

# TLS-4XX Console

## Site Prep and Installation Manual



# Notice

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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 .
- 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.
- Device-to-console wiring connection examples.
- Connecting ac power to console and initial startup procedure

## Contractor Certification Requirements

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Veeder-Root requires the following minimum training certifications for contractors who will install and setup the equipment discussed in this manual:

**Installer (Level 1) Certification:** Contractors holding valid Installer Certification are approved to perform wiring and conduit routing; equipment mounting; probe, sensor and carbon canister vapor polisher installation; wireless equipment installation; tank and line preparation; and line leak detector installation.

**ATG Technician (Level 2/3 or 4) Certification:** Contractors holding valid ATG Technician Certifications are approved to perform installation checkout, startup, programming and operations training, system tests, troubleshooting and servicing for all Veeder-Root Series Tank Monitoring Systems, including Line Leak Detection. In addition, Contractors with the following sub-certification designations are approved to perform installation checkout, startup, programming, system tests, troubleshooting, service techniques and operations training on the designated system.

- Wireless 2
- Tall Tank

**VR Vapor Products Certification:** Contractors holding a certification with the following designations are approved to perform installation checkout, startup, programming, system tests, troubleshooting, service techniques and operations training on the designated system.

- ISD – In Station Diagnostics
- PMC – Pressure Management Control
- CCVP - Veeder-Root Vapor Polisher
- Wireless – ISD/PMC Wireless
- A current Veeder-Root Technician Certification is a prerequisite for the VR Vapor Products course.

**Warranty Registrations** may only be submitted by selected Distributors.

## Related Documents

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### DOCUMENTS REQUIRED TO INSTALL EQUIPMENT

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

| Equipment   | ATEX<br>Descriptive System | IECEX<br>Descriptive System | UL/cUL<br>Control Drawing |
|---|----------------------------|-----------------------------|---------------------------|
|   | Document No.               | Document No.                | Document No.              |
| <b>Associated Apparatus</b>                                   |                            |                             |                           |
| TLS-450   | 331940-006                 | 331940-106                  | 331940-008                |
| TLS-350R or TLS-350 Plus                                      | 331940-001                 | 331940-101                  | 331940-011                |
| TLS-300   | 331940-002                 | 331940-102                  | 331940-013                |
| TLS-50 or TLS2 or TLS-IB                                      | 331940-003                 | 331940-103                  | 331940-014                |
| <b>Intrinsically Safe Apparatus for Wireless Applications</b> |                            |                             |                           |
| 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.

|  |  |
|--|--|
|  <p><b>EXPLOSIVE</b><br/>Fuels and their vapors are extremely explosive if ignited.</p>   |  <p><b>FLAMMABLE</b><br/>Fuels and their vapors are extremely flammable.</p>  |
|  <p><b>ELECTRICITY</b><br/>High voltage exists in, and is supplied to, the device. A potential shock hazard exists.</p>   |  <p><b>TURN ELECTRICAL POWER OFF</b><br/>Live power to a device creates a potential shock hazard. Turn Off electrical power to the device and associated accessories when servicing the unit.</p> |
|  <p><b>WARNING</b><br/>Heed the adjacent instructions to avoid damage to equipment, property, environment or personal injury.</p>   |  <p><b>WEAR EYE PROTECTION</b><br/>Wear eye protection when working with pressurized fuel lines or epoxy sealant to avoid possible eye injury.</p>  |
|  <p><b>GLOVES</b><br/>Wear gloves to protect hands from irritation or injury.</p>  |  <p><b>INJURY</b><br/>Careless or improper handling of materials can result in bodily injury.</p>  |
|  <p><b>READ ALL RELATED MANUALS</b><br/>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.</p> |  |



## National Electrical Code Compliance

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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) and the Code for Motor Fuel Dispensing Facilities and Repair Garages, (NFPA 30A).

### 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.

#### Splices

Veeder-Root recommends that no splices be made in the wire run between a sensor or probe junction box and the console. Each splice degrades signal strength and could result in poor system performance.

#### 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 a Class 1 circuit. 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  $\mu$ H/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.

### SENSOR AND PROBE JUNCTION BOXES

Weatherproof electrical junction boxes with a gasketed cover are required on the end of each probe and sensor conduit run at the manhole or monitoring well location. Gasketing or sealing compound must be used at each entry to the junction box to ensure a waterproof junction. The interior volume of each junction box must be a minimum of 16 cubic inches.

Veeder-Root recommends the following junction boxes or equivalent:

- Appleton Electric Co. - JB-DX junction box, JBK-B cover, and JB-GK-V gasket.
- Crouse-Hinds Co. - GRFX-139 junction box, GRF-10 cover, and GASK-643 gasket.

Permissible Console Input/Output Connections

Figure 1 illustrates the console's plug-in module locations and the maximum number allowed in each of the two bays of the console: Comm Bay and Module Bay. Input/output cables to the console's Comm modules attach to connectors on each module's end plate, and are accessible through an opening in the base of the console. Permissible slots and configurable ports for Comm cards are shown in Table 1.

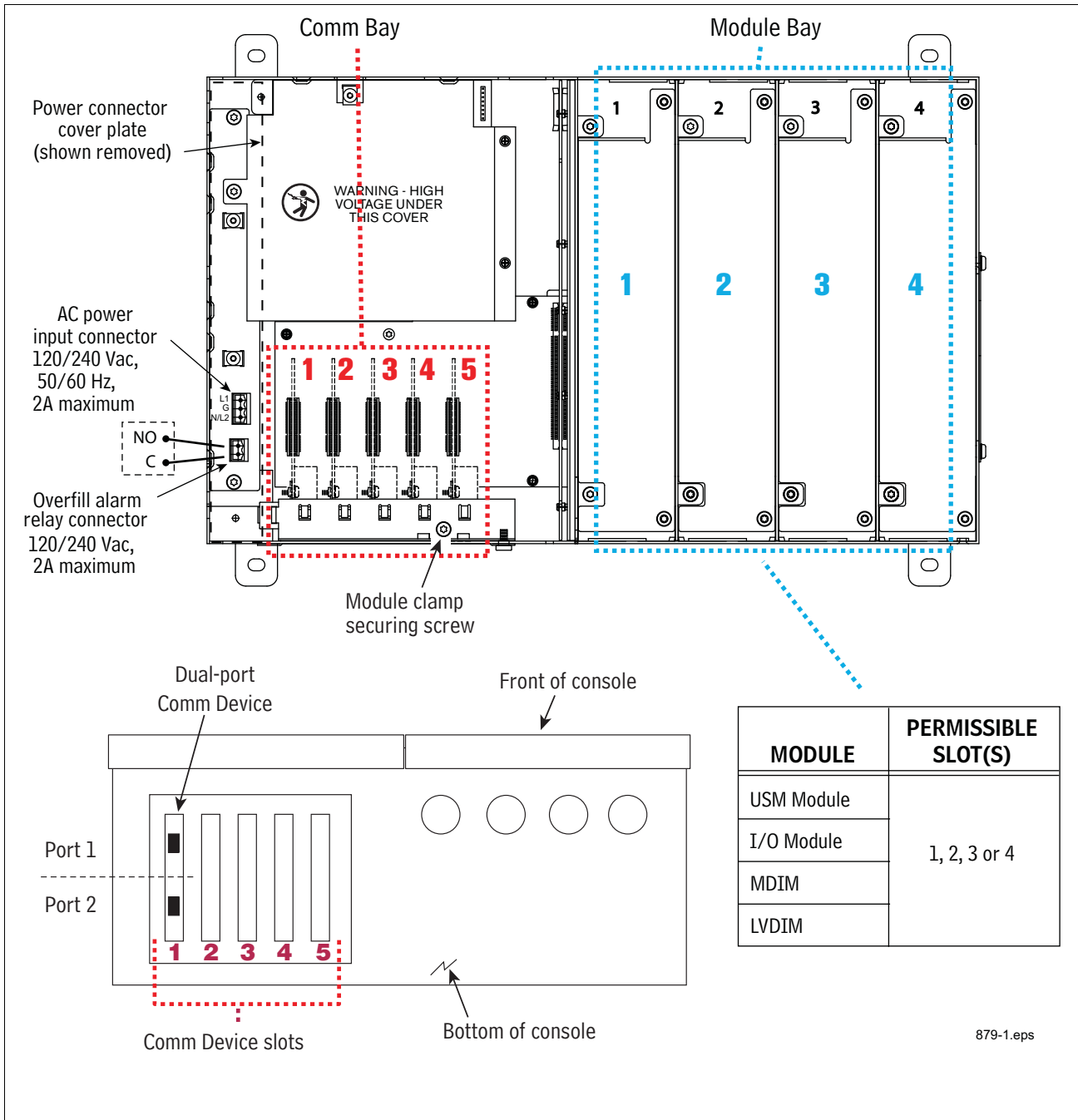


Figure 1. TLS-450 Console - Plug-in Module Compartments

Table 1.- Comm Module Permissible Slots and Port Availability

| Comm Module   | Comm Type     | Slot 1        |             | Slot 2        |               | Slot 3 |               | Slot 4         |              | Slot 5     |              |
|---|---------------|---------------|-------------|---------------|---------------|--------|---------------|----------------|--------------|------------|--------------|
|   |               | Port          |             | Port          |               | Port   |               | Port           |              | Port       |              |
|   |               | 1             | 2           | 1             | 2             | 1      | 2             | 1              | 2            | 1          | 2            |
| RS-232 Single Port<br>(also EDIM, Satellite S-SAT and Satellite H-JBox apps.) | Serial        | NC            | C           | NC            | C             | NC     | C             | ----           | ----         | ----       | ----         |
| RS-232 Dual Port<br>(also EDIM, Satellite S-SAT and Satellite H-JBox apps.)   |               | C             | C           | C             | C             | NC     | C             | C <sup>1</sup> | NC           | ----       | ----         |
| RS-485 Single Port  |               | NC            | C           | NC            | C             | NC     | C             | ----           | ----         | ----       | ----         |
| RS-485 Dual Port  |               | C             | C           | C             | C             | NC     | C             | ----           | ----         | ----       | ----         |
| RS-232/RS-485 Dual Port   |               | C<br>(RS-232) | C<br>RS-485 | C<br>(RS-232) | C<br>(RS-485) | NC     | C<br>(RS-485) | C <sup>1</sup> | NC           | ----       | ----         |
| SiteFax / Modem   |               | NC            | C           | NC            | C             | NC     | C             | ----           | ----         | ----       | ----         |
| Ethernet  | TCPIP         | ----          | ----        | ----          | ----          | ----   | ----          | NC             | C            | NC         | C            |
| Ethernet / USB Dual Port  | TCPIP/<br>USB | ----          | ----        | ----          | ----          | ----   | ----          | NC             | C<br>(TCPIP) | C<br>(USB) | C<br>(TCPIP) |
| USB   | USB           | ----          | ----        | ----          | ----          | ----   | ----          | ----           | ----         | C          | NC           |
| CDIM <sup>2</sup>   | DIM           | C             | NC          | C             | NC            | ----   | ----          | C              | NC           | ----       | ----         |

<sup>1</sup>Limited RS-232 availability (only RX, TX and Enable are active and this port is without full handshaking capability)

<sup>2</sup>Slot 4 is preferred.

## Planning Probe and Sensor Installations

The contractor should diagram, all proposed trench and conduit runs between the console's intended location and its deployed sensors and probes. A site diagram will help you to calculate conduit and wiring lengths, and necessary quantities of junction boxes, sealing boxes, clamps, brackets, etc.

Throughout this planning process and in the actual installation, you must follow the latest National Electric Codes, federal, state, and local codes, as regards conduit type, depth below grade, sealing, grounding, wire capacities, etc.

Reminder: to ensure optimum signal strength, plan sensor and probe wiring lengths so that there will be no splices between the field junction box connection and the interface module connection in the console. Every splice in the hazardous area requires the use of an epoxy sealing kit which should not be pulled through the conduit and must be located in a separate waterproof, sealed junction box.

To maintain the intrinsically-safe integrity of the installed console, sensor and probe conduits can share the same trenches with power conduits, but the intrinsically safe sensor and probe wiring can NOT share the same conduit with any other wiring. Also, the intrinsically safe wiring for console can NOT share the same conduit with another device's intrinsically safe wiring.

Install conduit from all probe and sensor locations to the console's location. Knockouts for 3/4 and 1" I.P.S. conduit are provided in both the top and bottom of the console for probe and sensor wiring.

The conduit must be properly sealed in accordance with the latest National Electric Code (NFPA 70) and the Code for Motor Fuel Dispensing Facilities and Repair Garages (NFPA 30A) since they pass from a Class I, Division 1 or 2 hazardous area into a non-hazardous area. Figure 2 illustrates a typical site deployment of probes and sensors.

If the console is being installed into a paved site, you can either dig out trenches in the pavement to run conduit out to sensors and probes as described above, or you can cut grooves in the pavement, run direct burial cable to these devices, and then seal over the cable grooves (if permitted).

NOTE: Installation of the Direct Burial System can only be done in those locations where local codes permit the use of buried cable instead of conduit, and epoxy splices instead of junction boxes.

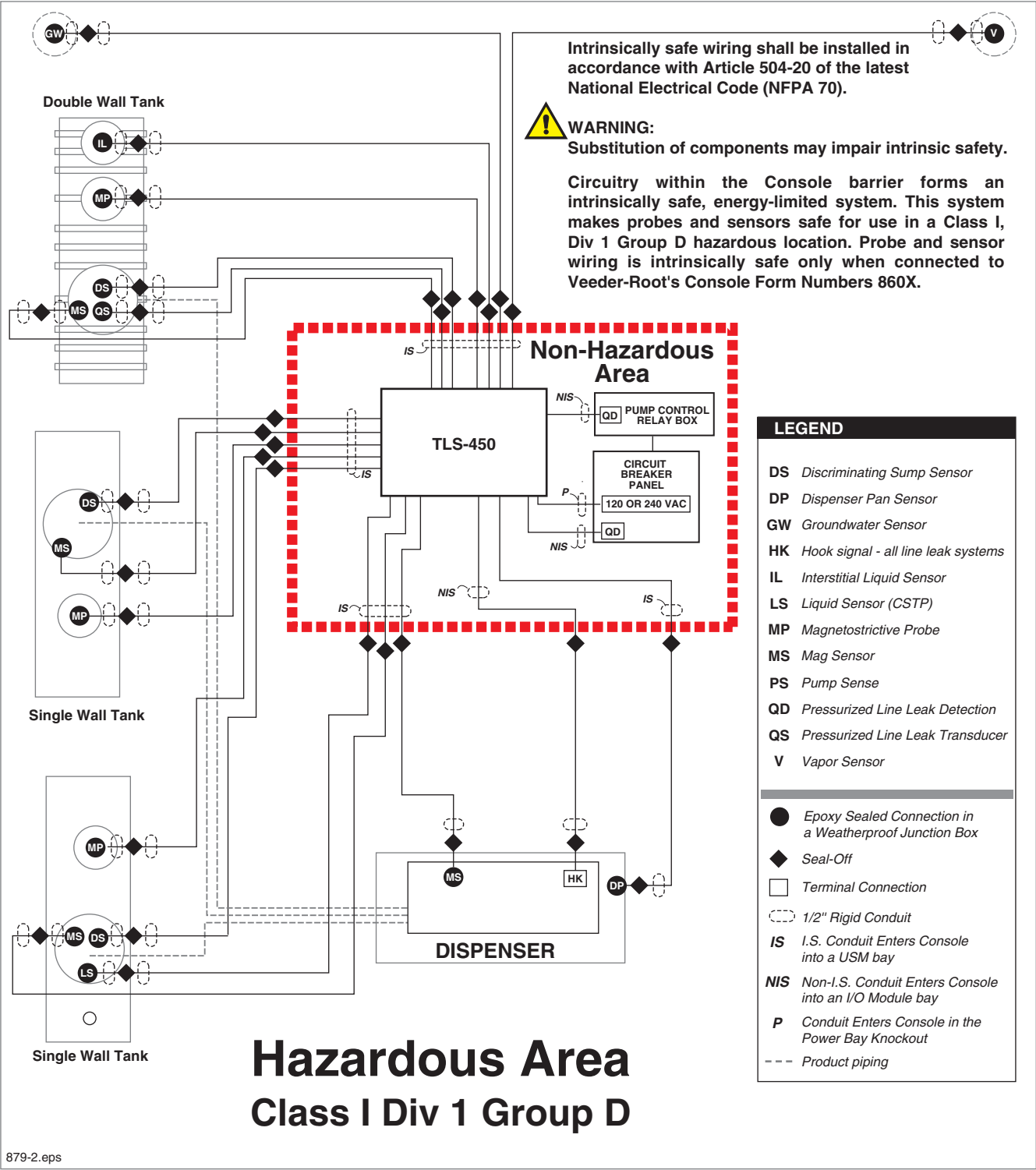




Figure 2. TLS-450 System Typical Site/Forecourt Layout

## Console Installation

### Locating the Console

---

|  <b>WARNING</b> |   |
|--|---|
|                 | <p><b>FAILURE TO COMPLY WITH THE FOLLOWING WARNINGS AND SAFETY PRECAUTIONS COULD CAUSE DAMAGE TO PROPERTY, ENVIRONMENT, RESULTING IN SERIOUS INJURY OR DEATH.</b></p> <p><b>Explosive vapors or flammable liquids could be present near locations where fuels are stored or being dispensed.</b></p> <p><b>This console is not explosion proof. Do not install this console in a volatile, combustible, or explosive atmosphere.</b></p> <p><b>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).</b></p> |

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 3. 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 3 shows the two designated knockouts through which power wiring can safely enter the console.

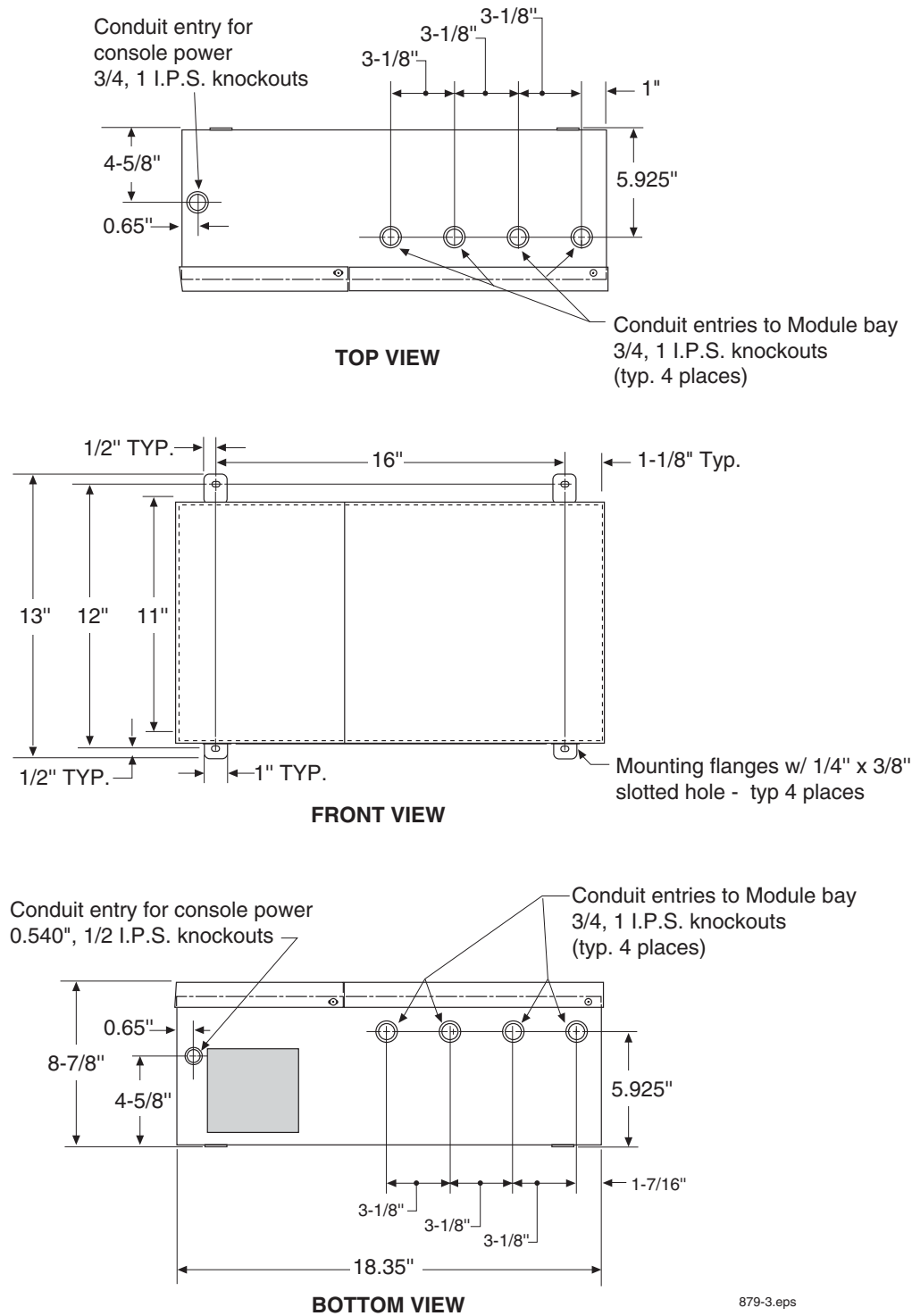
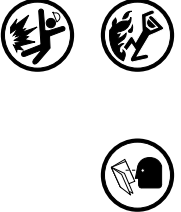


Figure 3. TLS-450 Console Dimensions and Designated Conduit Knockouts

## Wiring Conduit Safety Issues

| <b>⚠ WARNING</b>  |   |
|---|---|
|  | <p><b>FAILURE TO COMPLY WITH THE FOLLOWING WARNINGS AND SAFETY PRECAUTIONS COULD CAUSE DAMAGE TO PROPERTY, ENVIRONMENT, RESULTING IN SERIOUS INJURY OR DEATH.</b></p> <p><b>Probes and sensors operate in areas where flammable liquids and explosive vapors may be present.</b></p> <p><b>Improper installation may result in fire or explosion causing serious injury or death.</b></p> <p><b>Practice the following:</b></p> <ol style="list-style-type: none"><li><b>1. Read thoroughly and follow the instructions shipped with each probe and sensor.</b></li><li><b>2. Probe and sensor wiring conduit must not contain any other wires.</b></li><li><b>3. Probe and sensor wiring and conduits must enter the console only through their designated areas.</b></li><li><b>4. Power and communication wires and conduit must not enter the intrinsically safe area of the console.</b></li></ol> |

Wiring between the console and the probes and sensors is of limited electrical power so that there is insufficient energy to ignite fuel. In the console, the low power, probe and sensor wiring is considered intrinsically safe because it is physically isolated from all high power wiring. To maintain the integrity of this safety feature, you must install probe and sensor wiring in separate conduits from all other wiring. In addition, probe and sensor conduits can only enter the console through the designated intrinsically safe area knockouts.

**NOTE:** Wiring from separate probes and sensors may be run in the same conduit or trough provided they are powered by the same console. Improper system operation will result if probe and sensor wiring to separate consoles share the same conduit. Do not run probe and sensor wiring to separate consoles in the same conduit. Do not run probe and sensor wiring with other equipment's intrinsically safe wiring in the same conduit. Improper system operation could also occur if the conduit locking nuts attaching conduit to the console are not tightened sufficiently to score the console's paint film and make good metal-to-metal contact. For proper grounding use grounding/bonding set screw conduit locknuts to achieve a good conduit-to-console metal bond.



## Determining Tank Tilt

The following procedure to determine tank tilt is intended for U.S. installations. Record the required measurements in Table 2 for each of the tanks. If the probe is installed in the center of the tank, the value is 000.00 inches (0000.0 mm). NOTE: if using metric units, substitute millimeters for inches in the steps below.

1. Stick the tank at the fill riser opening at least three times. Record the average measurement taken at the top of the fill riser in column A of Table 2.
2. Measure the distance in inches between the centers of the probe riser and the fill riser. Record this distance in column B.
3. Measure the distance in inches from the center of the probe riser to the center of the tank. Record this distance in column C.
4. Record the probe's Fuel Height reading in inches in column D.
5. Subtract the value entered in column D from the value entered in column A. Record the result in column E.
6. Divide the value in column E by the value in column B to determine the pitch. Record the results in column F.
7. Multiply the value in column C by the value in column F to determine Tank Tilt. Record this value in column G.
8. Enter the calculated tilt in inches for each tank when you enter the Tank setup parameters (Tank Setup/ General tab screen).

**Table 2. Tank Tilt Calculation Worksheet**

| Tank No. | A<br>Stick Gauge<br>Avg. Height<br>@ Fill Riser | B<br>Distance<br>from Fill to<br>Probe Riser | C<br>Distance from<br>Probe Riser to<br>Center of Tank | D<br>Probe's Fuel<br>Height Reading | E<br>(A - D = E) | F<br>Pitch<br>(E / B = F) | G<br>Tank Tilt*<br>(F x C = G) |
|----------|---|--|--|-------------------------------------|------------------|---------------------------|--------------------------------|
| 1        |   |  |  |                                     |                  |                           |                                |
| 2        |   |  |  |                                     |                  |                           |                                |
| 3        |   |  |  |                                     |                  |                           |                                |
| 4        |   |  |  |                                     |                  |                           |                                |
| 5        |   |  |  |                                     |                  |                           |                                |
| 6        |   |  |  |                                     |                  |                           |                                |
| 7        |   |  |  |                                     |                  |                           |                                |
| 8        |   |  |  |                                     |                  |                           |                                |
| 9        |   |  |  |                                     |                  |                           |                                |
| 10       |   |  |  |                                     |                  |                           |                                |
| 11       |   |  |  |                                     |                  |                           |                                |
| 12       |   |  |  |                                     |                  |                           |                                |
| 13       |   |  |  |                                     |                  |                           |                                |
| 14       |   |  |  |                                     |                  |                           |                                |
| 15       |   |  |  |                                     |                  |                           |                                |
| 16       |   |  |  |                                     |                  |                           |                                |

\*Tank Tilt may be a positive (+) or negative (-) value.

## Determining Mag Probe Length

### Probe Manhole Installation

At each underground probe location there must be a 14-inch minimum diameter manhole. If necessary you must install this manhole according to the manufacturer's instructions (Note: probes should be located at least 12 inches from the submersible pump to avoid erroneous probe readings when the pump is running). Position the manhole so that there is necessary clearance for junction box installation and wiring.

### Determining Mag Probe Length for Installation in a Dedicated Riser

1. Measure the distance from the bottom of the tank to the top of the probe manway - this is the minimum probe length (ref. Figure 4).
2. The probe canister must be within the riser pipe (minimum length of 10 inches [254mm]).

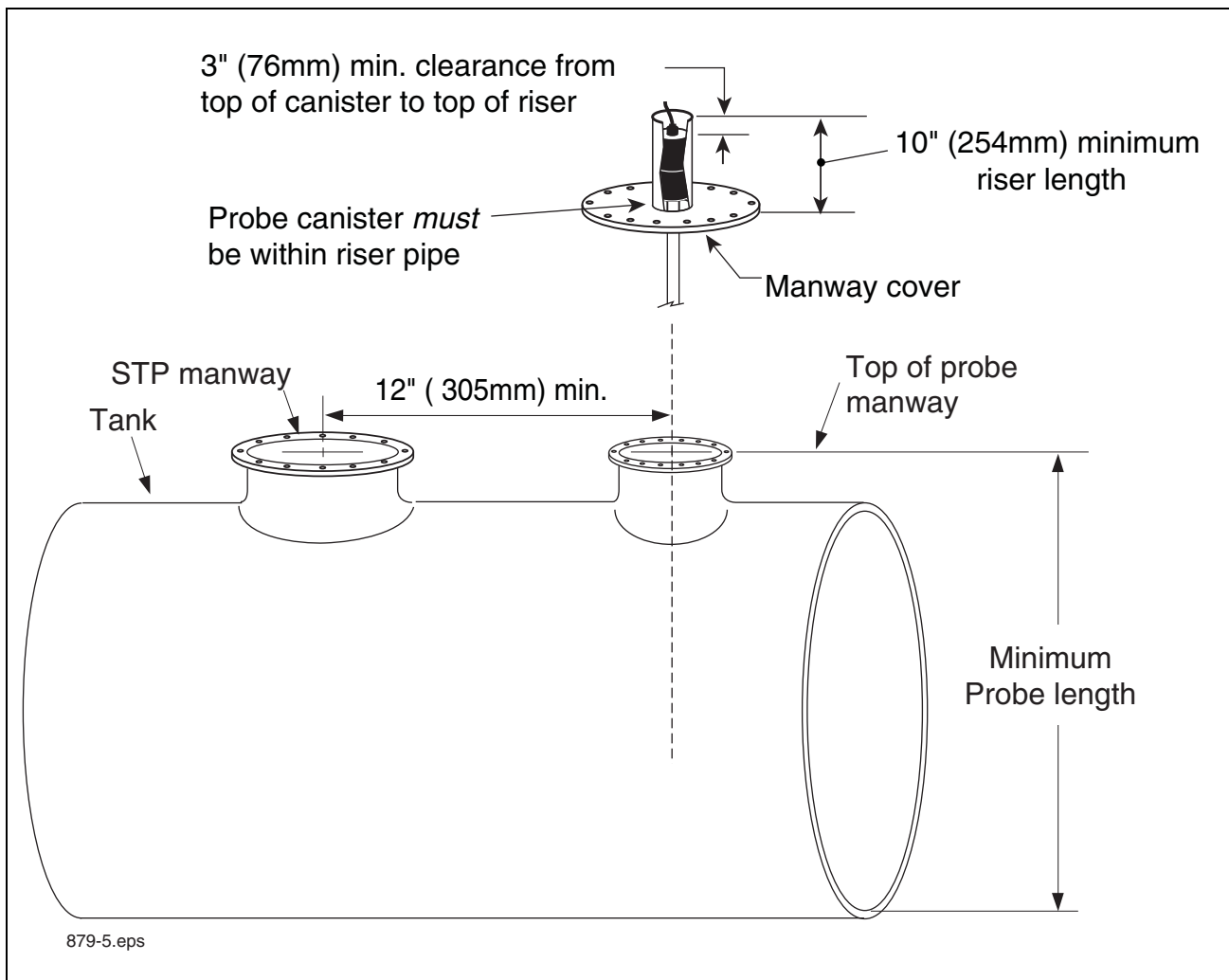


Figure 4. Determining the minimum mag probe length

## Determining Mag Probe Length for Installation in a Vapor Extractor Riser

1. Measure the distance from the top of the riser to the Extractor Cage Cross Pin (see Figure 5). Record this distance as "D1" (Important - Dimension "D1" must be at least 25 inches).
2. Use the extractor wrench tool (OPW Part Number: 89-0044) to remove the Ball Float Check Valve Assembly from the riser.
3. Measure from the top of the riser to the bottom of the tank and record this distance as "D2".
4. Subtract "D1" from "D2", then add 7 inches, to determine the correct probe length.

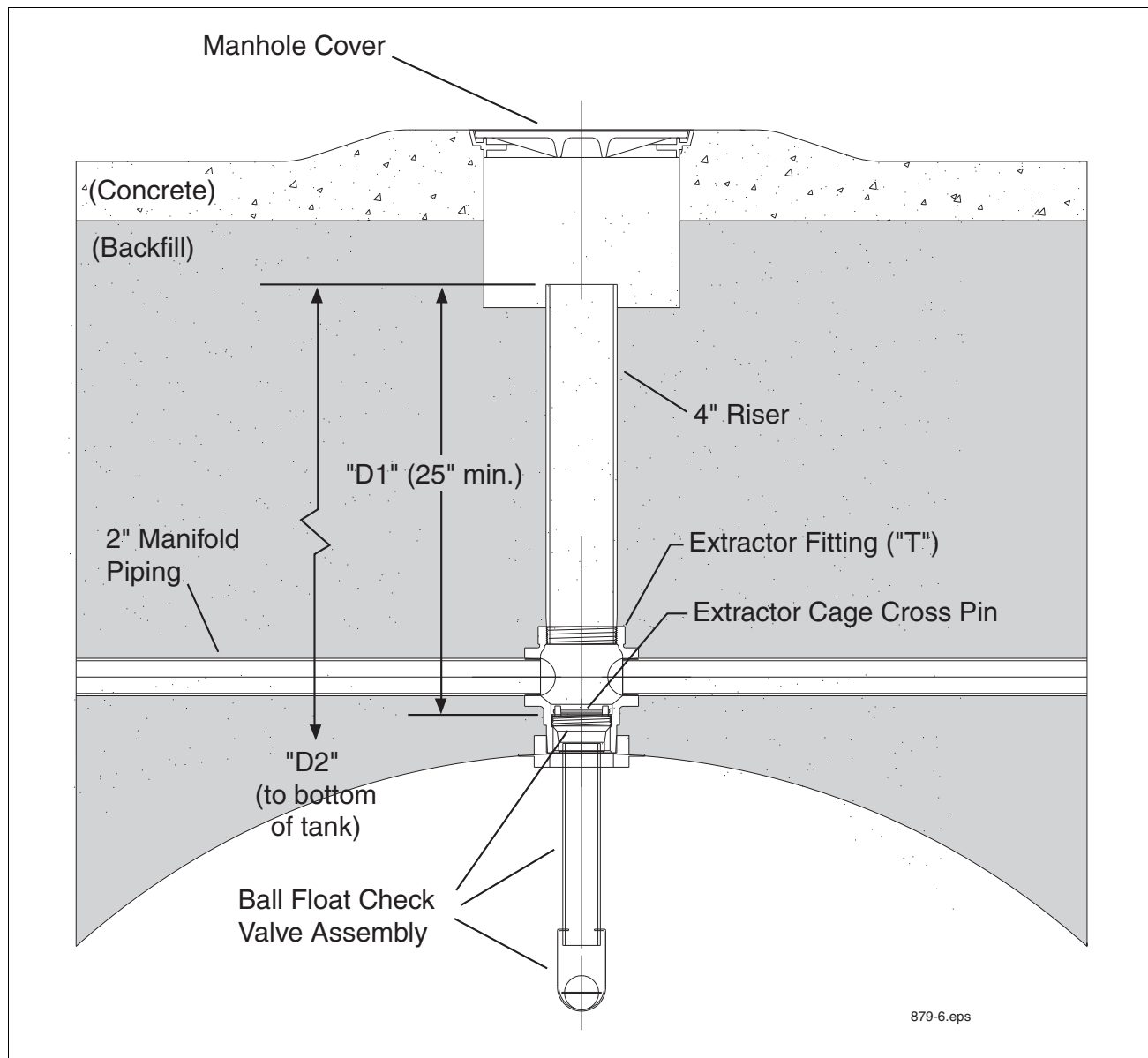


Figure 5. Determining Mag Probe length for installation in a vapor extractor riser

## Special Mag Probe Installation Kits

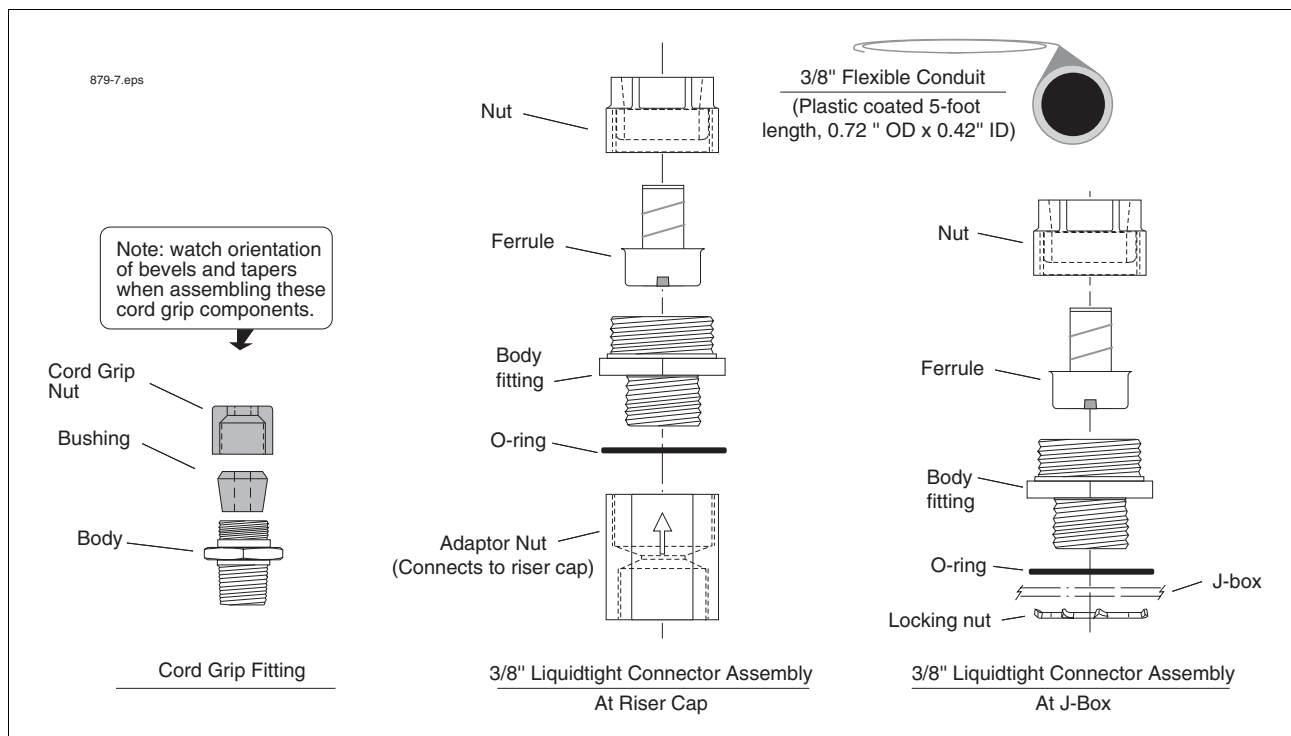
In addition to the Mag Probe installation kits shipped with each probe (containing floats, spacer rings, cable, etc.), your installation may also require one or more of the special kits described in this section.

### 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 3 and shown in Figure 6.

**Table 3. Mag Probe AST installation kit - Part No. 312020-984**

| Quantity | Description  | Part Number |
|----------|--|-------------|
| 5 feet   | 3/8" Flexible conduit                                  | 576008-294  |
| 1        | 3/8" Adaptor nut                                       | 329972-002  |
| 2        | 3/8" Straight liquidtight connectors and related parts | 576008-295  |
| 1        | Cord Grip Group  | 331028-001  |



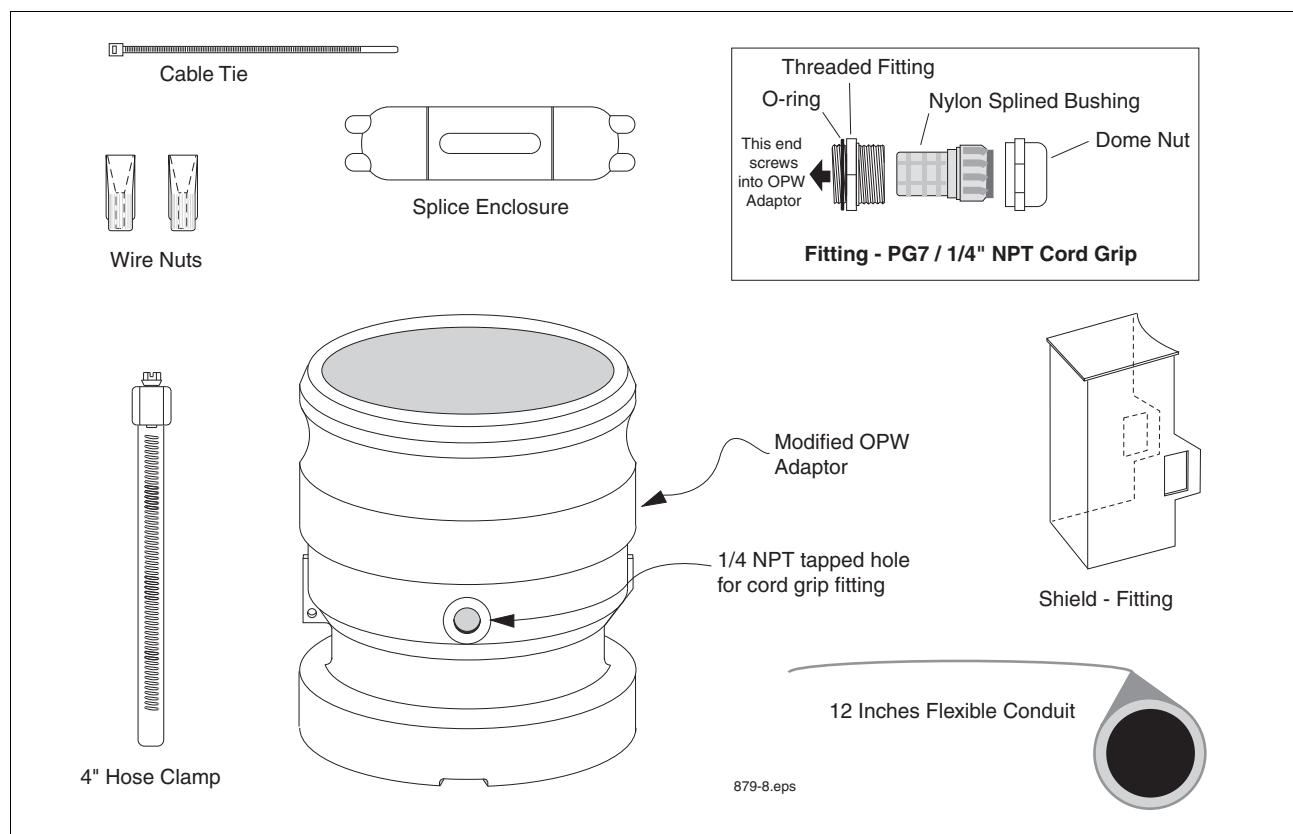
**Figure 6. Mag Probe AST Installation Kit**

## Vapor Extraction Riser Kit w/ Coupling Adaptor

This kit contains parts needed to install a Mag Probe into a Vapor Extractor Riser that has a Coupling Adaptor (parts listed in Table 4 and shown in Figure 7):

**Table 4. Vapor Extraction Riser Kit (w/ coupling adaptor) - 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 Adaptor           | 331448-001  |
| 1         | Shield -Fitting                | 331449-001  |
| 1         | 4" Hose Clamp                  | 576008-638  |
| 12 inches | Flex Conduit                   | 576008-294  |



**Figure 7. Mag Probe vapor extractor w/coupling adaptor installation kit**

## Vapor Extraction Riser Kit w/o Coupling Adaptor

This kit contains parts needed to install a probe in a Vapor Extractor Riser that does not have a coupling adaptor (parts listed in Table 5 and shown in Figure 8):

Table 5. Vapor Extraction Riser Kit (w/o coupling adaptor) - 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 Instructions 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  |

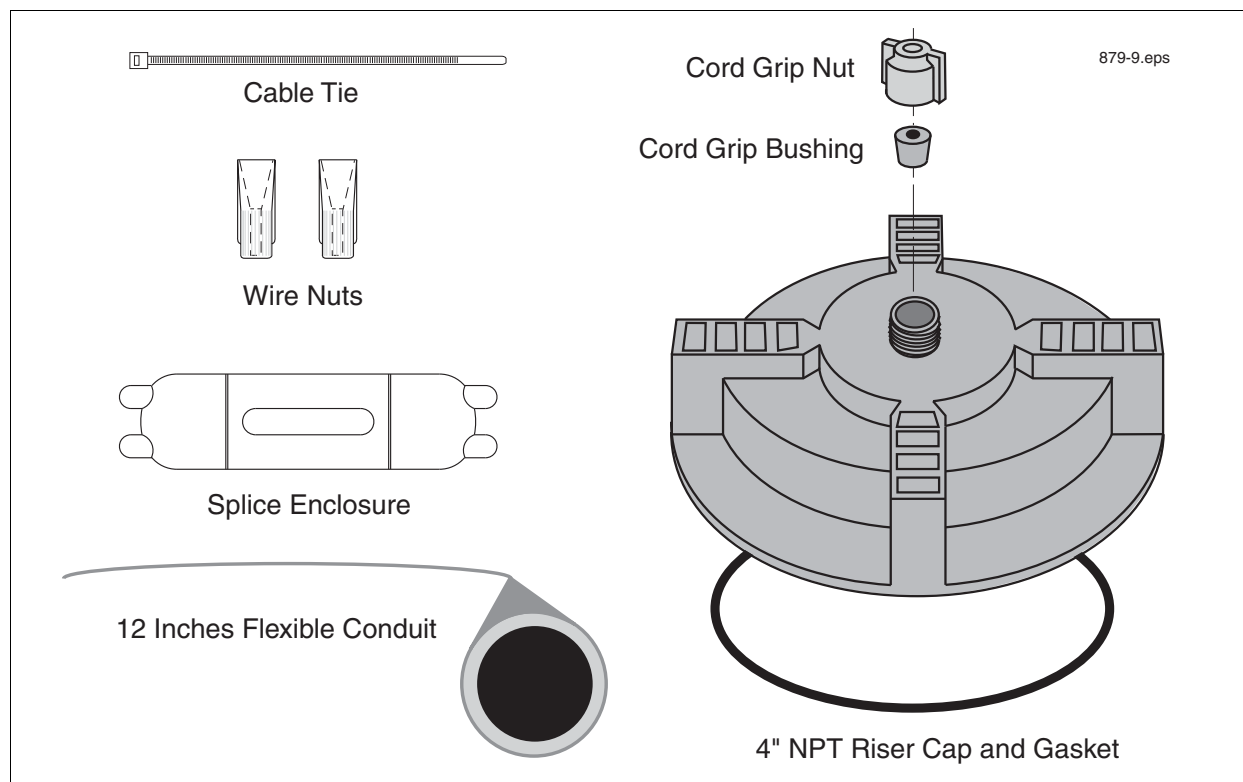


Figure 8. Mag Probe vapor extractor w/o coupling adaptor installation kit

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 6) contains a non-metallic cap which screws onto the 4" NPT riser (Figure 9). The cap comes drilled and tapped with a cord grip.

Table 6. 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  |

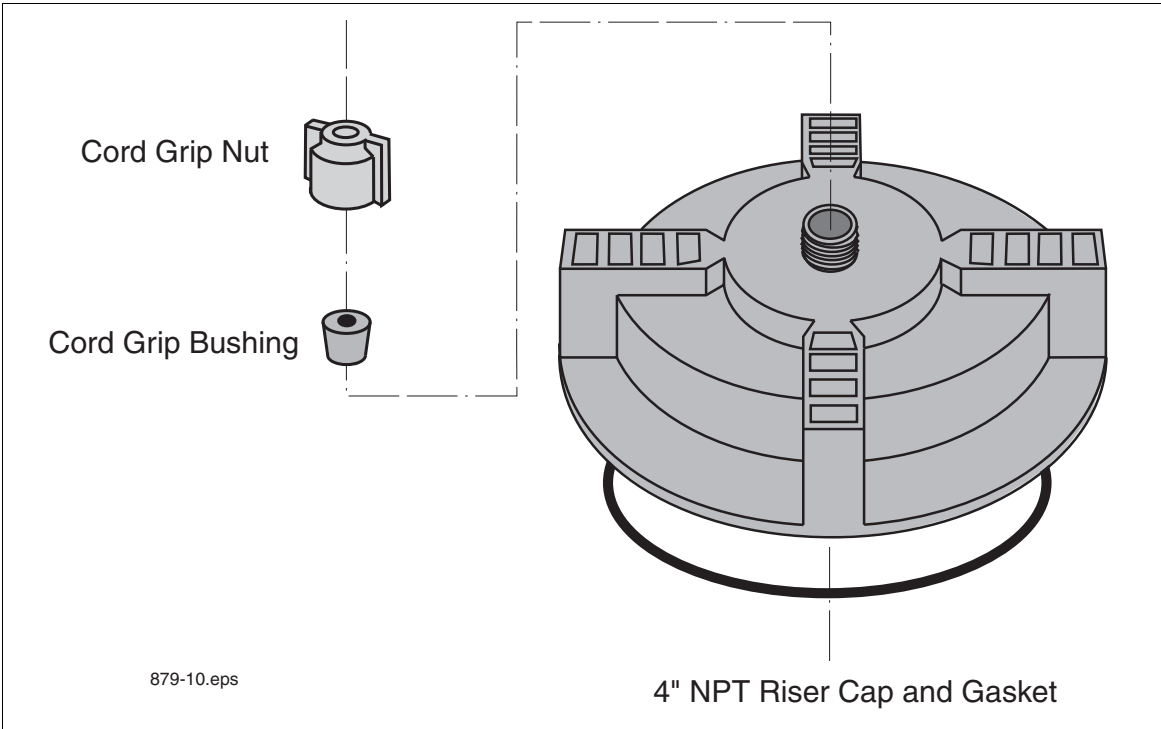


Figure 9. Cap and Cord Grip Kit

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 7). The cap comes drilled and tapped with a cord grip (Figure 10).

Table 7. Metal cap and ring kit - Part No. 312020-952

| Quantity | Description             | Part Number |
|----------|-------------------------|-------------|
| 1        | Adapter ring and gasket | 514100-332  |
| 1        | Cap and gasket          | 327869-003  |
| 1        | Group Cord Grip         | 331028-001  |

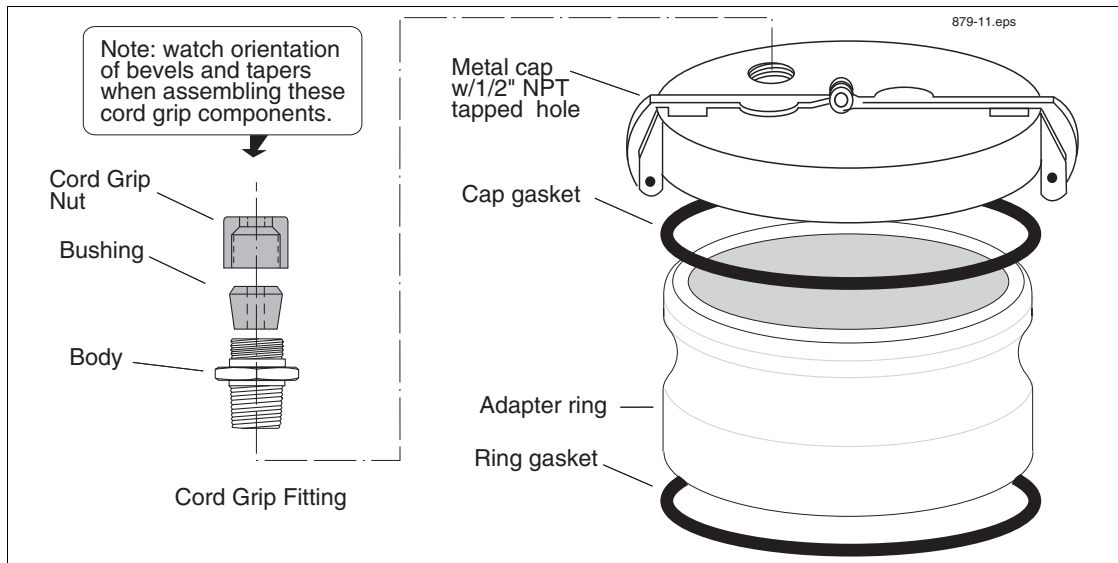


Figure 10. Metal Cap and Ring Kit

### 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 11].

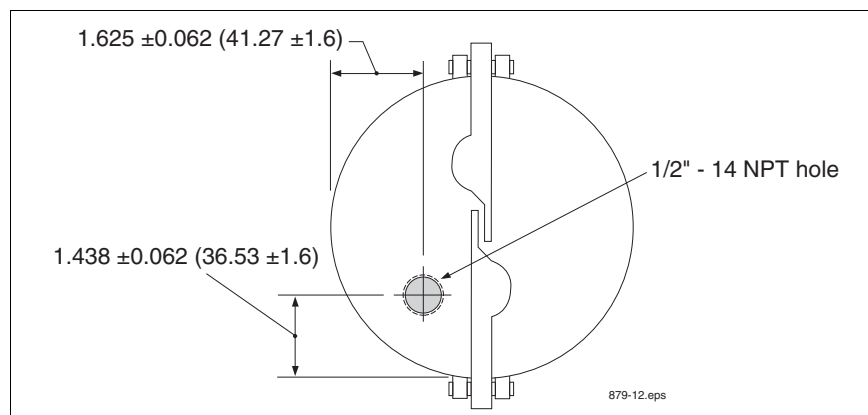


Figure 11. Modifying an existing metal riser cap



# 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 12 for UST installation or Figure 13 for AST installation].



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

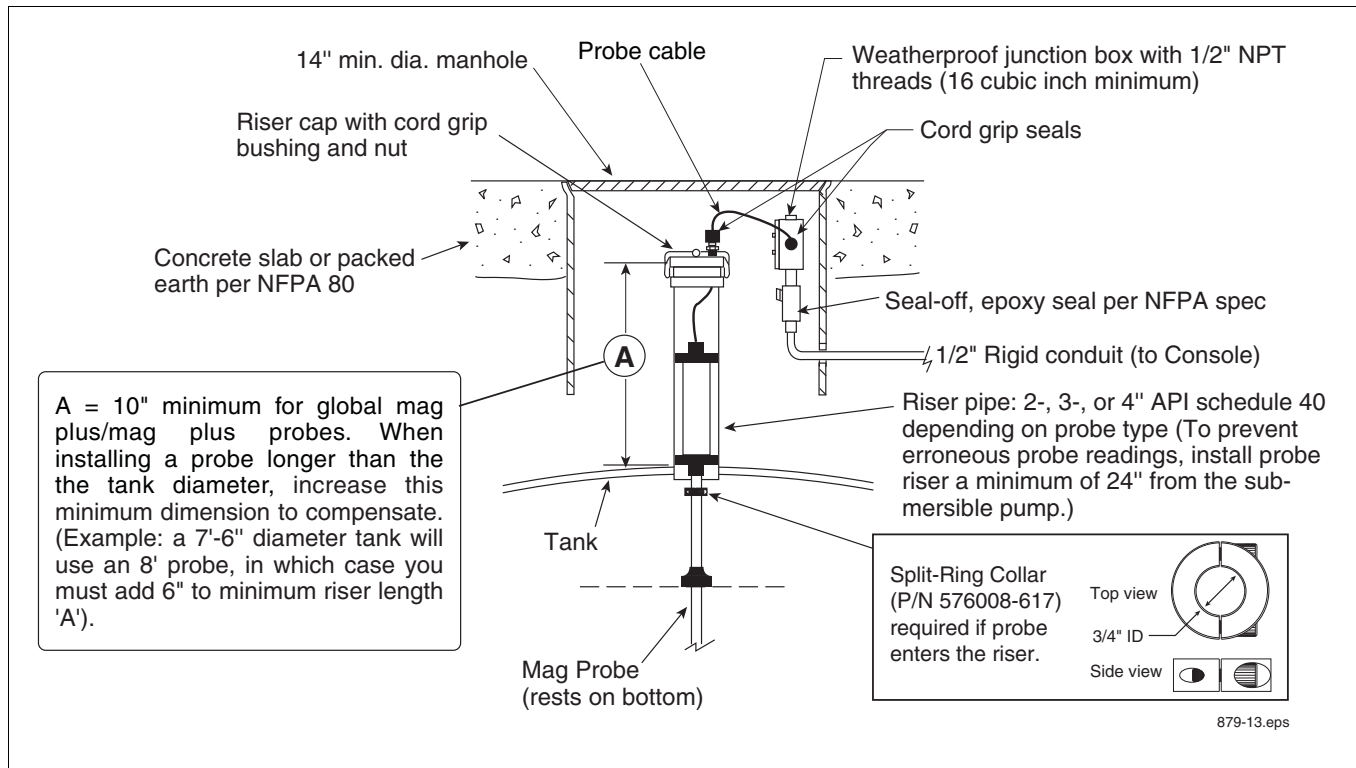
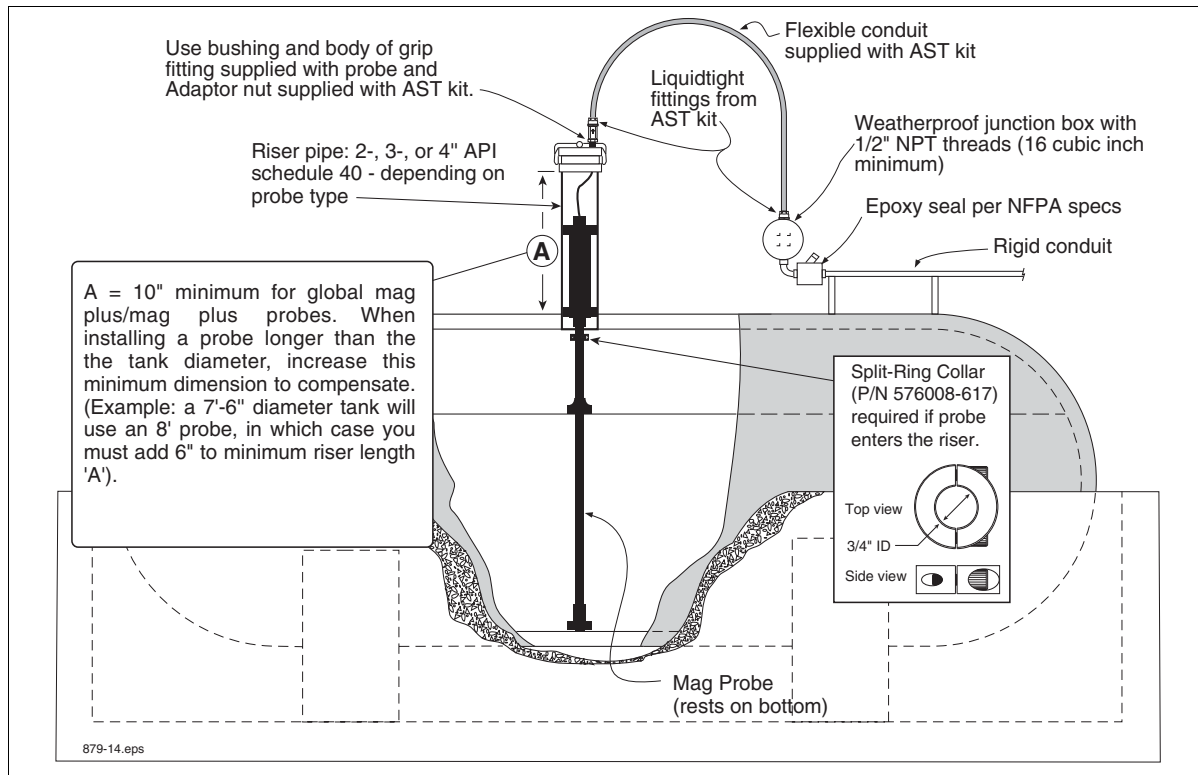


Figure 12. UST probe installation - dedicated riser

### UST RISER CAP ATTACHMENT

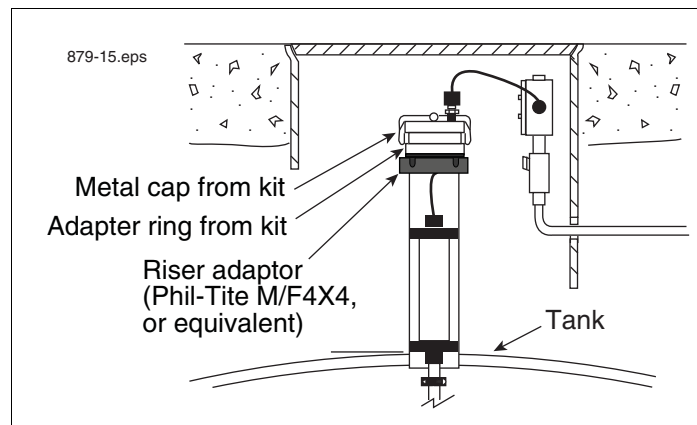
1. If you are using the one piece cap (see Figure 9 on page 18), push the end of the probe cable through the cord grip bushing and nut on the cap, leaving a minimal amount of slack between the probe and cap. Screw the cap onto the riser by hand until the gasket first contacts the pipe. Then lightly tap the cap with a hammer to tighten it an additional 3/4 turn. Go to Step 3.



**Figure 13. AST probe installation - dedicated riser**

2. If you are installing the metal cap and adapter ring (see Figure 10 on page 19), 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 adaptor (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 adaptor 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 14).



**Figure 14. Installing a riser adaptor 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 as shown in the Probe and Sensor Field Wiring on page 37.

### AST RISER CAP ATTACHMENT

1. If you are using the one piece cap (see Figure 9 on page 18), 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 Adaptor Nut from the AST kit to the cap (see Figure 6 on page 15). Tighten the Adaptor Nut until the cable is held firmly. Go to Step 3.
2. If you are installing the metal cap and ring (see Figure 10 on page 19), 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 Adaptor Nut from the AST kit onto the cord grip fitting (see Figure 6 on page 15). Push the cable through the metal cap, bushing, and Adaptor 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 Adaptor Nut until the cable is held firmly.
3. Next assemble the liquidtight connectors on both ends of the flexible conduit as shown in Figure 6. Push the cable through the flexible conduit assembly and into the J-box. Connect the flexible conduit assembly to the Adaptor 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 as shown in the Probe and Sensor Field Wiring on page 37.

### UST Installation - Vapor Extractor Riser w/ Coupling Adaptor

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 15). A piece of flex conduit should be in place as shown to protect the cable.

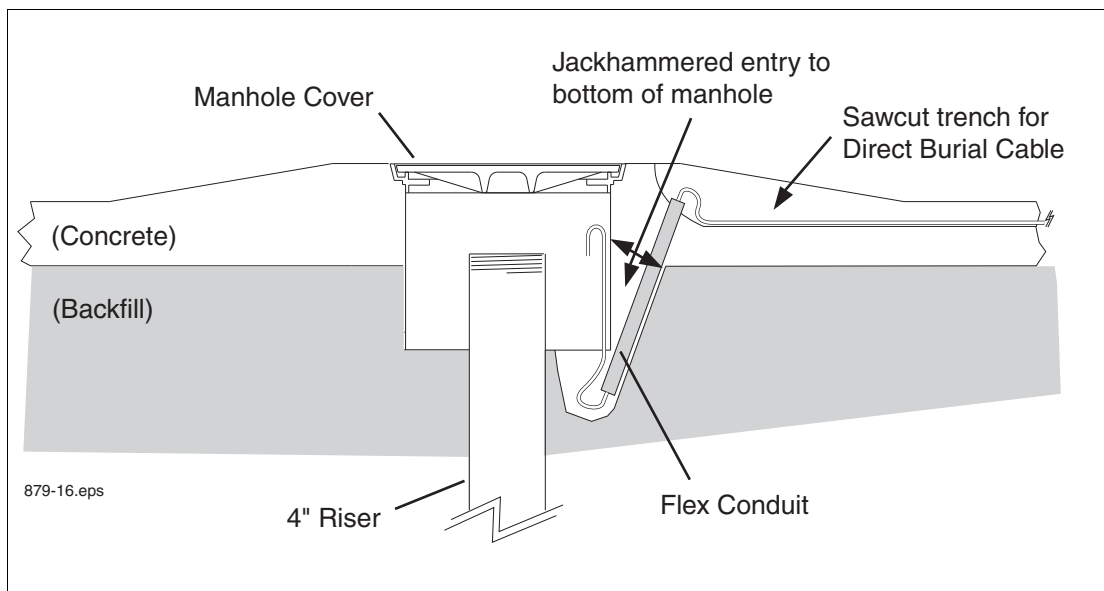


Figure 15. Vapor extractor cabling entry

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 (ref. Figure 5 on page 14). 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 Adaptor and out the tapped opening in its side.
8. Screw the Coupling Adaptor onto the 4" riser until the gasket first contacts the riser pipe. Then use a pipe wrench to tighten the Coupling Adaptor 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 Adaptor (ref Figure 7 on page 16 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 Adaptor.
12. Position the Shield-Fitting over the PG7 cord grip and secure with the hose clamp (see Figure 16 on page 24).
13. Splice the probe cable to the direct burial cable as shown in the Probe and Sensor Field Wiring on page 37, 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-450 console alarm, drop tube with overfill protection valve or some other accepted means).**

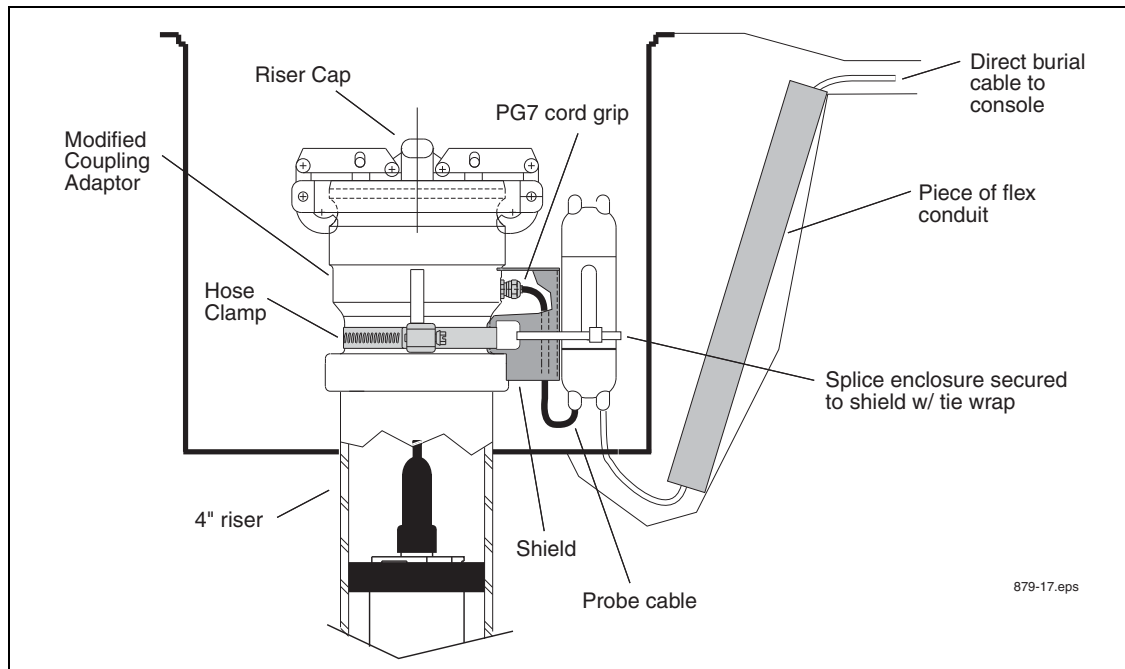


Figure 16. Mag probe vapor extractor riser installation - w/ coupling adaptor

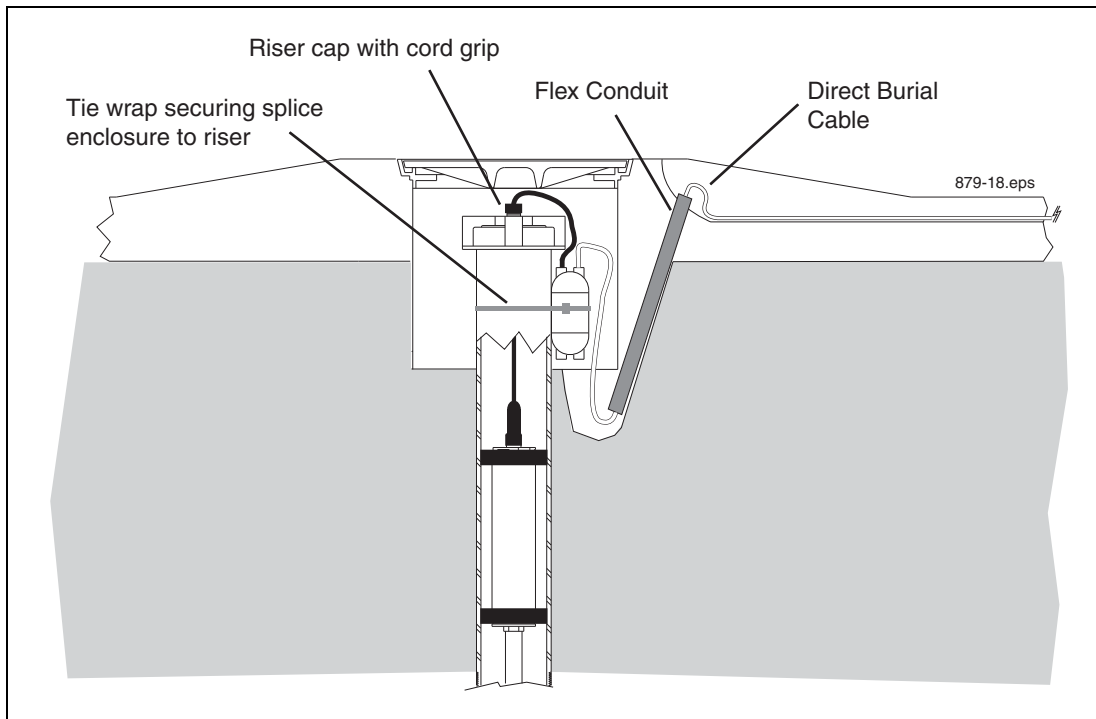
## UST Installation - Vapor Extractor Riser w/o Coupling Adaptor

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 15 on page 22). 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 (ref. Figure 5 on page 14). 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 as shown in the Probe and Sensor Field Wiring on page 37, 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-450 console alarm, a drop tube with overfill protection valve or some other accepted means).**



**Figure 17. Mag probe vapor extractor riser installation - w/o coupling adaptor**

## Sensor Installation

### Sensor Installation Diagrams

General installation diagrams for various Veeder-Root sensors are shown in Figure 18 through Figure 32. When installing sensors you must adhere to the procedures shown in these figures, unless a separate manual is shipped with your sensor, in which case you should follow that manual's installation guidelines.

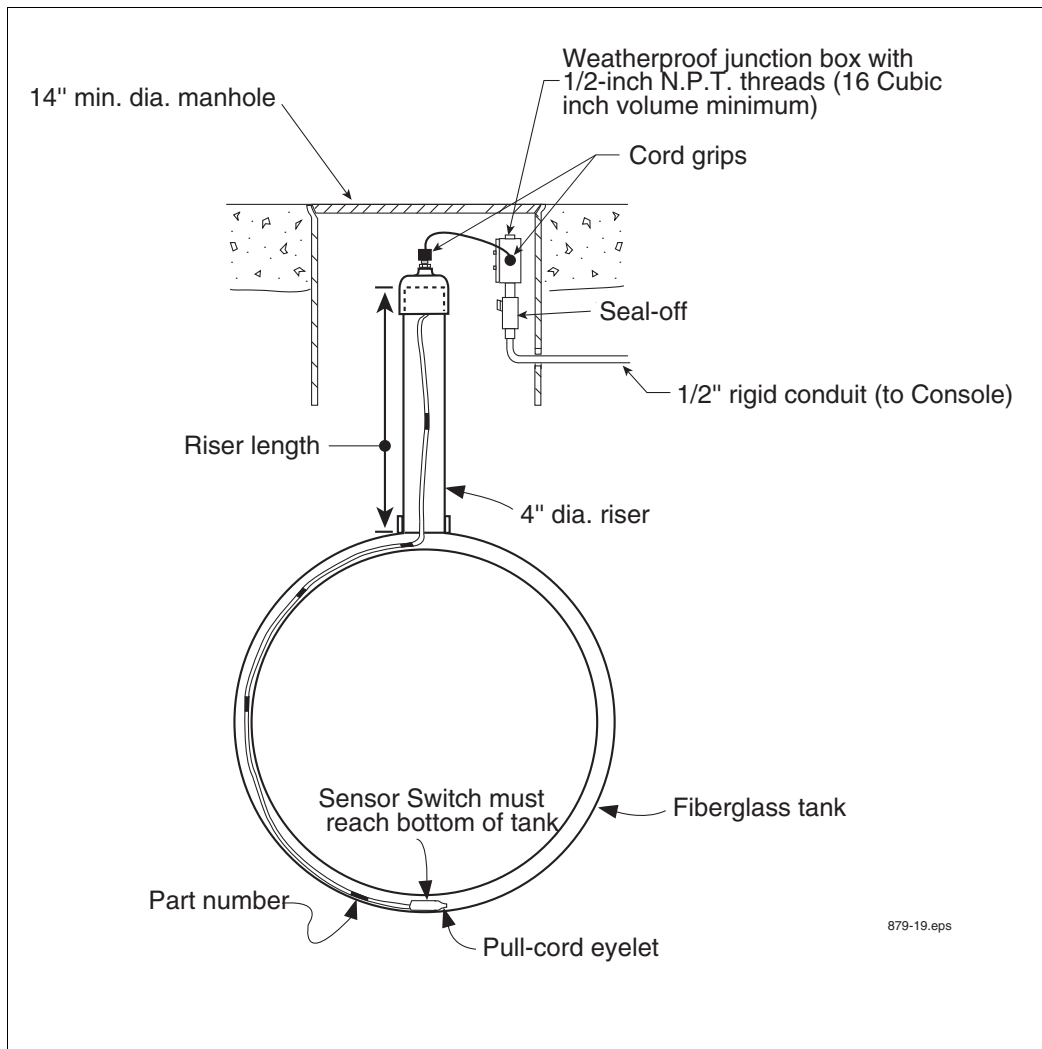


Figure 18. Example Interstitial Sensor Installation - Fiberglass UST

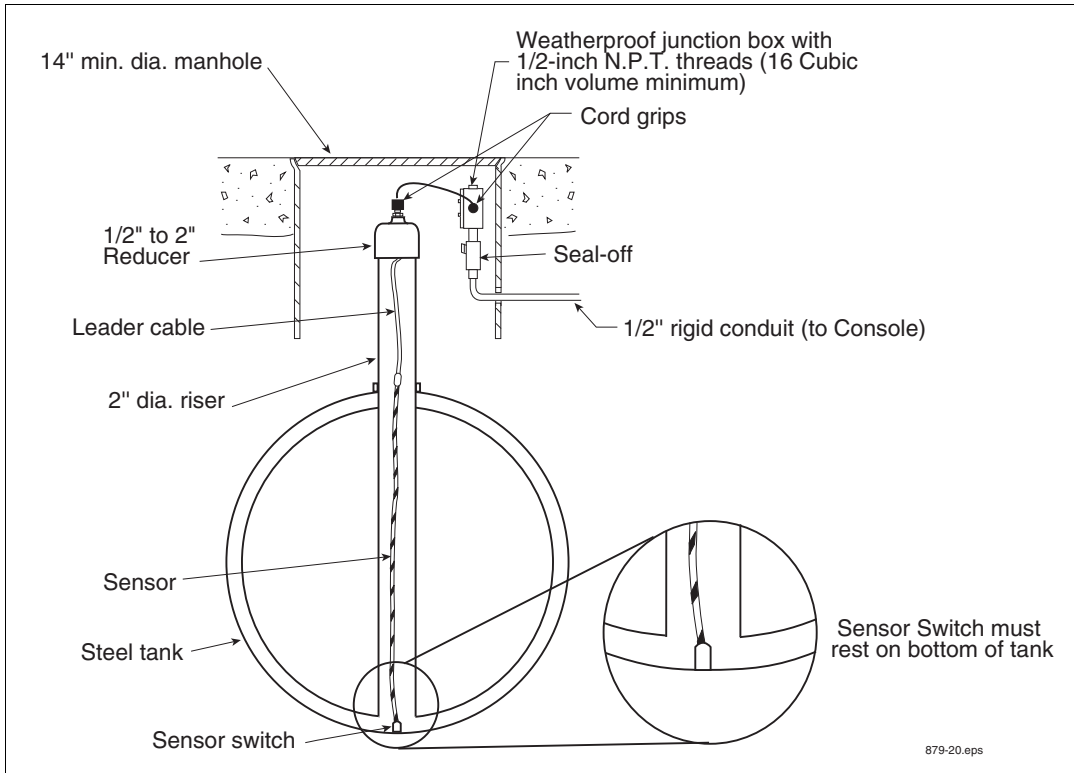


Figure 19. Example Interstitial Sensor Installation - Steel UST

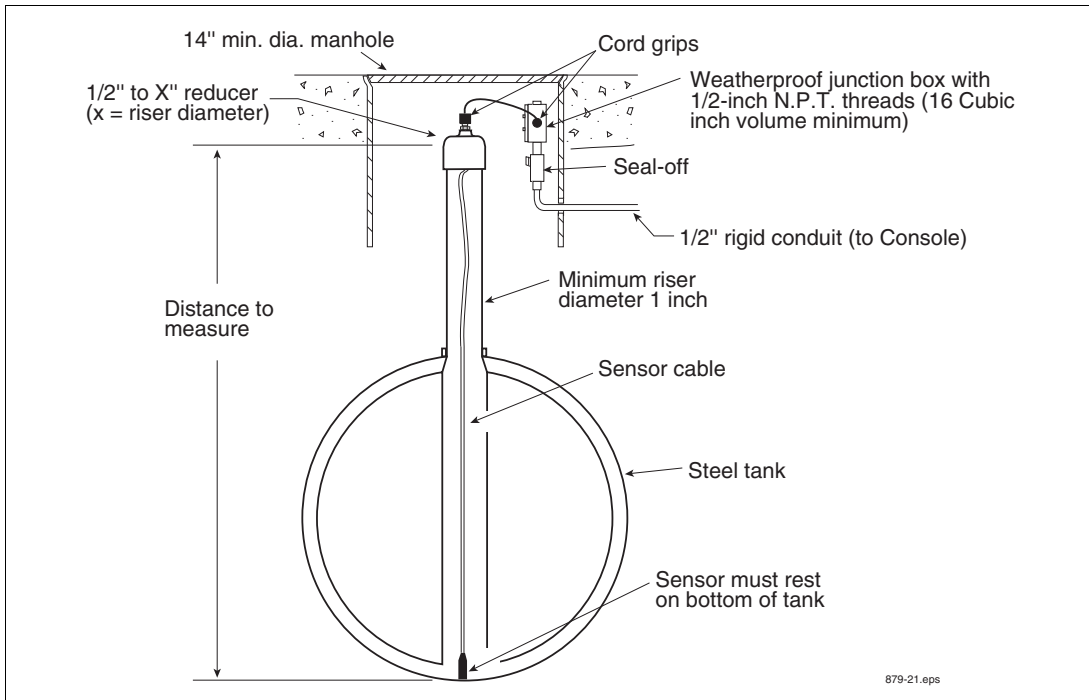
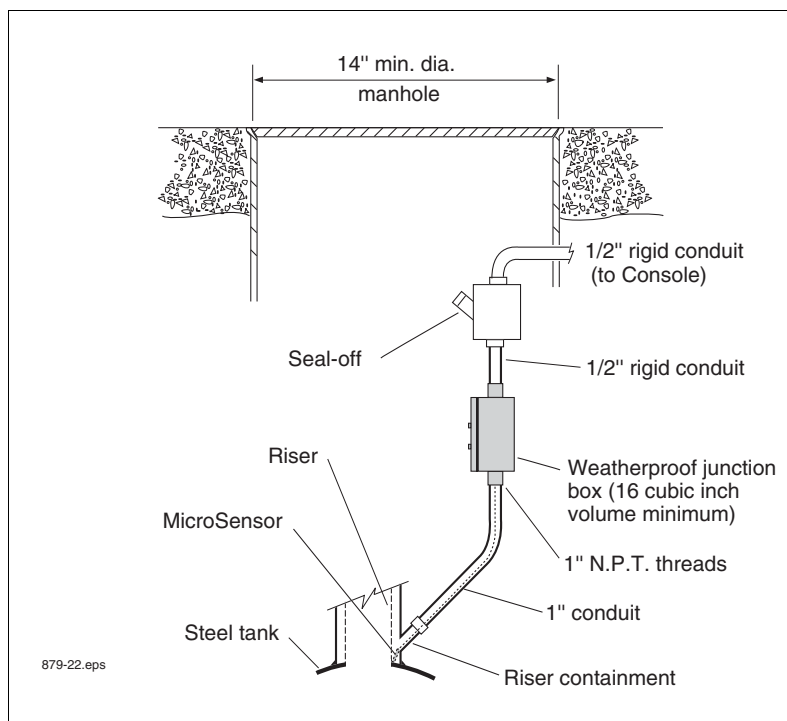
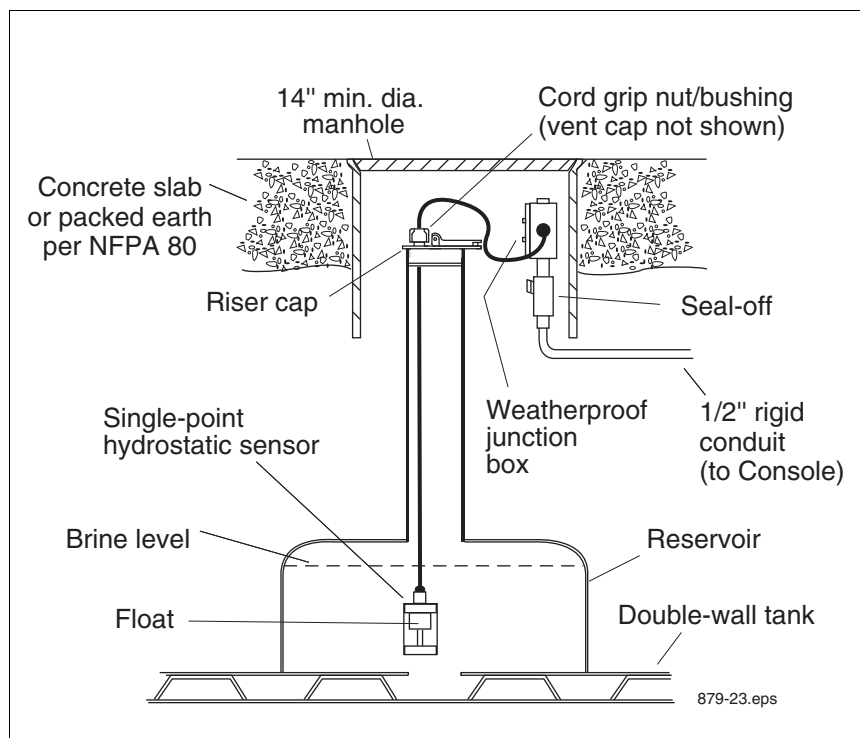


Figure 20. Example Interstitial MicroSensor Installation - Steel UST

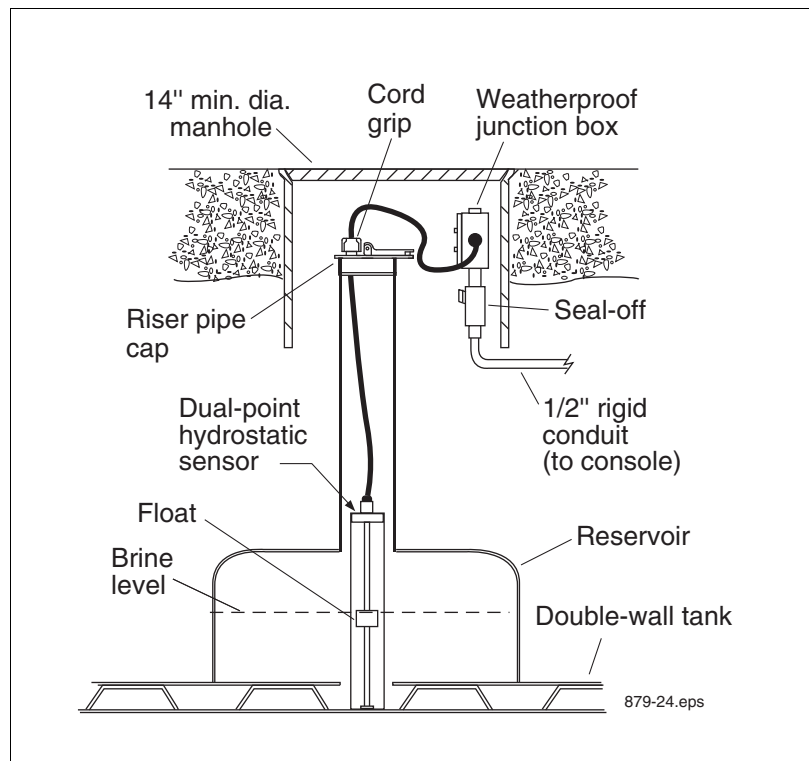




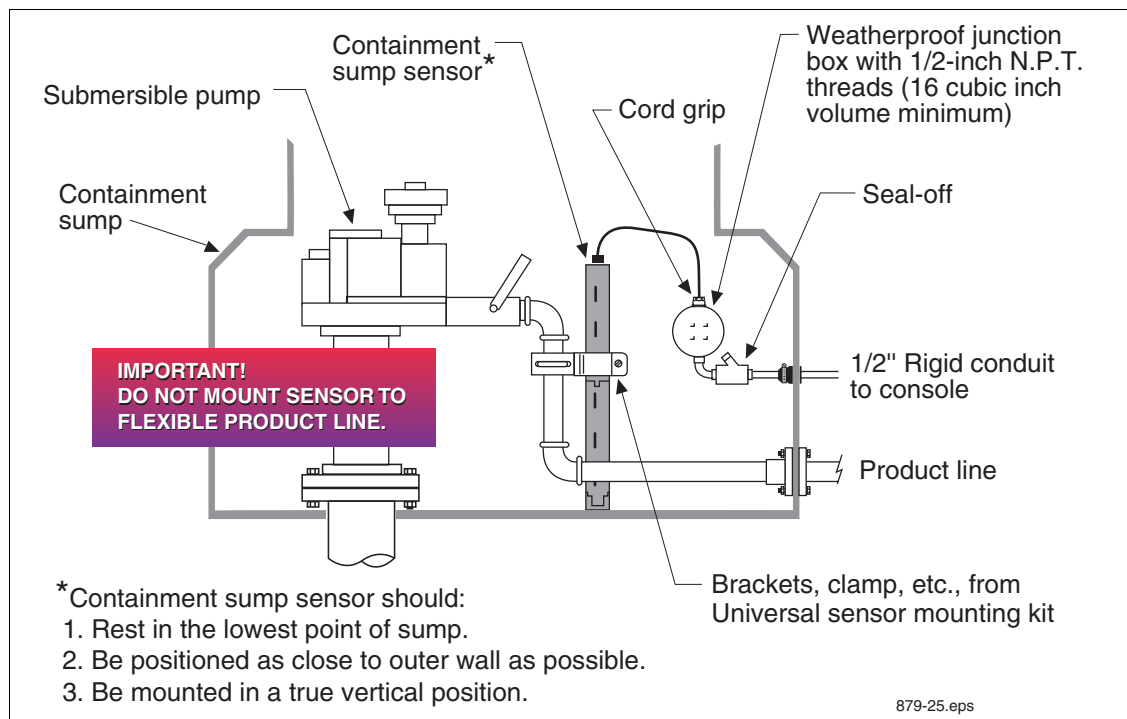
**Figure 21. Example MicroSensor Installation in Riser Containment - Steel UST**



**Figure 22. Example Hydrostatic Reservoir Single Float Sensor Installation**



**Figure 23. Example Hydrostatic Reservoir Dual Float Sensor Installation**



**Figure 24. Example Containment Sump Sensor Installation**

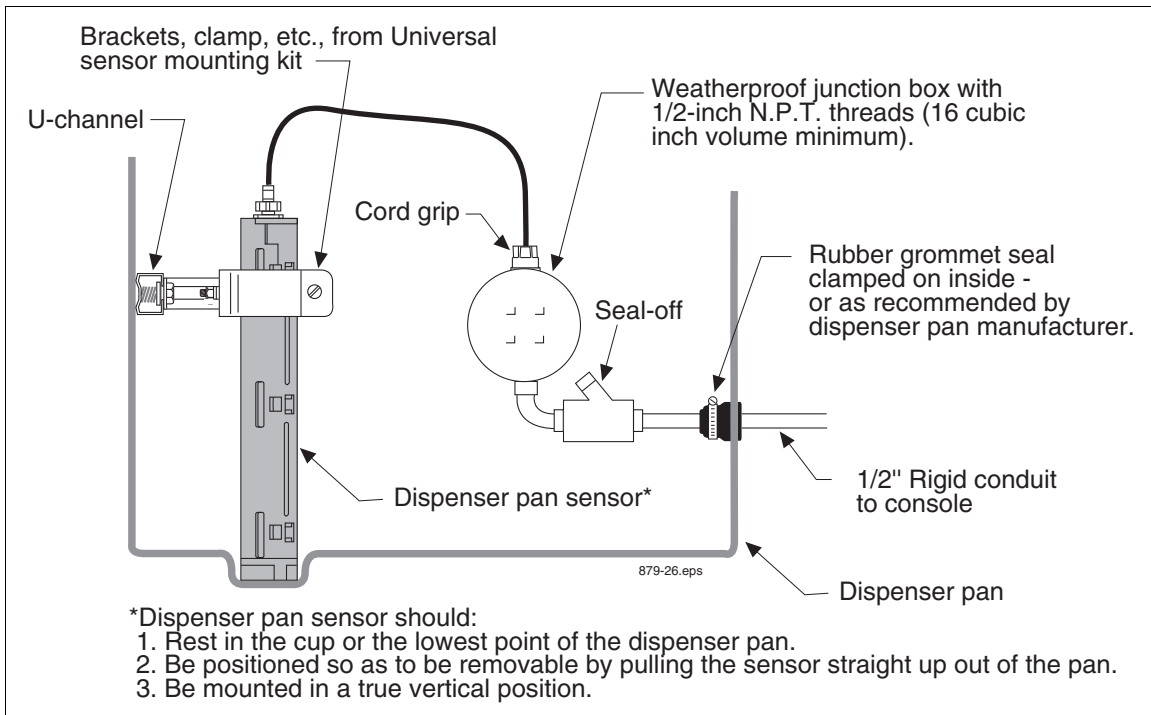


Figure 25. Example Dispenser Pan Sensor Installation

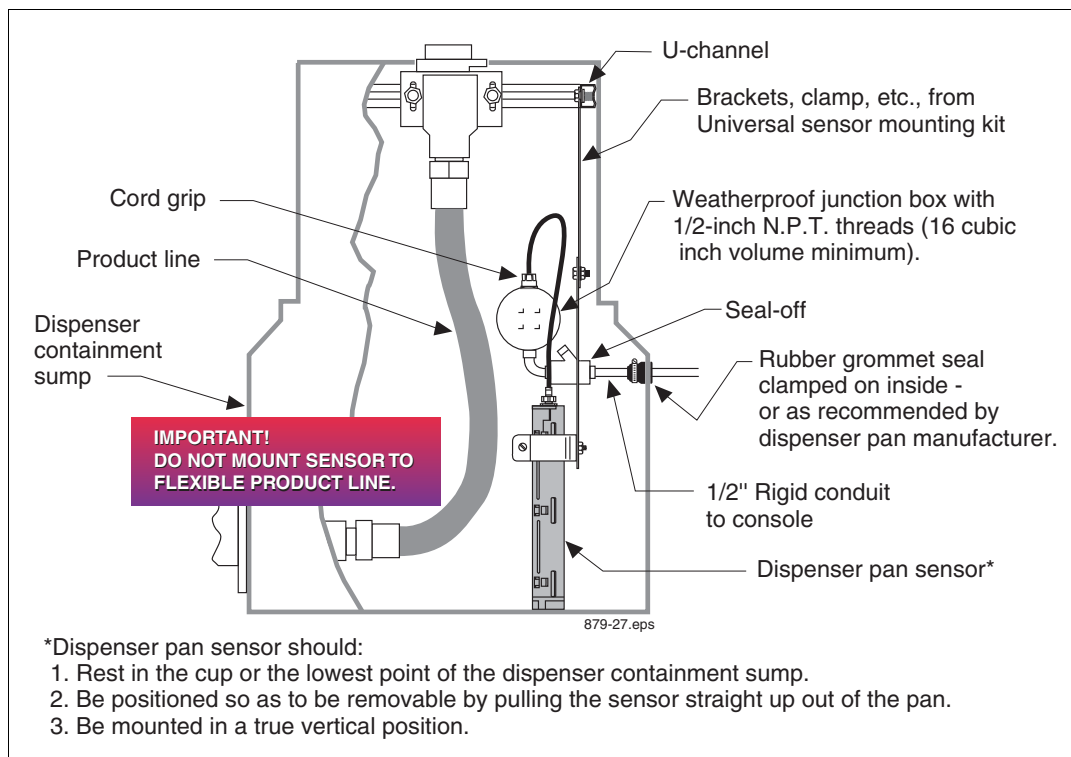


Figure 26. Example Dispenser Pan Sensor Installation in a Containment Sump

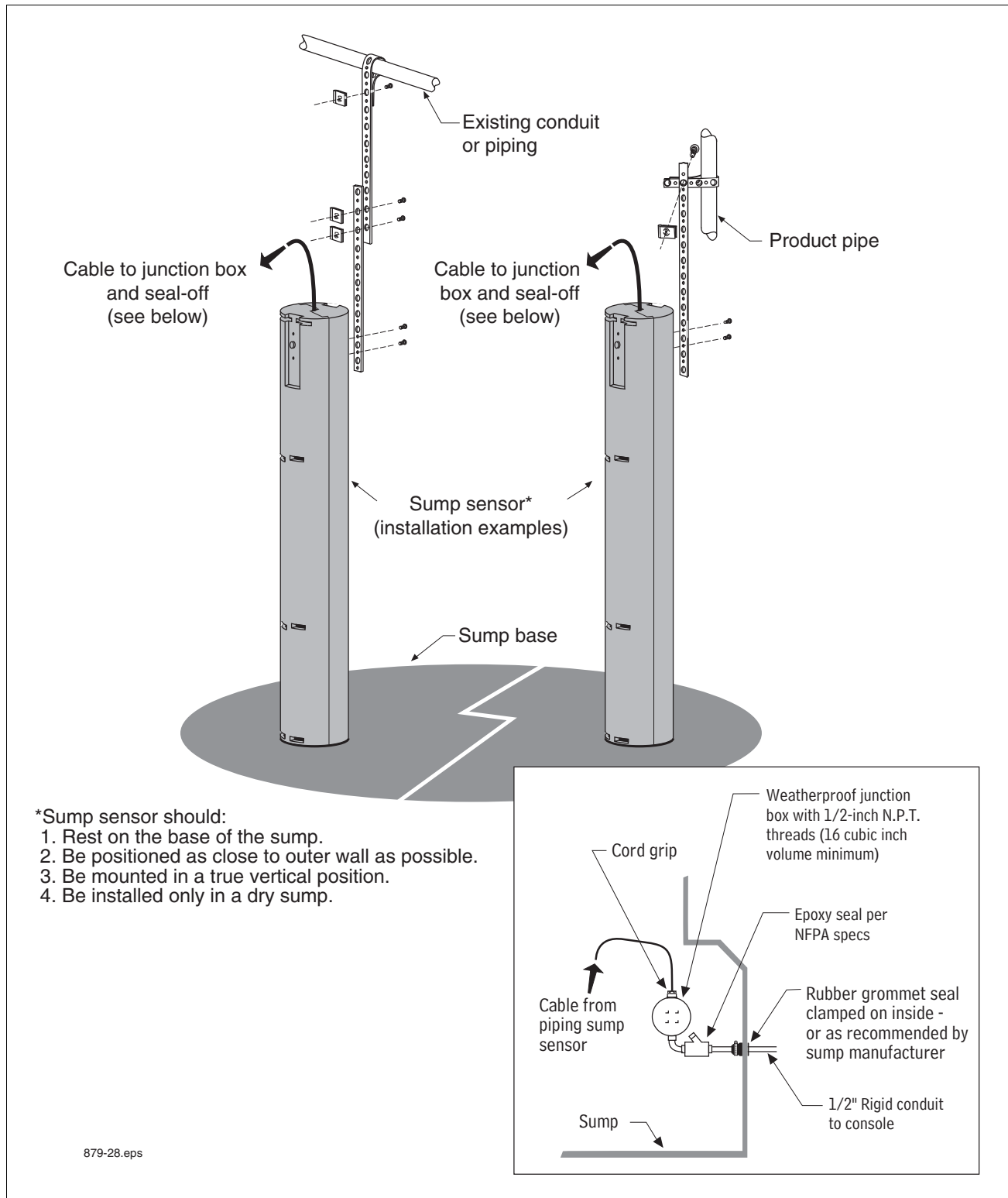


Figure 27. Example Sump Sensor Installations in Sump

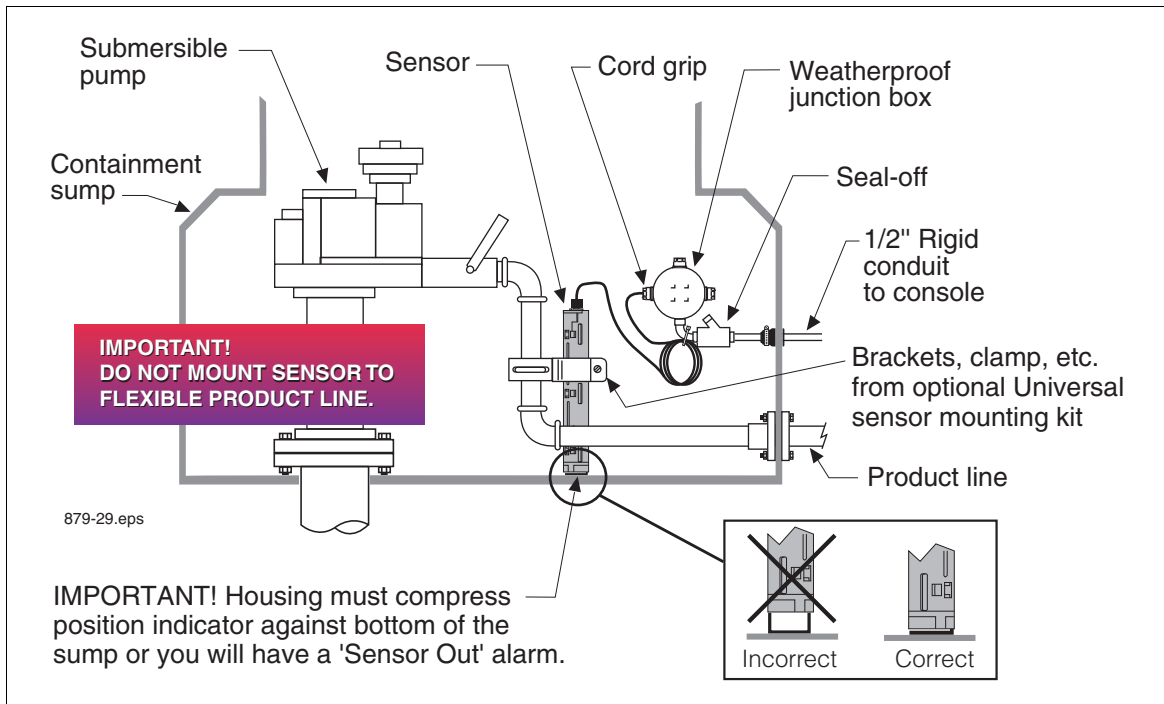


Figure 28. Example Position-Sensitive Sensor Installation

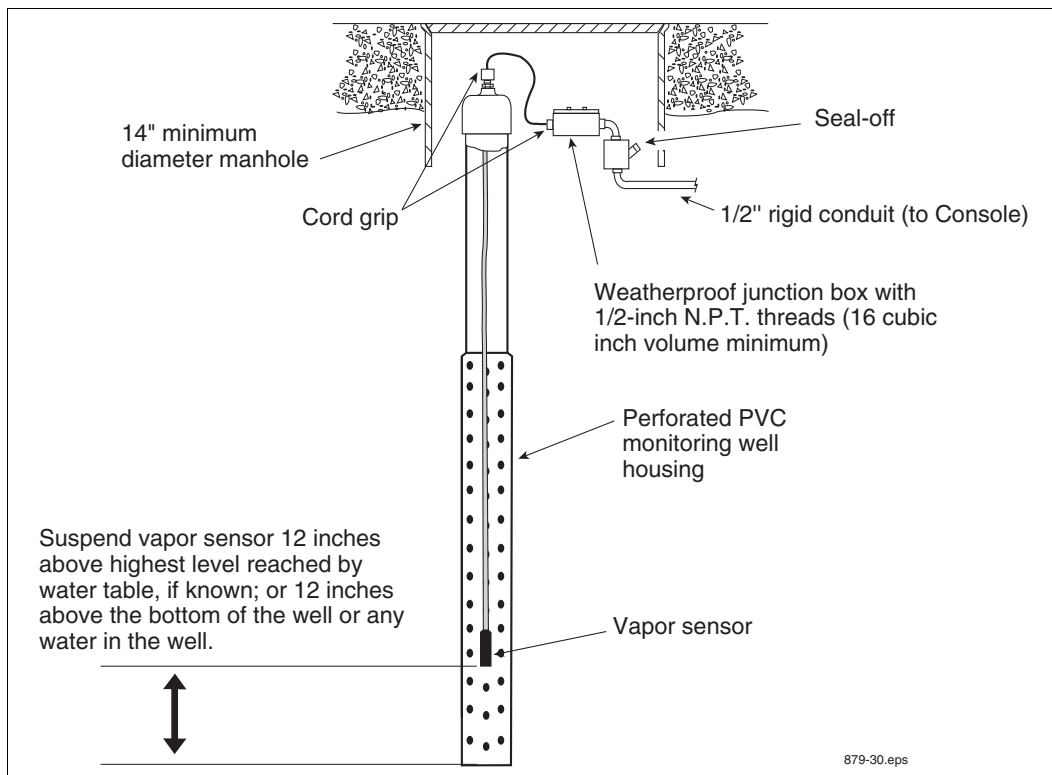


Figure 29. Example Vapor Sensor Installation

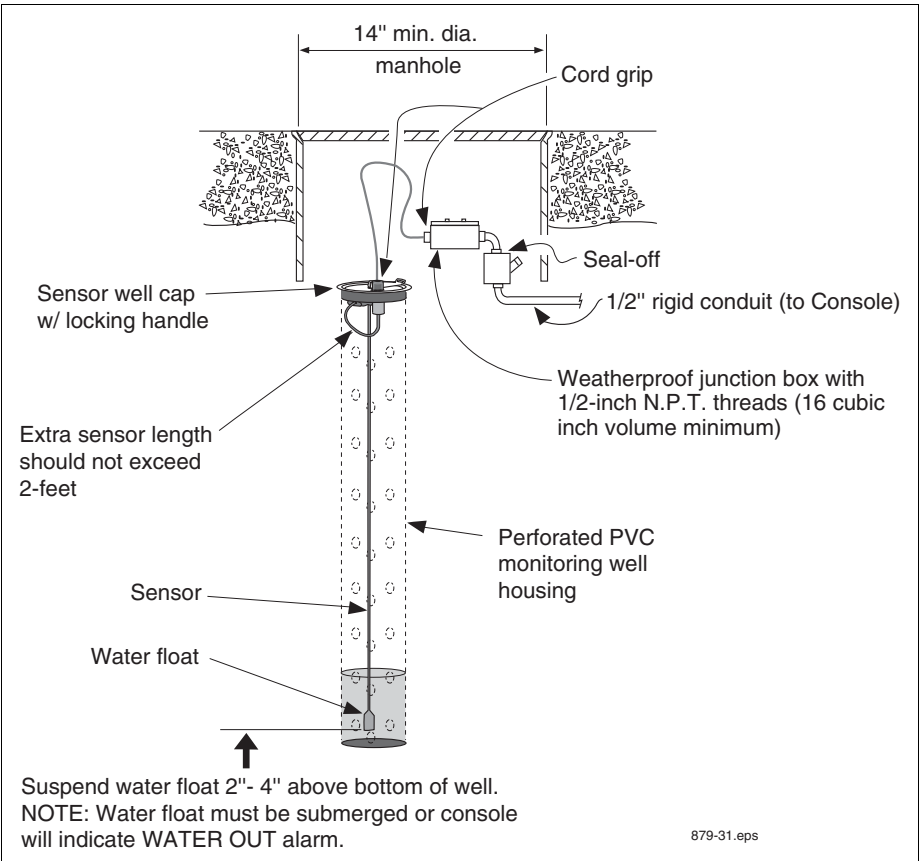


Figure 30. Example Groundwater Sensor Installation

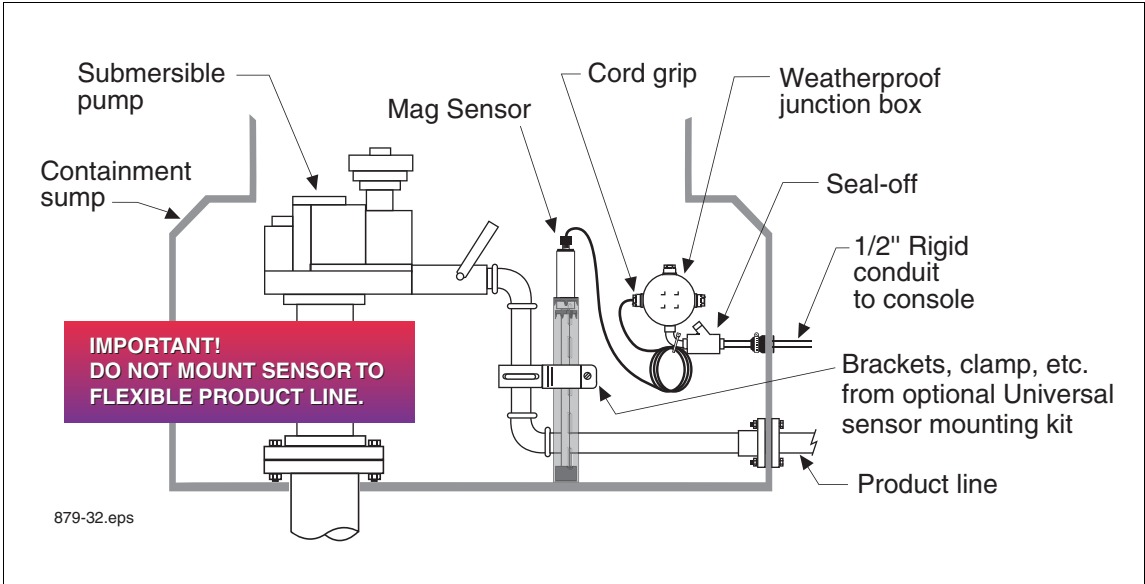
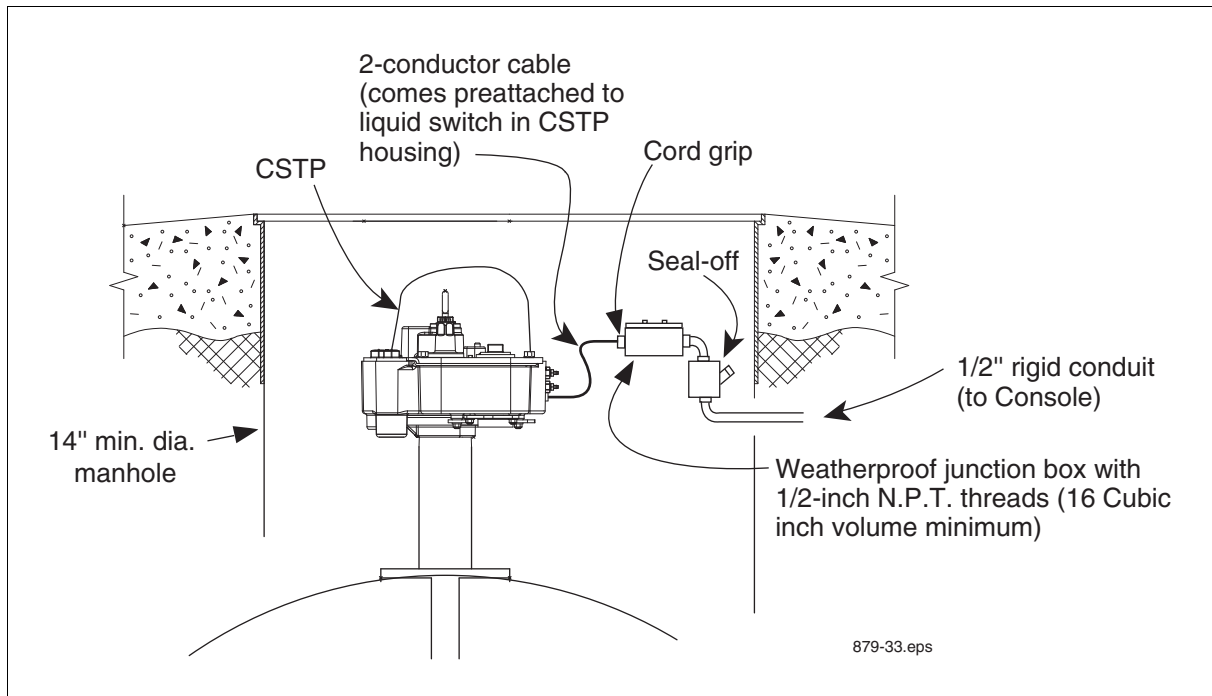
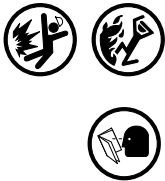


Figure 31. Example Mag Sensor Installation

**Figure 32. CSTP Liquid Sensor Wiring Installation**

## 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 4 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 33].

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.

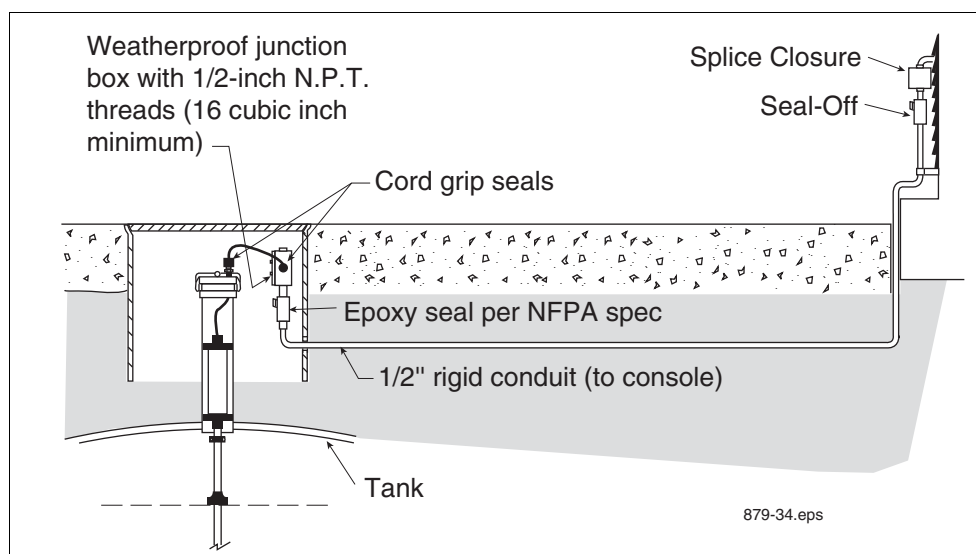


Figure 33. Example Probe Wiring Run in Buried Rigid Conduit

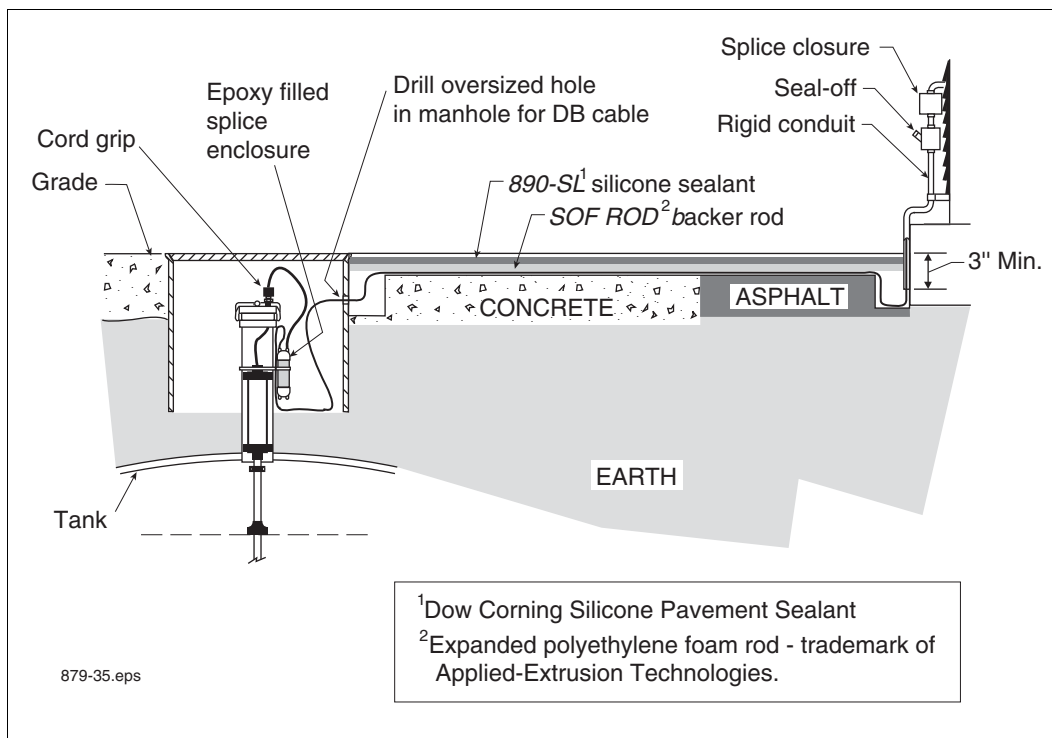


**CAUTION:** Since wires for multiple sensors may enter the console through a single conduit, it is recommended that you use a different color-code for each wire or individually mark each wire to identify sensor inputs. Also, if the intrinsically safe wires enter the building in a wiring trough, only 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 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 34].

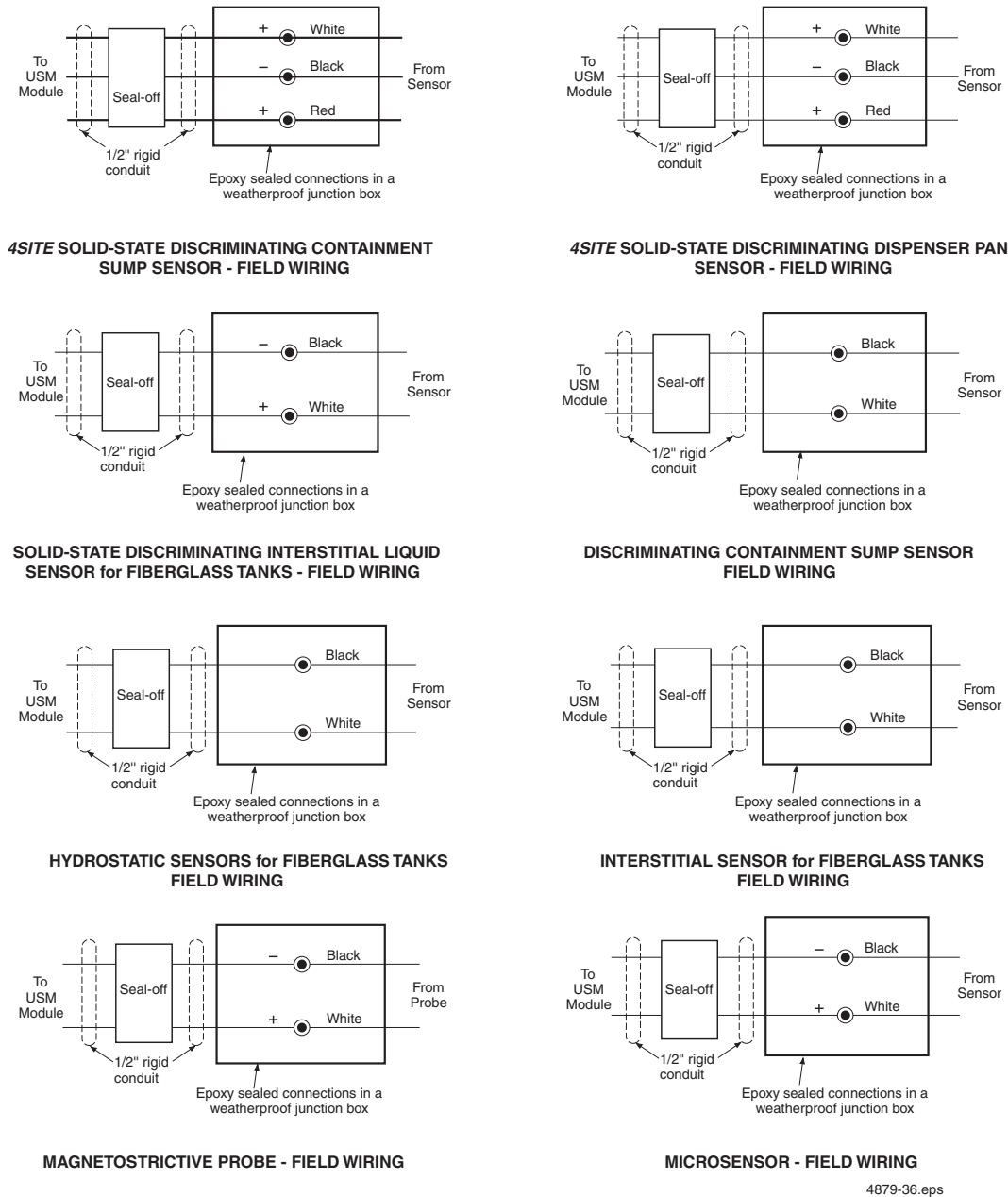
If you decide upon the direct burial method, consult the direct burial cable installation manual for detailed installation instructions (reference manual 576013-858).



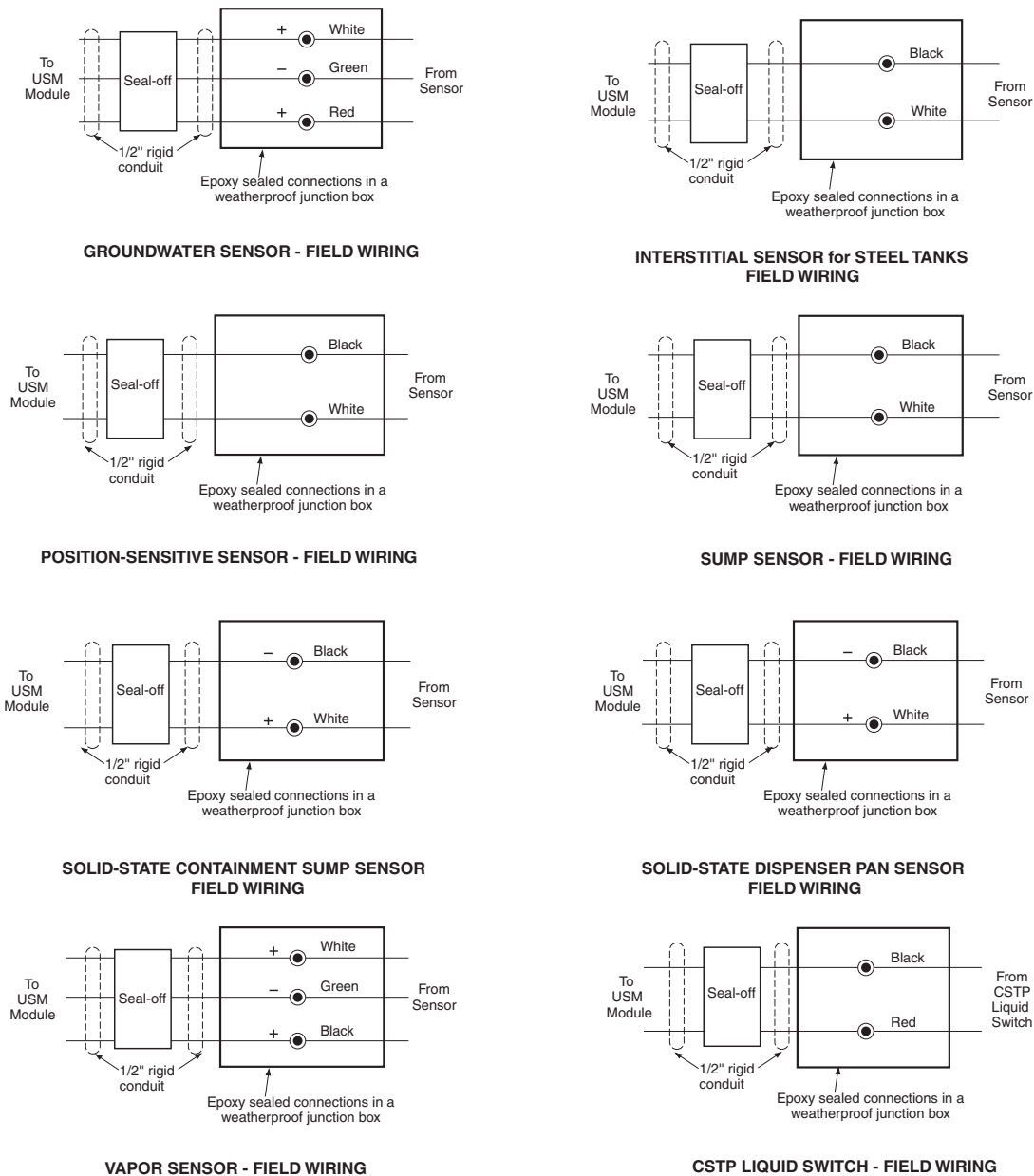
**Figure 34. Example Probe Wiring Run via Direct Burial Cable**

## Probe and Sensor Field Wiring

Figure 35 and Figure 36 contain diagrams for connecting, at the field junction box, cables from the probe and sensor to cables from the console. Check diagrams closely for polarity requirements.



**Figure 35. Field Wiring Probes and Sensors Cables to Console Cables**



879-37.eps

Figure 36. Field Wiring Probes and Sensors Cables to Console Cables - concluded.

## Sealing Field Connections

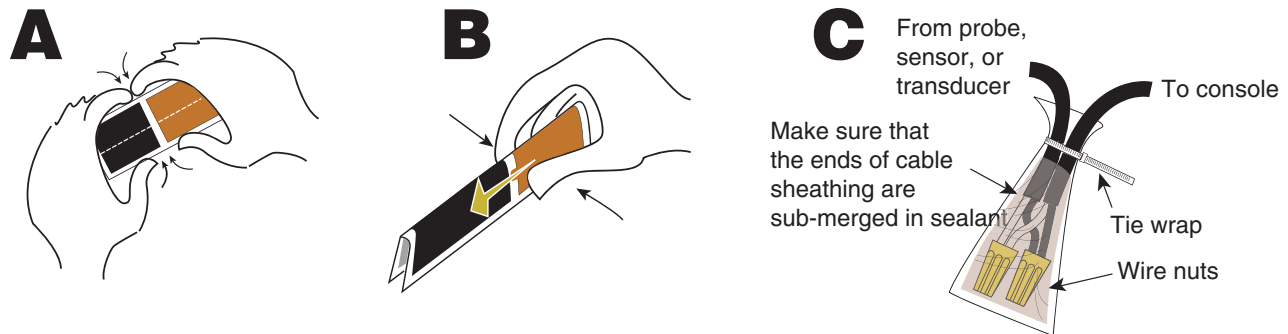
### WIRING RUN THROUGH RIGID CONDUIT

1. Pull the wires from the probe or sensor into the junction box. Pull the two or three wires from the console through the seal-off box, the conduit attaching the junction box to the seal-off box and into the junction box.

2. Using wire nuts, connect the two or three wires from the probe or sensor to the two or three wires coming from the console. Be sure to observe color codes or tags when making these connections so that the sensor or probe outputs are attached to the correct terminals in the console and that polarity is maintained when required.
3. Seal wire nuts with epoxy sealant following the instructions in Figure 37.
4. Do NOT terminate shield or drain wire in the field junction box. Ground shield and drain wires at console only.
5. Place the bag with the resin sealed wiring connections in the junction box. Replace and tighten the junction box cover.

### DIRECT BURIAL CABLE

When using direct burial cable for probe- or sensor-to-console wiring runs, the sealing materials and procedure are completely different. Refer to the Direct Burial Cable Installation Manual 576013-858.



#### Instructions:

**NOTE:** When temperature is below 50°F (10°C), keep resin in a warm place prior to mixing (e.g., in an inside pocket next to body).

1. Open epoxy sealant package, and remove resin pak.
2. Holding resin pak as shown in A, bend pak along long length.
3. As shown in B, firmly squeeze the RED SIDE of the resin, forcing it through the center seal and into BLACK SIDE.

4. Mix thoroughly to a uniform color by squeezing contents back and forth 25-30 times.
5. Squeeze mixed, warm resin into one end of bag and cutoff other end.
6. Slowly insert wiring connections into sealing pack until they fit snugly against the opposite end as shown in C.
7. Twist open end of bag and use tie wrap to close it off and position the tie wrapped end up until the resin jells.






**CAUTION:** Epoxy sealant is irritating to eyes, respiratory system, and skin. Can cause allergic skin reaction. Contains: epoxy resin and Cycloaliphatic epoxy-carboxylate.

**Precautions:** Wear suitable protective clothing, gloves, eye, and face protection. Use only in well ventilated areas. Wash thoroughly before eating, drinking, or smoking.

879-38.eps

**Figure 37. Epoxy Sealing Probe and Sensor Field Connections**

## Wiring Devices to Console

|  <b>WARNING</b>   |  |
|--|--|
| <br><br> | <p><b>FAILURE TO COMPLY WITH THE FOLLOWING WARNINGS AND SAFETY PRECAUTIONS COULD CAUSE DAMAGE TO PROPERTY, ENVIRONMENT, RESULTING IN SERIOUS INJURY OR DEATH.</b></p> <p>The equipment is used in location where lethal voltages and explosive vapors or flammable fuels may be present.</p> <p>Care must be taken when installing, servicing or replacing parts in the system or serious injury or death from explosion, fire or shock may occur.</p> <p>For this system:</p> <ol style="list-style-type: none"><li>1. Comply with the latest National Electric Code, federal, state, and local codes, and any other applicable safety codes. In addition, take necessary precautions during installation, service, and repair to prevent personal injury, property loss and equipment damage.</li><li>2. Refer servicing to trained and qualified personnel only.</li><li>3. Substitution of components may impair intrinsic safety.</li><li>4. Be sure AC power is "OFF" before opening the console panel doors and connecting device wiring. Do not short any voltage across any barrier terminal including sensors or probes.</li></ol> |

### Probe and Sensor Wiring Precautions



**IMPORTANT** - You must read and understand this information prior to wiring devices to console.



**WARNING!** During programming, the devices wired to each connector are identified and stored in system memory. If a device is later removed and reconnected to a different set of connectors, the system will not properly recognize the data being received. Once a device has been wired to certain connectors on a USM or I/O Module and the system has been programmed, the wires from that device may not be relocated to other connectors without reprogramming that device.

### Connecting Wiring to Console Modules



**Warning! only intrinsically-safe wiring can enter a USM module slot's knockouts.**

Refer to Control Drawing for TLS-450 Consoles, D/N 331940-008, to identify modules installed in your console and the designated devices that can be connected to them.

Try not to have too much wire in your console. Pull unneeded wire back into your wiring trough and loop it neatly.

1. Open both front doors of the console (see Figure 38).
2. For sensors and probes, make sure that you terminate the ground shields to the ground lug on the module. As you already know, the other end at the probe or sensor is NOT grounded.
3. Write in the device name for each wire connection on the connector block in the module's wiring label attached to the inside of the door.
4. Make sure that you loop the wire neatly under the lip of the module. This will keep your wires from interfering with the door when it closes.

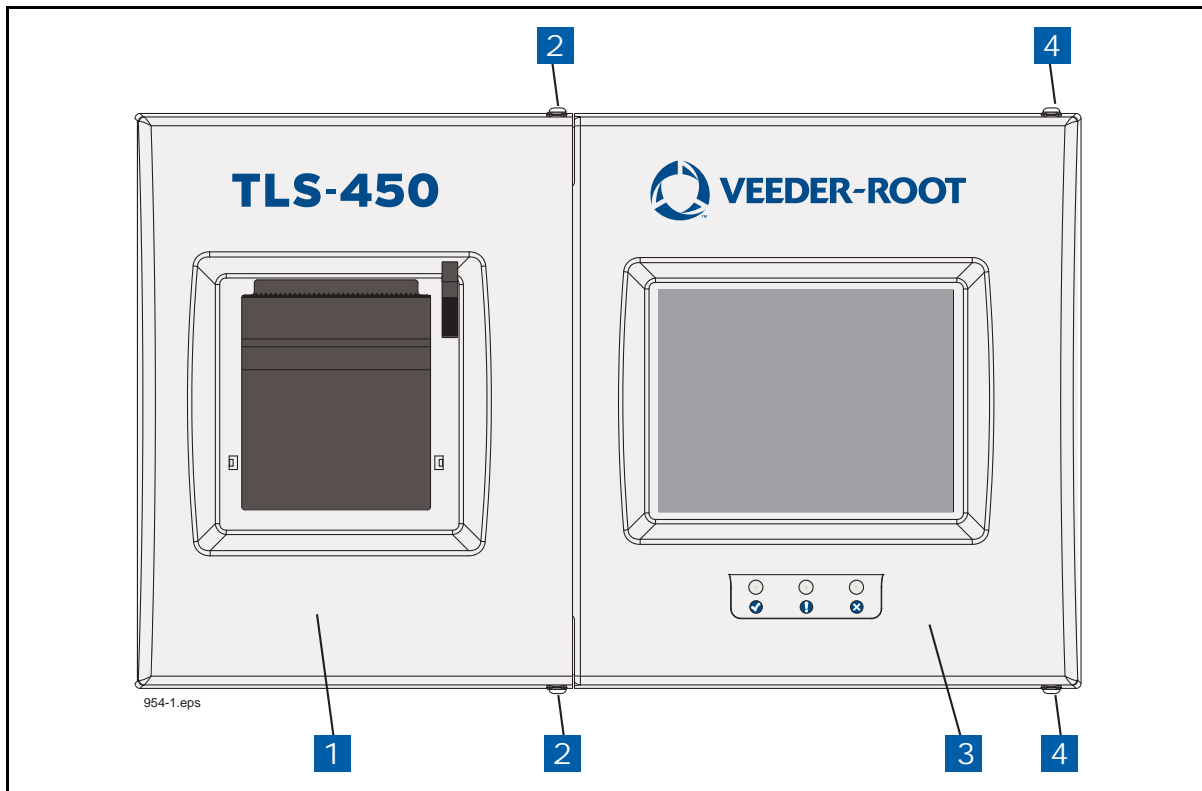
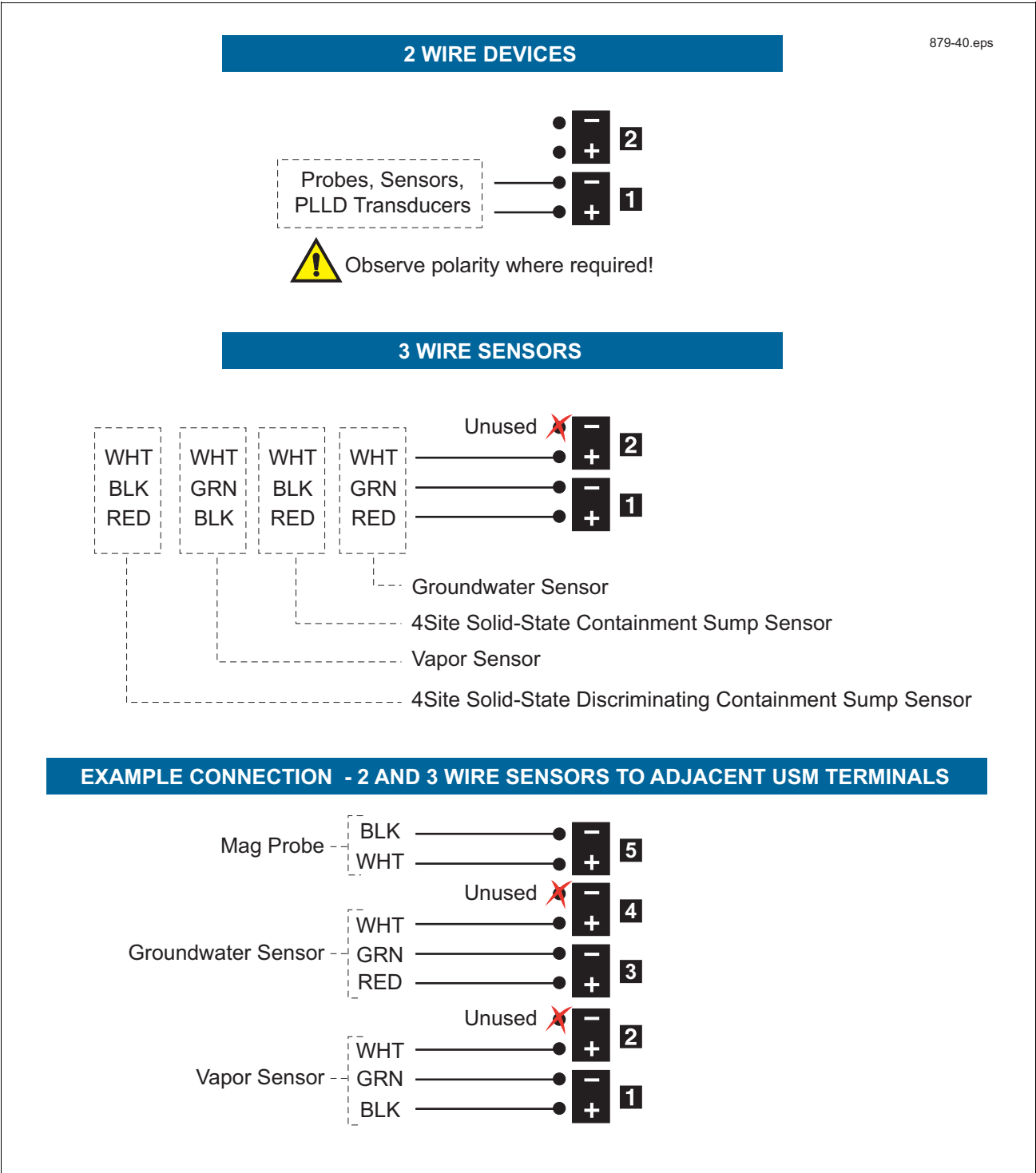


Figure 38. Front doors

**Legend for numbered boxes in Figure 38**

- |  |   |
|--|---|
| 1. Left (Printer) door   | 3. Right (Display) door   |
| 2. Using a T-15 Torx driver, remove the top and bottom screws securing left door and swing door to left. | 4. Using a T-15 Torx driver, remove the top and bottom screws securing right door and swing door to left. |

- Refer to the figures below for USM, I/O, MDIM and LVDIM module wiring connection examples:
  - Figure 39 - USM module Intrinsically-safe wiring connections
  - Figure 40 - I/O module wiring connections
  - Figure 41 - MDIM module wiring connections
  - Figure 42 - LVDIM module wiring connections
- Connect applicable interface cable(s) to the CDIM and EDIM (RS-232) modules as defined in the POS Application Guide 577013-401.



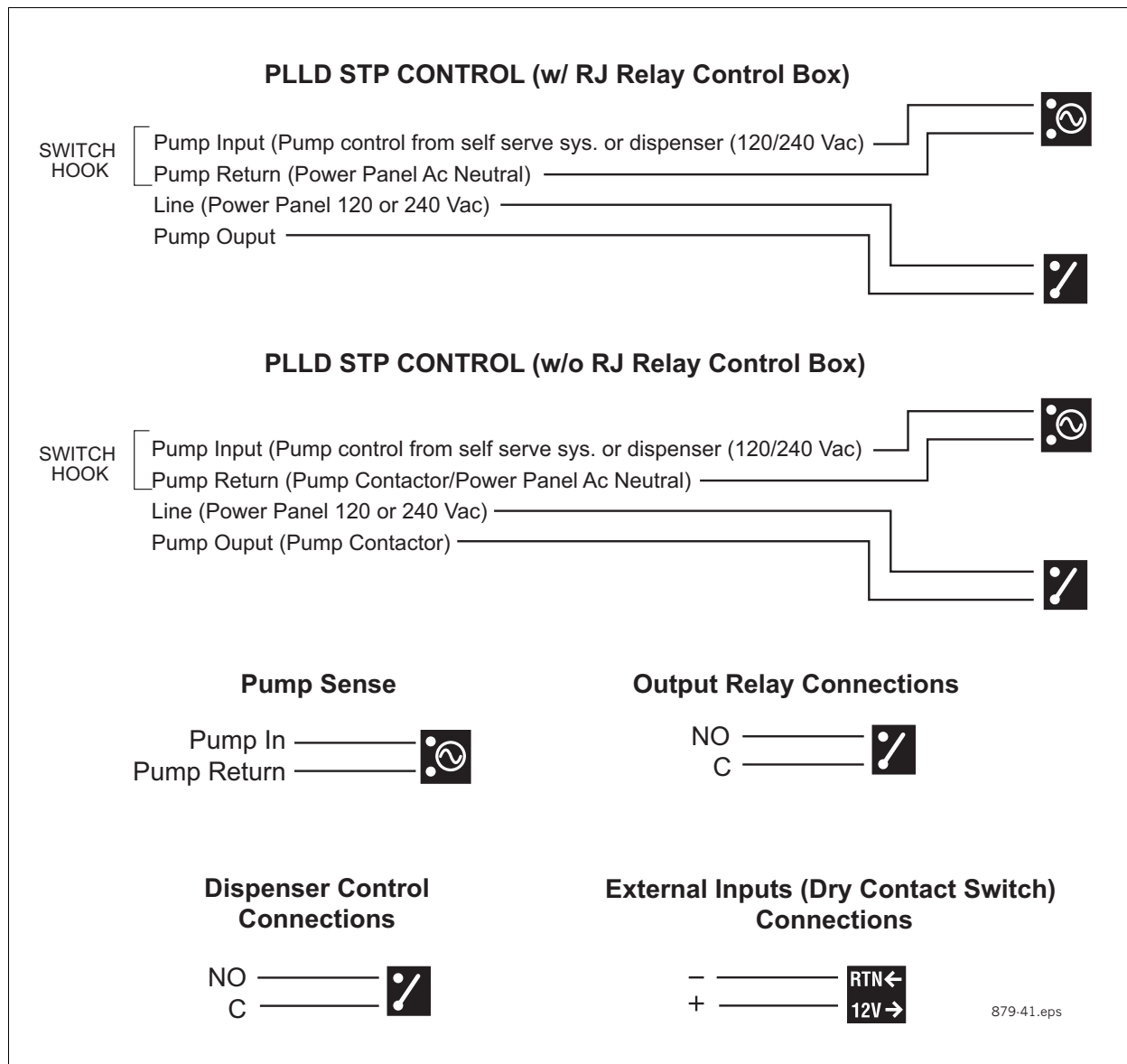


Figure 40. I/O Relay Module Connections

**Important Output Relay Connection Restrictions**

1. Do not connect output relays to a device that draws more than 5 amperes of current. Output power: output relay contact, resistive load - 120/240 Vac, 24 Vdc, 5 A max.
2. Alarm relays cannot be used for flow control. Alarm relays provide only a momentary closure and cannot actuate flow control devices such as valves and pump motor relays.



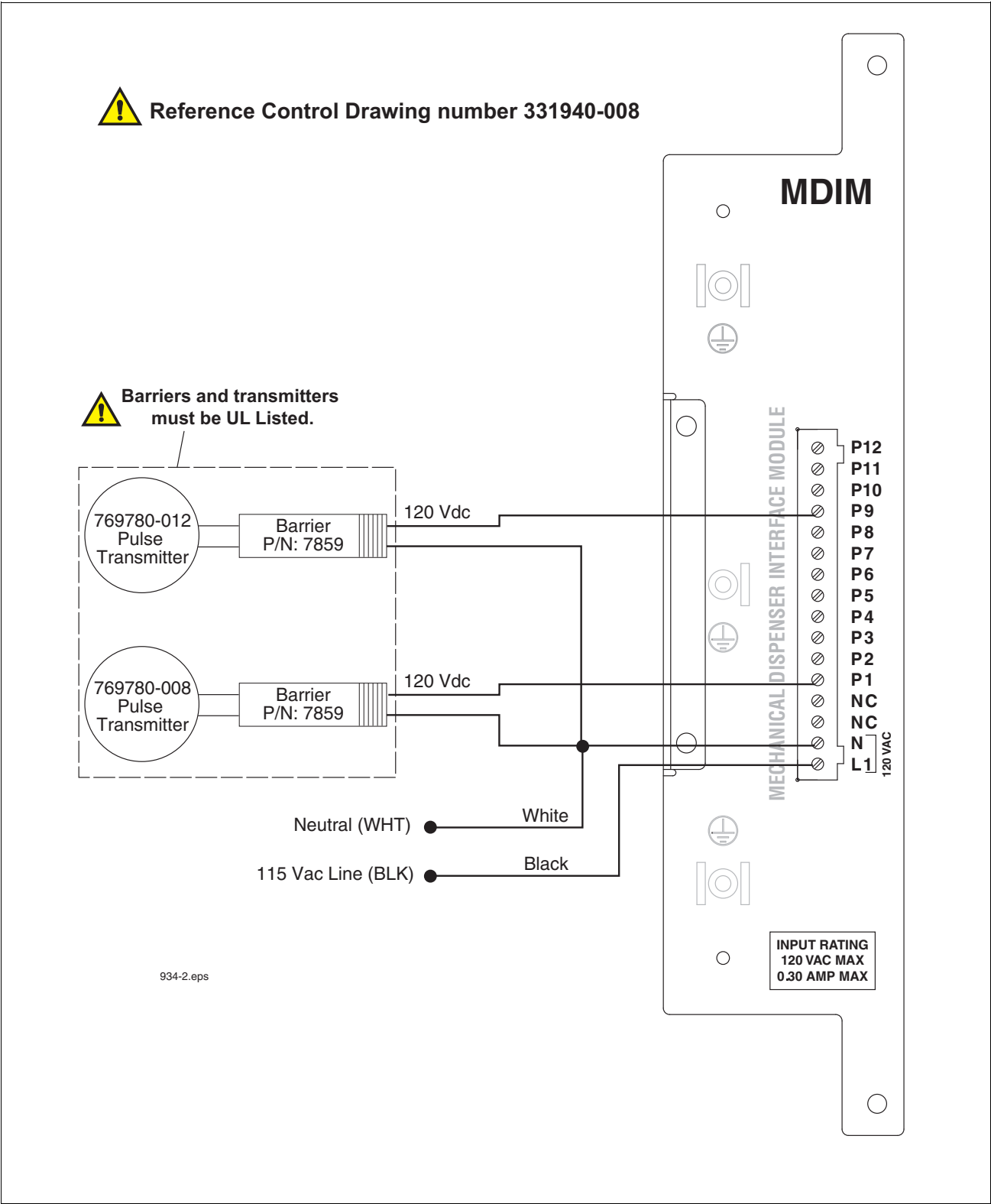


Figure 41. Connecting devices to the MDIM module

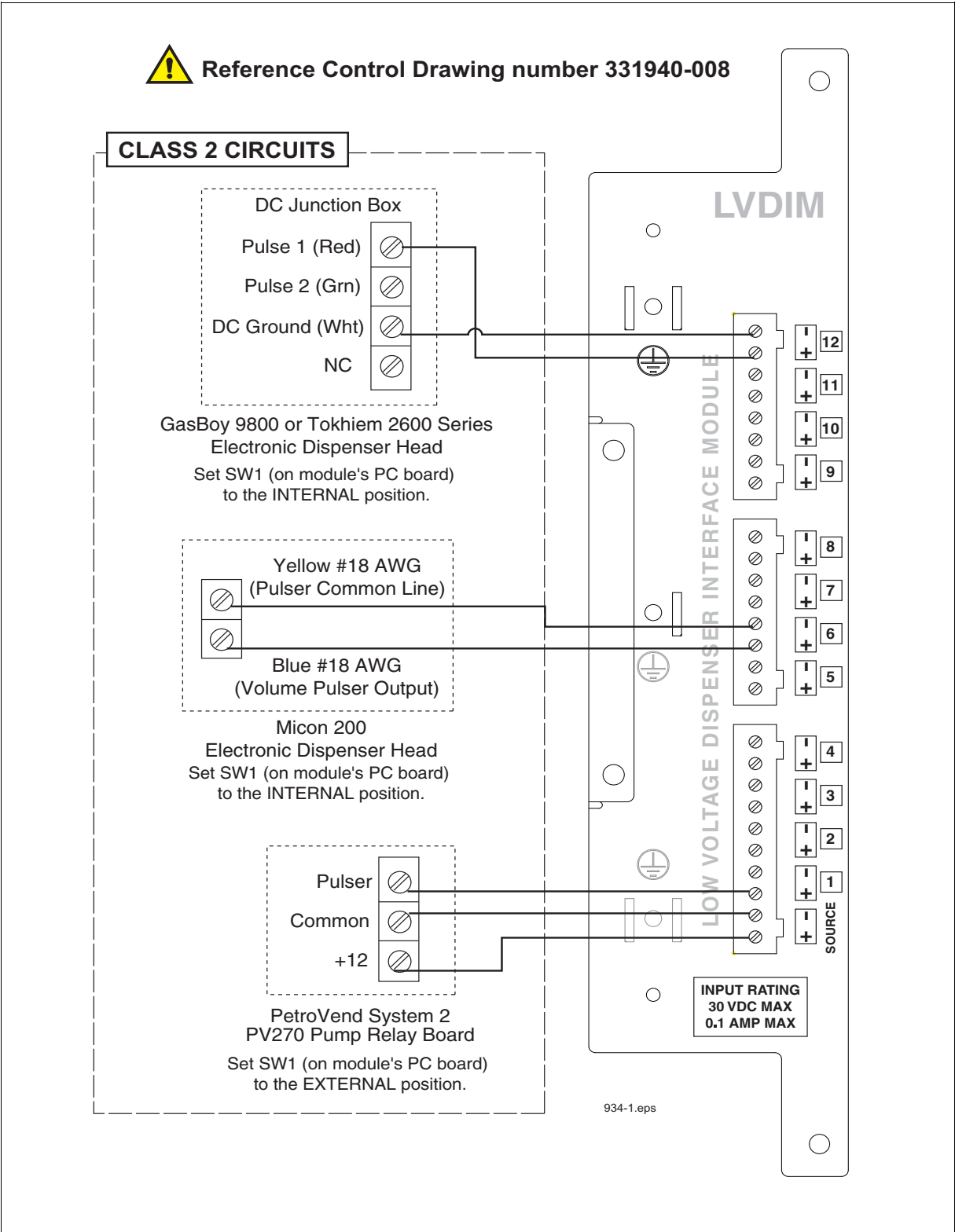


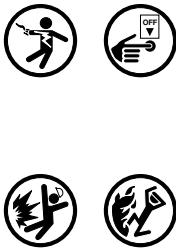
Figure 42. Connecting devices to the LVDIM module

## Connecting Power to the Console

When the TLS-450 is used with a TLS RF Wireless 2 System (W2), the TLS-450 must be on a separate circuit breaker from the TLS RF console(s).

After all connections have been made to the console, connect the wires carrying ac power to the console at the breaker panel - Check the Input Power Rating on the label affixed to the underside of the console to verify input power requirements.

### ⚠ 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. Turn power off at the circuit breaker. 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. Pull four wires between the power panel and the console; three #14 AWG or larger color-coded wires for AC line (hot), AC neutral and chassis ground; and one #12 AWG wire for barrier ground.
2. Connect the input 120 or 240 Vac power wires as shown in Figure 43.

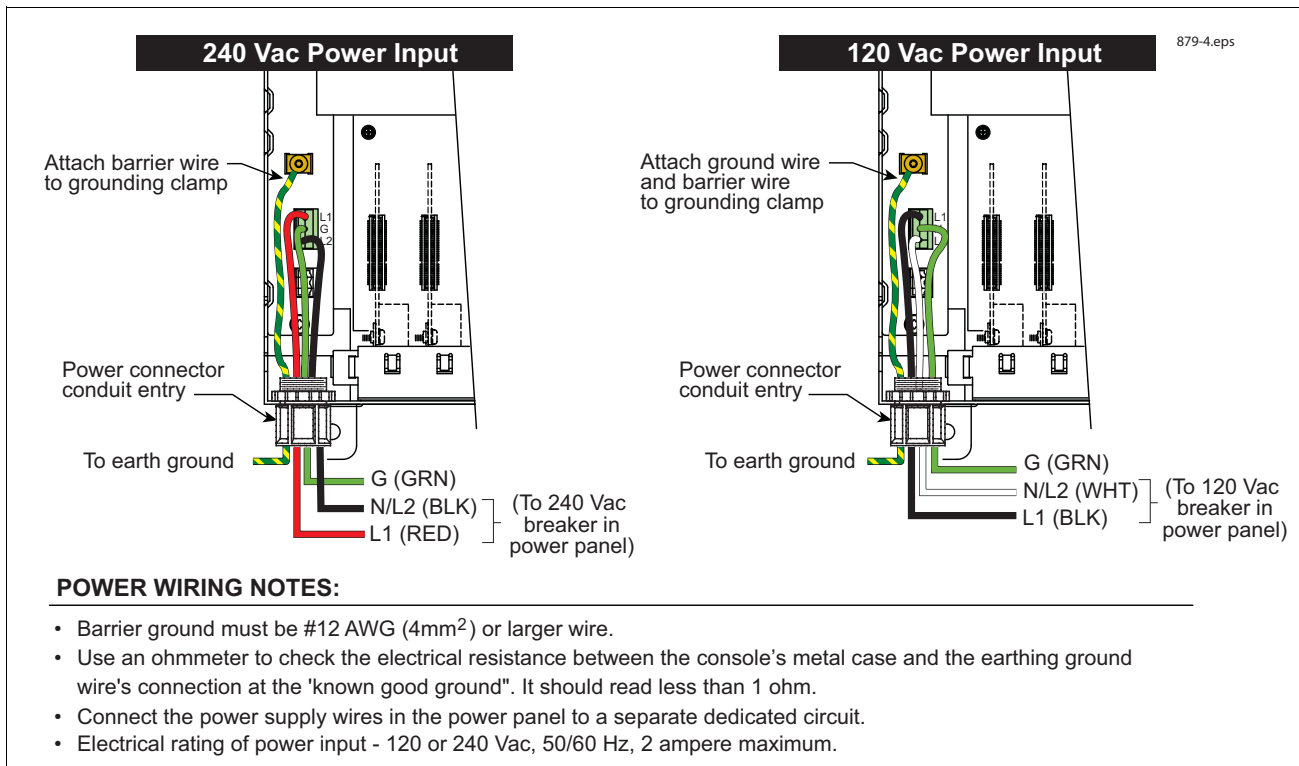


Figure 43. Wiring AC Power to the TLS-450 Console

## Initial Startup Procedure

### **A SITE THAT HAS A BRAND NEW TLS-450 WITHOUT WIRELESS 2 DEVICES**

1. Power up the TLS-450 Console and wait 5 minutes until the device 'Discover Mode' is complete.
2. Setup the TLS-450 Console.

### **A SITE THAT HAS A BRAND NEW TLS-450 WITH WIRELESS 2 DEVICES**

1. Power up all wireless devices.
2. Power up the TLS RF Console and wait about 5 minutes, before applying power to the TLS-450.
3. Power up the TLS-450 Console and wait 5 minutes until the device 'Discover Mode' is complete.
4. Setup the TLS-450 Console.

