

Model # \_\_\_\_\_

# The Over Voltage Protector (OVP)



## Operating and Installation Instructions

### READ ENTIRE DOCUMENT BEFORE INSTALLING THE OVP.

Before installing or testing the OVP, all normal safety regulations and practices should be observed, including those pertinent to hazardous locations when applicable.

### CERTIFICATIONS

#### United States:

The OVP is Underwriters Laboratories (UL) listed as an over voltage protective device for use in hazardous locations in accordance with NFPA 70 (U.S. National Electric Code) for Class I, Division 1 and Division 2 locations, Groups A, B, C, and D. For comparable zone listings, refer to NFPA 70. This listing applies for ambient temperatures from -45°C to +85°C. The operating temperature code is T6 ( $\leq 85^\circ\text{C}$ ). For over voltage protection due to lightning, the OVP complies with the pertinent requirements of ANSI C62.11.

The OVP is also UL listed as meeting the requirements of an effective grounding path as defined in NFPA 70, Article 250.2, and is suitable for the isolation of objectionable DC current from cathodically protected systems to ground as defined in Article 250.6(E). The OVP enclosure is rated NEMA 6P (comparable to IP68) and is suitable for outdoor use in submersible and non-submersible applications.

#### Canada:

The OVP has been called C-UL listed to

Canadian Standards Association (CSA) effective grounding path criteria as defined in CSA Code Section 10-500, 10-806, and CSA C22.2 No. 0.4-M1982

#### Europe:

The devices have been examined by a Notified Body (UL/Demko) for compliance with ATEX directive 94/9/EC using EN50021. The device is marked II 3 G EEx nA II T6 for Zone 2 use and should be installed using wiring methods appropriate for the above classification.

### APPLICATION CONSIDERATIONS

When the OVP is used for DC isolation/AC grounding (or coupling), the OVP is a high impedance device for both AC and DC up to the voltage blocking level selected and an "effective grounding path" (or coupling path) for any voltage that attempts to exceed the voltage blocking level. The blocking voltage (which is user selected at 1 to 4 volts when ordering an OVP) is identified by the "A/B" part of the model number located on the nameplate, where "A" is the negative blocking voltage level and B is the positive blocking voltage level in peak volts. All polarities are referenced from the flexible lead (the negative terminal) to the OVP housing (the positive terminal).

The OVP should only be installed where the steady state DC voltage is less than the blocking voltage selected and where there is no steady state AC voltage present. Before installation, confirm that this condition exists by measuring

the AC and DC voltage between the two planned connection points.

### RATINGS

The system on which the OVP is installed should be compatible with the ratings on the nameplate of the model ordered. The ratings available and the ratings of this OVP are listed as follows.

<b>AC Fault Current Ratings (Amps AC-RMS Symmetrical)</b>		
Cycles	60 Hz	50 Hz
1	6,500	6,100
3	5,000	4,700
10	4,200	3,900
30	3,700	3,500

<b>Lightning Current Rating</b>	
All Models	100kA peak (8 x 20 waveform)

In the event that either of the above ratings are exceeded so that failure would occur, failure occurs in the shorted mode. In the shorted mode the unit will carry rated current, still function as an effective grounding (or coupling) path, but it will not be blocking DC current.

### DC LEAKAGE CURRENT VS. VOLTAGE

The DC leakage current for any OVP model is typically less than 10 milliamperes at the maximum blocking voltage. At normal cathodic protection voltages, the leakage current is less than 1.0 milliamperes which is insignificant to a

cathodic protection system.

## **MOUNTING/LEAD CONNECTIONS**

The OVP should be mounted so that the total length of lead required is minimized. All leads have inductance which will cause a significant voltage drop per unit of lead length under high values of lightning surge current.

To minimize the voltage developed between the two OVP connection points, install the OVP as close as practical to the required connection points and cut the lead to the shortest possible length during installation.

For most insulated joint applications the OVP can be installed with about 6 inches ( $\approx 150$  mm) of lead. The standard lead length furnished with the OVP is 12" ( $\approx 300$  mm) unless a longer length has been specified. Refer to the attached figure for the mounting option ordered.

To illustrate the effects of lead length, following is a summary of the clamping voltage provided by the OVP versus lead length measured with a 50,000 ampere peak lightning current waveform. Since the internal elements of the OVP have a very low clamping voltage, practically all of the clamping voltage between the OVP connection points is caused by lead inductance.

For a 50 kA, 8 x 20 microsecond waveform:

Clamping voltage  $\approx 100$  V with zero lead length (i.e., at bushing terminal)

Clamping voltage  $\leq 1.25$  kV with 6" (152 mm) lead.

Clamping voltage  $\leq 1.50$  kV with 12" (457 mm) lead.

Under field conditions, the actual clamping voltages may be more or less than the above values due to the wide range of lightning surge current magnitudes and wave shapes that can occur.

## **Polarity**

The OVP enclosure is the positive (+) terminal and the single lead is the negative (-) terminal. Connect the negative lead to the cathodically protected structure and the positive lead to ground. In insulated joint (or similar) applications where each side of the joint is cathodically protected, connect the negative lead to the more negative side of the joint.

## **Welding**

If preferred and allowed, the OVP lead may be thermowelded to the structure.

## **Field Testing**

To confirm proper functioning of the OVP after installation and to assure that it is applied within its intended ratings, measure the peak AC voltage (i.e.,  $V_{ac-rms} \times 1.414$ ) and the DC voltage across the OVP terminals with a voltmeter and measure the AC and DC current flow through the lead with a clamp-on ammeter. The peak steady-state AC voltage (if any is present) plus the DC voltage should be less than the threshold voltage of the OVP being installed. If this is not the case, the OVP will be conducting current, which may adversely affect cathodic protection.

If the cathodic protection system is ON, the cathodic protection voltage should appear across the OVP terminals, assuming one side of the OVP is referenced to ground. When measured with a voltmeter, this voltage will be less than the actual cathodic protection voltage which is normally measured with respect to a reference cell. If the cathodic protection system is ON and there is no DC voltage across the OVP terminals, further testing is required as described below. However, if both sides of the OVP are connected to cathodically protected systems, then it is normal to measure near zero volts DC.

The AC and DC current flow through the OVP lead should be so low as to not be measurable with a clamp-on ammeter. A more sensitive meter may

indicate DC current flow, but this value should be less than 10 mA. If a higher current flow is present, this likely indicates that the absolute voltage ( $V_{dc} + V_{peak ac}$ ) is above the OVP threshold level selected, thereby indicating an improper application or a failed OVP.

If the absolute voltage across the OVP is less than or equal to the blocking voltage selected and there is measurable current flow, it is possible that the OVP has been damaged from excessive current. The OVP can be more comprehensively checked using a multimeter that has a resistance checking function. Before performing the following test, all normal safety regulations and practices should be observed, including those pertinent to hazardous locations when applicable.

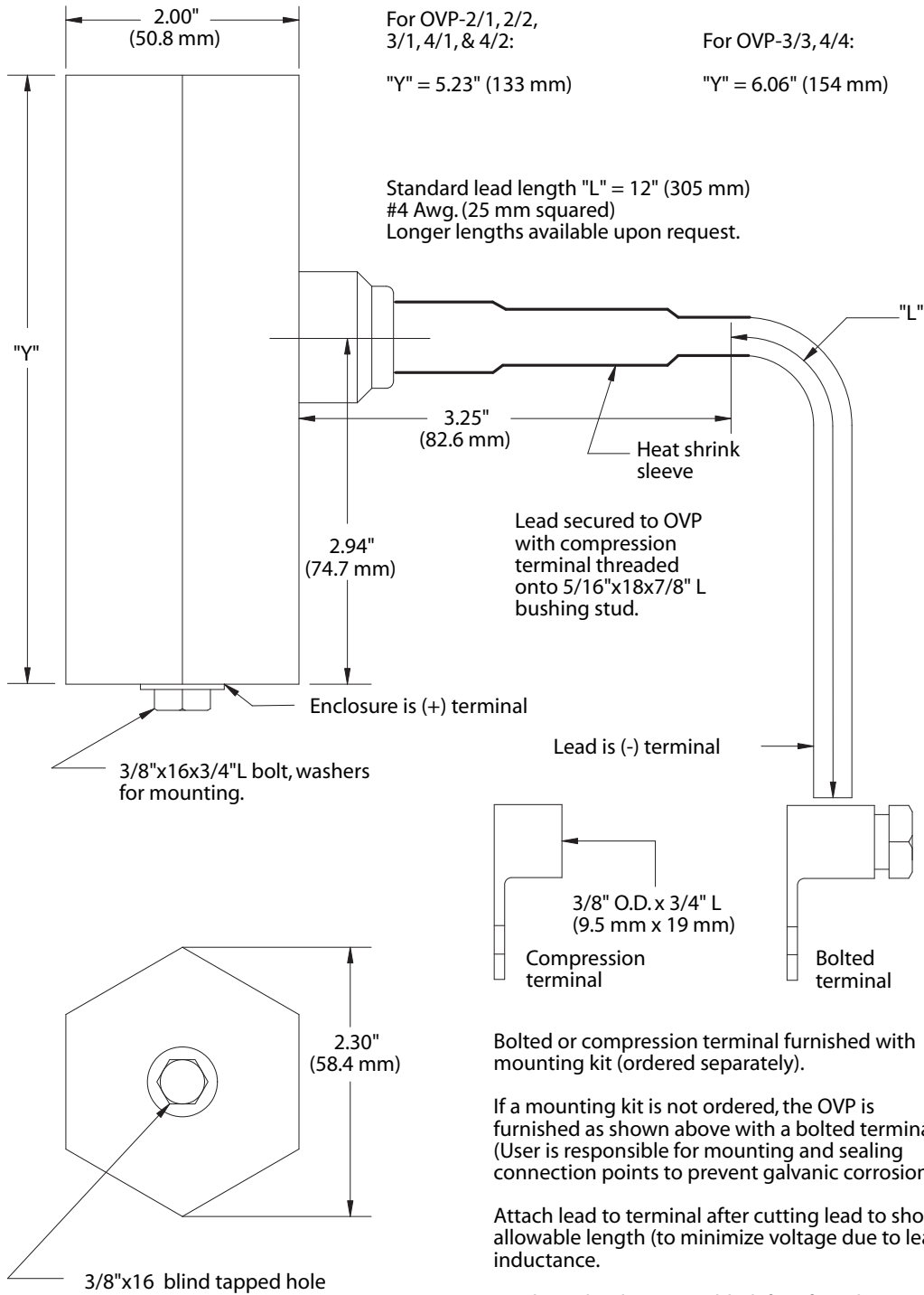
(1) Disconnect one lead of the OVP so that it is isolated.

(2) Connect the positive lead of the multimeter to the OVP positive (+) terminal, which is the same as the OVP housing, and the negative (-) lead to the OVP flexible lead. The resistance should be at least several hundred thousand ohms.

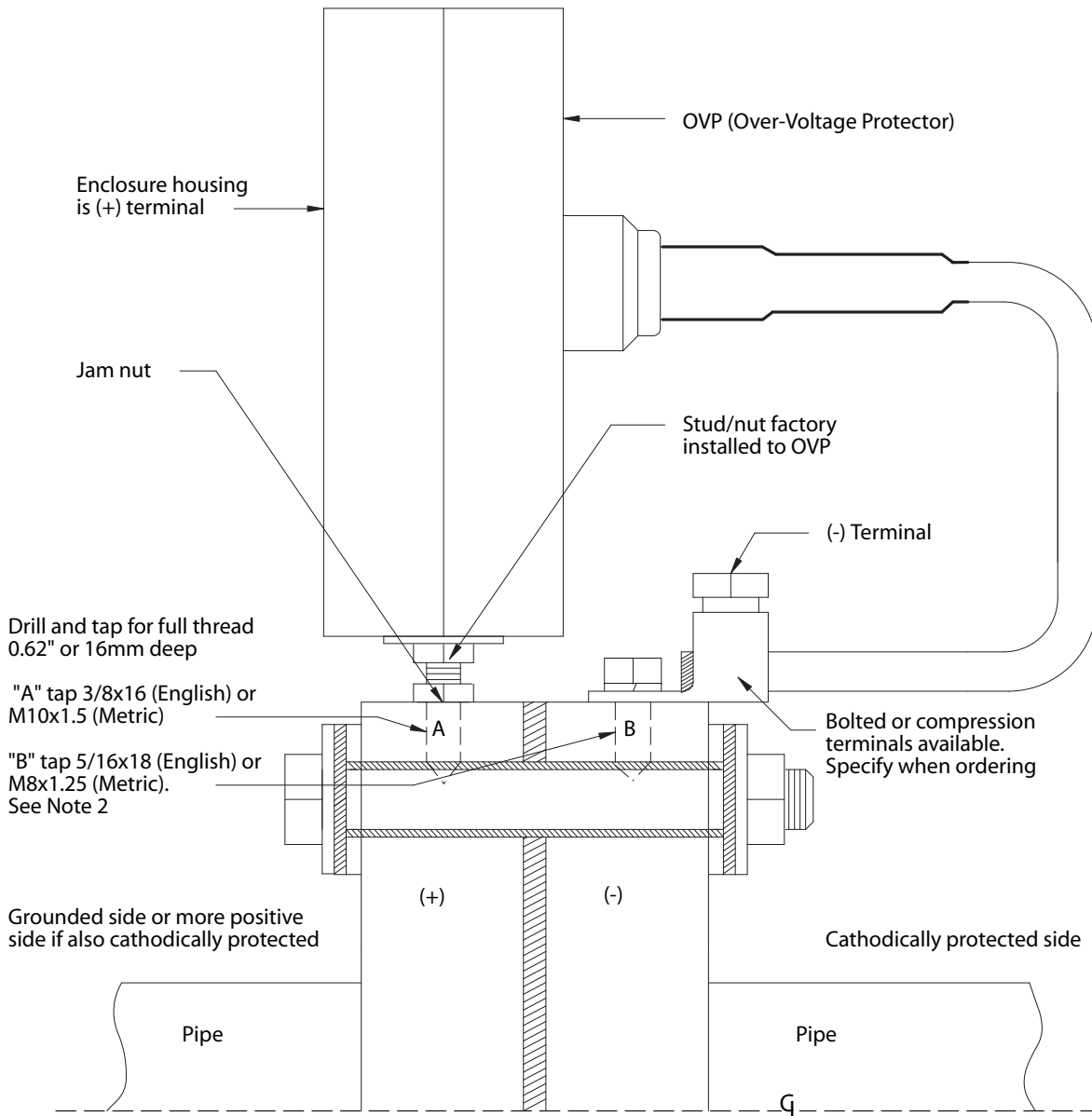
(3) Then reverse the multimeter leads. The resistance again should be at least several hundred thousand ohms. If the resistance measured is significantly lower, the OVP may be failed or damaged from excessive current.

If any field test results are inconclusive, or an OVP appears failed, DEI is willing to retest and repair (if required) any returned OVP.

**FIGURE 1 OVP Outline Dimensions**

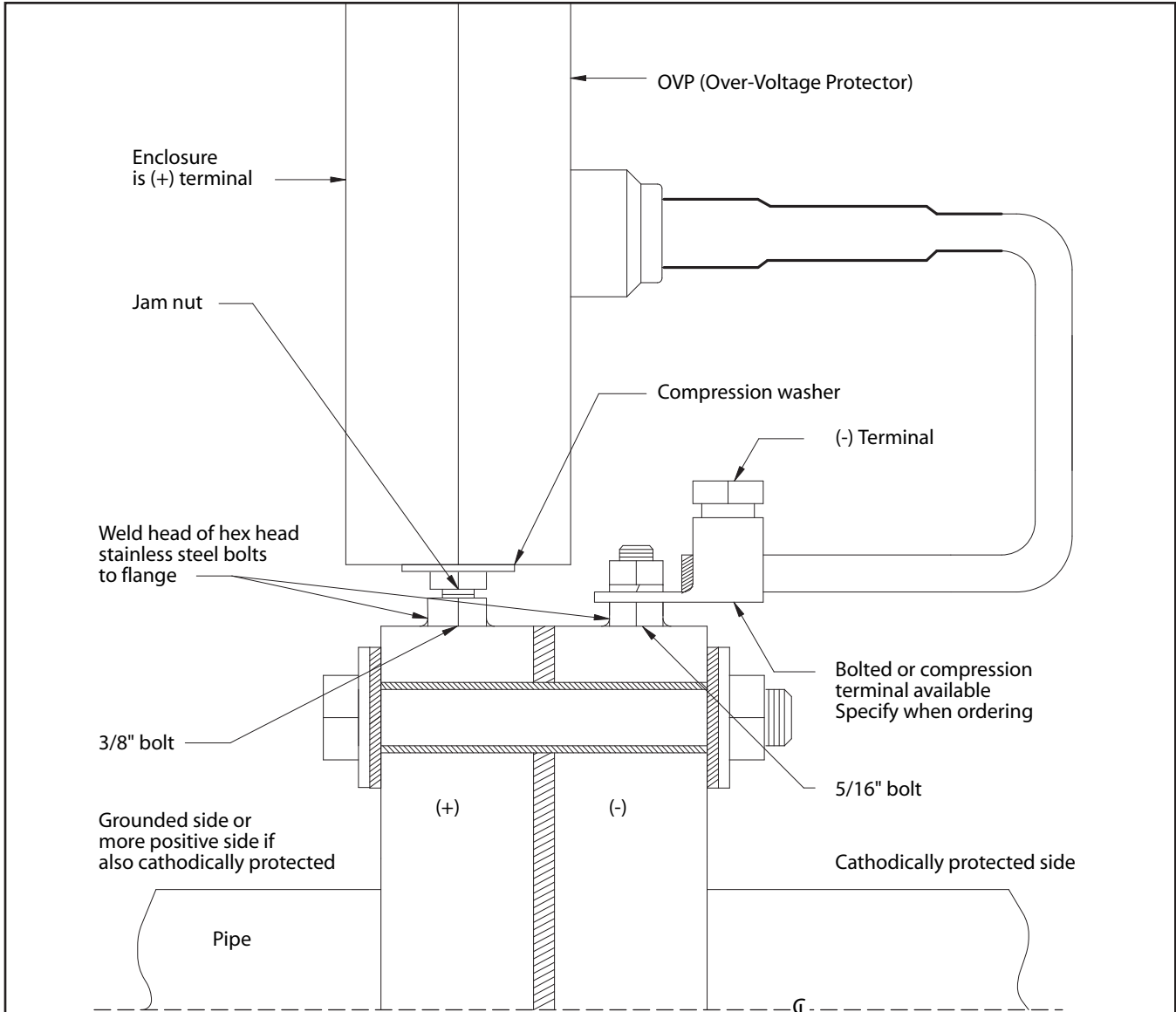


**FIGURE 2** Insulated Joint Application: Flange Mount Using Tapped Holes



1. User is responsible to determine if drilling and tapping is acceptable.
2. Mounting Kit FMTH-3/8-5/16 requires English taps, FMTH-M10-M8 metric taps.  
If required, off-set bolts to maintain clearance between (+) and (-) connections to flange.
3. Liberally apply lubricant/corrosion inhibitor (furnished) to all threads.
4. Thread OVP into tapped hole, orient as desired, and securely tighten jam nut.
5. Attach (-) terminal to flange with bolt provided and securely tighten.
6. Cut lead to shortest allowable length.
7. Remove lead insulation as appropriate for terminal. Apply corrosion inhibitor to bare strands.
8. Insert bare conductor into terminal and securely tighten terminal bolt (or compress as required if a compression terminal).
9. Cover all connections and attachment points with an appropriate coating/sealing material to prevent galvanic corrosion.

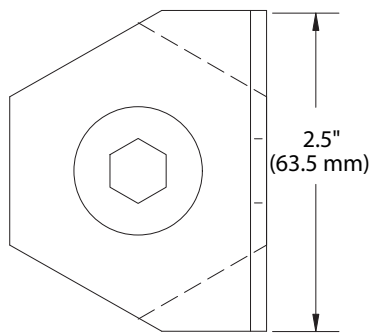
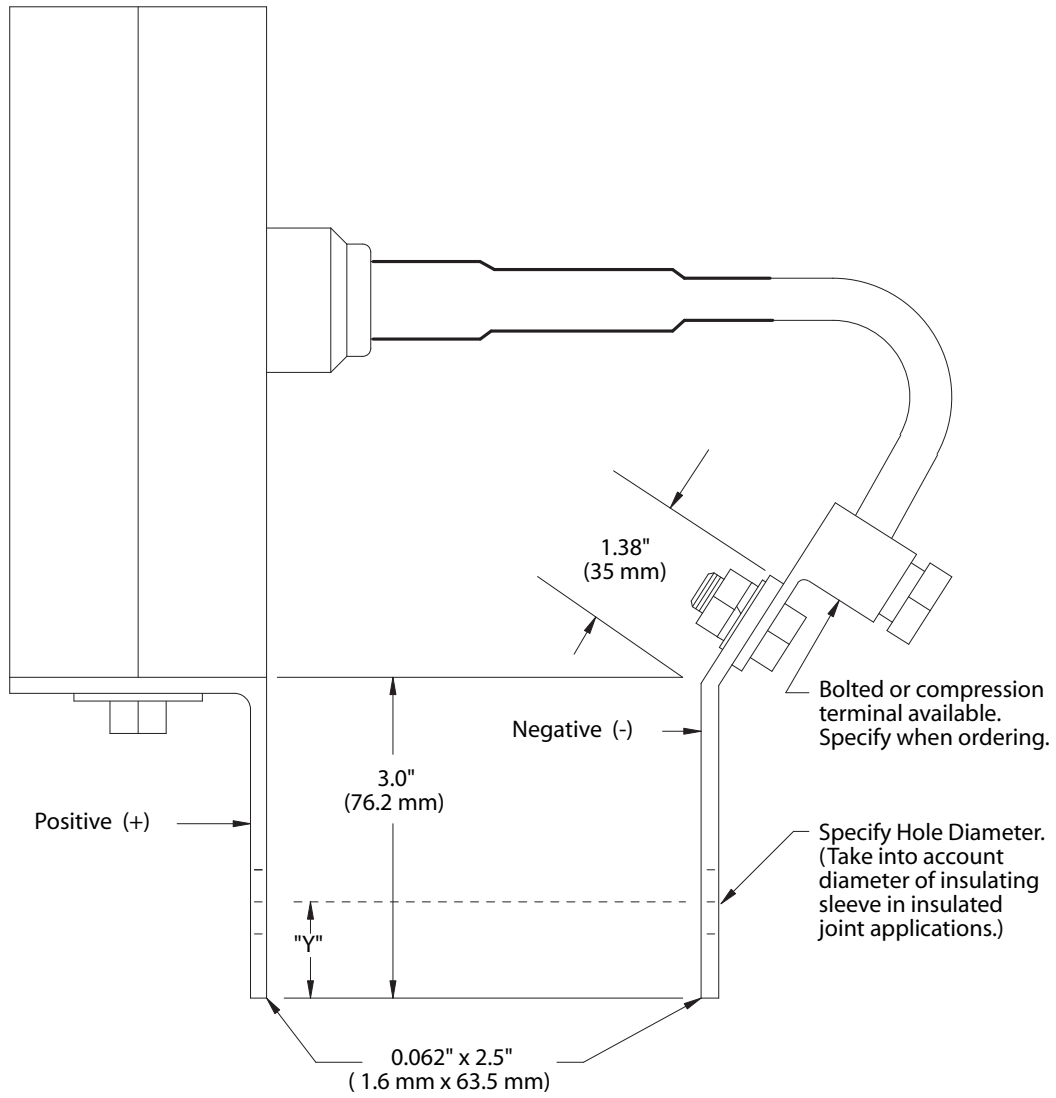
**FIGURE 3** Insulated Joint Application: Flange Mount Using Welded Hex Bolts



1. User is responsible to determine if welding to structure is acceptable.
2. Weld head of bolts to flange as shown. For narrow flanges it may be necessary to radially off-set bolts to provide electrical clearance between the OVP housing and the (-) terminal.
3. Liberally apply lubricant/corrosion inhibitor (furnished) to all threads.
4. Thread OVP onto 3/8" stud, orient as desired, and securely tighten jam nut.
5. Attach terminal to 5/16" stud and securely tighten hex nut.
6. Cut flexible lead to shortest allowable length.
7. Remove lead insulation as appropriate for terminal. Apply corrosion inhibitor to bare strands.
8. Insert bare conductor into (-) terminal and securely tighten terminal bolt (or compress as required if a compression terminal).
9. Cover all connections and attachment points with an appropriate coating/sealing material to prevent galvanic corrosion.

**FIGURE 4A** Insulated Joint Application: Flange Mount Using Existing Flange Bolts

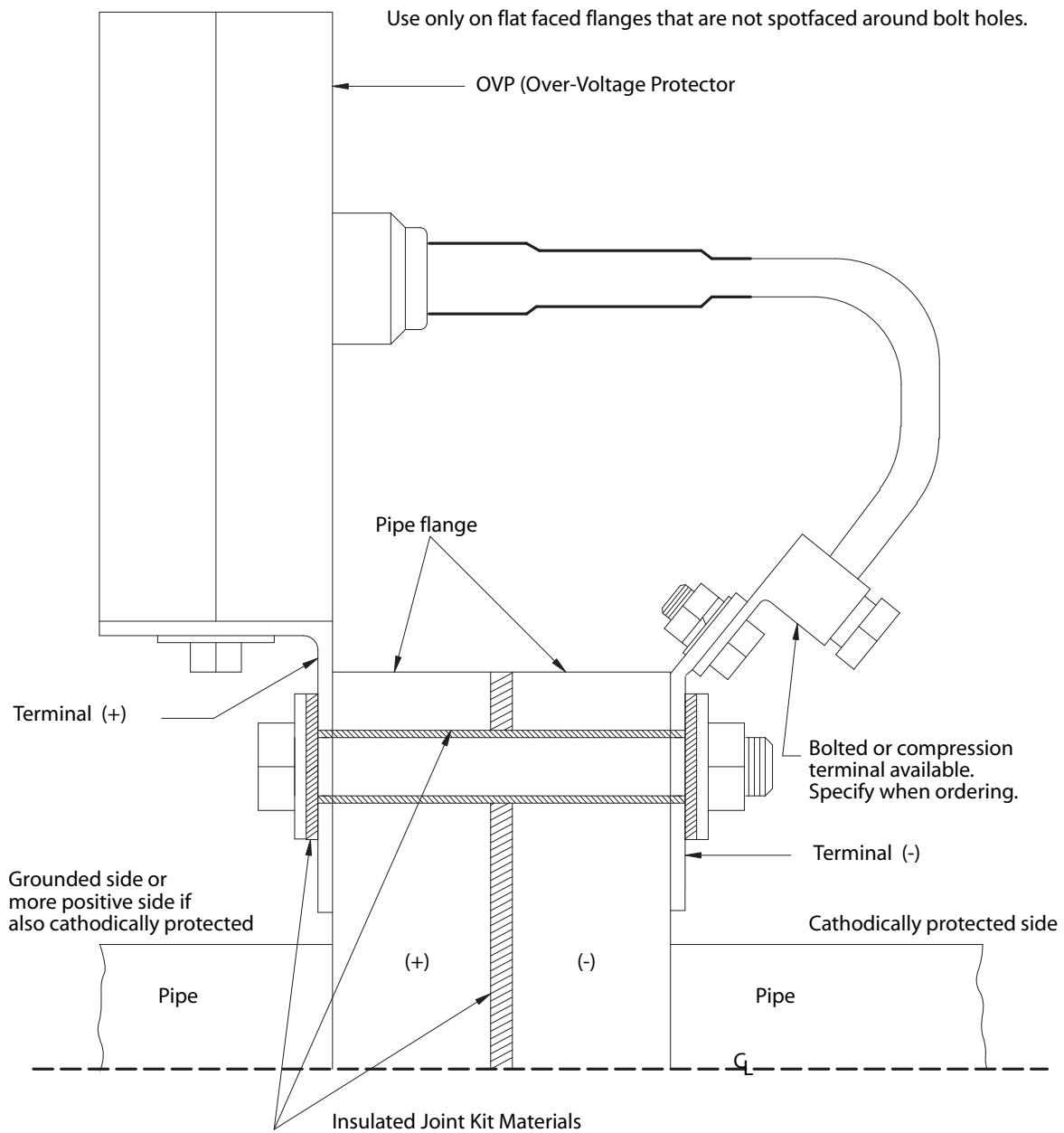
Use only on flat faced flanges that are not spotfaced around bolt holes.



If Hole Diameter is:	Then "Y" is:
1/2" - 7/8" (12 mm - 22 mm)	3/4" (20 mm)
1.0" - 1-1/8" (25 mm - 29 mm)	1.0" (25 mm)
1-1/4" - 1-3/8" (32 mm - 35 mm)	1-1/4" (32 mm)

For other required hole diameters, contact DEI.

**FIGURE 4B** Insulated Joint Application: Flange Mount Using Existing Flange Bolts



1. Bolt OVP to insulated joint as shown. Flange must be bare metal under terminal plates. Liberally apply corrosion inhibitor (furnished) over entire surface of terminal plates in contact with flange.
2. Confirm that there is no continuity across the insulated joint and confirm that there is continuity between each OVP terminal and its adjacent flange.
3. Cut flexible lead to shortest allowable length.
4. Remove lead insulation as appropriate for terminal. Apply corrosion inhibitor to bare strands.
5. Insert bare conductor into (-) terminal and securely tighten terminal bolt (or compress as required if a compression terminal).
6. Cover all connections and attachment points with an appropriate coating/sealing material to prevent galvanic corrosion.