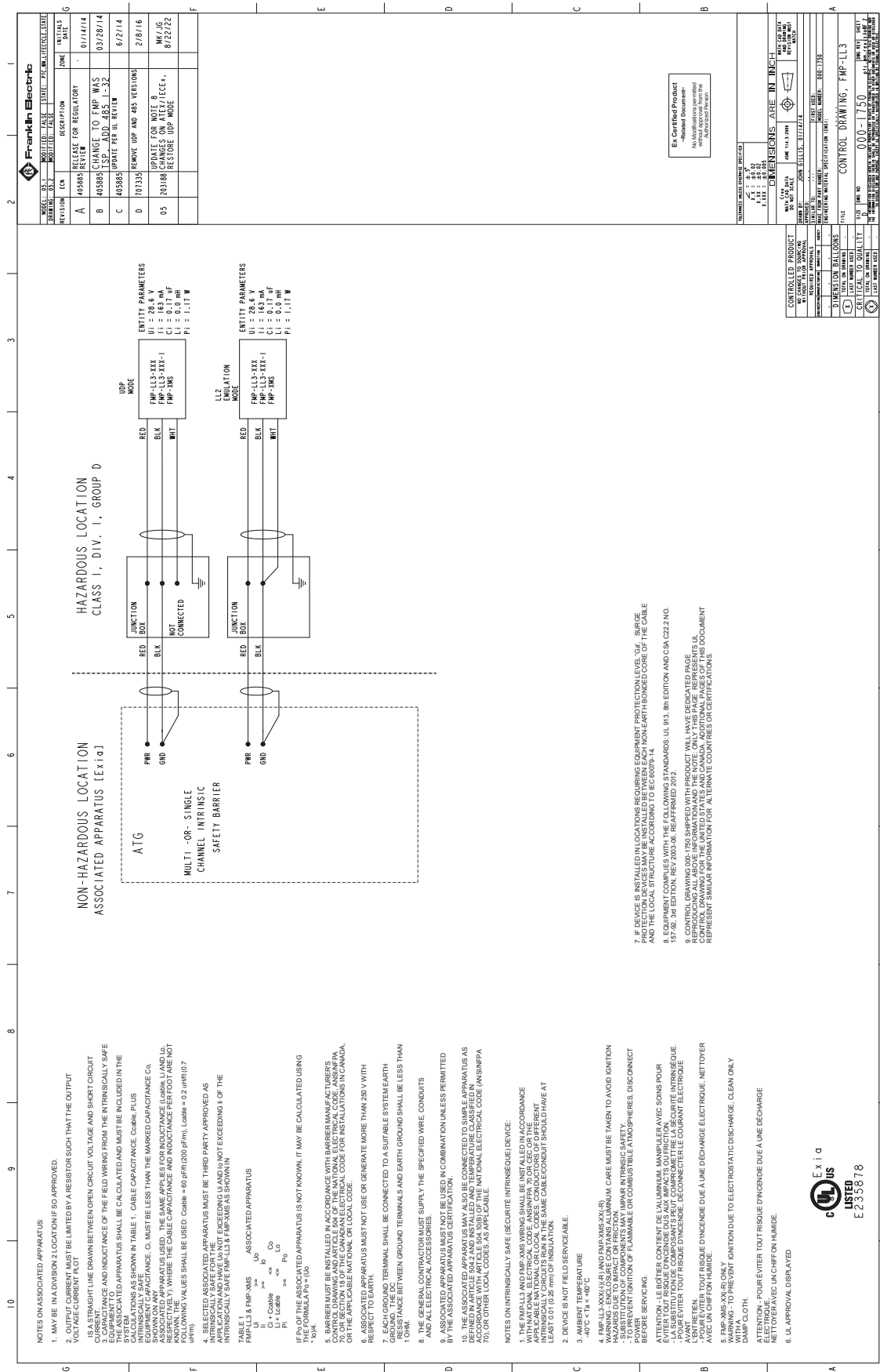
Documentation can be found online at www.franklinfueling.com.

TABLE 6.1 – Related Documents

Part Number	Description
000-0251	TSP-LL2-XXX-LPG Install Guide
000-1050	TANK SENTINEL® Install Guide
000-1176	Two Inch Float Install Guide
000-0113	TSP-K4AS with TSP-UVPK Installation Instructions
000-0527	Density Measurement Option Installation Guide
000-0293	LL3 Probe Install Quick Reference Guide
000-1041	Direct Burial Cable Installation Instructions
000-1133	Direct Burial Splice Kit Installation Guide
000-2142	Fuel Management System Programming Guide
000-2150	Fuel Management System Installation Guide
000-2173	TS-550 EVO™ and TS-5000 EVO™ Programming Guide
000-2170	TS-550 EVO™ and TS-5000 EVO™ Installation Guide
000-2153	Colibri™ Automatic Tank Gauge Installation Guide
000-2155	Colibri™ Set-Up and Operation Guide
228180003	EVO™ 200 & 400 Series Console Install Guide
228180015	EVO™ 200 & 400 Series Console Programming Guide
228180033	EVO™ 600 & 6000 Series Console Install Guide
228180061	EVO™ 600 & 6000 Series Console Programming Guide

6.2 Approvals and Certifications

- UL & cUL listed, ATEX, IECEx



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