Manual No: **577014-038** Revision: **C**

Mag-FLEX Probe

Installation Manual - EU Version

VEEDER-ROOT

Notice

This product is intended for use in conjunction with a Gilbarco Veeder-Root automatic tank gauge system for the purpose of liquid fuel storage tank level measurement. Only Gilbarco Veeder-Root sensors may be connected to the console. Connection of any sensor not supplied by Gilbarco Veeder-Root may result in damage to the console, impair system performance and/or impair the system safety. Connection of any sensor not supplied by Gilbarco Veeder-Root will void the product warranty.

Gilbarco Veeder-Root makes no warranty of any kind with regard to this publication, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose.

Gilbarco Veeder-Root shall not be liable for errors contained herein or for incidental or consequential damages in connection with furnishing, performance, or use of this publication.

Gilbarco Veeder-Root reserves the right to change system options or features, or the information contained in this publication.

For complete warranty, technical support and additional product information refer to your Gilbarco Veeder-Root representative.

DAMAGE CLAIMS

Thoroughly examine all components and units as soon as they are received. Check the items supplied against the delivery note for shortages and incorrect items. Immediately notify Gilbarco Veeder-Root of any damage, loss or incorrect items.

RETURN SHIPPING

Before returning any Gilbarco Veeder-Root equipment please request a returned goods authorisation (RGA) from Gilbarco Veeder-Root customer care. Instructions for the return of goods will be provided.

Please do not return any product without first obtaining authorisation.

Introduction

Mag-FLEX Probe Overview

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Introduction

This manual contains installation instructions for the Veeder-Root Mag-FLEX probe. Procedures contained within this manual include:

- Site layout considerations
- Installing the Mag-FLEX
- Cabling between the Mag-FLEX and the TLS Console
- TLS Console used with the Mag-FLEX

Tank Gauge Requirements

The Mag-FLEX is a digital flexible probe designed to measure product temperature, product level and water level in large storage tanks. The Mag-FLEX probes can measure liquid heights of up to 9.9 metres with TLS2 consoles and up to 22 metres with TLS-3XX and TLS4/TLS-450 consoles (reference table below). For storage vessels with maximum liquid levels up to 3.66 metres it is recommended that a Veeder-Root Mag Plus probe be used.

Console with Mag-FLEX	Max Height (metres)		Max Volume (litres)	
	Front Panel	Serial Line	Front Panel	Serial Line
TLS2	9.9	9.9	984,100	984,100
TLS-300	22.0	22.0	3,785,408	3,785,408
TLS-350	22.0	22.0	3,785,408	3,785,408
TLS-450	22.0	22.0	9,999,999	9,999,999

Related Documents

It is important that installers have knowledge of all relevant procedures before commencing work. Read and understand all manuals thoroughly. Do not to undertake work without understanding safety and required installation practices. For ATG installation and set-up refer to the appropriate TLS manual.

Contractor Certification Requirements

Service Technician Certification (Previously known as Level 2/3): Contractors holding valid 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.

TLS-3xx Technician Certification: Contractors holding valid TLS-350 Technician Certifications are approved to perform installation checkout, startup, programming and operations training, troubleshooting and servicing for all Veeder-Root TLS-300 or TLS-350 Series Tank Monitoring Systems, including Line Leak Detection and associated accessories.

TLS-4xx Technician Certification: Contractors holding valid TLS-450 Technician Certifications are approved to perform installation checkout, startup, programming and operations training, troubleshooting and servicing for all Veeder-Root TLS-450 Series Tank Monitoring Systems, including Line Leak Detection and associated accessories.

All service personal on site must comply with all recommended safety practices identified by OSHA and your employer.

Review and comply with all the safety warnings in this and any related documents, and any other Federal, State or Local requirements.

Warranty Registrations may only be submitted by selected Distributors.

Safety Symbols

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.

SLIPPERY
Curved metal tank surfaces can be extremely slippery. Wear approved boots with slip resistant soles.

FALLING OBJECTS
Being struck by even small objects falling from tall structures can result in severe injury or death. Wear your hard hat at all times when working alongside tall structures.

POWER
To prevent ignition of flammable or combustible atmospheres, disconnect battery before servicing.

NOTICE **NOTICE** is used to address practices not related to physical injury.

⚠WARNING **WARNING** indicates a hazardous situation which, if not avoided, could result in death or serious injury.

⚠CAUTION **CAUTION** indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

SAFETY HARNESS
Injury or death resulting from falls while working on tall structures can be prevented by wearing a 5-point harness that is tethered securely by a shock absorbing lanyard to the structure.

SAFETY BARRICADES
Unauthorized people or vehicles in the work area are dangerous. Always use safety cones or barricades, safety tape, and your vehicle to block the work area.

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.

Safety Marking

The Mag-FLEX Probe is an intrinsically safe apparatus designed to be installed in Zone 0 and on the boundary of hazardous areas between Zone 1 and Zone 0, i.e., the wall of a fuel tank. Associated apparatus connected to this product must have a compatible barrier and/or shall have suitable entity parameters.

	Device suitable for potentially explosive areas
II	Group II: for installations in areas other than mines and related surface equipment
1	Category 1: to be installed in Zone 0, Zone 1 or Zone 2 hazardous areas
1/2	Category 1/2: to be installed on the boundary of Zones 0 and Zone 1 hazardous areas
2	Category 2: to be installed in Zone 1 or Zone 2 hazardous areas
G	For potentially dangerous areas characterized by the presence of gases, vapours or mists

This apparatus is an intrinsically safe device suitable that is intended to be installed in hazardous areas characterized by the presence of gases, vapours or mists formed by groups IIA or IIB dangerous substances. The Mag-FLEX is in compliance with the Directive 94/9/EC (ATEX). The sample of the type has been tested by TÜV NORD CERT GmbH, ID 0044, Langemarckstraße 20, 45141 Essen, Germany, and approved by the issue of the EC type certificate, where the complete name Mag Plus 1 Flex is used.

TÜV 12 ATEX 105828

The manufacturing process has been approved by BASEEFA which has authorized the use of its ID 1180 after the symbol of the CE marking.

When used in potentially explosive atmospheres, the maximum service temperature depending on the temperature class and category is shown below:

Table 1. Temperature Class Ta Tf

Temperature Class	Ambient Temperature Range	Medium Temperature
Category 1 and EPL Ga (Filling level sensor entirely erected in Zone 0)		
T4, T3, T2, T1	-20°C to +60°C	-20°C to +60°C
Category 1/2 and EPL Ga/Gb (Sensor pipe erected in Zone 0, Sensor head erected in Zone 1)		
T4, T3, T2, T1	-40°C to +75°C	-20°C to +60°C
Category 2 and EPL Gb (Filling level sensor entirely erected in Zone 1)		
T4	-40°C to +75°C	-40°C to +135°C
T3	-40°C to +75°C	-40°C to +200°C
T1	-40°C to +75°C	-40°C to +300°C
T1	-40°C to +75°C	-40°C to +450°C

EC-TYPE CERTIFICATES FOR AN INTRINSICALLY SAFE SYSTEM

TLS Monitoring Systems are installed according to the conditions specified in the applicable ATEX Certificates. ATEX Certificate Number DEMKO 06 ATEX 137480X is the system certificate that details all of the equipment that is approved for use in a TLS Monitoring System. Except for the cables used to connect intrinsically safe apparatus, information contained on the system certificate and each of the device certificates, provide the safety related information (i.e., Ex ia) required to install a TLS Monitoring System. Cables used to connect intrinsically safe apparatus must be considered in determining ATEX compliance and are limited to the maximum allowable cable parameters listed in this manual. For assistance in calculating the required (Ex ia) safety parameters, contact GVR as described on the inside cover of this manual. Additional equipment compliance information is available on the EC Declaration of Conformity including the technical standards applied by the Notified Body in creating the respective ATEX Certificates.

Before You Begin

Before you begin installation, please read the following guidelines:

Mag-FLEX probes are intended for installation and operation in the highly combustible environment of a petroleum fuel storage tank. It is essential that you carefully read and follow the warnings and instructions in this manual to protect yourself and others from serious injury, explosion, or electrical shock.

For safety reasons, we have taken particular care in the design of this product to limit the power in the wiring to the fuel tanks and to keep that wiring physically separated from any other wiring. It is your responsibility to maintain the effectiveness of these safety features by installing this product in accordance with the following instructions and warnings. Failure to do so could create danger to life and property.

Failure to install this product in accordance with its instructions and warnings will result in voiding of all product warranties.

⚠ WARNING

The Mag-FLEX is installed and operated in the highly combustible environment of a petroleum storage tank,

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

1. **It is essential that you carefully read and follow the warnings and instructions in this manual to protect yourself and others from serious injury due to fire or explosion. Failure to do so could result in undetected potential environmental and health hazards.**
2. **Comply with all local regulations, codes of practice, and other applicable safety codes. All wiring must comply with relevant local electrical regulations and codes.**
3. **Confirm that the site maintains current storage tank certification prior to commencing work.**
4. **Installation must only be carried out by personnel trained and competent in petroleum fuel storage tank work.**
5. **Perform appropriate safety checks prior to commencing any work.**
6. **Failure to comply with these requirements could result in death, serious personal injury, property loss, or equipment damage.**
7. **Substitution of components may impair intrinsic safety.**
8. **Circuitry within the Mag-FLEX is intrinsically safe only when connected to the appropriate barrier.**

EQUIPMENT PROTECTION

TLS monitoring equipment, including the Mag-FLEX Probe, is designed and certified to comply with the Directive 94/9/EC (ATEX) and the IECEx scheme. The installer must consider any local regulations, which may differ or be more stringent, prior to installing any equipment. The suitability/safety of any installation is ultimately determined by the local authority having jurisdiction.

The Mag-FLEX Probe is part of the TLS Monitoring System and can be installed in equipment Category 1 and is suitable for use in a Zone 0 hazardous location. Extreme care must be taken when determining the suitability of the installation conditions and operation of the TLS Monitoring System. The Mag-FLEX probe is provided with a standard process connection suitable for the boundary between zone 0 and zone 1 locations. In addition to the mounting location and method, at least the following items must be considered and will aid in the determination if a probe is to be installed in the boundary between Zone 0 and Zone 1 or if it will be installed directly in a Zone 0 hazardous location:

1. Equipotential bonding of the installation site,
2. Minimizing static hazards associated with the underground storage of flammable liquids, and
3. Protection of the system against lightning strikes and any other source of possible electrical surges caused by electrical railway systems, high voltage direct current facilities and the like.

EQUIPOTENTIAL BONDING

Consult any local regulations prior to installing a Mag-FLEX Probe into any tank. The Mag-FLEX is supplied with an approved process connection.

The intrinsically safe circuit in the TLS Monitoring System is derived from a fuse protected zener diode intrinsic safety barrier. This type of explosion protection requires that the intrinsically safe electric circuit is referenced to the safety ground associated to the mains circuit. If the site has a submersible pump (DIN/EN 15268) connected to the same mains safety ground as the TLS Monitoring System Console and it is installed in a metallic riser of a metallic storage tank, the zener diode barrier must be referenced to the same earth (safety) ground.

The body of the probe can be directly bonded to the tank structure via a $4mm^2$ cable (not supplied) using the grounding screw and saddle clamp on the probe housing.

MINIMIZATION OF ELECTROSTATIC HAZARDS

Consult any local regulations prior to installing a Mag-FLEX probe into any tank. Veeder-Root supplies approved process connections for installations where direct connection between the probe body and tank structure is required (see Probe Installation Using Process Connection instructions below).

The Mag-FLEX probe housing complies with the 500 volt electrical strength requirements in IEC/EN 60079-11. In addition, the probe housing should be equipotentially bonded to the tank structure via a $4mm^2$ wire (not provided) and the saddle clamp and grounding screw on the probe housing.

All TLS Consoles provide an alarm if either of the two wires to the Mag-FLEX probe is disconnected or short circuited due to a malfunction.

If a probe must be serviced or replaced, observe any required relaxation time prior to opening any covers and removing the probe.

LIGHTNING AND SURGE PROTECTION

Consult any local regulations prior to installing a Magnetostrictive Probe into any tank. Local rules or regulations may require surge arrestors when installing equipment that crosses from a less restrictive zone, e.g., zone1 to zone 0 independent of the risk assessment. When required Veeder-Root can supply appropriate surge protection devices.

In locations where the intrinsically safe cables or circuits are considered to be at risk of developing hazardous potential differences within Zone 0, an external surge protection device may be needed. Perform the lightning risk analysis to determine if surge protection is required, and if necessary, the surge protector shall be installed in accordance with IEC/EN 60079-25 and IEC/EN 60079-14. Reference Figure 2 and Figure 3 for mounting locations for a surge protector.

When they are deemed necessary, the surge arrestor shall either be a certified in-line device or a simple apparatus conforming to the requirements of EN 60079-14: Electrical installations design, selection and erection. Only gas-discharge type surge protectors that comply with Clause 12 of IEC/EN 60079-25 are acceptable. Additional installation requirements for surge protection devices are defined in Clause 12.3 of standard IEC/EN 60079-14.

Mag-FLEX Probe Overview

Product Description

The Mag-FLEX is digital flexible probe is able to read temperature, product level and water level in the tank.

The Mag-FLEX Probe is a corrugated flexible probe designed to be used with any TLS console wherever there is a requirement to monitor liquid levels higher than the current maximum height of Veeder-Root Mag probes (3.66m). The following table details Mag-FLEX maximum measuring heights:

Mag-FLEX Probe Limitations

Maximum Limits	Console Series				
	TLS-450/TLS-XB	TLS4/8601	TLS-350	TLS-300	TLS2
Probe Length in Centimeters	2,200	2,200	2,200	2,200	975
Tank Volume in Litres	9,999,999	9,999,999	3,785,408	3,785,408	984,207
Maximum Number of Mag-FLEX Probes per Console	32	12	16	2 or 4	6

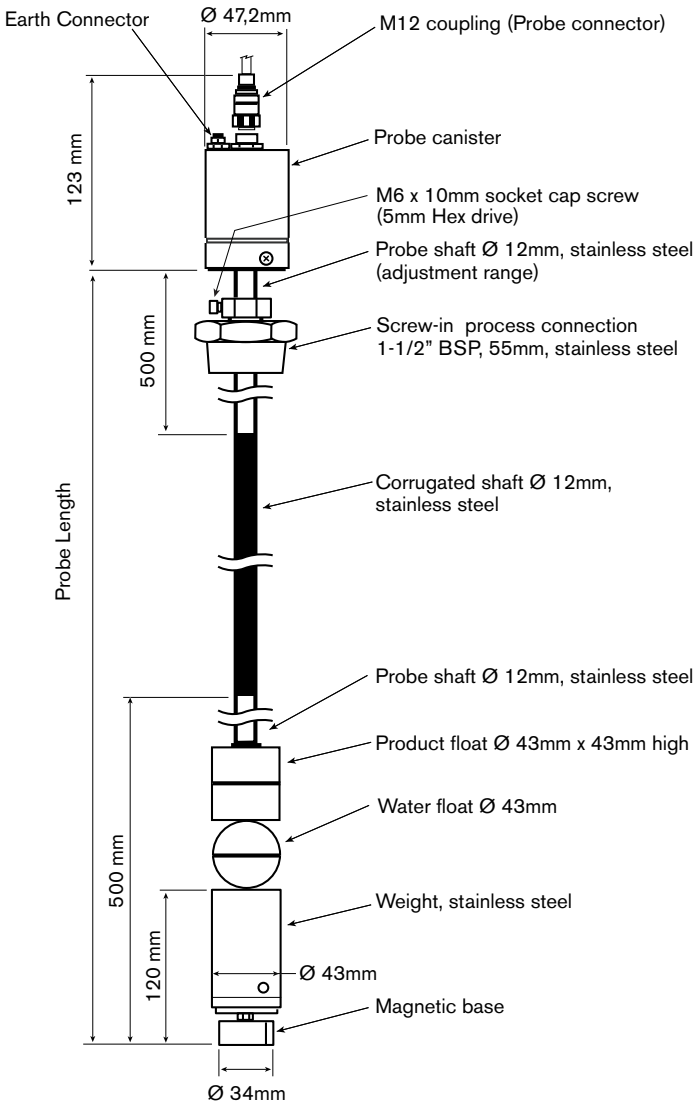
Any combination of Mag and Mag-FLEX probes can be connected to a TLS console, up to the maximum number of inputs available on the channel.

The Mag-FLEX Probe has a weight and magnet at the base of the probe to give stability, suitable for use in a wide range of products and available with or without water detection. The Mag-FLEX Probe with standard water float uses a process connection requiring a 1-½" tank entry point with a BSP thread. Table 2 lists minimum tank opening required for the Veeder-Root Mag-FLEX probe with the standard water float and with the optional low level water float.

Table 2. Dimensions for Mag-FLEX Probe Tank Opening

V-R Water Float	V-R Water Float OD inch (mm)	Recommended Tank Opening Size	
		inch	mm
Standard	1.7 (43)	2	50
Low Level	3.8 (96.52)	4	100

Mag-FLEX Technical Data



- **Level accuracy:**
  - **Precision: +/- 2mm**
  - **Repeatability: +/- 0.5mm**
  - **Resolution: 0.001 mm**
- **Digital communication**
- **Temperature sensing**
- **Water detection (optional)**
- **Max liquid height: 15.0m**
- **Top mounted**
- **Process connection: for height adjustable installation R 1½" stainless steel, WAF 55**
- **Electrical connection: M12 connector**
- **Housing index of protection: IP68**
- **Sensor materials:**
  - **Housing in stainless steel: 303**
  - **Tube: 316Ti**
  - **Corrugated hose: 316L**
- **Weight: stainless steel: 316L. Encapsulation of retaining magnet: conductive plastic (PTFE with graphite)**
- **Ex approvals: TÜV 12 ATEX 105828, IECEx TUN 12.0027**
- **Operating temperature range: -20 °C to +60 °C when fully installed in Zone 0, from -40 °C to +75 °C in all other locations**

Mag-FLEX Probes Part Number Specification

Table 3 and Table 4 contain part numbers for ATEX version Mag-FLEX probes.

Table 3. ATEX Version - For TLS4/4B pre-Version 6A or TLS-450 pre-Version 4M or TLS-3xx & TLS 2 / 2P All Versions

Part Numbers* – ATEX Version	English - Feet		Metric - mm	
88956Y-1XX (Petroleum up to E10) **88956Y-2XX (Diesel)** **88956Y-3XX (No Water Detect)** **(Where Y = 0 or 1 depending on factory build date; and XX = numbers selected in the column below)**	**Min. length**	**Max. Length**	**Min. length**	**Max. Length**
00		6.56		2000
01	6.59	9.84	2010	3000
02	9.88	13.12	3010	4000
03	13.16	16.40	4010	5000
04	16.44	19.69	5010	6000
05	19.72	22.97	6010	7000
06	23.00	26.25	7010	8000
07	26.28	29.53	8010	9000
08	29.56	32.81	9010	10000
09	32.84	36.09	10010	11000
10	36.12	39.37	11010	12000
11	39.40	42.65	12010	13000
12	42.68	45.93	13010	14000
13	45.96	49.21	14010	15000
14	49.25	52.50	15010	16000
15	52.52	55.77	16010	17000
16	55.81	59.06	17010	18000
17	59.08	62.33	18010	19000
18	62.36	65.61	19010	20000
19	65.64	68.89	20010	21000
20	68.93	72.18	21010	22000

**For example, to order a Mag-FLEX Probe for Diesel, min./max. length 42.68 – 45.93 feet (in green), order P/N 889561-212.*

Table 4. ATEX Version - For TLS4 & 4B from Version 6A or TLS-450 from Version 4M

Part Numbers – ATEX Version	English - Feet		Metric - mm	
88956Y-4XX (Petroleum up to E10) **88956Y-5XX (Diesel)** **88956Y-6XX (No Water Detect)** **(Where Y = 0 or 1 depending on factory build date; and XX = numbers selected in the column below)**	**Min. length**	**Max. Length**	**Min. length**	**Max. Length**
00		6.56		2000
01	6.59	9.84	2010	3000
02	9.88	13.12	3010	4000
03	13.16	16.40	4010	5000
04	16.44	19.69	5010	6000
05	19.72	22.97	6010	7000
06	23.00	26.25	7010	8000
07	26.28	29.53	8010	9000
08	29.56	32.81	9010	10000
09	32.84	36.09	10010	11000
10	36.12	39.37	11010	12000
11	39.40	42.65	12010	13000
12	42.68	45.93	13010	14000
13	45.96	49.21	14010	15000
14	49.25	52.50	15010	16000
15	52.52	55.77	16010	17000
16	55.81	59.06	17010	18000
17	59.08	62.33	18010	19000
18	62.36	65.61	19010	20000
19	65.64	68.89	20010	21000
20	68.93	72.18	21010	22000

**For example, to order a Mag-FLEX Probe with No Water Detect, min./max. length 49.25 – 52.50 feet (in orange), order P/N 889561-614.*

MAG-FLEX SPARE PARTS AND ACCESSORIES

Item	Part Number
Single-Channel Surge Protector (Wireless Install)	848100-001
Dual-Channel Surge Protector (Wired Install)	848100-002
Overvoltage Protection Device Type BA 350, 2-wire	903313
Leader Cable with M12 Connector	908704 (Spare part only, supplied with all new probes)
FAFNIR USB Adapter [Mag-Flex]	900180
Water Float for Biodiesel	908546
Connecting cable with M12 connector	908704

Fafnir BA-350 Protection Device (Surge Protector)

This section details safety information that is pertinent to the Fafnir Surge Protector only. The Veeder-Root Surge Protector is certified by UL/DEMKO.

The overvoltage protection device is intended to protect intrinsic safety sensor apparatus from overvoltage eventually caused by atmospheric static electricity and conveyed by the connecting cables.

INFORMATION ON SAFE USE

The equipment is for use of discharge overvoltage and is designed as a simple apparatus according to EN/IEC 60079-11, clause 5.7. Therefore, it can be used without a type examination certificate inside potentially explosive atmospheres (zone 1 and zone 2). The overvoltage protection is for use of all gas groups (IIA, IIB, and IIC) and its temperature class is T6.

The overvoltage protection is enclosed by a metal enclosure. The material composition of the enclosure includes according to EN/IEC 60079-0, clause 8.1.2 for an EPL Gb less than 7,5% magnesium and titan, such as AlSi12.

This instruction manual is valid of types BA 350-X.

INFORMATION ON SAFE MOUNTING RESP. DEMOUNTING

The overvoltage protection is built-on a metal enclosure with a degree of protection IP66. For the installation the housing cover has to be removed (four screws) and it has to be put in place and tight again by the screws after the connection of the wirings. Cable glands have to be tight as appropriate to maintain the IP 66 grade of protection.

INFORMATION ON SAFE INSTALLATION

The wiring may only take place de-energized. Special regulations, among other things, EN/IEC 60079-14 resp. EN/IEC 60079-25 resp. the local installation regulations should be noted. Wall mounting of the overvoltage protection is possible.

General remark (see also EN/IEC 60079-25, clause 12 resp. EN/IEC 60079-14, clause 12.3): The overvoltage protection device must be installed outside zone 0 but as near as technical possible to the boundary of zone 0, preferable in a distance of maximum 1m.

Both terminal blocks can be used either as an input or output. Polarity must be observed.

For the connection to the potential equalisation (PA) a terminal on the outside of the enclosure is provided.

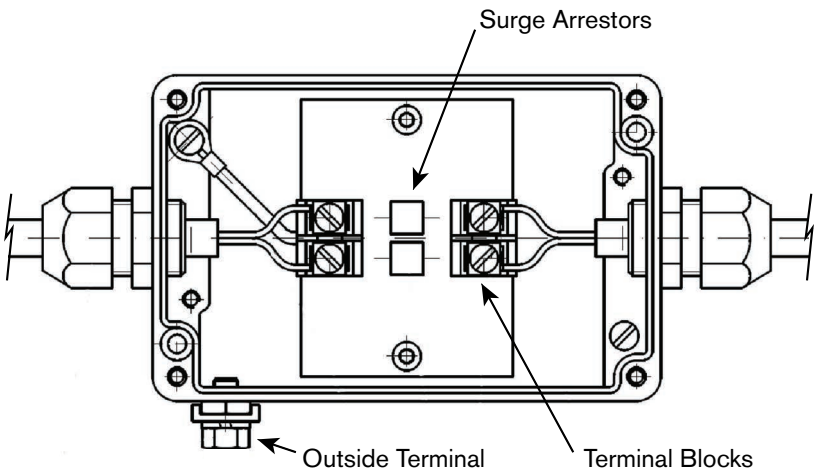


Figure 1. View Into Open Enclosure Of A BA-350-2

INFORMATION ON SAFE ADJUSTMENT

There are no required safety adjustments.

INFORMATION ON SAFE PUTTING INTO SERVICE

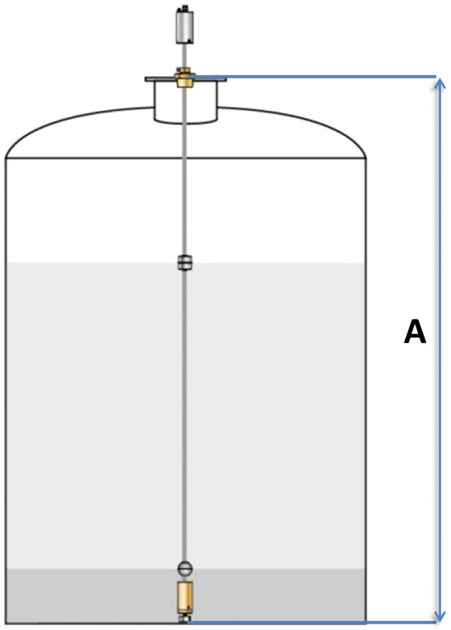
Before putting the Mag-FLEX probe into service, double check connections and mounting.

INFORMATION ON SAFE MAINTENANCE AND REPAIRING

In general, the equipment is maintenance free. Defective equipment must be returned to the manufacturer or one it's representatives. If a test is required, it must be conducted under well-controlled conditions (an explosive atmosphere shall not be present). It is also necessary to disconnect the overvoltage discharge device, according to EN/IEC 60079-25, clause 12, because of a non-conformance with EN/IEC 60079-11, clause 6.3.13.

Mag-FLEX Probe Length Calculation

Before ordering the Mag-FLEX Probe, an accurate dimension for “A” must be obtained. Measure internally the Insertion Length ‘A’ from the 1½” entry point to the bottom of the tank (see diagram below). Probe length for ordering purposes = A + 250 mm.



Probe Handling

It is important to handle the Mag-FLEX probe with care at all times during the installation. Avoid excessive bending of the probe especially at the points the ridged sections meet with the flexible shaft. Below you can see examples of mishandling that would cause irreversible damage to the probe and invalidate the terms of warranty.

System Safety Layout

NOTICE **Conduit/ducting requirements are dependent on local electrical regulations.**

⚠WARNING **Substitution of components may impair intrinsic safety. Probe, probe wiring and console wiring are intrinsically safe only when connected via this barrier.**

Field Cable Ducting / Cable Trays

⚠WARNING  **Explosion could occur if other wires share ducts with intrinsically safe circuits. Ducting from probes or sensors must not contain any other wiring.**

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

Minimum diameters for underground probe ducting are:

- Up to 20 cables -100 mm diameter
- Up to 50 cables -150 mm diameter

Run suitable diameter cable ducting and / or cable trays from the TLS Console to each Mag-FLEX probe location. For underground tanks, all cable duct entry points must be sealed to prevent the escape of hydrocarbon vapour and liquid and the ingress of water. Cable duct & cable tray plans must be designed to suit local site requirements and must conform to local/national regulations and industry standards.

For multiple TLS installations, the Mag probe and Mag-FLEX cabling for one TLS system must be contained in separate cable duct or tray to those cables belonging to another TLS system. Combining cables from different TLS systems will be in violation of the intrinsically safe approval for this system and is not permitted. Combining cables from different systems may also result in improper system operation.

Unless specified otherwise, any draw pits should be sited at 10 metre intervals or where acute cable duct angles are unavoidable.

Ensure that all ducting is equipped with cable pull through ropes and that all visible cable ducts are properly fixed and finished off in a neat and tidy manner.

All above ground cable runs should be properly secured and adequately protected from accidental damage.

Cable Specifications For Intrinsically Safe Apparatus Cabling

Cable must be installed to comply with local and national regulations in force at the time of installation. It is the Installer's responsibility to ensure that the installation complies with all relevant local and national legislation and codes of practice.

Do not run the Mag-FLEX probe cable from the tank to the TLS Console in the same cable duct as non-intrinsically safe wiring.

Gilbarco Veeder-Root requires the use of shielded cable for Mag-FLEX cabling. The cable must have a minimum conductor CSA of 0.75 mm^2 and must meet with intrinsically safe system installation requirements. The cable capacitance, inductance and L/R ratio must conform to the intrinsically safe output characteristics of the TLS Console and the intrinsically safe input characteristics of the Mag-FLEX probe.

Field Cable, ATG to Probe 2 x 0.75 mm^2 shielded: i.e. Gilbarco Veeder-Root cable p.n. 222-001-0029.

NOTICE **The TLS Console to Mag-FLEX probe cable length must not exceed 300 meters.**

Mag-FLEX Installation And Handling Procedure

Probe Installation Requirements

NOTICE **The instructions herein are intended as reference material only, the Gilbarco Veeder-Root training modules contain comprehensive information and must be completed before any installation work is attempted - contact Gilbarco Veeder-Root for details.**

Installation requires a minimum of two people to allow correct handling of the probe. Please note that the flexible and therefore fragile nature of the Mag-FLEX probe makes it more prone to mechanical shock. The probe must not be unpacked until it has been brought to its place of installation and where possible unpacked at the Tank top. The probe corrugated shaft is supplied in a 1 meter diameter coil this coil MUST not be reduced in size. The packaged curve is the maximum bend possible to prevent damage.

Miscellaneous Requirements

TANK ENTRY

The tank entry point provided must have an internal thread of 1½" BSP - or 4" BSP when installing a low level water float.

PROBE ASSEMBLY

The process connection, water float, product float, weight and magnet are shipped pre-assembled on the probe.

TOOLS AND MATERIALS

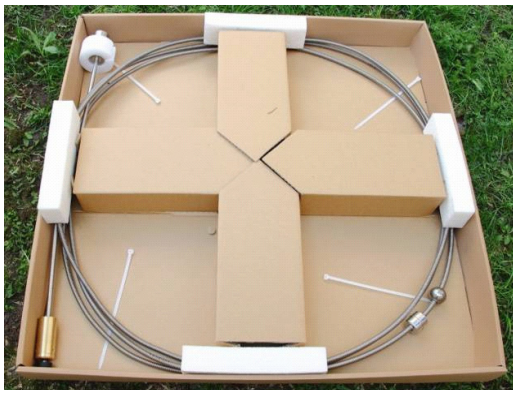
Before starting the installation you should have the following tools & materials:

- Mag-FLEX probe suitable for the tank height. See Mag-FLEX Probe Length Calculation on page 12.
- 2-Core probe cable run from TLS location to tank top. See Cable Specifications For I.S. Apparatus Cabling on page 13.
- Surge protector BA-350 Part number 903313 (wired install only), or V-R P/N 848100-002 for wired install or V-R P/N 848100-001 for wireless install
- Non-sparking 55 mm Spanner for the process connection 55mm WAF (Width across Flat)
- Liquid sealing material for process connection, compatible with the tank material & product to be monitored
- Non-sparking Hexagon key (5mm) for the locking screw
- Non-sparking 30mm Spanner for the gland 30mm WAF (Width across Flat)
- Measuring tape to establish the correct position to lock the probe shaft into place

Mag-FLEX Probe Installation

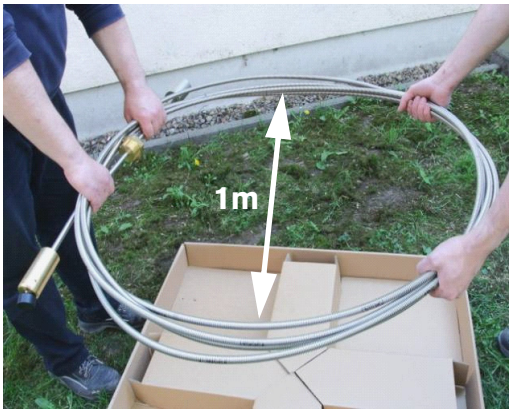
1. **Unpacking the probe**

   The probe shipping box is 1.1m square and12cm deep. The probe is coiled to a diameter of approximately 1m. The probe should not be unpacked until the tank is ready to accept it. Where possible, the probe should be transported to the top of the tank in its packaging.



2. **Removal of the packaging**

   Two people are required to remove the probe from its packaging to prevent any kinking or distortion of the flexible probe shaft.

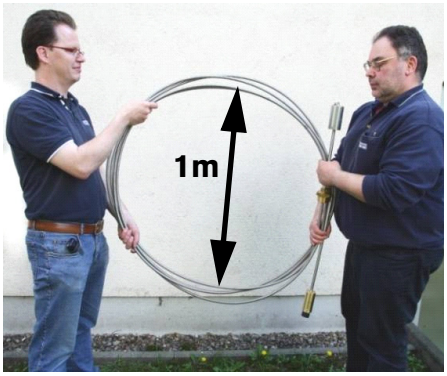


   NOTICE **Damage caused by mishandling will not be covered under warranty.**

   - If there is deformation at the transition points between probe shaft and corrugated sections extreme care must be taken to straighten them before installation in to the tank.
   - Always keep the probe coils parallel. Do not lift one coil separately from the others. Never twist one coil 90° from the others.
   - Do not twist the probe during installation. Always keep the coils of the probe parallel. “Unroll” it progressively into the tank.
   - Do not let the coil become less than 1m in diameter whilst uncoiling.

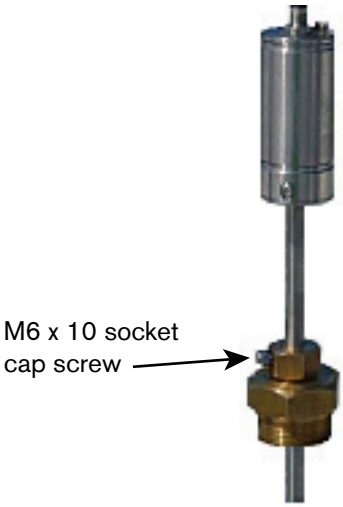
3. **Probe held ready for installation**

The coil should be held as shown maintaining the coiled shape to prevent kinking.



4. **Process Connection**

With the 5mm hex key, loosen the socket cap screw and gland. Slide the process connection towards the probe head and temporarily secure.



5. **Lowering the probe into the tank**

Feed the lower end of the probe (magnetic base) into the tank as shown.

6. **Feeding the probe into the tank**

Unroll the corrugated shaft as the probe is lowered into the tank taking care to avoid chafing on the tank entry.

7. **Corrugated shaft lowered into tank**

Steel Tanks

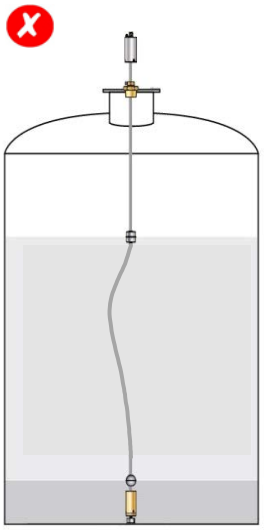
At this point lower the probe slowly until you feel the magnetic attraction as it contacts the bottom of the tank.

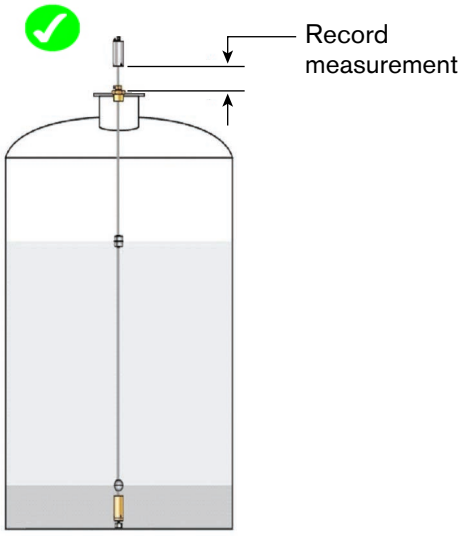
Non Steel tanks

Lower the probe until you feel the weight contact the tank bottom.

8. Installation dimension

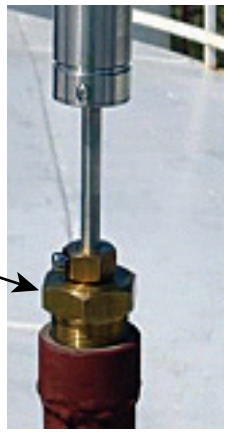
With the probe in contact with the tank bottom & the probe held taut measure the clearance from the lower edge of the probe canister to the top of the tank entry point (installation dimension) record this measurement.





9. **Fitting the process connection**

Apply sealant to the thread of the process connection. Carefully lower the process connection into the tank entry fitting. Screw in and tighten using a 55mm WAF spanner..



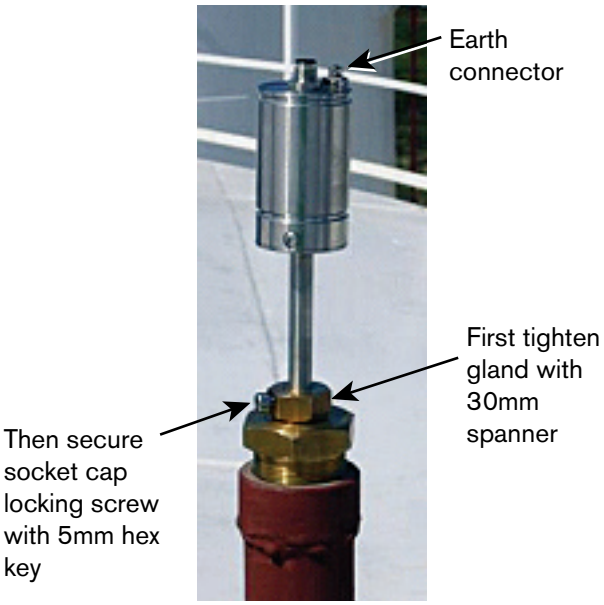
10. **Securing the probe**

Raise the probe canister until the exact installation dimension that you measured & recorded in step 8 is achieved.

Attention!

Do not raise the probe any higher as it will become detached from the bottom of the tank.

With the probe in this position tighten the gland nut using a 30mm WAF spanner. Secure the locking screw with the 5mm Hexagon key.



11. Example installations

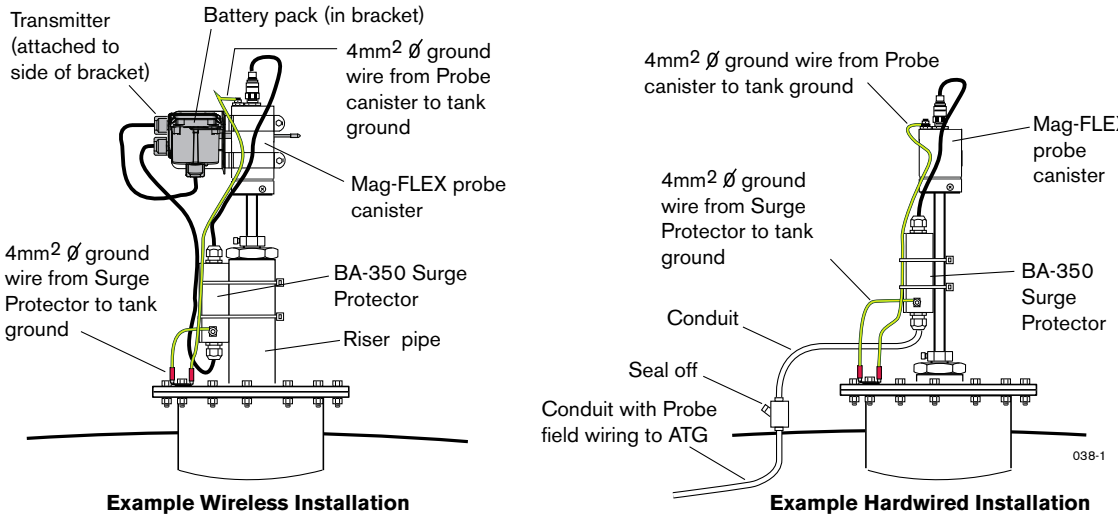


Figure 2. BA-350 Surge Protector Installation Examples

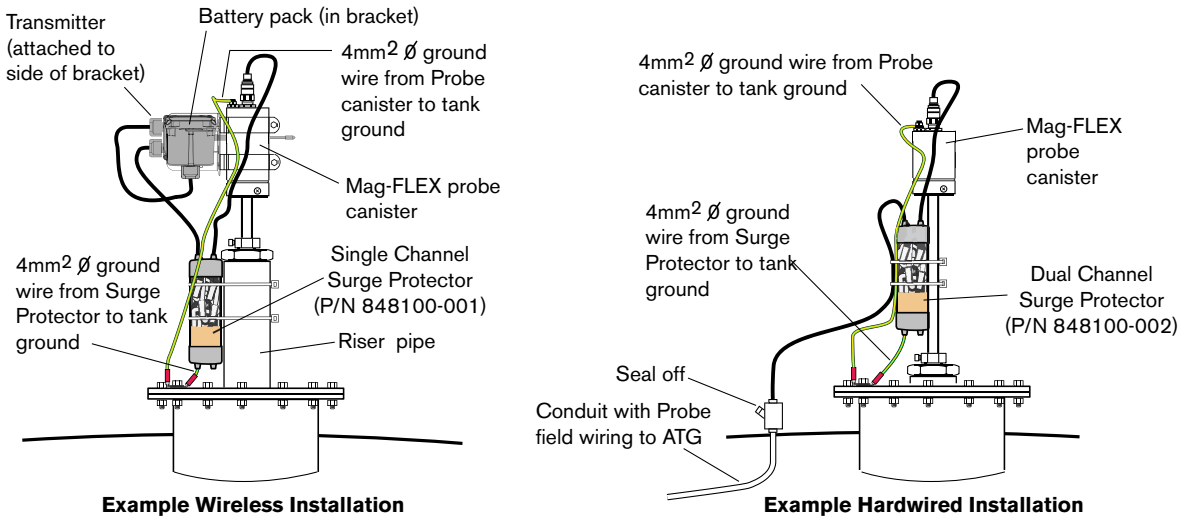


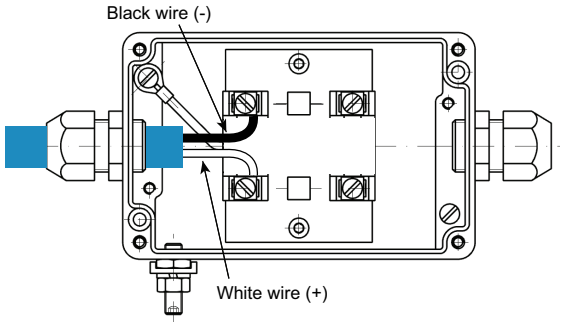
Figure 3. Veeder-Root Single- And Dual-Channel Surge Protector Installation Examples

Mag-FLEX Probe-To-Surge Protector Wiring Connections

BA-350A SURGE PROTECTOR - WIRED INSTALLATIONS ONLY

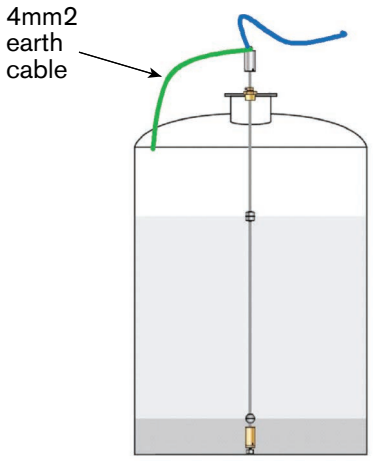
1. **Connecting the probe leader cable** - Connect the leader cable supplied with the probe to the M12 connector located on the top of the probe canister. Attach the connector of the supplied Leader Cable to the M12 connector on the probe head. First tighten the union nut of the M12 connector by hand and then tighten the nut a further 180° using an open-ended spanner. The tightening torque should be in the range of 100~150 N/cm.

2. **Fitting the screw-in gland assembly** - Connect the other end of the probe leader cable to the surge protector as shown below.



3. **Grounding the probe to the tank**

NOTICE **A 4 mm² earth cable must be connected between the probe canister earth connector and tank ground.**

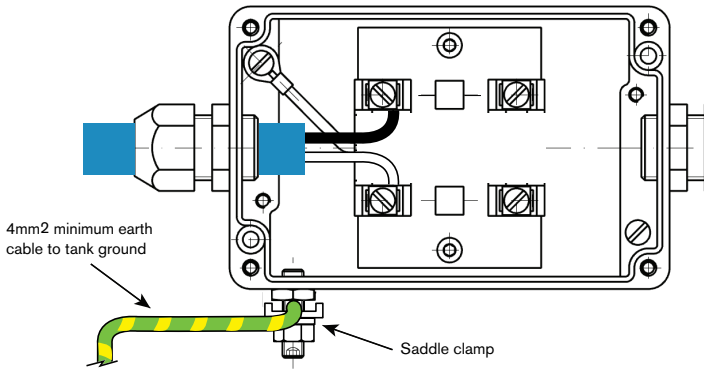


4. **Grounding the surge protector to the tank**

NOTICE **An 10 gauge (4mm²) eearth cable must be connected between the surge protector and tank ground connection**.

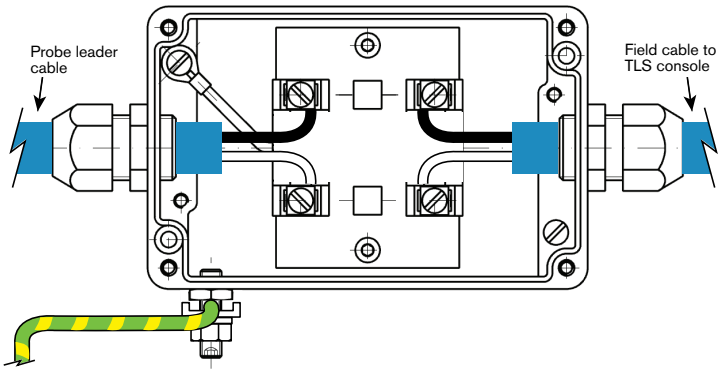
According to the provision of EN/IEC 60079-14, the minimum size of the earth cable shall be 4 mm².

The earth cable should be connected to the external saddle clamp of the surge protector.



5. **Field cable connection**

Connect the 2 wire field cable from the TLS console probe channel to the surge protector as shown below. Correct polarity MUST be maintained. The field cable length should not exceed 300 metres.



6. **Surge protector cover** - Refit the surge protector cover, secure and tidy all wiring to complete the probe installation.

VEEDER-ROOT SURGE PROTECTORS

1. Cut the soft vinyl epoxy enclosure end cap entrance holes of the surge protector to accommodate each cable diameter. Keep the hole sizes to a minimum. Insert about 5 inches (127mm) of each cable through the openings [Figure 4]. Remove 3 inches (76mm) of the outer jacket from each cable. Trim the insulation from the conductors.

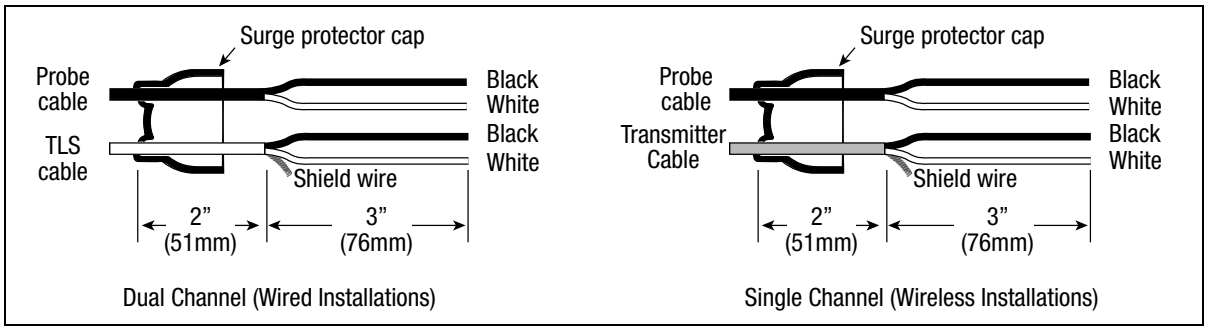


Figure 4. Splice Length Dimensions

2. Make the connections to the four black and white wires in the surge protector using wire nuts as shown in Figure 5. Depending on the installation, cut off the TLS console or Transmitter cable's bare shield wire at the cable jacket.

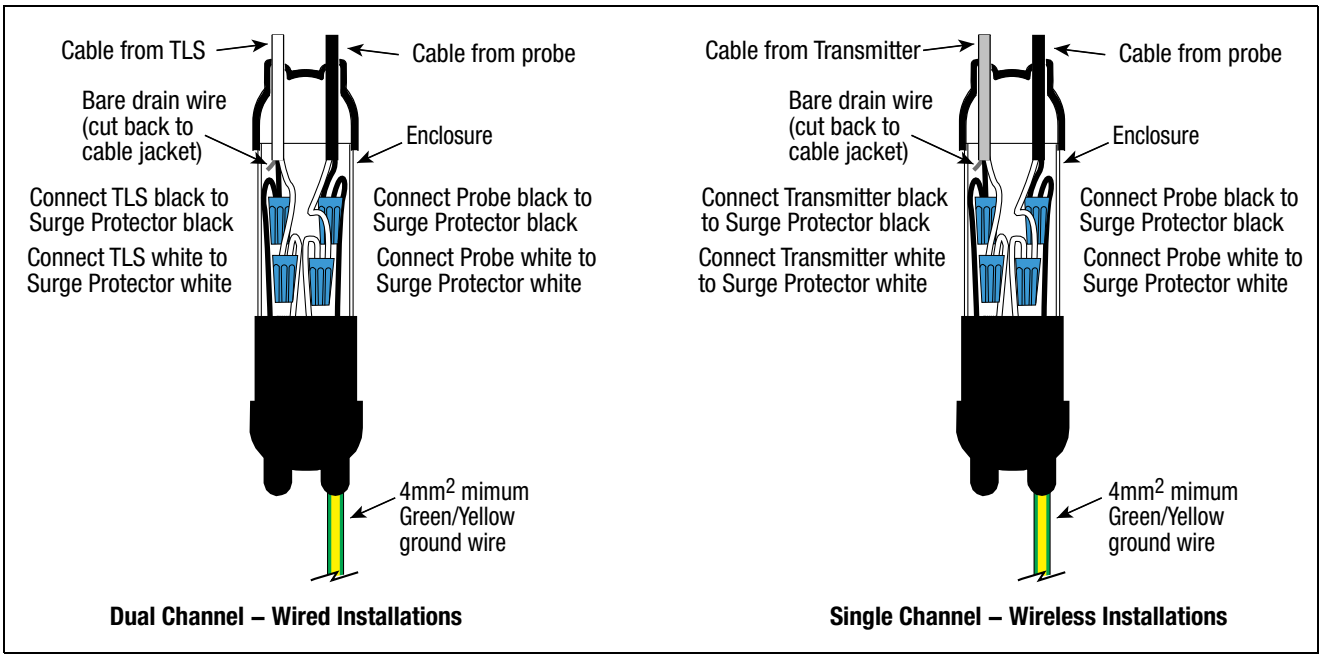


Figure 5. Splice Connections

3. Center the splices in the clear plastic sleeve. Assemble the surge protector closure, making sure the sleeve is fully inserted into each of the vinyl end caps. Rotate the sleeve cover until both slot openings line up. Arrange the closure so the slot openings are facing up and the surge protector is as level as possible.

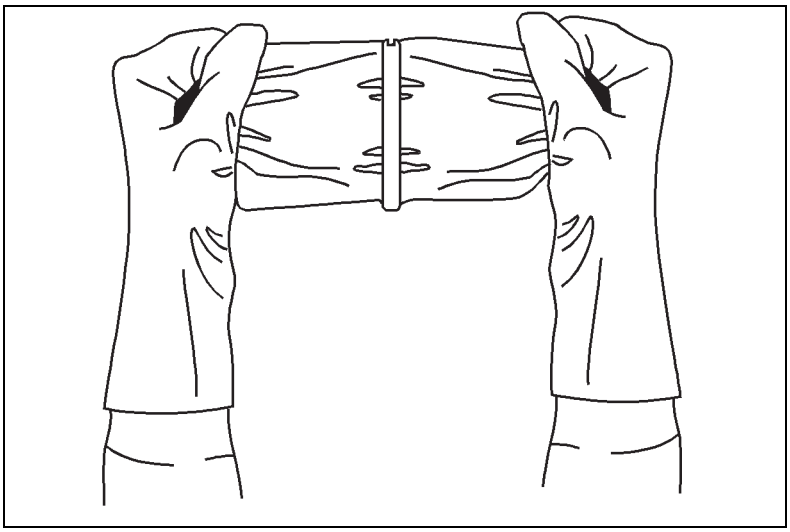
⚠ WARNING!

Sealing compound contains isocyanate. Vapor and liquid may cause sensitization. May be irritating to the eyes.

Avoid skin and eye contact. Avoid repeated and prolonged breathing of vapor. Use only in well ventilated areas. Wear chemically resistant gloves.

Inhalation - provide fresh air. In case of eye contact flush eyes with plenty of water for 10 minutes and get medical attention. If ingested do not induce vomiting. Get medical attention. Wash with soap and water in case of skin contact.

4. Remove bag of "Sealing compound" from foil package. Grasp the ends, one in each hand, then pull sharply to remove plastic clip [Figure 6].



13149-C

Figure 6. Removing Sealing Compound Clip

5. Thoroughly mix compound together. Invert bag several times while squeezing compound from one end to the other for a minimum of one minute.
6. Once the mixture feels warm, immediately cut one corner and slowly fill the surge protector's plastic sleeve. Stop just short of filling the entire sleeve. **Do not overfill**. [Figure 7]

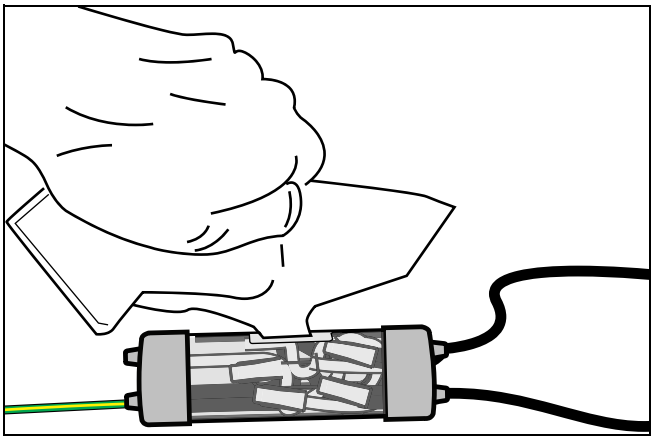


Figure 7. Pouring Sealing Compound Into Sleeve

7. With a twisting motion, rotate the outer clear plastic barrel to close the pouring slot.Wait at least five minutes, then use the large cable tie to mount the surge protector to the riser pipe or probe canister as applicable.

NOTICE 8. **An earth cable must be connected between the surge protector and a tank ground connection. According to the provision of EN/IEC 60079-14, the minimum size of the earth cable shall be 4 mm².**

Connect the green/yellow ground wire from the surge protector to an appropriate tank ground (see Figure 3).

TLS Setup

The TLS console Mag-FLEX setup is similar to that for a standard Mag Plus Probe setup. Listed below are the setup exceptions.

- **Float Type** - For TLS2, TLS-3XX or TLS-450 consoles, the float type must be set as 3" FLOAT (76.2 mm).
  Notes:
  1. This is the default float type.
  2. Water detection starts at 5" (127 mm) therefore water height warnings and alarms should be set above 5".
  3. See manual 577014-056 for setup instructions when installing a low level water float.
- **Tank Profile** - Select 'Linear' for TLS2, TLS-3XX or TLS-450 consoles, or 'Multi-Point' if an accurate tank chart is available.
- **Tank Diameter** - For vertical cylindrical tanks, enter the full tank height here (NOT the diameter of the cylinder). Full height is the distance from the bottom of the tank to the top of the cylinder excluding the domed lid at the top of the tank. Set the height in mm.

  Exit setup mode and check the inventory report, the water reading should now be "0". Check all TLS setup parameters are correct. If necessary, secure all console doors.

Appendix A: Mag-FLEX Safety Information

Equipment Marking

Mag-FLEX probe

1. Manufacturer: Veeder Root Co., Duncansville, PA – USA
2. Type designation: Mag-FLEX
3. Certificate number: TÜV 12 ATEX 105828 – IECEx TUN 12.0027
4. ATEX marking: Ex II 1 G, II 1/2 G, II 2 G
5. EN/IEC marking: Ex ia IIB T4 Ga, Ex ia IIB T4 Ga/Gb, Ex ia IIB T4 Gb
6. CE marking: CE 1180

Intrinsically Safe TLS Tank Gauge System

1. EC-Type Examination Type Certificate: DEMKO 06 ATEX 137480X
2. IECEx Certficate of Conformity: IECEx ULD 08.0002X

Technical Data

The intrinsically safe input characteristics of the Mag-FLEX probe are listed below. Refer to the site preparation procedures in this manual for general instructions on safe installation, use and replacement.

Parameter	
Ui	13 V
Ii	200 mA
Pi	625 mW
Li	410 µH
Ci	20 nF

The above values are to be used when assembling a system in the field when for calculating its maximum cable run (field + sensor cable).

When used in potentially explosive atmospheres, the maximum temperatures depending on the temperature classes and categories can be found in Table A-1.

Table A-1. Temperature Class Ta Tf

Temperature Class	Ambient Temperature Range	Medium Temperature
Category 1 and EPL Ga (Filling level sensor entirely erected in Zone 0)		
T4, T3, T2, T1	-20°C to +60°C	-20°C to +60°C
Category 1/2 and EPL Ga/Gb (Sensor pipe erected in Zone 0, Sensor head erected in Zone 1)		
T4, T3, T2, T1	-40°C to +75°C	-20°C to +60°C

Table A-1. Temperature Class Ta Tf

Temperature Class	Ambient Temperature Range	Medium Temperature
Category 2 and EPL Gb (Filling level sensor entirely erected in Zone 1)		
T4	-40°C to +75°C	-40°C to +135°C
T3	-40°C to +75°C	-40°C to +200°C
T1	-40°C to +75°C	-40°C to +300°C
T1	-40°C to +75°C	-40°C to +450°C

It must be ensured through appropriate measures that at no point on the sensor head the temperature (Ta) for the respective temperature class is exceeded.

General information (see also EN/IEC 60079 0, clause 1):

Zone 0 is given only under atmospheric conditions:

Temperature range: -20 °C … +60 °C
Pressure range: 0,8 bar … 1,1 bar
Oxidants: Air (oxygen content of about 21%)

Specific Conditions of Use

None.

VEEDER-ROOT™

For technical support, sales or other assistance, please visit:
veeder.com