Manual No: **577013-934** ● Revision: **F**

TLS-450/TLS-450PLUS Consoles

Site Prep Certification Manual

VEEDER-ROOT

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Introduction

This manual assumes that you are installing the console in a new site (before pavement is put down and with no wiring runs in place). Among the topics covered are:

- Site layout considerations.
- Installing the console and connecting wiring from the AC power panel.
- Probe installation procedures.
- Sensor installation procedures.
- Installing wiring conduit between the console and the probes and sensors.
- Probe and sensor field junction box wiring diagrams.
- Attaching sensor wiring to the console.

Related Documents

DOCUMENTS REQUIRED TO INSTALL EQUIPMENT

This equipment must be installed according to the applicable installation document:

Equipment	ATEX Descriptive System Document No.	IECEx Descriptive System Document No.	UL/cUL Control Drawing Document No.
Associated Apparatus			
TLS-450/TLS-450PLUS	331940-006	331940-106	331940-008
Intrinsically Safe Apparatus for Wireless Applications			
Tank Gauge Accessories	331940-005	331940-105	331940-012

Safety Precautions

The following safety symbols may be used throughout this manual to alert you to important safety hazards and precautions.

EXPLOSIVE Fuels and their vapors are extremely explosive if ignited.	**FLAMMABLE** Fuels and their vapors are extremely flammable.
ELECTRICITY High voltage exists in, and is supplied to, the device. A potential shock hazard exists.	**TURN ELECTICAL POWER OFF** Live power to a device creates a potential shock hazard. Turn Off electrical power to the device and associated accessories when servicing the unit.
WARNING Heed the adjacent instructions to avoid damage to equipment, property, environment or personal injury.	**READ ALL RELATED MANUALS** Knowledge of all related procedures before you begin work is important. Read and understand all manuals thoroughly. If you do not understand a procedure, ask someone who does.

National Electrical Code Compliance

The following information is for general reference and is not intended to replace recommended National Electric Code (NEC) procedures. It is important for the installer to understand that electrical equipment and wiring located in Class I, Division 1 and 2 installations shall comply with the latest appropriate Articles found in the National Electric Code (NFPA 70), the Automotive and Marine Service Station Code (NFPA 30A), CEC codes and all applicable local codes.

PROBE- AND SENSOR-TO-CONSOLE WIRING

Wire Type

To ensure the best operating systems available, Veeder-Root **REQUIRES** the use of shielded cable for all probes and sensors regardless of conduit material or application. In these installations, shielded cable must be rated less than 100 picofarad per foot and be manufactured with a material suitable for the environment, such as Carol™ C2534 or Belden™ 88760, 8760, 8770 or similar.

Note: Throughout this manual, when mentioning any cable or wire being used for probe and sensor to console wiring, it will be referring to shielded cable.

Wire Length

Improper system operation could result in undetected potential environmental and health hazards if the probe- or sensor-to-console wire runs exceed 1000 feet. Wire runs must be less than 1000 feet to meet intrinsic safety requirements.

Wire Gauges - Color coded

Shielded cable must be used in all installations. Sensor-to-console wires should be #14-#18 AWG stranded copper wire and installed as Class 2 circuits. As an alternate method when approved by the local authority having jurisdiction, #22 AWG wire such as Belden 88761 may be suitable in installations with the following provisions:

- Wire run is less than 750 feet
- Capacitance does not exceed 100 pF/foot
- Inductance does not exceed 0.2 μH/foot

POWER WIRING

Wires carrying 120 or 240 Vac from the power panel to the console should be #14 AWG (or larger) copper wire for line, neutral and chassis ground (3); and #12 AWG copper wire for barrier ground.

Console Installation

Locating the Console

⚠ WARNING

FAILURE TO COMPLY WITH THE FOLLOWING WARNINGS AND SAFETY PRECAUTIONS COULD CAUSE DAMAGE TO PROPERTY, ENVIRONMENT, RESULTING IN SERIOUS INJURY OR DEATH.

Explosive vapors or flammable liquids could be present near locations where fuels are stored or being dispensed.

This console is not explosion proof. Do not install this console in a volatile, combustible, or explosive atmosphere.

An explosion or fire resulting in serious injury or death, property loss and equipment damage could occur if the console is installed in a volatile, combustible or explosive atmosphere (Class I, Division 1 or 2).

Select a mounting location on the inside of any building. The console must be protected from severe vibration, extremes in temperature and humidity, rain, and other conditions that could harm computerized electronic equipment. The console's operating temperature range is 32 to 104°F (0 to 40°C), and its storage temperature range is -40 to +162°F (-40 to +74°C).

The mounting surface should be strong enough to support the console's weight which could be approximately 35 pounds with a full complement of modules. You should also consider wall space for routing the power wiring conduits and probe and sensor wiring conduits that must be connected to the console.

Mounting the Console

Install the console fastening devices to the mounting surface using the hole pattern shown in Figure 1. Up to 1/4" diameter screws may be used.

Mount the console to the mounting surface using the four mounting flanges on the back of the unit. Install metal conduit between the console and the power panel. Figure 1 shows the two designated knockouts through which power wiring can safely enter the console.

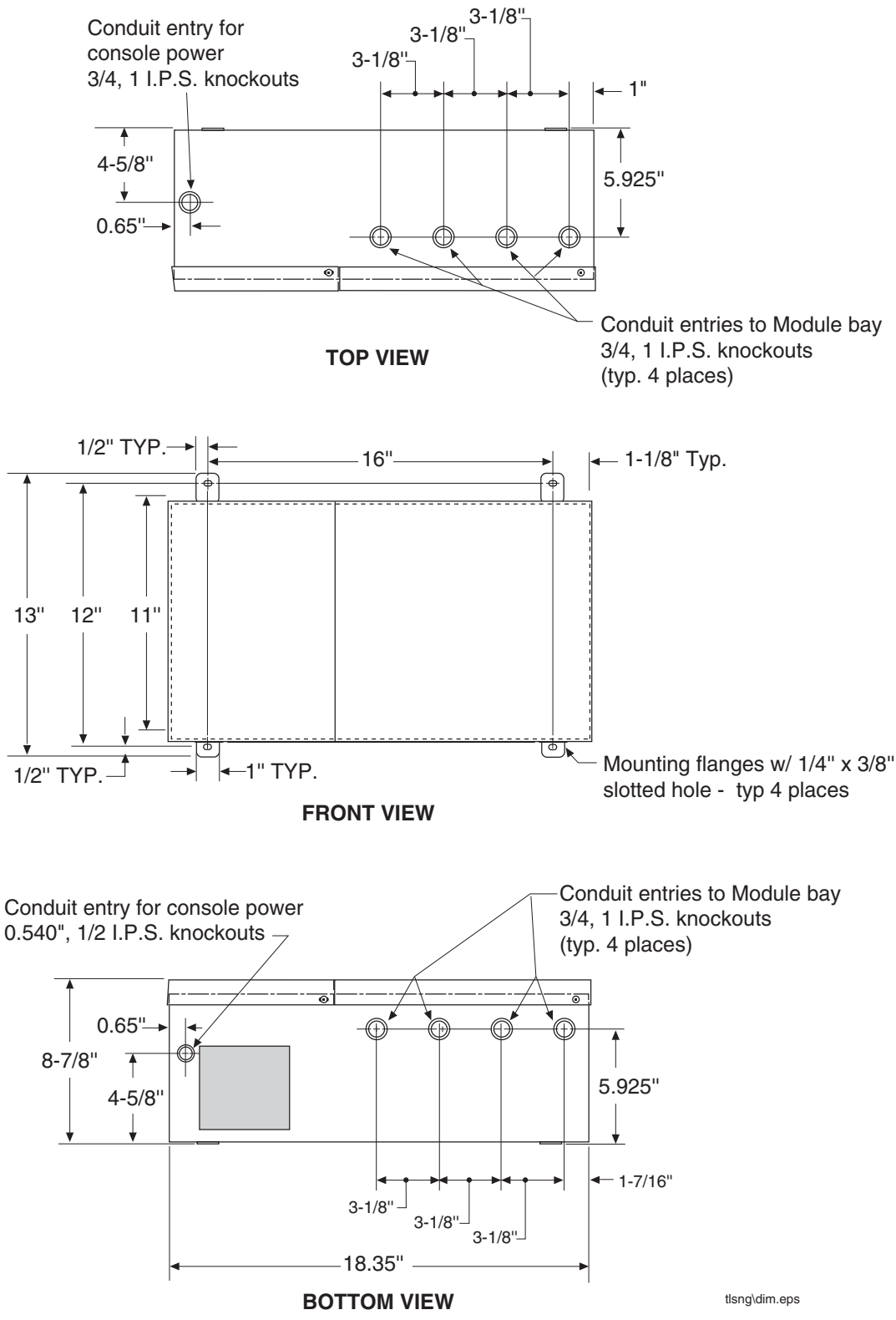


Figure 1. TLS-450/TLS-450PLUS Consoles Dimensions and Designated Conduit Knockouts

Wiring the Console

⚠ WARNING

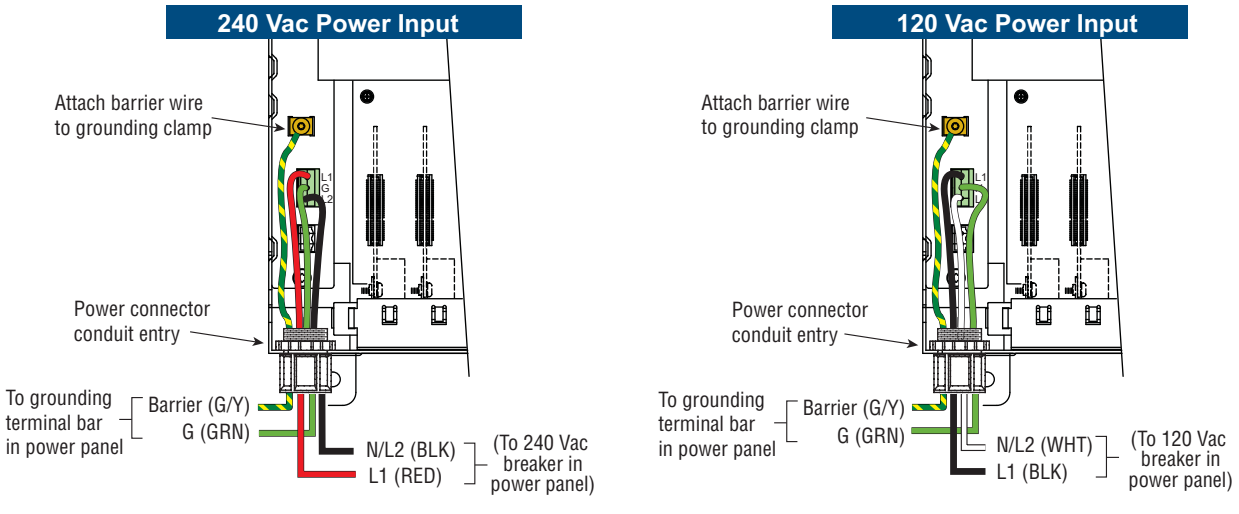
This console contains high voltages which can be lethal. It is also connected to low power devices that must be kept intrinsically safe.

1. **Do not connect the console AC power supply wires at the breaker until all devices are installed.**
2. **Attach conduit from the power panel to the console's Power Area knockouts only.**

Connecting power wires to a live circuit can cause electrical shock that may result in serious injury or death.

Routing conduit for power wires into the intrinsically safe compartment can result in fire or explosion resulting in serious injury or death.

1. Check the Input Power Rating on the label affixed to the underside of the console to verify whether input power requirements are 120 Vac or 240 Vac.
2. Pull three #14 AWG or larger color-coded wires for AC line (hot), AC neutral and chassis ground between the power panel and the console.
3. Pull one wire, with a minimum 90°C rating, for barrier ground - For UL/cUL installations use a # 12 AWG wire; For ATEX/IECEx installations use a 4 mm^2 wire.
4. Connect the input 120 or 240 Vac power wires as shown in Figure 2.



POWER WIRING NOTES:

- Barrier ground wire requirements:
  - For UL/cUL approved systems, use a 12 AWG barrier ground wire
  - For ATEX/IECEx approved systems, use a 4 sq. mm barrier ground wire
- Use an ohmmeter to check the electrical resistance between the console's metal case and the power panel's earthing ground wire connection at the 'known good ground'. It should read less than 1 ohm.
- Connect the power supply wires in the power panel to a separate dedicated circuit.
- Electrical rating of power input - 120 or 240 Vac, 50/60 Hz, 2 A maximum.
- See Figure 1 for locations of power conduit knockouts into the console. Power wiring must enter the console through designated knockouts.

Figure 2. Wiring AC Power To The TLS-450/TLS-450PLUS Consoles

Special Mag Probe Installation Kits

In addition to the Mag Probe installation kits shipped with each probe (containing floats, spacer rings, cable, etc.), your installation may also require one or more of the special kits described in this section.

AST Installation Kit

This kit is recommended when installing Mag Probes into an above ground storage tank (AST). This kit contains a length of flexible conduit, connectors, etc., for easier probe access. The kit contents are listed in Table 1 and shown in Figure 3.

Table 1. Mag Probe AST Installation Kit - Part No. 312020-984

Quantity	Description	Part Number
5 feet	3/8” Flexible Conduit	576008-294
1	3/8” Adapter Nut	329972-002
2	3/8” Straight Liquidtite Connectors And Related Parts	576008-295
1	Cord Grip Group	331028-001

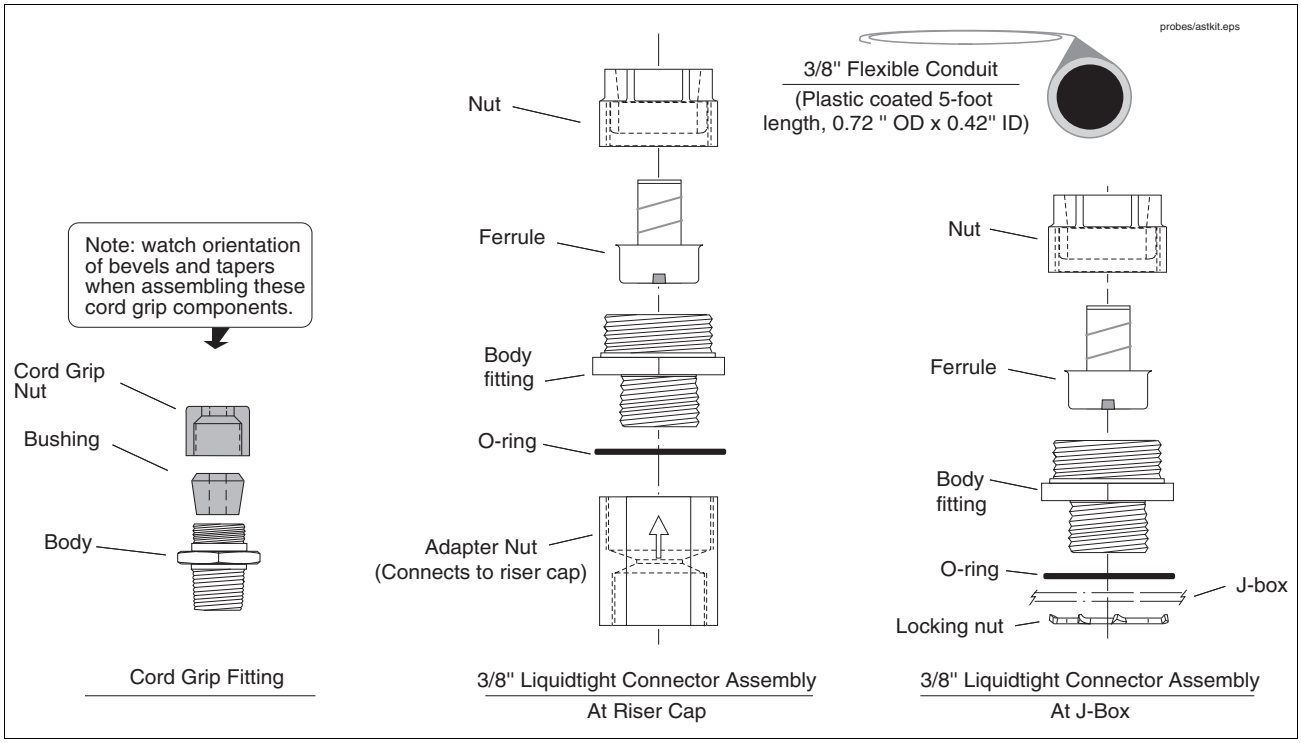


Figure 3. Mag Probe AST Installation Kit

Vapor Extraction Riser Kit W/ Coupling Adapter

This kit contains parts needed to install a Mag Probe into a Vapor Extractor Riser that has a Coupling Adapter (parts listed in Table 2 and shown in Figure 4):

Table 2. Vapor Extraction Riser Kit (w/ coupling adapter) - Part No. 846500-001

Quantity	Description	Part Number
2	Wire Nut	576008-461
1	Cable Tie	576008-482
1	Splice Enclosure	514100-357
1	Splice Kit Instructions Manual	576013-861
1	PG7 / 1/4” Cord Grip Fitting	576008-637
1	Modified OPW Adapter	331448-001
1	Shield -Fitting	331449-001
1	4” Hose Clamp	576008-638
12 inches	Flex Conduit	576008-294

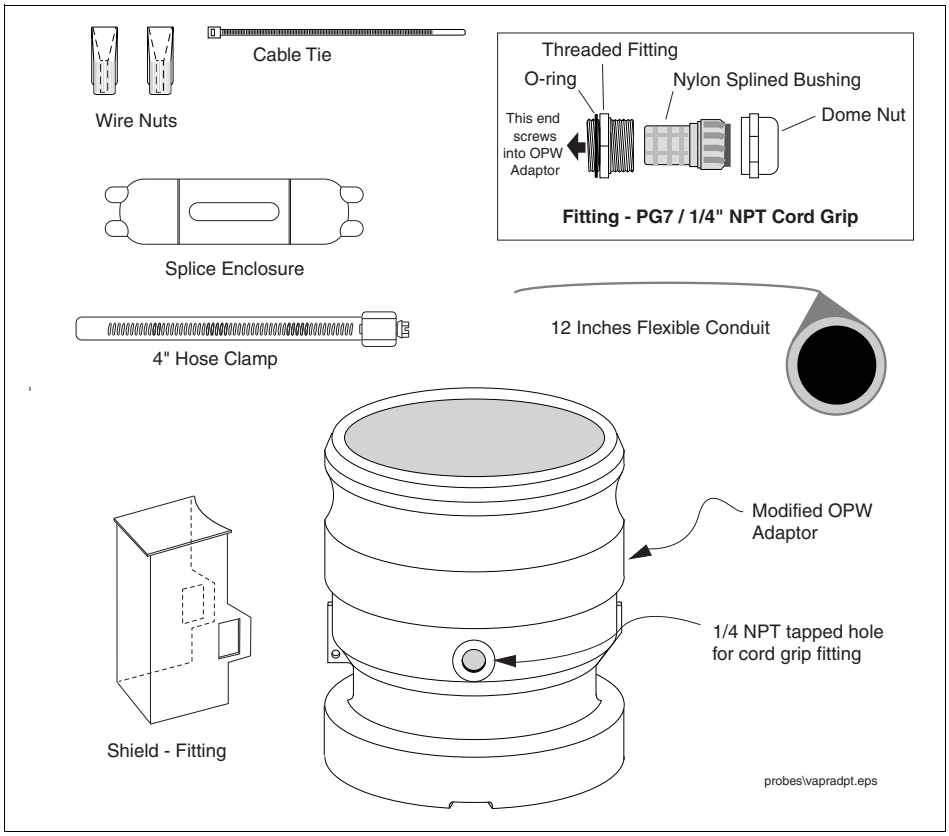


Figure 4. Mag Probe Vapor Extractor W/coupling Adapter Installation Kit

Vapor Extraction Riser Kit W/O Coupling Adapter

This kit contains parts needed to install a probe in a Vapor Extractor Riser that does not have a coupling adapter (parts listed in Table 3 and shown in Figure 5):

Table 3. Vapor Extraction Riser Kit (W/O Coupling Adapter) - Part No. 846500-002

Quantity	Description	Part Number
2	Wire Nut	576008-461
1	Cable Tie	576008-482
1	Splice Enclosure	514100-357
1	Splice Kit Instruction Manual	576013-861
1	Riser Cap	331106-001
1	Gasket	331140-001
1	Cord Grip Bushing	330787-001
1	Cord Grip Nut	330594-001
12 inches	Flex Conduit	576008-294

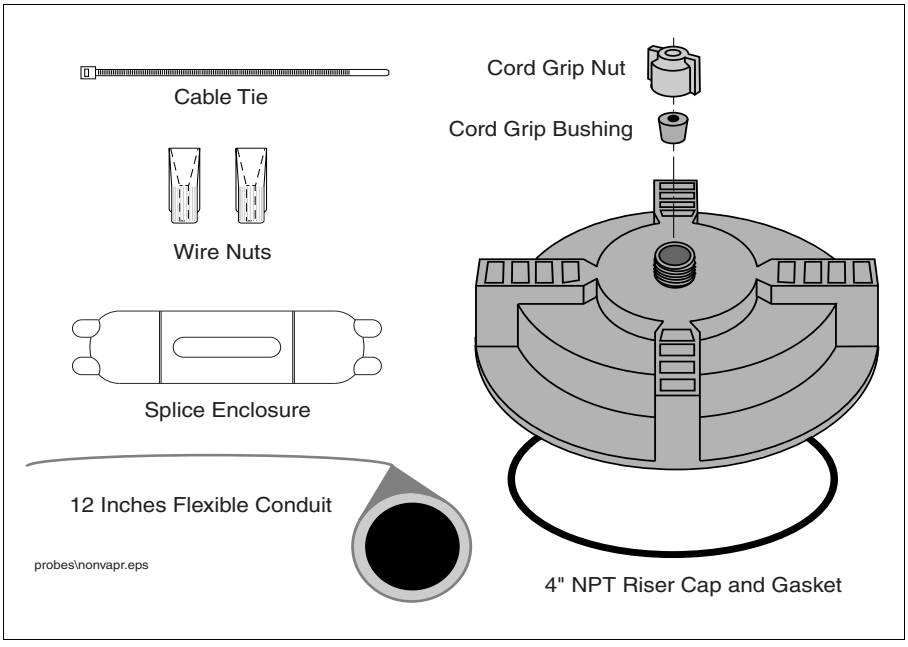


Figure 5. Mag Probe Vapor Extractor W/O Coupling Adapter Installation Kit

Riser Cap Kit for Mag Probe Installations

The cap on the riser containing the Mag Probe must be modified to allow the probe's cable to exit the riser. This modification requires making a 1/2"-14 NPT tapped hole in the cap for a cord grip. Two types of drilled and tapped Riser Cap kits are available for purchase, or you may be able to modify the existing riser cap.

CAP AND CORD GRIP KIT

This Riser Cap kit (Table 4) contains a non-metallic cap which screws onto the 4" NPT riser (Figure 6). The cap comes drilled and tapped with a cord grip.

Table 4.- Cap and cord grip kit - Part No. 330020-282

Quantity	Description	Part Number
1	Cap Riser	331106-001
1	Gasket	331140-001
1	Bushing - Cord Grip	330787-001
1	Nut - Cord Grip	330594-001

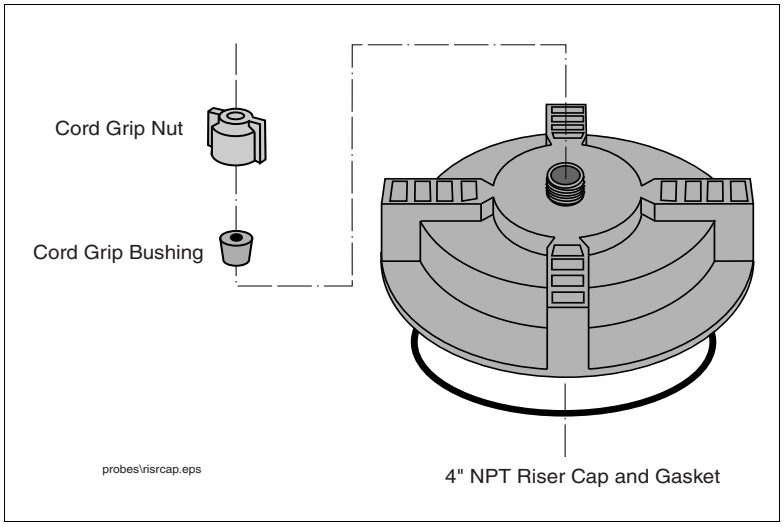


Figure 6. Cap And Cord Grip Kit

METAL CAP AND RING KIT

This riser cap kit contains an adapter ring which screws onto the 4"NPT riser and a quick-release metal cap which clamps onto the ring (Table 5). The cap comes drilled and tapped with a cord grip (Figure 7).

Table 5.- Metal cap and ring kit - Part No. 312020-952

Quantity	Description	Part Number
1	Adapter Ring And Gasket	514100-332

Table 5.- Metal cap and ring kit - Part No. 312020-952

Quantity	Description	Part Number
1	Cap And Gasket	327869-003
1	Group Cord Grip	331028-001

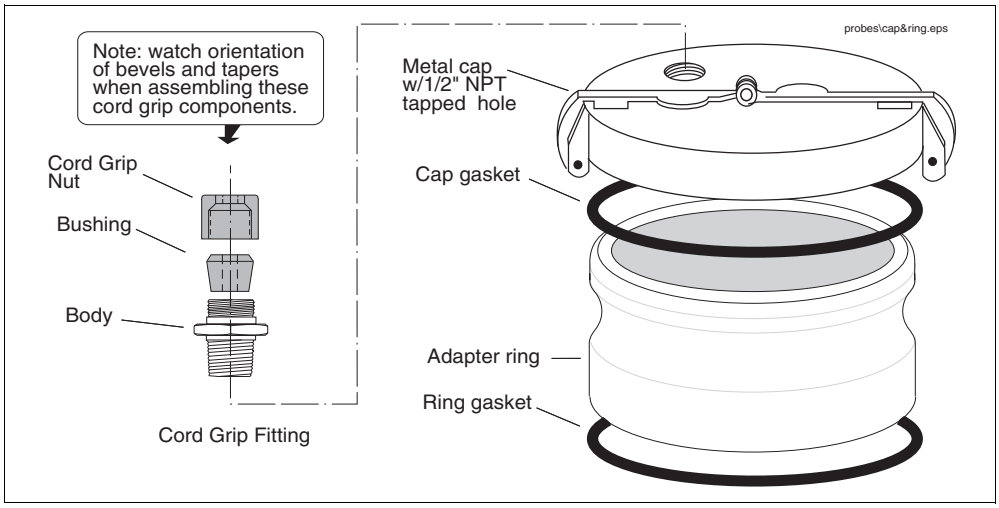


Figure 7. Metal Cap And Ring Kit

Modifying an Existing Metal Cap

In order to ensure that the riser cap seals properly to the probe cable and riser, we recommend that you purchase one of the kits available for this purpose. Riser Caps from other manufacturers may require modification. If you use your own metal riser cap, you must drill and tap it for a cord grip fitting (P/N 331028-001) as follows.

1. Remove the cap to a non-hazardous location.
2. Drill and tap the cap for a 1/2”-14 NPT cord grip thread [Figure 8].

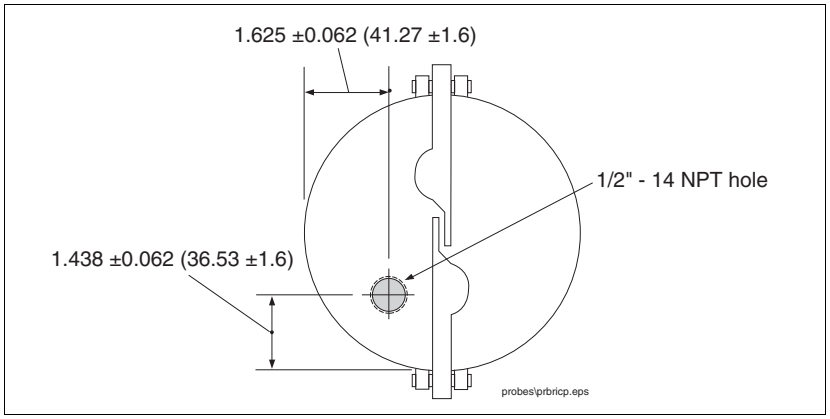


Figure 8. Modifying An Existing Metal Riser Cap

Mag Probe Installation

UST/AST Tank - Dedicated Riser

1. Turn OFF power to the console.
2. Remove any sludge from the bottom of the tank.
3. Check that floats, boot, and cable are assembled correctly on probe (ref. Mag Probe Assembly Manual).
4. Gently slide the float(s) to the bottom of the probe shaft before raising the probe. Carefully lower the probe into the riser pipe until the boot rests on the bottom of the tank [See Figure 9 for UST installation or Figure 10 for AST installation].

WARNING! Handle probes carefully. Striking or dropping the probe will result in loss of calibration and damage to the probe.

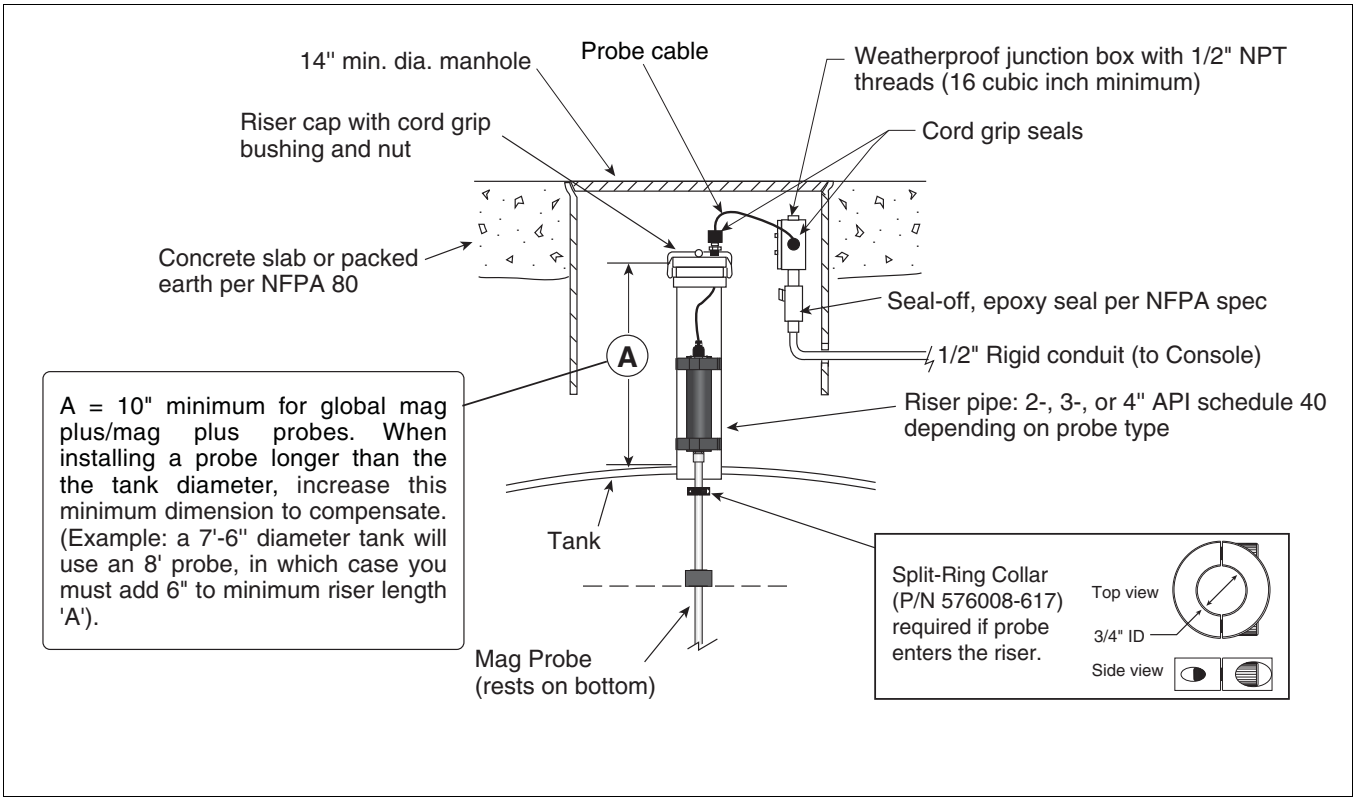


Figure 9. UST Probe Installation - Dedicated Riser

UST RISER CAP ATTACHMENT

1. If you are using the one piece cap (see Figure 6 on page 9), push the end of the probe cable through the cord grip bushing and nut on the cap, leaving a minimal amount of slack between the probe and cap. Screw the cap onto the riser by hand until the gasket first contacts the pipe. Then lightly tap the cap with a hammer to tighten it an additional 3/4 turn. Go to Step 3.

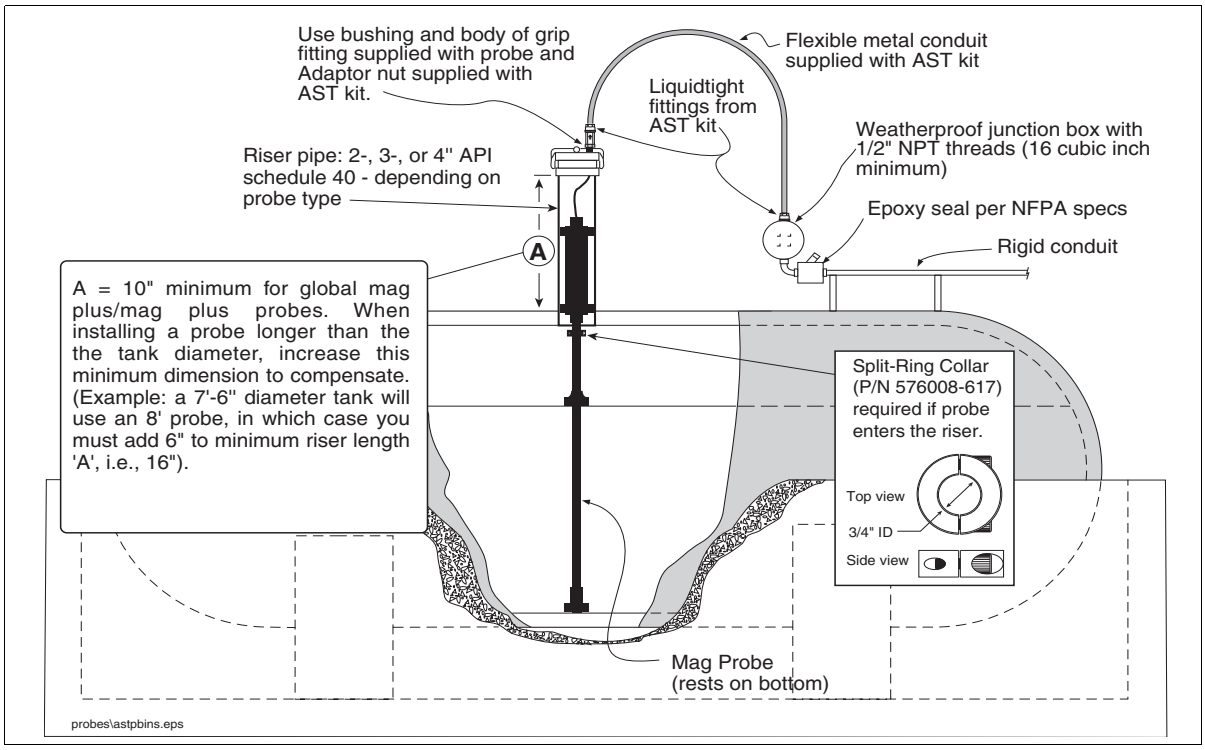


Figure 10. AST Probe Installation - Dedicated Riser

2. If you are installing the metal cap and adapter ring (see Figure 7 on page 10), screw the ring onto the 4” riser until the gasket contacts the pipe, then use a pipe wrench to tighten it an additional 3/4 turn. Push the cable through the metal cap and cord grip, then clamp the cap onto the ring.

   At sites that require installation of a riser adapter (Phil-Tite M/F 4X4 or equivalent) at the top of the riser, do so following the manufacturer’s instructions. Next screw the adapter ring from the Veeder-Root kit (P/N 312020-952) onto the riser adapter by hand until the gasket contacts the sealing surface. Then use a torque wrench attached to an appropriate strap wrench (K-D Specialty tools nylon strap oil filter wrench, or equivalent) and tighten the ring to 35 - 45 ft-lbs. Loosen the cord grip nut and push the cable through the metal cap and cord grip, then clamp the cap onto the ring (see Figure 11).

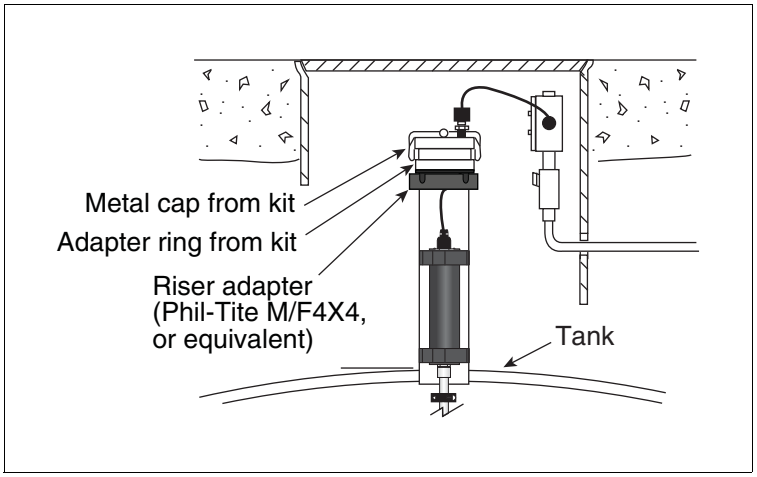


Figure 11. Installing A Riser Adapter Beneath The Metal Cap And Adapter Ring

3. Make sure there is a minimal amount of slack between the probe and cap, then tighten the cord grip nut until the cable is held firmly. Push the end of the cable through the field J-box cord grip, then tighten that cord grip nut as well. Splice and seal the wires in the J-box.

AST RISER CAP ATTACHMENT

1. If you are using the one piece cap (see Figure 6 on page 9), push the end of the probe cable through the cap and cord grip bushing, leaving a minimal amount of slack between the probe and cap. Discard the cord grip nut and attach the adapter Nut from the AST kit to the cap (see Figure 3 on page 6). Tighten the adapter Nut until the cable is held firmly. Go to Step 3.
2. If you are installing the metal cap and ring (see Figure 7 on page 10), screw the ring onto the 4" riser until the gasket contacts the pipe, then use a pipe wrench to tighten it an additional 3/4 turn. Using UL-classified pipe sealant (suitable for the fuels involved), screw the cord grip fitting into the tapped hole and tighten. Place the cord grip bushing in the fitting. Discard the cord grip nut and loosely screw the adapter Nut from the AST kit onto the cord grip fitting (see Figure 3 on page 6). Push the cable through the metal cap, bushing, and adapter nut, then clamp the cap onto the ring. Make sure there is a minimal amount of slack between the probe and cap, then tighten the adapter Nut until the cable is held firmly.
3. Next assemble the liquidtight connectors on both ends of the flexible conduit as shown in Figure 3. Push the cable through the flexible conduit assembly and into the J-box. Connect the flexible conduit assembly to the adapter Nut on one end and the J-box on the other.
4. Tighten the fittings until snug. Splice and seal the wires in the J-box.

UST Installation - Vapor Extractor Riser W/ Coupling Adapter

This type installation is usually a retrofit and is usually connected to the console via direct burial cabling. The site should already be prepped (all digging, saw cutting, and jackhammering done) prior to probe installation (see Figure 12). A piece of flex conduit should be in place as shown to protect the cable.

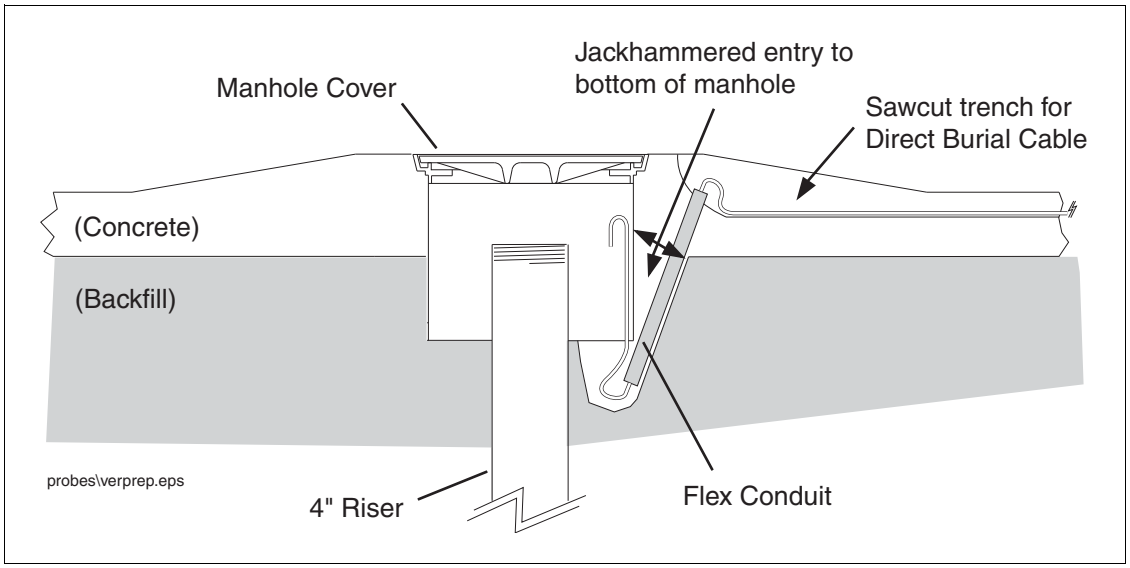


Figure 12. Vapor Extractor Cabling Entry

1. Remove any existing hardware from the Vapor Extractor Riser so that it's 4" NPT riser threads are exposed.

2. Use the extractor wrench tool (OPW Part Number: 89-0044) to remove the Ball Float Check Valve and Extractor Cage inside the bottom of the 4" riser. Important! - Ball Float Check Valve and Extractor Cage may be difficult to remove; **use caution**.
3. Remove any sludge from the bottom of the tank.
4. Assemble the probe floats, spacer rings, and cable as per the Mag Probe Assembly Manual.
5. Gently slide the float(s) to the bottom of the probe shaft. Important! - Handle probes carefully. Striking or dropping the probe will result in loss of calibration and could cause permanent damage.
6. Carefully lower the probe into the riser pipe until the boot rests on the bottom of the tank.
7. Thread the probe cable through the bottom of the new Coupling adapter and out the tapped opening in its side.
8. Screw the Coupling Adapter onto the 4" riser until the gasket first contacts the riser pipe. Then use a pipe wrench to tighten the Coupling Adapter an additional 3/4 turn.
9. Test pull the cable to insure that it is free of spring and that the probe is resting on the bottom of the tank. (Make sure there is some slack in the cable.)
10. Slip the PG7 cord grip fitting (o-ring end first) over the cable and screw it into the tapped hole in the Coupling Adapter (ref Figure 4 on page 7 for the correct PG7 cord grip assembly). Tighten snugly - **Be careful not to overtighten.** Slide the domed nut of the PG7 fitting down the cable and tighten securely onto the PG7 fitting so that the cable stays firmly in place. **Again, be careful not to overtighten.**
11. Reattach the riser cap from the original installation onto the Coupling Adapter.
12. Position the Shield-Fitting over the PG7 cord grip and secure with the hose clamp (see Figure 13 on page 15).
13. Splice the probe cable to the direct burial cable and seal following instructions shipped with the splice kit. Observe polarity!
14. Secure splice enclosure against the Shield-Fitting with the tie wrap.

WARNING! If Ball Float Check Valve was part of your Overfill Protection System, you now need to consider another form of overfill protection (i.e. TLS console alarm, drop tube with overfill protection valve or some other accepted means).

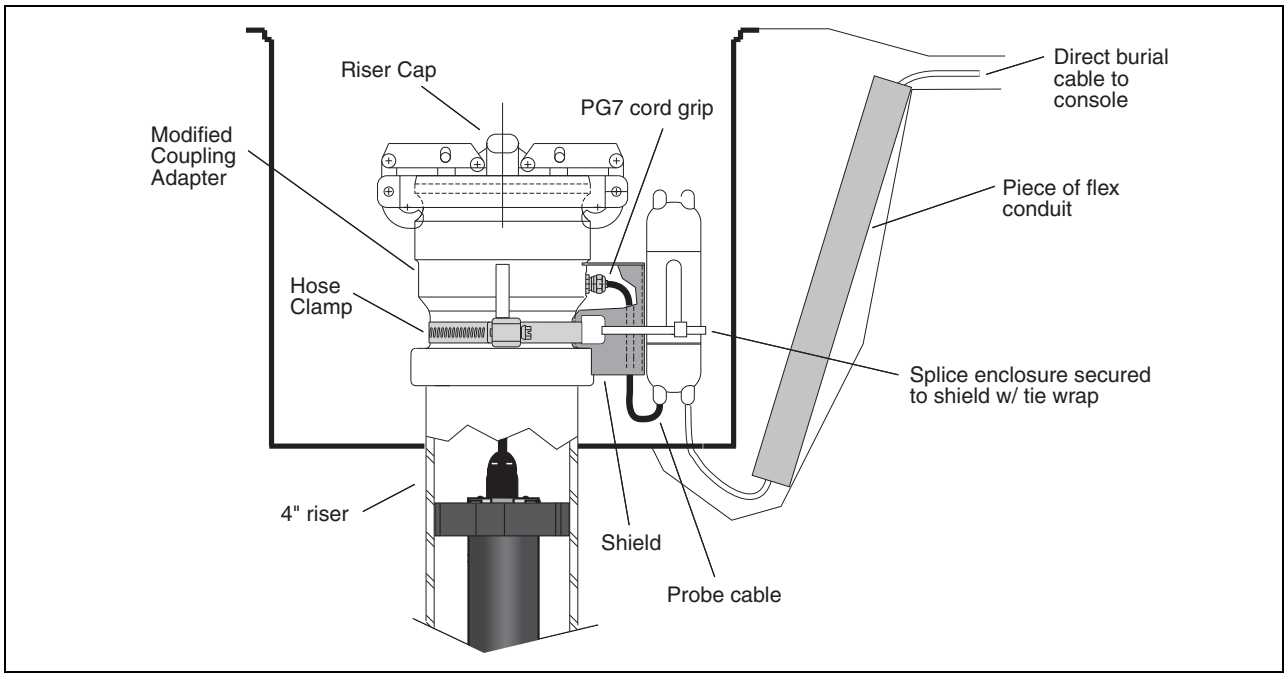


Figure 13. Mag Probe Vapor Extractor Riser Installation - w/ Coupling Adapter

UST Installation - Vapor Extractor Riser W/O Coupling Adapter

This type installation is usually a retrofit and is usually connected to the console via direct burial cabling. The site should already be prepped (all digging, saw cutting, and jackhammering done) prior to Probe Installation (see Figure 12 on page 13). A piece of flex conduit should be in place as shown to protect the cable.

1. Remove any existing hardware from the Vapor Extractor Riser so that it's 4" NPT riser threads are exposed.
2. Use the extractor wrench tool (OPW Part Number: 89-0044) to remove the Ball Float Check Valve and Extractor Cage inside the bottom of the 4" riser. Important! - Ball Float Check Valve and Extractor Cage may be difficult to remove; **use caution**.
3. Remove any sludge from the bottom of the tank.
4. Assemble the probe floats, spacer rings, and cable as per the Mag Probe Assembly Manual.
5. Gently slide the float(s) to the bottom of the probe shaft. Important! - Handle probes carefully. Striking or dropping the probe will result in loss of calibration and could cause permanent damage.
6. Carefully lower the probe into the riser pipe until the boot rests on the bottom of the tank.
7. Ensure that the cord grip nut on the new cap is loose so that the bushing can rotate freely.
8. Thread the probe cable through the bushing and nut on the cap, leaving a minimal amount of slack between the probe and cap.
9. Install the cap onto the riser, threading it by hand until the gasket first contacts the riser pipe. Then lightly tap the cap with a hammer to tighten it an additional 3/4 turn.
10. Splice the probe cable to the direct burial cable and seal following instructions shipped with the splice kit. Observe polarity!
11. Bring the cable down the side of riser and secure into place with the tie wrap.

WARNING! If Ball Float Check Valve was part of your Overfill Protection System, you now need to consider another form of overfill protection (i.e. TLS console alarm, a drop tube with overfill protection valve or some other accepted means).

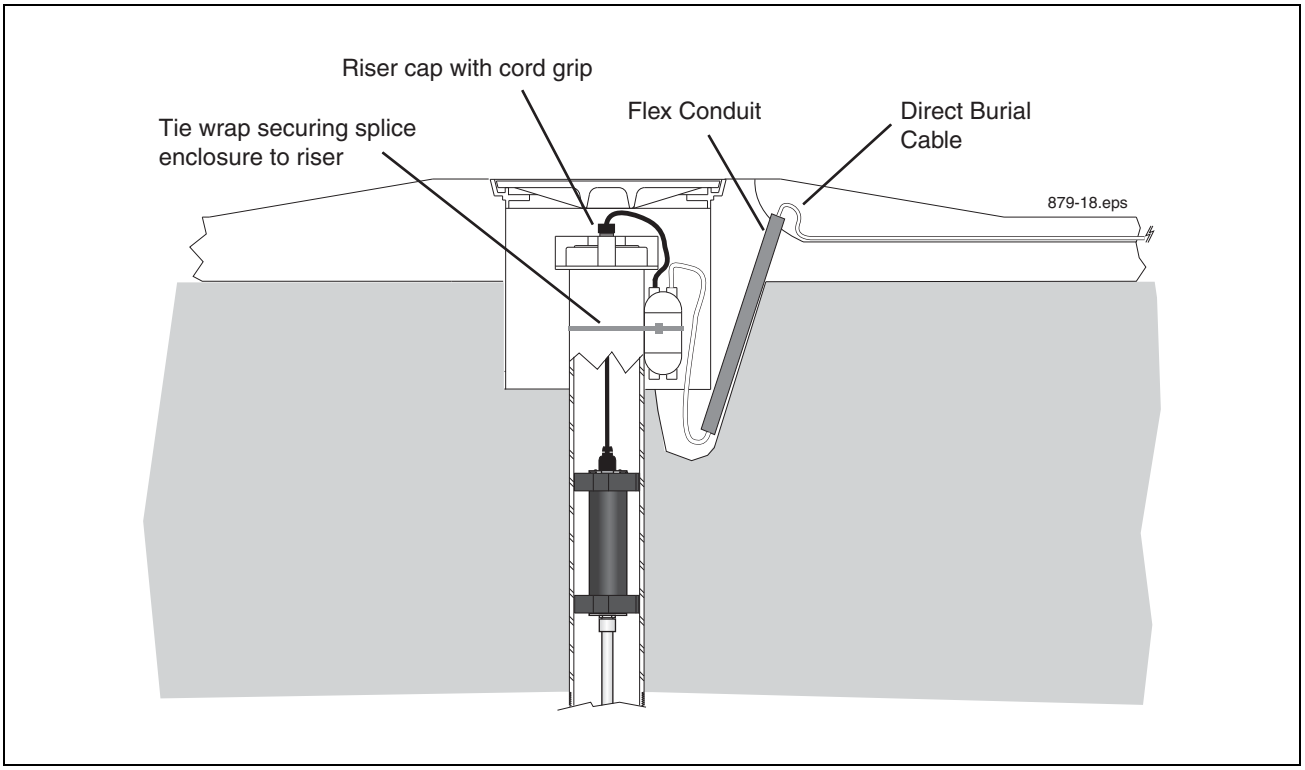
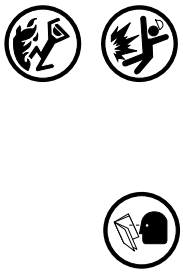


Figure 14. Mag Probe Vapor Extractor Riser Installation - W/O Coupling Adapter

Probe and Sensor Conduit Installation

⚠ WARNING



Probes and sensors operate in areas where flammable liquids and explosive vapors may be present.

Improper installation may result in fire or explosion causing serious injury or death.

Practice the following:

1. **Read thoroughly and follow the instructions shipped with each probe and sensor.**
2. **Probe and sensor wiring conduit must not contain any other wires.**
3. **Probe and sensor wiring and conduits must enter the console only through their designated areas.**
4. **Power and communication wires must not enter the intrinsically safe compartment of the console.**

Wiring Run Methods

Two wiring run methods are commonly used for probes and sensors - Wiring pulled through buried, sealed 1/2" conduit; or direct burial cable. NOTE: PVC conduit is an acceptable alternate where accepted by local codes [ref. "National Electrical Code Compliance" on page 2 for more detail on cable requirements].

BURIED RIGID CONDUIT

The preferred method, especially in new sites before driveway surfaces are paved, is to pull probe and sensor wiring through buried 1/2" rigid conduit [Figure 15].

Pull two or three conductors shielded cable (as required). Individual wires should be color-coded between the console and the junction box at each probe and sensor location (do not gang wires together, i.e., splicing all sump sensor + wires together to run one wire back to console). Use single lengths of wire with no splices to ensure optimum signal strength.

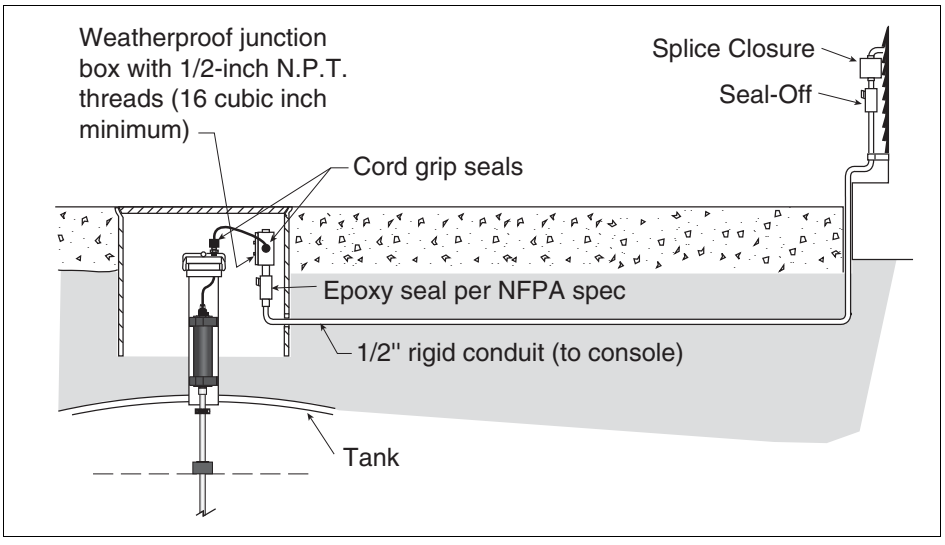


Figure 15. Example Probe Wiring Run In Buried Rigid Conduit

CAUTION: Since wires for multiple sensors may enter the console through a single conduit, it is recommended that you use a different color-code for each wire or individually mark each wire to identify sensor inputs. Also, if the intrinsically safe wires enter the building in a wiring trough, only Veeder-Root intrinsically safe wire can be in the trough. Keep all low power (intrinsically safe) wiring isolated from high power wires in all wiring troughs.

DIRECT BURIAL CABLE

An alternative to trenching through existing pavement is to use direct burial cable. Before considering the direct burial method, check to be sure that direct burial practices are acceptable at this location. The direct burial method requires grinding using an abrasive wheel, a 1/4" to 3/8" wide by 1-1/4" deep groove (adding 1/4" of depth for each additional cable) in the pavement surface, laying Veeder-Root supplied direct burial cable down in the bottom of the groove, laying an expanded polyethylene foam backer rod over the cable(s), and then a placing a 1/4" to 1/2" bead of silicone sealant over the backer rod to within a minimum of 3/8" below the pavement surface [see Figure 16].

If you decide upon the direct burial method, consult the direct burial cable installation manual for detailed installation instructions (reference manual 576013-858).

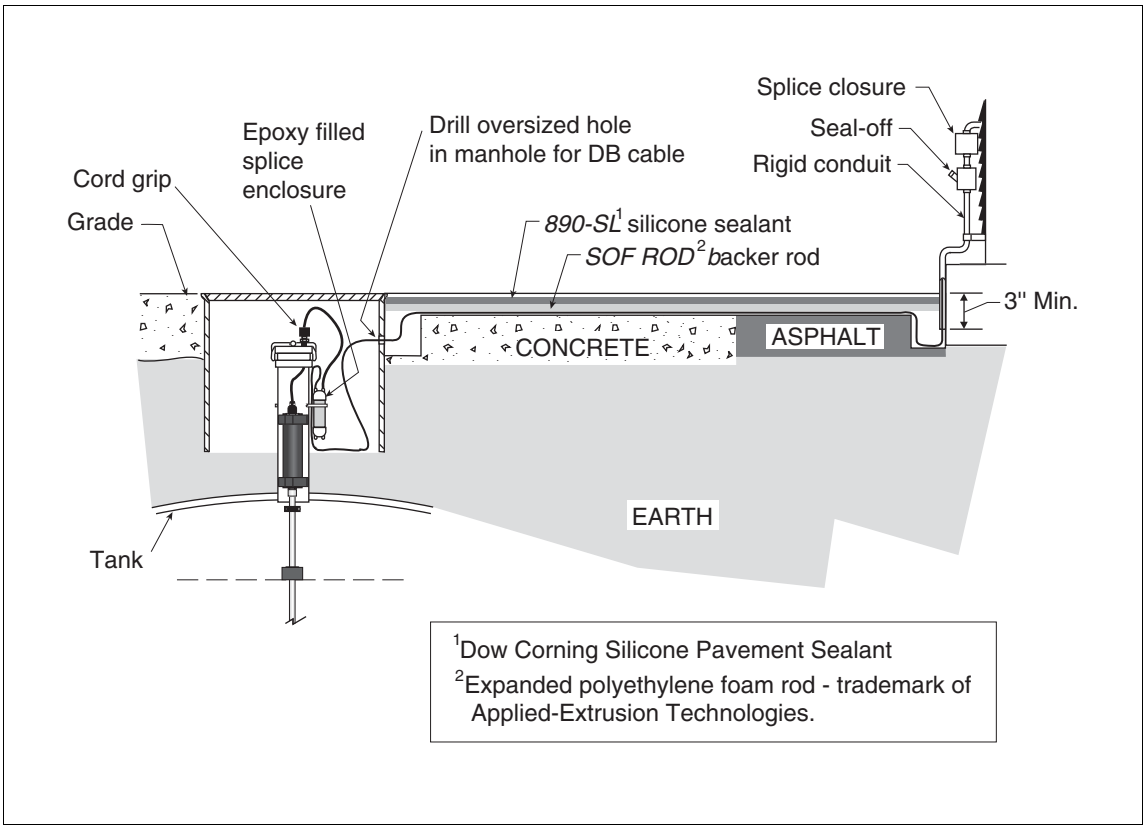


Figure 16. Example Probe Wiring Run Via Direct Burial Cable

I/O Module Wiring

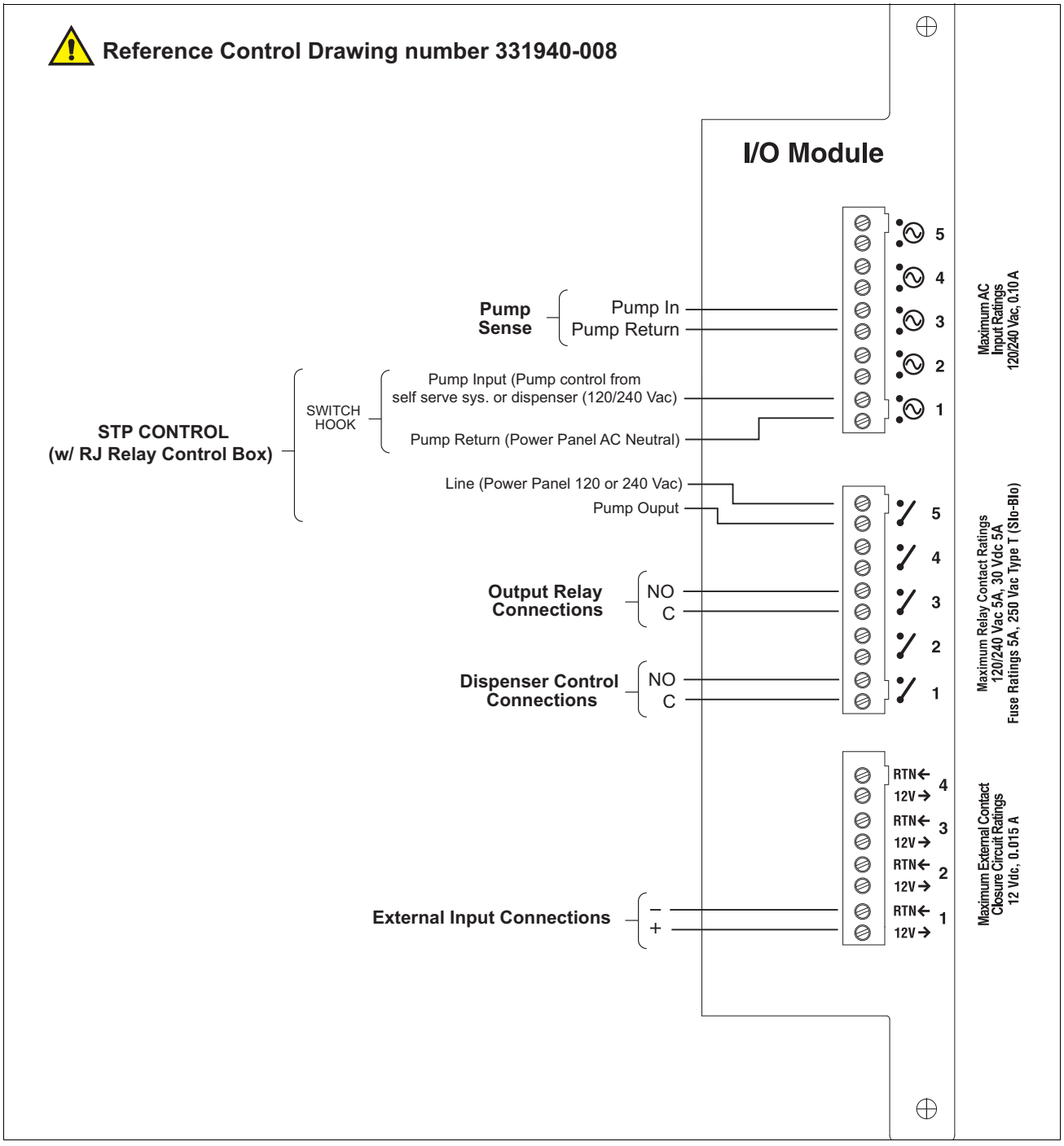


Figure 17. I/O Relay Module Connections

10 Amp Controller Module Wiring

CAUTION: This module is to be installed in Slot 4 only!

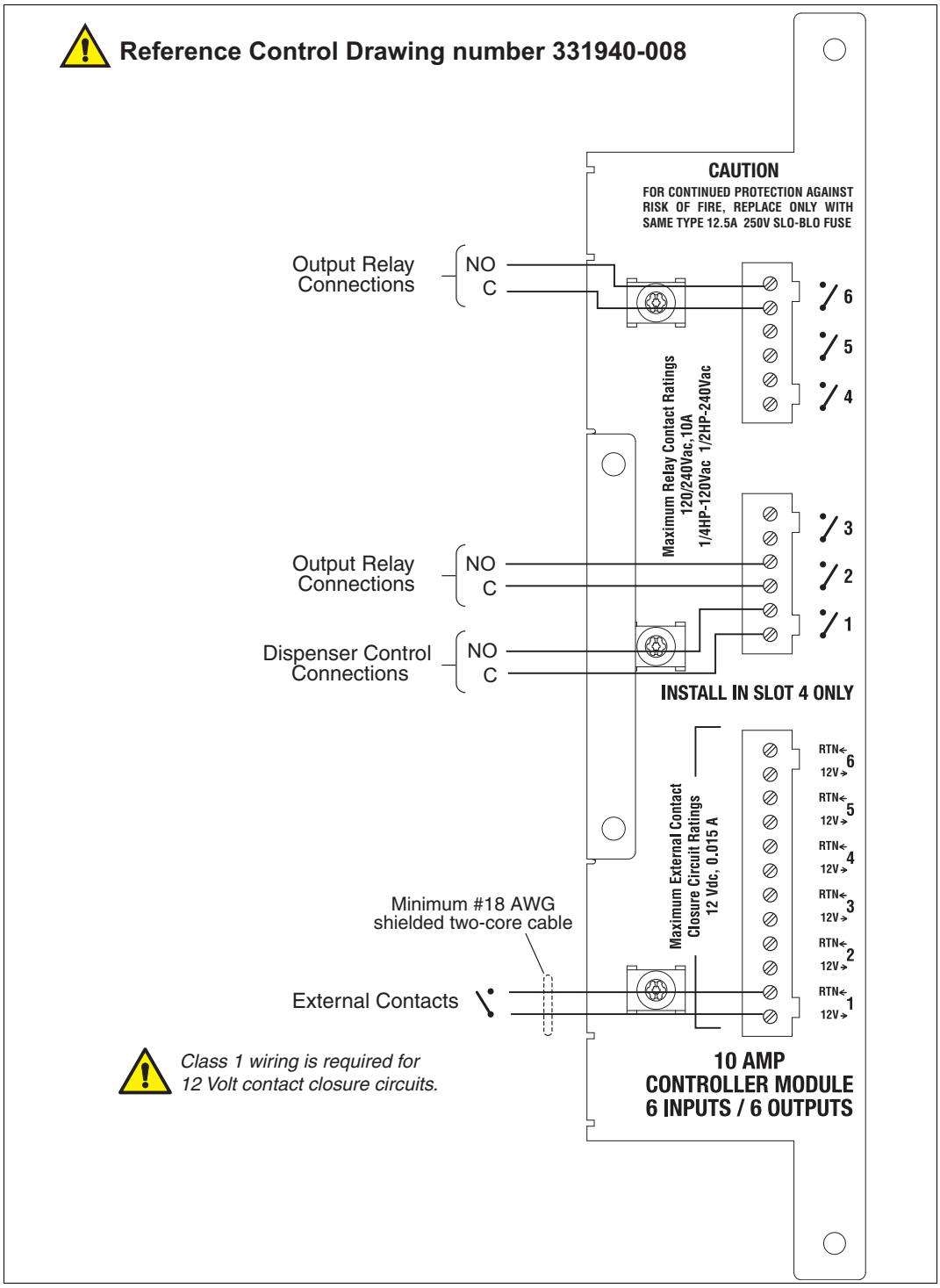


Figure 18. 10 Amp Controller Module Connections

MDIM Module Wiring

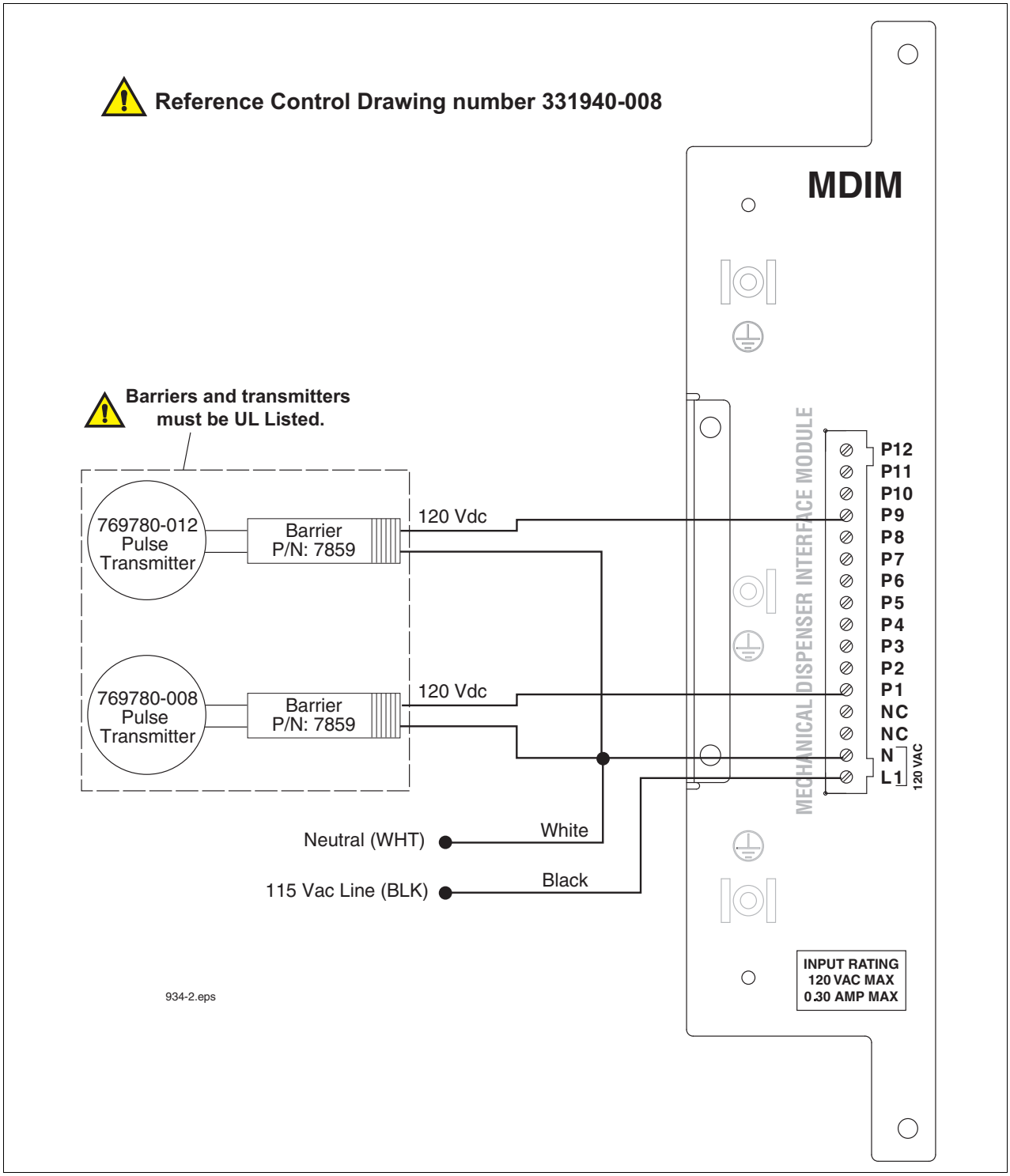


Figure 19. MDIM Module Pulser Connections

LVDIM Module Wiring

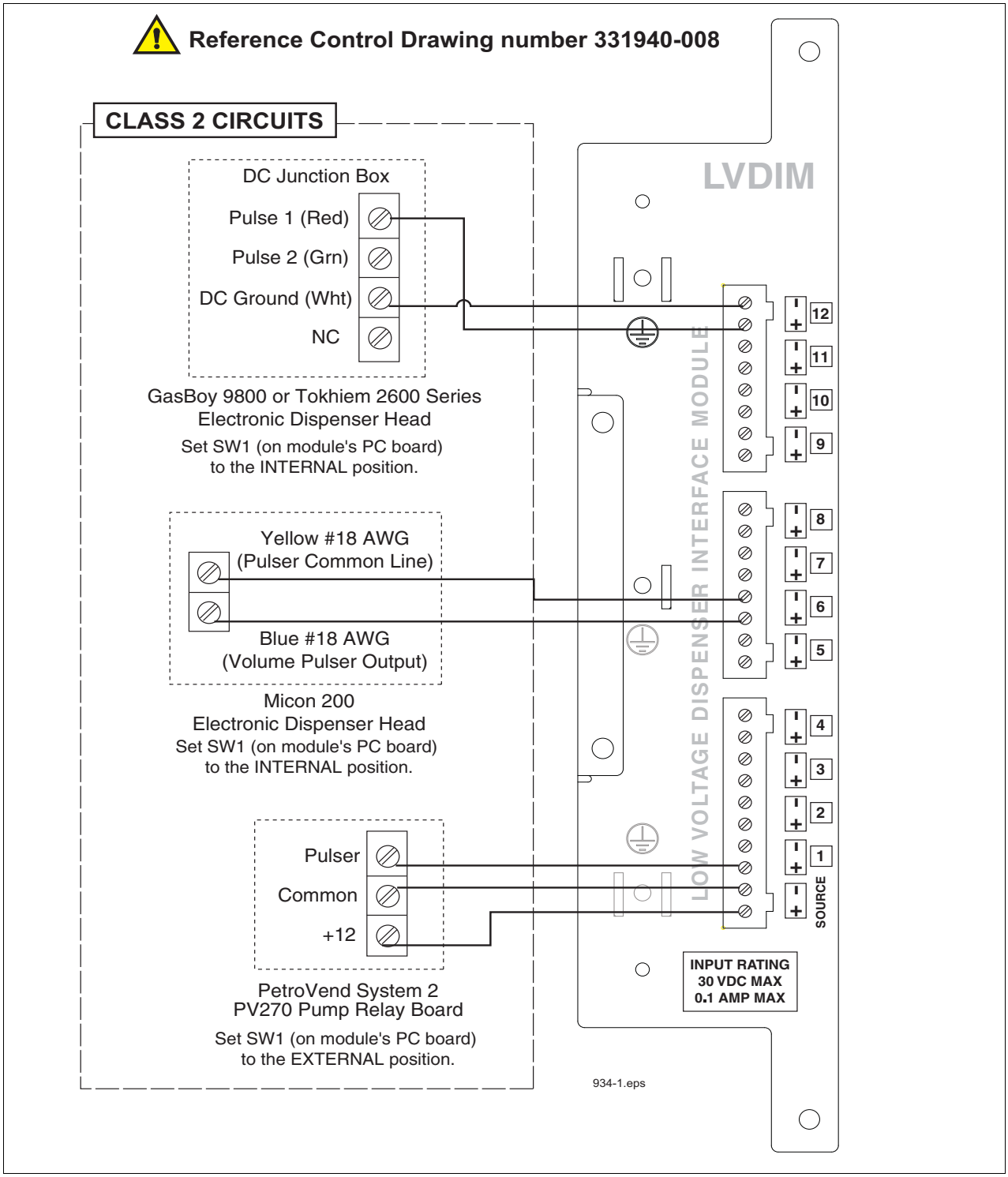


Figure 20. LVDIM Module POS/Pulser Connections

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