

## **Model 7777DVP Immersion/In-Line Mounting for Durafet<sup>®</sup> III pH Electrodes Installation and Maintenance**

70-82-25-116  
Rev. 1  
3/04

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# About This Document

## Abstract

This manual provides immersion and in-line installation instructions for Durafet® III pH Electrodes as part of a 7777DVP electrode assembly.

## Contacts

## Contacts

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Honeywell Organization	WWW Address (URL)
Corporate	<a href="http://www.honeywell.com">http://www.honeywell.com</a>
Industrial Measurement and Control	<a href="http://www.honeywell.com/imc">http://www.honeywell.com/imc</a>
International	<a href="http://www.honeywell.com/Business/global.asp">http://www.honeywell.com/Business/global.asp</a>

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	Organization	Phone Number
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		1-888-423-9883 Q&A Faxback (TACFACS)
		1-800-525-7439 Service
Asia Pacific	Honeywell Asia Pacific Hong Kong	(852) 2829-8298
Europe	Honeywell PACE, Brussels, Belgium	[32-2] 728-2111
Latin America	Honeywell, Sunrise, Florida U.S.A.	(854) 845-2600

# Symbol Definitions

The following table lists those symbols used in this document to denote certain conditions.

Symbol	Definition
	This CAUTION symbol on the equipment refers the user to the Product Manual for additional information. This symbol appears next to required information in the manual.
	<b>WARNING</b> <b>PERSONAL INJURY:</b> Risk of electrical shock. This symbol warns the user of a potential shock hazard where HAZARDOUS LIVE voltages greater than 30 Vrms, 42.4 Vpeak, or 60 Vdc may be accessible. <b>Failure to comply with these instructions could result in death or serious injury.</b>
	ATTENTION, Electrostatic Discharge (ESD) hazards. Observe precautions for handling electrostatic sensitive devices
	Protective Earth (PE) terminal. Provided for connection of the protective earth (green or green/yellow) supply system conductor.
	Functional earth terminal. Used for non-safety purposes such as noise immunity improvement. NOTE: This connection shall be bonded to protective earth at the source of supply in accordance with national local electrical code requirements.
	Earth Ground. Functional earth connection. NOTE: This connection shall be bonded to Protective earth at the source of supply in accordance with national and local electrical code requirements.
	Chassis Ground. Identifies a connection to the chassis or frame of the equipment shall be bonded to Protective Earth at the source of supply in accordance with national and local electrical code requirements.

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# 1. Introduction

## 1.1 Overview

The 7777DVP Series of electrode mountings enables a user to interface a Durafet® III pH electrode to a process by either submersing the electrode or mounting it into a 3/4" threaded connection.



Honeywell's Durafet III Series of industrial electrodes have been designed to provide accurate and stable pH measurements for a wide variety of industrial applications. The Durafet III pH electrode is a non-glass pH electrode. The pH measurement is based in ISFET (Ion Selective Field Effect Transistor) technology, which results in a solid state pH sensing electrode. The Durafet pH electrode is much more rugged than the traditional glass pH electrode. The sturdy pH electrode reduces replacement and inventory costs. The solid state sensing element is packaged in a durable Ryton® body that results in a pH electrode that has extended life in a wide variety of process conditions. The ISFET technology also produces an electrode that is up to 10 times faster than glass electrodes. This fast response improves product quality and provides better process control to optimize chemical usage.

## 1.2 Compatibility

Durafet III pH electrodes for the 7777DVP Series are available in a number of options to meet customer application and installation needs. The electrode body is 1" in diameter with 3/4" threads at both ends of the electrode. For submersion applications conduit is threaded on to the top of the electrode so that it can be lowered into the process. For in-line applications the electrode is threaded into one leg of a pipe tee. A temperature sensor is mounted internal to the electrode to measure process temperature and provide a temperature signal for automatic (Nernstian) temperature compensation. Two temperature sensors are available: 8550 ohm thermistor and 1000 ohm RTD.

The Durafet III pH electrode is compatible with various pH instrumentation:

- Honeywell 7082 and 9782 Series pH Analyzers with Cap Adapter.
- APT2000/4000 Series with Cap Adapter.
- Non-Honeywell instruments with Cap Adapter. Consult your Honeywell sales representative for a list of instruments with this compatibility.

### 1.3 Application Restrictions

Avoid using the Durafet III series pH electrode with these chemicals and applications:

- Hydrofluoric acid
- High purity water (<10  $\mu\text{S}/\text{cm}$ )
- Hot caustic (see Figure 1-1 below)

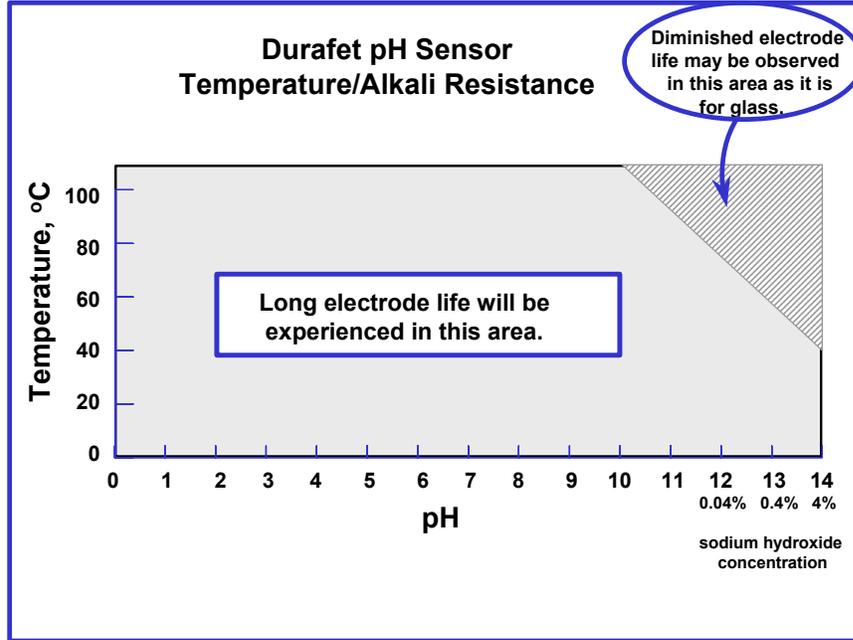


Figure 1-1 Temperature vs. Alkali Resistance

## 2. Specifications

¾" NPT Specifications	
Operating Range	0-14 pH
Pressure Rating	345 kPa (50 psig) @ 100°C, 690 kPa (100 psig) @ 50°C
Temperature Rating	-10 to 110° C
Temperature Sensor	8550 ohm Thermistor and 1000 ohm RTD
Wetted Materials	Ryton body, silicon ISFET die, Ceramic reference junction, Viton media seal, EPM reference frit seals
Electrical Connection	Durafet III: Vario Pin, 11 conductor connector, IP68 rated
Acceptable Cables and Lengths (ordered separately)	DirectLine Remote Cable: 20 feet and 50 feet Cap Adapter (for 9782P and APT Series): 20 feet and 50 feet
Weight	Durafet III: 0. 23 kg (0.5 lb)

## 2.1 Catalog Suffix Designations

### Instructions

- Select the desired Key Number. The arrow to the right marks the selection available.
- Make one selection each per table using the column below the proper arrow.
- A dot (•) denotes unrestricted availability.

Key Number
I
II
III

-----
-
  I  
-
  II  
-
  III

KEY NUMBER	Description	Selection	Availability
7777DVP	Durafet III Electrode w/Vario Pin Connector In-line or Immersion Mtg.	07777DVP	↓

**TABLE I - Mounting Type, Temperature Sensor, Part No. (Durafet II pH Electrode)**

Mounting	Temperature Sensor	Electrode P/N	Selection	Availability
Immersion (w/Tip Guard)	8550 Ohm Thermistor	51453503-005	01	•
	1000 Ohm RTD	51453503-006	02	•
In-Line (w/o Tip Guard)	8550 Ohm Thermistor	51453503-001	03	•
	1000 Ohm RTD	51453503-002	04	•

TABLE II - Instrumentation to Sensor Cables			07777DVP	↓
Cable length	Cable Type	Part Number	Selection	Availability
None			00	•
20 ft (6,10 m)	Cap Adapter	51453388-001	04	•
50 ft (15,24 m)	Cap Adapter	51453388-002	05	•

**TABLE III - Options**

Tagging	None	00__	•
	Stainless Steel Customer I.D. Tag - 3 lines, 22 characters/line	SS__	•
Certifications	None	__00	•
	Calibration & Conformance	__CC	•

### 3. Dimensions

mm  
inches

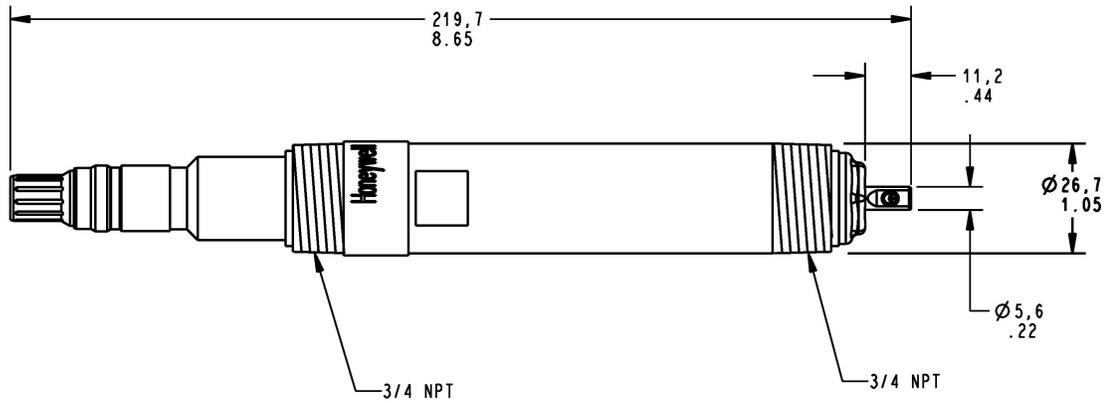


Figure 3-1 Durafet III (Vario Pin Connector) pH Electrode for In-Line Mountings (Smooth Tip)

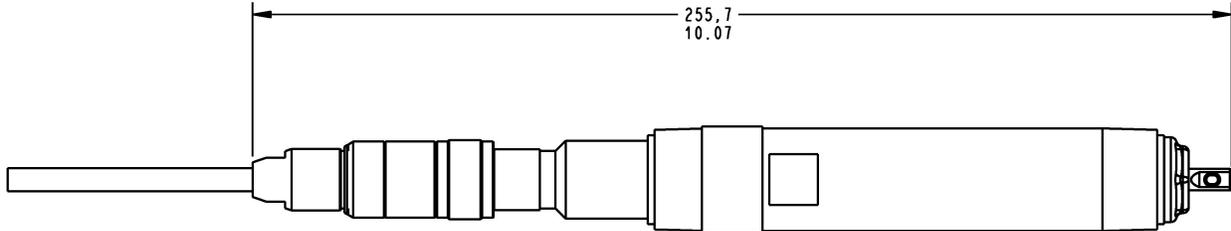


Figure 3-2 Durafet III (Vario Pin Connector) pH Electrode for In-Line Mountings (Smooth Tip), with cable

Dimensions

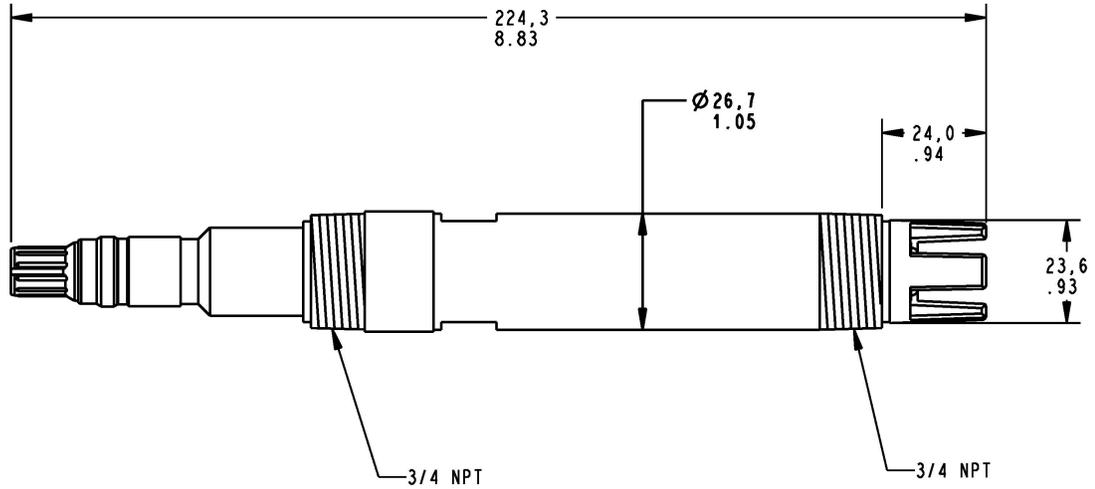


Figure 3-3 Durafet III (Vario Pin Connector) pH Electrode for Immersion Mountings (Guarded Tip)

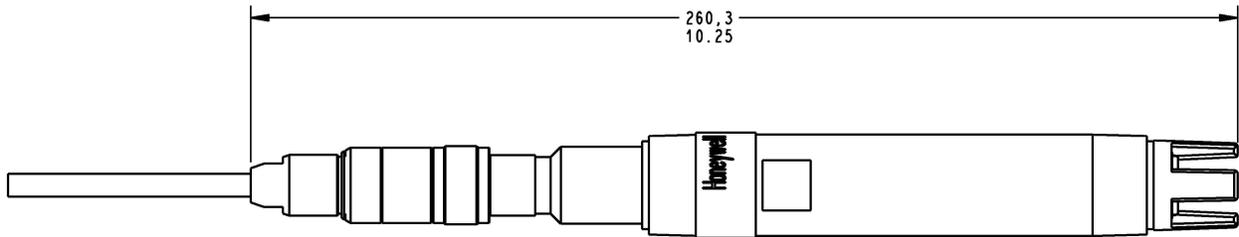


Figure 3-4 Durafet III (Vario Pin Connector) pH Electrode for Immersion Mountings (Guarded Tip), with cable

## 4. General Assembly Instructions

### 4.1 Selecting Materials of Construction

#### Electrode

The materials used in the construction of the DurafetIII pH electrode are listed in the specifications. Materials of wetted parts must be compatible with the process temperature and corrosion conditions.

#### User-supplied components

Pipe couplings, and tees must be supplied by the user. Select materials that are compatible with the process temperature and corrosion conditions.

### 4.2 Sealing Pipe Joints

When making pipe joints apply Teflon tape pipe sealant to male threads. Wrap the threads with the tape overlapping by 50% on each wrap. Start the wrap at the end of the pipe and wrap in the direction of the thread at least two turns.

When installing an electrode, apply Teflon tape to the threads, then hand-tighten the electrode in the fitting only until snug. If necessary to stop a leak, a wrench may be applied to the electrode's wrenching flats to further tighten the joint only until the leak has stopped. Always leave at least one thread on the electrode showing outside the fitting.

---

#### **CAUTION**

When tightening an electrode never exceed 15 ft-lb applied torque. Applying too much torque can result in damage to the electrode.

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### 4.3 Durafet III Electrode Preparation

Prepare Durafet III electrode as described in the electrode manual, part number 70-82-25-115.

### 4.4 Cap Adapter Option for Durafet III Electrodes

The Cap Adapter option for Durafet III electrodes eliminates the need to separately mount a preamplifier. The Cap Adapter is a preamplifier electronics module that is integral with the electrode-to-instrument cable. The preamplifier PCA is molded into the cap of the quick-disconnect connector. The cable has tinned leads that are ready to be wired directly to 9782/7082 Analyzer or APT2000/4000 Transmitters and Analyzers.

The Cap Adapter mounts directly on the Durafet III electrode. The electrode has a key that mates with the keyway in the connector on the cable. The cap is then threaded onto the electrode. The cap should be hand-tightened and engage the O-ring at the top of the electrode. The knurled fitting at the top of the cap should be hand-tightened to seal an internal O-ring around the cable. When properly threaded onto the electrode the connection is waterproof.

## 5. Pressure Test

### When to perform the test

Before submerging an assembly do a low-pressure test to check the various seals made during the assembly operation.

### How to perform the test

Table 5-1 lists the steps for pressure testing the assembly.

**Table 5-1 Instructions for Pressure Test**

Step	Action
1	Double back the cable into the immersion pipe.
2	Connect a source of low-pressure air to the immersion pipe. [Approximately 69 kPa (10 psi) will simulate immersion in 6.10 m (20 ft) of water.]
3	Immerse the assembly in a shallow tank of water and look for any indication of air bubbles streaming from the assembly.
4	To seal leaking connections: <ul style="list-style-type: none"> <li>• Use extra Teflon tape on pipe joints.</li> <li>• Use silicone grease on O-ring seals.</li> <li>• Make the connecting rings on the preamplifier snug.</li> </ul>

---

## 6. Electrode Cable Connections

### 6.1 Electrode Cables

The Durafet III pH electrode is supplied with a connector at the electrode top to provide a quick disconnect for easy electrode replacement or with an integral cable.

---

#### CAUTION



ESD sensitive devices inside Durafet III electrodes and Cap Adapter Cables.

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#### Cable connectors

The electrode cable terminates with a female Vario Pin connector on one end and tinned leads at the instrument end.

#### Avoid contamination

The connectors are constructed with high resistance insulating material which can be contaminated if exposed to oil and salts from bare hands. Avoid contaminating the internal area of the connectors.

---

#### CAUTION

Do not allow liquids or other foreign matter to contact the cable connectors. Save the protective cap supplied with electrodes with connectors and put the cap on the connector whenever the cable is not installed on an electrode.

---

#### How to clean the connectors

The connectors can be cleaned by wiping with a cotton swab moistened with isopropyl or grain alcohol. **Allow connectors to dry completely before making connections.**

### 6.2 Cable Connection

Make sure electrode connector and cable connector are clean and dry. Align key way on VarioPin connector of electrode with tab inside mating connector on cable. Press cable connector onto electrode firmly. Tighten knurled bushing of cable connector by hand to ensure waterproof seal.

## 7. Connecting a Cap Adapter to an Instrument

### 7.1 Cap Adapter

The Cap Adapter is an integral part of the electrode cable. It is essentially a preamplifier that does not require separate mounting. The output from the Cap Adapter can be connected directly to a pH instrument. The Cap Adapter and cable for Durafet III electrodes are available in lengths of 20' and 50'. One end of the Cap Adapter cable is the mating connector to the Vario Pin of the Durafet III electrode. The other end of the cable terminates with tinned leads. The tinned leads connect to the input terminals of the pH instrument as described below.



Figure 7-1 Cap Adapter Cable

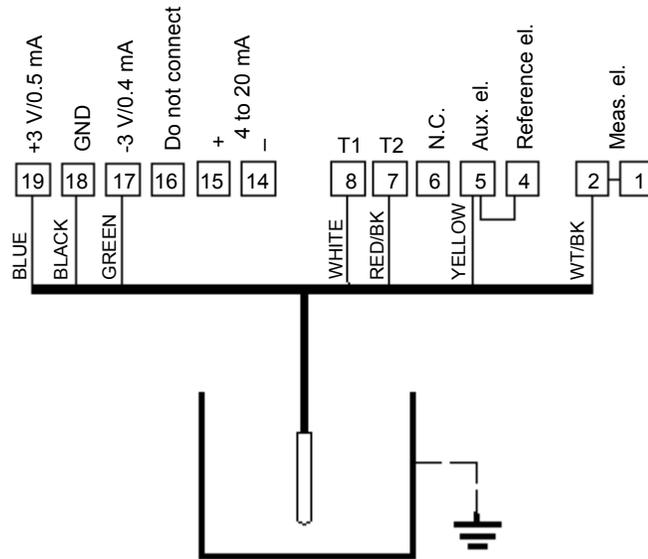
### 7.2 Connection to a 9782 pH Analyzer

The Cap Adapter is connected to a 9782P-01 analyzer. (See *Instruction Manual #70-82-25-73 "9782 pH/ORP Multifunction Analyzer/Controller"*, for a more detailed description of the 9782.) Connect the tinned leads of the Cap Adapter cable as follows:

Wire Color	9782 Terminal
Orange	PA
Blue	V+
Green	V-
White	SC
Black	SC
Red	TH
Yellow	Ground Screw
White/Black	Not Used
Red/Black	TH

### 7.3 Connection to an APT2000 pH Transmitter

The Cap Adapter can be connected to the APT2000 pH Transmitter. (See the *APT2000 pH Transmitter Manual*, part number 70-82-25-92, for more detailed description of the APT2000.)



**NOTE:**

Orange and Red wires are not typically connected. These should be clipped and electrically sealed to avoid possible contact with other conductors.

**Figure 7-2 Connecting to an APT2000 pH Transmitter**

### 7.4 Connection to an APT4000 pH Analyzer

The Cap Adapter can be connected to the APT4000 pH Analyzer. (See the APT4000 pH Analyzer Manual, part number 70-82-25-103, for more detailed description of the APT4000.)

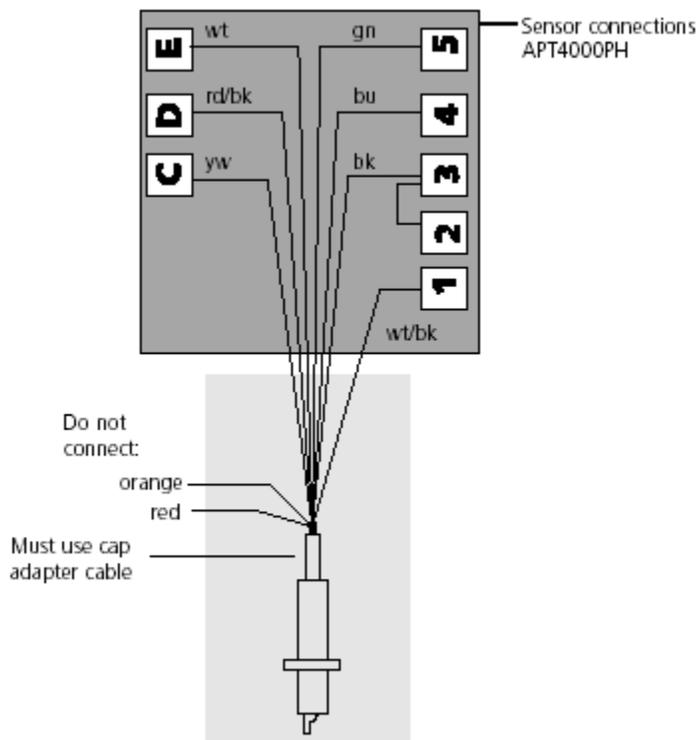


Figure 7-3 Connecting to an APT4000 pH Analyzer

## 8. Immersion Mounting

### 8.1 General Information

#### Intended Use

The system can be used in a variety of configurations to accommodate many techniques for support, immersion, and removal of the electrode in a process solution.

A variety of mounting configurations are used according to the process application. By using accessory parts such as pipe, pipe fittings and cable grips, an immersion assembly can be built to suit a specific application.

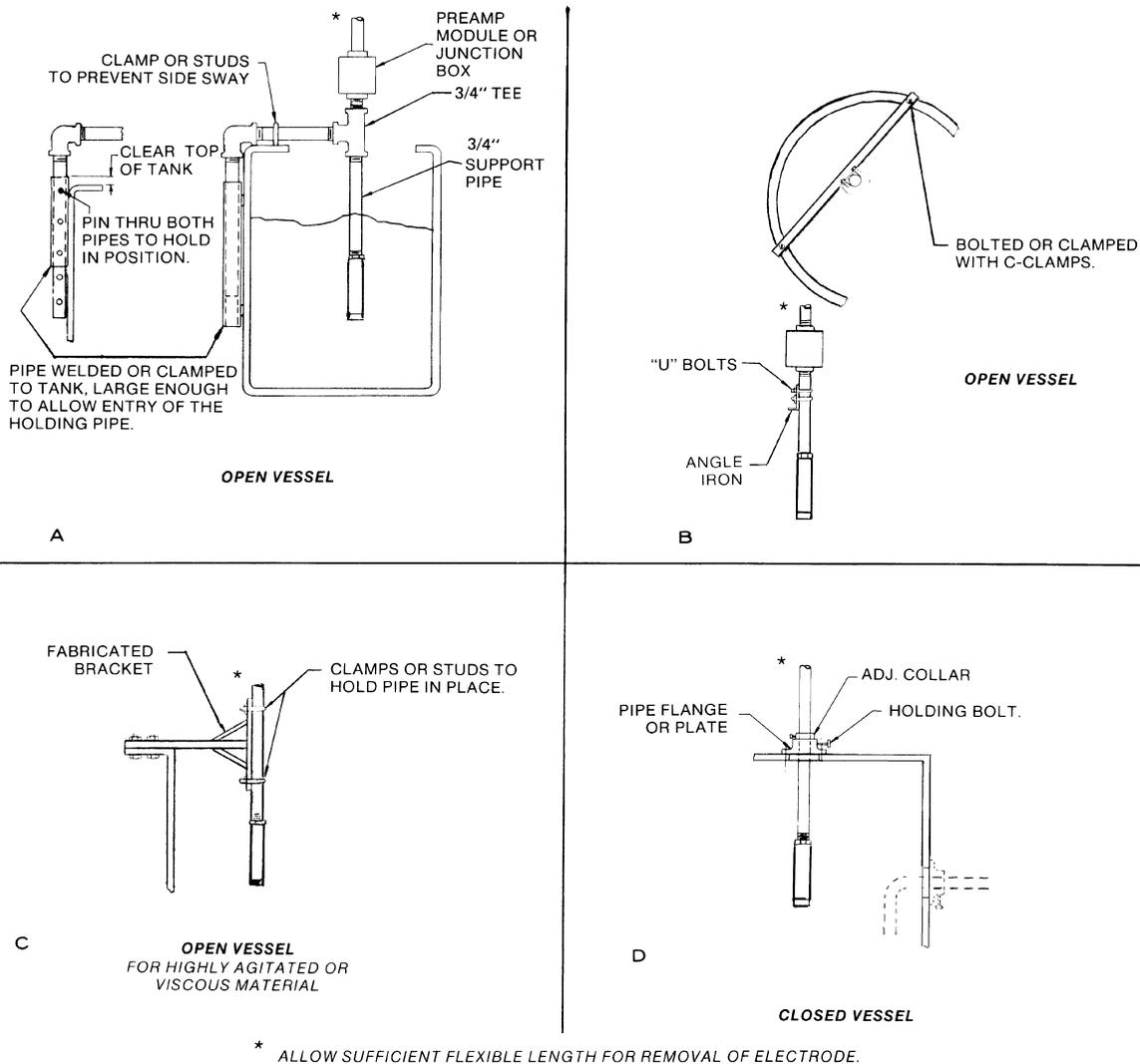
#### Minimum immersion depth

In all cases, the electrode body should be immersed a minimum of 5.08 cm (2 in.) into the process liquid to ensure proper temperature compensation.

#### Suggested support arrangements

Figure 8-1 illustrates possible support arrangements for immersion mounting of the Durafet III electrode.

**Immersion Mounting**



**Figure 8-1 Suggested Support Arrangements**

## 8.2 Direct Electrode-to-Instrument Applications (Cap Adapter)

### Application

Figure 8-2 illustrates this configuration.

### Materials required

The material supplied with this catalog number is listed below.

Quantity	Item
1	Durafet III Electrode with slotted tip and cable

Materials supplied by the user are listed below.

Quantity	Item
1	Length of 3/4 in. Sch. 40 pipe, threaded on both ends. Pipe length to be determined by user. When planning pipe length, allow enough cable between the pipe and the instrument to permit removal for servicing.
2	3/4 in. NPT metal Sch. 40 pipe couplings
1	3/4 in. NPT cable grip for 1/8 in. diameter cable

### Assembly

Assemble the materials as shown in Figure 8-2.

#### CAUTION

Do not push excess electrode cable into the immersion pipe or pipe coupling.

### Dimensions

For mounting dimensions, see Section 2.

### Cable electrode to instrument

Cable electrode to instrument as described in Section 6.

### Pressure test

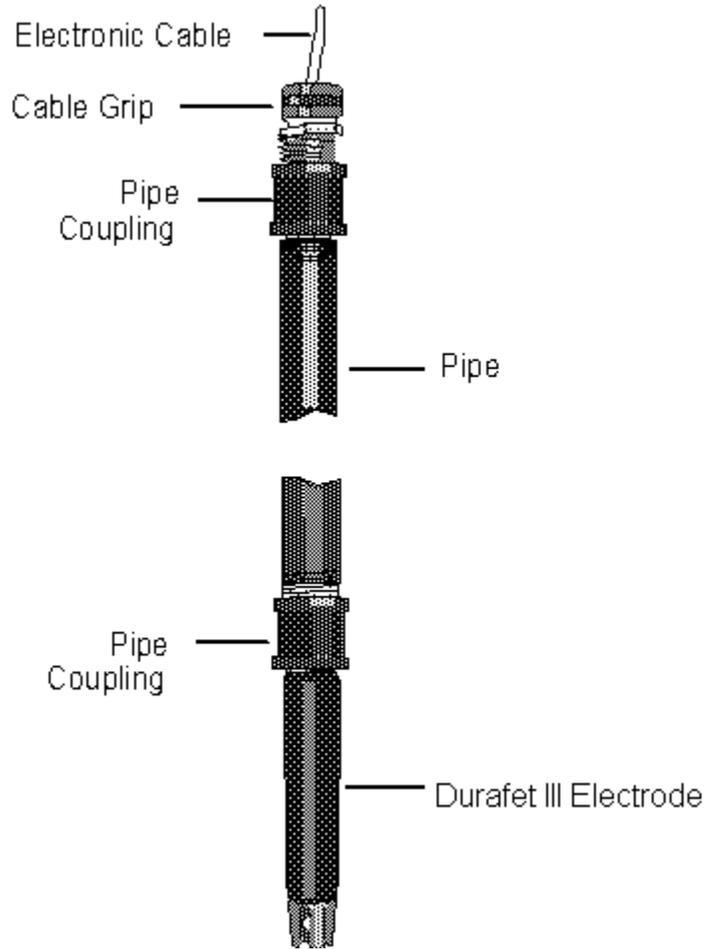
Perform a submersible pressure test (see Section 5).

### Mounting

Mount the assembly. See Figure 8-1 for mounting suggestions.

**Arrangement of components**

Figure 8-2 illustrates the configuration of components used for direct connection of the electrode to the instrument without an external preamplifier module or external preamp adapter.



**Figure 8-2 Direct Electrode-to-Instrument Connection**

## 9. In-Line Mounting

### 9.1 General Information

#### Choice of pipe tee

This mounting allows the electrode body to be inserted directly into a Schedule 40, 3/4 in. NPT metal pipe tee in a pipe line. The electrode will NOT fit into standard **PLASTIC** pipe tees. Use a metal tee or the special Honeywell schedule 80 CPVC 3/4 in. pipe tee, Honeywell part number 31120167.

#### Avoiding damage to the electrode

The Durafet III electrode for in-line mounting has an exposed sensor. Exercise care when inserting or removing the electrode from the pipe tee to prevent damage to the sensor surface.

#### Ensuring accurate temperature sensing

When process temperature varies considerably from ambient temperature, insulate the entire Durafet III electrode body to ensure accurate process temperature sensing.

#### Orientation of electrode

For reliable measurement, the electrode must be immersed in the process fluid. Therefore, orientation of the electrode vertical to the horizon is not recommended, as this orientation may prevent sufficient depth penetration to reliably immerse the sensor. The electrode mounting angle should be at least 45 degrees from vertical as shown in Figure 9-1. If solids are present in the process fluid, avoid angles exceeding 90 degrees from vertical to minimize accumulation of solids around the sensor.

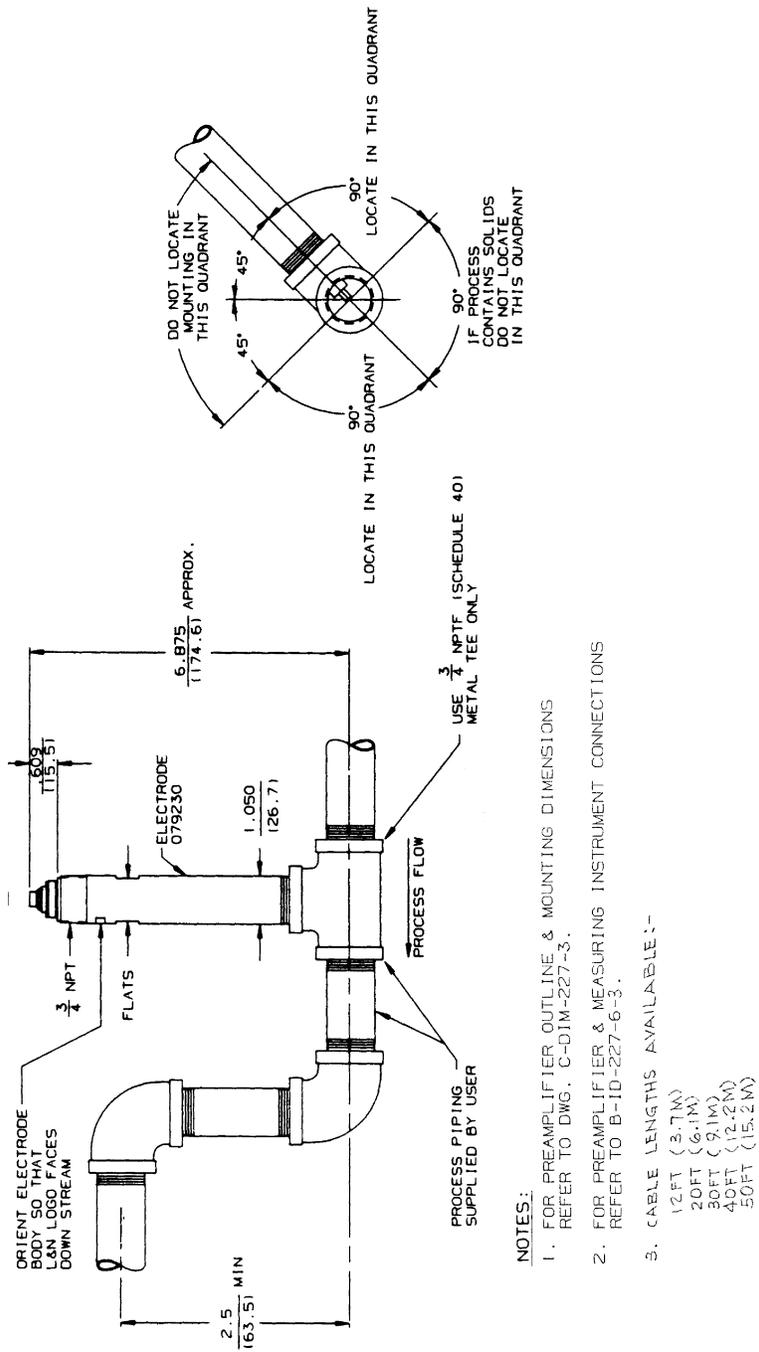


Figure 9-1 Proper Mounting Angle for Electrode

## 10. Maintenance, Standardization, and Replacement Parts

### 10.1 Maintenance

#### Keeping electrode moist

When an electrode is removed from the process for any reason, assure that it does not become dry and remain dry for more than a short period of time. The electrode may require more frequent maintenance if used in a batch treatment installation which leaves the electrode dry between batches, or if it is exposed to process fluids that leave a deposit on the surface of the sensor chip (measuring electrode) and reference electrode. The manual supplied with the electrode contains instructions for cleaning the electrode. Thoroughly rinse the electrode with water after any type of cleaning.

In addition to periodic cleaning, other electrode maintenance includes electrode performance checks, and treatment for a clogged junction or severely dry electrode.

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#### **CAUTION**

Read the manual (part number 70-82-25-115) supplied with the electrode before attempting any maintenance procedures.  
Improper handling of the electrode can result in damage that will affect accuracy.

---

### 10.2 Standardization

In addition to electrode maintenance, successful pH measurement relies on periodic standardizing of the measurement instrument and its electrode system. (This is required because all electrodes do not produce exactly the same potential in a solution of known pH. A periodic corrective adjustment eliminates any deviation from the standard value.) Establish regular intervals for standardizing according to conditions and experience. Procedures for standardizing are given in the measuring instrument instructions.

### 10.3 Accessories, Replacement Parts, Cables

Description	Part Number
<b>Accessories</b>	
NIST Buffer – 4.01 pH	31103001
NIST Buffer – 8.86 pH	31103002
NIST Buffer – 9.18 pH	31103003
Reference Gel refill kit	51205807-002
<b>Replacement Parts</b>	
Guarded Electrode Tip (immersion) see <i>Figure 10-1, item 1</i>	51204992-001
Smooth Electrode Tip (In-line) see <i>Figure 10-1, item 2</i>	51204993-001
Frit O-Ring (small) see <i>Figure 10-1, item 3</i>	51198302-001
Frit O-Ring (large) see <i>Figure 10-1, item 4</i>	31074364
ESD Protective cap see <i>Figure 10-1, item 5</i>	51500474-003
Storage Cap see <i>Figure 10-1, item 6</i>	51453164-001
<b>Cables</b>	
20' Cap Adapter cable	51453388-001
50' Cap Adapter cable	51453388-002

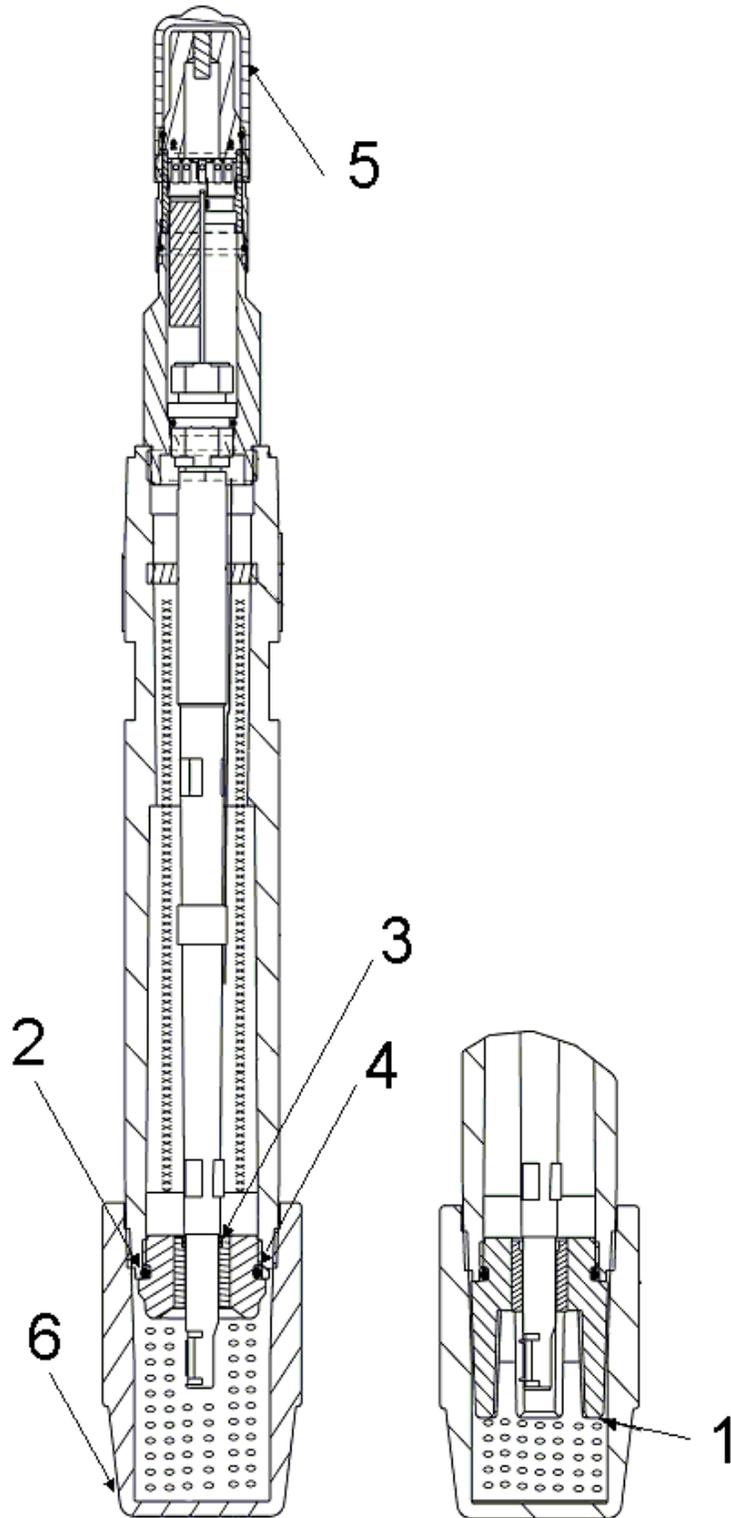


Figure 10-1 Durafet III parts





# Honeywell

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