Honeywell

Durafet® II Industrial pH Electrode Series Operator's Manual

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About This Document

Abstract

The purpose of this manual is to support the installation, operation, and maintenance of the Durafet® II Industrial pH Electrode Series. The electrodes are designated by the following Part Numbers:

Part Number	Description
51204976-001	12 mm body, combination electrode cable connector, 8550 ohm temperature sensor
51204976-002	12 mm body, measuring only, cable connector, 8550 ohm temperature sensor
51204976-003	12 mm body, combination electrode, 12’ integral cable, 8550 ohm temperature sensor
51204976-004	12 mm body, combination electrode, 12’ integral cable, 8550 ohm temperature sensor
51204976-005	12 mm body, combination electrode, 12’ integral cable, 8550 ohm temperature sensor
51204976-006	12 mm body, combination electrode, cable connector, 100 ohm RTD temperature sensor
51204976-007	12 mm body, combination electrode, cable connector, 1000 ohm RTD temperature sensor
51204976-008	12 mm body, measuring only electrode, cable connector, 100 ohm RTD temperature sensor
51204976-009	12 mm body, measuring only electrode, cable connector, 1000 ohm RTD temperature sensor
51205554-001	3/4” NPT body, in-line, cable connector, 8550 ohm temperature sensor
51205554-002	3/4" NPT body, immersion, cable connector, 8550 ohm temperature sensor
51205554-003	3/4" NPT body, immersion, 12’ integral cable, 8550 ohm temperature sensor
51205554-004	3/4" NPT body, immersion, 20’ integral cable, 8550 ohm temperature sensor
51205554-005	3/4" NPT body, immersion, 50’ integral cable, 8550 ohm temperature sensor
51205554-006	3/4" NPT body, immersion, 4’ integral cable, 8550 ohm temperature sensor
51205554-007	3/4" NPT body, immersion, 8’ integral cable, 8550 ohm temperature sensor
51205554-008	3/4" NPT body, in-line, cable connector, 100 ohm RTD temperature sensor
51205554-009	3/4" NPT body, in-line, cable connector, 1000 ohm RTD temperature sensor
51205554-010	3/4" NPT body, immersion, cable connector, 100 ohm RTD temperature sensor
51205554-011	3/4" NPT body, immersion, cable connector, 1000 ohm RTD temperature sensor

Revision Notes

The following list provides notes concerning all revisions of this document.

Rev. ID	Date	Notes
0	5/99	This is the initial release of this manual. The basis for this manual was from the Honeywell manual 70-82-25-63 Rev 0.
1	2/00	Updated info to include new electrodes: 51205554-008 to -011 and 51204976-006 to -009. Cap Adapter information also added.

References

The following list identifies all Honeywell documents that may be sources of reference for the material discussed in this publication.

Document Title	Document No.
7773 Multipurpose Electrode Mounting Assembly for Meredian and Durafet II Electrodes Installation and Maintenance	70-82-25-90
7758 Pipe-Line Electrode Mounting Assembly for Meredian and Durafet II Electrodes Installation and Maintenance	70-82-25-91
7774 Series Stainless Steel Insertion/Removal Assemblies for Meredian and Durafet II Electrodes Installation and Maintenance	70-82-25-88
7777 Immersion/In-Line Mounting—Meredian® II pH/ORP Electrodes - Instruction Manual.	70-82-25-05
Durafet II Flat-Pak Preamplifier Kit 080239 Connecting Durafet II Electrodes to 7082-10, 11, 12 Controllers/Analyzers	70-82-25-64
Durafet II Models 079290 and 084755 Industrial Preamplifier Adapter Modules Specifications and Installation	70-82-25-13
7777 Immersion/In-Line Mounting—Durafet II pH Electrodes Installation and Maintenance	70-82-25-86

Contacts

World Wide Web

The following lists Honeywell's World Wide Web sites that will be of interest to our customers.

Honeywell Organization	WWW Address (URL)
Corporate	*http://www.honeywell.com*
Sensing and Control	*http://www.honeywell.com/sensing*
International	*http://www.honeywell.com/Business/global.asp*

Telephone

Contact us by telephone at the numbers listed below.

	Organization	Phone Number	
United States and Canada	Honeywell	1-800-423-9883 1-888-423-9883 1-800-525-7439	Tech. Support Q&A Faxback (TACFACS) 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.
	WARNING: 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.
	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 Honeywell Durafet® II Series of industrial electrodes has been designed to provide accurate and stable pH measurements for a wide variety of industrial applications. The Durafet II pH electrode is a non-glass pH electrode. The pH measurement is based on ISFET (Ion Selective Field Effect Transistor) technology, which results in a solid state pH-sensing electrode. The Durafet pH electrode is more rugged than the traditional glass pH electrode. The practically unbreakable 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 Description

Durafet II pH electrodes are available in a number of designs to meet customer application and installation needs. There are two basic sizes: 12 mm and 1” diameter. The 1" diameter electrode has a 3/4" NPT thread at both ends. The electrode is also available as a combination electrode or as a measuring only electrode (which requires a separate reference electrode). A temperature sensor is mounted internal to the electrode to measure process temperature and provide a temperature signal for automatic (Nernstian) temperature compensation. Three temperature sensors are available: 8550 ohm thermistor, 100 ohm RTD, and 1000 ohm RTD. The electrodes come with either a connector for separate cable connection or with an integral cable. The cable options are selected based on installation requirements and signal conditioning equipment (preamplifier or Cap Adapter). The Durafet II pH electrode is compatible with various pH instrumentation:

- Honeywell 7082 and 9782 Series pH Analyzers with either an external or internal preamplifier.
- Honeywell 7082 and 9782 Series pH Analyzers with Cap Adapter.
- Honeywell 7084 Controller with an external preamplifier.
- APT2000 Transmitter with Cap Adapter.
- Non-Honeywell instruments, when connected to a Honeywell interface adapter module. This adapter module can be either AC powered or battery powered.
- Non-Honeywell instruments with Cap Adapter. Contact your Honeywell sales consultant for a list of instruments with this compatibility.

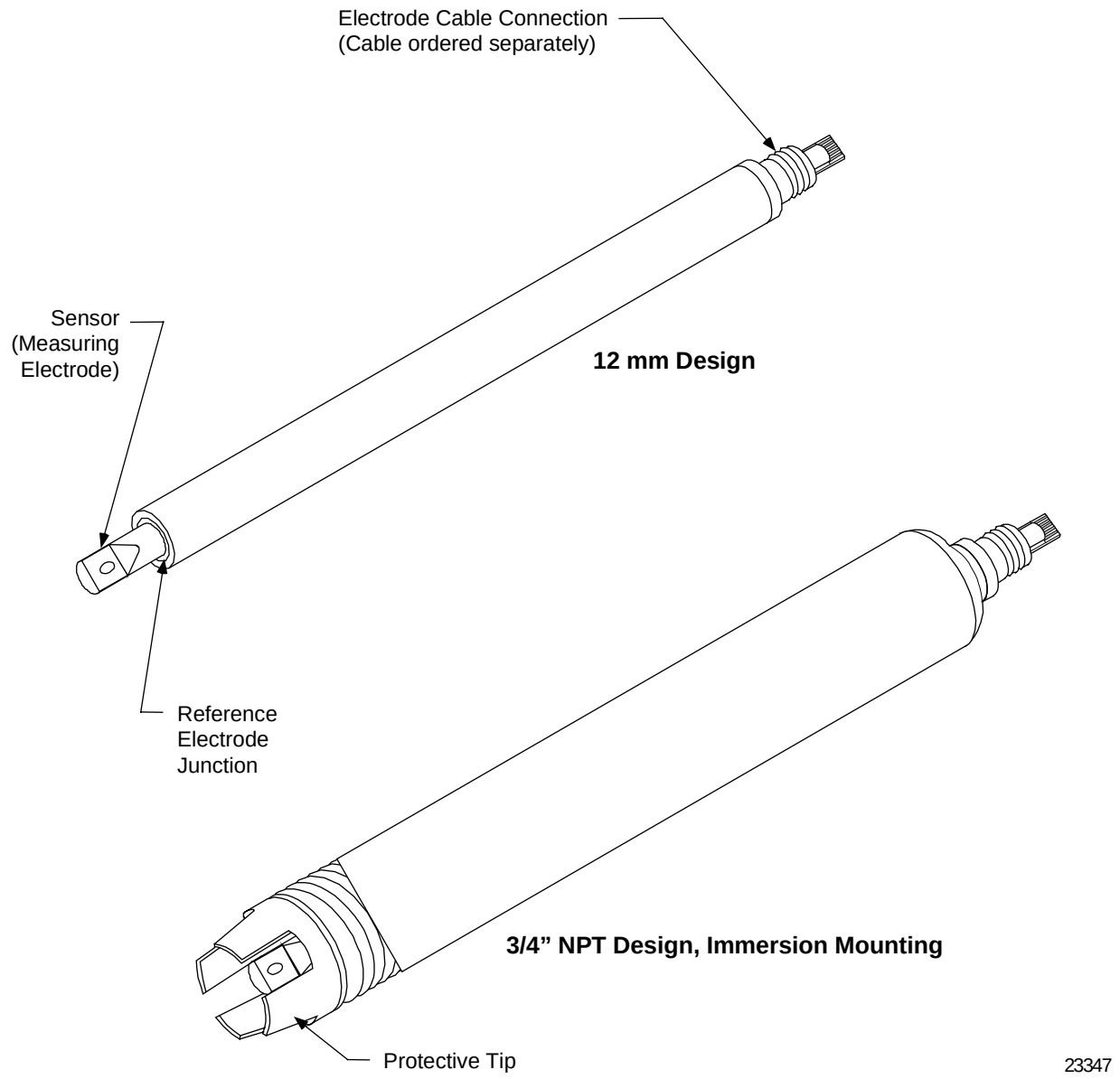

Figure 1-1 Durafet® II Electrode

Part Number 51204976-001, -003, -004, -005, -006, -007 – 12 mm body Durafet II Electrode

This Durafet II electrode has a reference electrode, a measuring electrode, and a temperature compensator. The reference electrode compartment is filled with a gelled formulation of potassium chloride and silver chloride to maximize reference electrode life. It can be supplied with a cable connector or an integral cable in 12', 20', or 50' lengths. *See Section 2 in this manual for Specifications.*

Part Number 51205554-001, -008, -009 – In-Line Durafet II Electrode

This electrode has a measuring electrode, a reference electrode, and a temperature compensator. This unit has been designed for in-line pipe mounting. The recommended mounting for this electrode is in a metal 3/4" NPT schedule 40 pipe tee utilizing the 3/4" pipe threads molded into the bottom of the electrode body. A plastic tee can also be used; but in this case the electrode must be mounted in an extended 3/4" plastic tee, as manufactured by Nibco (Honeywell P/N 31120167). *See Section 2 in this manual for Specifications.*

Part Number 51205554-002, -003, -004, -005, -006, -007, -010, -011 – Immersion Durafet II Electrode

This electrode is identical to the in-line Durafet II electrode except that the sensor end of this electrode has a protective slotted tip. This unit has been designed for immersion in process solutions. The electrode can be supplied with a cable connector or with an integral cable (4', 8', 12', 20', or 50'). For installations where moisture is a problem an integral cable is recommended. The cable end is mounted, using the 3/4" NPT thread, onto a coupling and pipe extension. *See Section 2 in this manual for Specifications.*

Part Number 51204976-002, -008, -009 – Measuring Only Durafet II Electrode

This electrode has a measuring electrode with an integral temperature compensator, but does not have an integral reference electrode. This unit must be used with a separate reference electrode. One of the reference electrodes listed below is recommended. *See Section 2 for Specifications.*

Recommended Reference Electrodes

Honeywell P/N 31035832 (plastic; diffusion type slurry, double junction)

Honeywell P/N 31117300 (glass; diffusion type slurry)

Honeywell P/N 31117392 (plastic; diffusion type slurry)

Honeywell P/N 31117481 (plastic; diffusion type gel)

Honeywell P/N 31117484 (glass; diffusion type gel)

Honeywell P/N 31008712 (glass; flowing junction)

1.3 Compatibility

Preamplifiers and Adapter Modules

The Durafet II Series Electrode can be used with various Honeywell preamplifiers and adapter modules for use with Honeywell instrumentation or other manufacturer's analyzers. The preamplifier output from the electrode system provides a conventional temperature compensated Nernstian output. Refer to Table 1-1 for a list of compatible electrode, preamplifier, and analyzer combinations.

Cap Adapter

The Durafet II Series Electrode is also compatible with the Cap Adapter conditioning module. This module is mounted integral with the electrode cable. The Cap Adapter eliminates mounting of a separate preamplifier. It also eliminates maintenance on a separate component. Separate cables with the integral Cap Adapter are:

- 51205965-001, 12-foot cable with Cap adapter
- 51205965-002, 20-foot cable with Cap Adapter
- 51205965-005, 50-foot cable with Cap Adapter
- 51205965-006, 4-foot cable with Cap Adapter
- 51205965-007, 8-foot cable with Cap Adapter

All these cables have a connector at one end to mate with the Durafet II electrode connector. The other end has tinned leads to connect to the pH instrument.

Table 1-1 Compatible Electrodes/Preamplifiers/Analyzers

Durafet II pH Electrode	Remote Preamplifier Mounting/Module	pH Analyzer
51204976-001, -002, -003, -004, -005, -006, -007	None – directly to analyzer	7082-1X and -2X series with 31080239 Preamplifier Kit; 7082-4X and 9782P-03, which includes internal preamplifier.
	None – Cap Adapter in electrode cable	9782-01, APT2000, 7082-1X and -2X, 7084. Also selected instruments other than Honeywell (contact your local Sales representative for information).
	31079236 Preamplifier in 7773 or in 31079288 Preamplifier Module for 7774 stainless steel and 7758 Mountings	7082-1X/-2X, 7084, 9782-01
	31079290 and 31084755 Industrial Adapter Module (120/240V) or 31075773 Battery Powered Adapter Module	Other than Honeywell
51205554-001, -002, -003, -004, -005, -006, -007, -008, -009, -010, -011	None – directly to analyzer	7082-1X and -2X Series with 31080239 Preamplifier Kit; 7082-4X and 9782P-03 which includes internal preamplifier.
	None – Cap Adapter in electrode cable	9782-01, APT2000, 7082-1X and -2X, 7084. Also selected instruments other than Honeywell (contact your local Sales representative for information).
	31079236 Preamplifier in 31079288 Preamplifier Module for 7777 and 7774 (CPVC) Mountings	7082-1X/-2X, 7084, 9782-01
	31079290 and 31084755 Industrial Adapter Modules (120/240V) or 31075773 Battery Powered Adapter Module	Other than Honeywell

1.4 Automatic Temperature Compensation Considerations

The temperature sensor is located approximately 1/2" above the sensor tip. The electrode body should be immersed at least 1" into the process to achieve the best temperature measurement. If process temperature changes abruptly, a small transient error in pH value may result from temperature lag.

1.5 Connections

Electrical connections to preamp or Cap Adapter and instrument are dependent upon the electrode and measuring system used. Connections are described in the appropriate electrode mounting or instrument manuals.

ATTENTION

Durafet II cables have a yellow shield wire that needs to be connected to ground. This connection can be made at the mounting screw on an external preamp or to the ground screw in the 9782, when using an external preamplifier or Cap Adapter.

1.6 Calibration

For calibration procedures, refer to the instrument manual for the instrument you are using with the electrode. For best results, Durafet II electrodes should be calibrated periodically.

2. Specifications

	51204976-002, -008, -009 *	51204976-001, -003, -004, -005, -006, -007	51205554-001	51205554-002, -003, -004, -005, -006, -007, -008, -009, -010, -011
Operating Range	0-14 pH**			
Operating Temperature Range	–10 °C to 110 °C	–10 °C to 110 °C sterilizable intermittently to 130 °C	–10 °C to 110 °C	
Maximum Process Pressure	150 psig at 80 °C		50 psig @ 100 °C 100 psig @ 50 °C	
Body	Glass-filled polyphenylene sulfide (PPS)			
Internal Reference	None	Silver-silver chloride gel-filled diffusion type		
Electrode Diameter	31/64" (12 mm)		1" (25.4 mm), with 3/4” NPT thread at ends	
Electrode Length	6-1/2" (165 mm)		6-3/4" (171 mm)	
Temperature Compensation	Automatic			
Cable Connection	Cable Connector	Cable Connector or Integral Cable		
Compatible Electrode Mountings	Honeywell Catalog 7758, 7773, 7774	Honeywell Catalog 7758, 7773, 7774 (stainless steel)	Honeywell Catalog 7774 (CPVC), 7777	
Materials in Contact with Process Solution	PPS, high alumina ceramic, silicon, EPDM			

* Temperature and pressure specifications for the 51204976-002 Durafet II electrode may be limited by the specifications of the separate reference electrode used.

** For the best accuracy when measuring the pH of solutions less than 1 or greater than 13, use the 51204976-002 Durafet II electrode with the 31008712 flowing reference electrode.

3. Electrode Preparation

3.1 Unpacking

To safely unpack your Durafet II Electrode, use the following procedure:

1. Carefully remove the electrode from the shipping carton.
2. Remove the sealing tape and pull plastic cap from the sensing end.
3. DO NOT ROTATE PLASTIC CAP. (This will loosen reference junction assembly).
4. The cotton packing material inside the cap is saturated with a potassium chloride salt solution. The solution protects the porous reference junction from drying during shipment and storage.
5. For Durafet II electrodes supplied with a cable connector:
   - Note the electrical connector that is located above the part number label on the electrode.
   - Keep the yellow protective cap over the electrical connection end until you are ready to connect the electrode cable.
   - Make sure that connector o-ring is always in place around electrode top and sitting on electrode shoulder, below threads.
   - Save the yellow connector cap for protection whenever the electrode cable is disconnected.
6. Any excess salt crystals on the sensor can be removed by placing the electrode under warm tap water until dissolved. Do not wet electrical connector end.

ATTENTION

Part number 51204976-002, -008, -009 in the Durafet II Series does not have an integral reference junction assembly, and so does not require cotton packing material or wetting solutions.

3.2 Precautions

- Do not allow liquids or other foreign matter to contact the cable connectors. Leave the protective cap in place on the electrode connector, if supplied with a cable connector, whenever the cable is not installed on an electrode.
- Observe the polarity key on the top of the electrode when mating to the cable connector. Align the key with the cable connector and slip on the cable connector. DO NOT FORCE THE CABLE CONNECTOR ONTO THE ELECTRODE — IT DOES NOT FIT ALL THE WAY DOWN ONTO THE ELECTRODE.
- Tighten the connector cap and ferrule by hand only.
- Avoid touching sensor area. Pressure applied to this area could damage the sensor.
- Avoid contaminating electrical connector contacts. Contamination can result in electrical leakage paths that affect the accuracy of pH measurements.
- Always replace the protective cap over the sensor when the electrode is not in use. *Be sure to reinstall the connector cap whenever the electrode is removed from service.* Ensure that the cotton packing in the cap is saturated with potassium chloride solution (does not apply to P/N 51204976-002, -008, -009). If solution is not available, substitute tap water or buffers of 4.01 or 6.86 pH *(see Section 6).*
- Remove the reference junction assembly only if gel replacement is necessary.
- Do not expose the electrode to hydrofluoric acid.
- The sensor will have a reduced service life in processes that use high temperatures in combination with alkaline conditions. Do not install electrodes where temperatures go below –10 °C (+14 °C) or freeze damage may result. Observe upper temperature limit specifications.
- In abrasive process streams, the electrode should be oriented so that the sensor surface faces downstream. In oily process streams, orient the sensor so that it faces 90° to the process flow. For Durafet II electrodes the “H” of the Honeywell logo on the label is aligned with the sensor.
- Promptly remove any water that might inadvertently come in contact with the electrode connector or cable connector. Blow drying with clean, low-pressure (15 psi) instrument air is a simple and effective means for drying the connector(s).

4. Shelf Life and Storage

4.1 Description

(The information contained in this section does not apply to P/N 51204976-002, -008, -009).

Periodic maintenance is required to ensure that the electrode does not dry out after prolonged shelf storage. Stored electrodes should be checked (by removing cap) once per year to ensure that the cotton packing is still wet.

The procedure outlined below should be performed once per year for stored electrodes.

1. Remove the electrode from its storage box, remove vinyl tape and pull the plastic cap from the sensing end.
2. DO NOT ROTATE PLASTIC CAP. (This will loosen reference junction assembly).
3. Remove any excess crystals on sensor area by rinsing with warm tap water.
4. Refill the cap with electrode storage solution *(see Section 3.2, Precautions).*
5. Replace the cap on the electrode.
6. Wrap the joint where the cap edge meets the electrode body with vinyl tape.
7. Place electrode in its storage box.
8. Mark the date on the box.

ATTENTION

Do not store electrode at or below –10 °C (+14 °F) or above 50 °C (122 °F)

5. Cleaning

5.1 Overview

The frequency of cleaning is dependent on process conditions. Some process materials tend to adhere to the sensor and could interfere with the accuracy or time response of measurements. Note the following information before attempting to clean your electrode.

- Remove the electrode from service. Disconnect the cable from the electrode, if electrode is supplied with a connector.
- Install electrode connector cap, if electrode is supplied with a connector.
- Placing the electrode under flowing warm tap water will normally remove loose or lodged debris.
- Oil deposits can be removed using a household detergent (Joy or Windex) or a laboratory detergent (Micro or Sparkleen).
- The PPS electrode body can be cleaned with almost any cleaning agent.
- Use dilute hydrochloric acid or other dilute acid to clean mineral scaling off the sensor. After cleaning, rinse thoroughly in distilled water. Allow it to soak for an hour in a neutral buffer (i.e. - 6.86 pH buffer, Honeywell Part Number 31103002).
- The sensor area can be wiped gently with a soft wet cotton swab.

The procedure outlined below should be performed if the reference electrode junction is clogged or dried. *(The information contained in this section does not apply to P/N 51204976-002).*

1. Remove the storage cap from the electrode (if necessary) for the cleaning process.

ATTENTION
For P/N 51205554-002, -003, -004, -005, -006, -007, -010, -011 do not remove the slotted tip.

2. Immerse the end of the electrode for one hour in tap water at approximately 90 °C.

If the procedure outlined above does not fully unclog the reference electrode junction, perform the following additional steps.

3. Place the electrode in a beaker of saturated potassium chloride (KCl) solution and heat to boiling.
4. Remove from heat and allow the electrode to soak in this solution until it cools to room temperature.

6. Accessories and Replacement Parts

Description	Part Number
Replacement Electrodes	
3/4” NPT body, in-line, cable connector, 8550 ohm temperature sensor	51205554-001
3/4” NPT body, immersion, cable connector, 8550 ohm temperature sensor	51205554-002
3/4” NPT body, immersion, 12’ integral cable, 8550 ohm temperature sensor	51205554-003
3/4” NPT body, immersion, 20’ integral cable, 8550 ohm temperature sensor	51205554-004
3/4” NPT body, immersion, 50’ integral cable, 8550 ohm temperature sensor	51205554-005
3/4” NPT body, immersion, 4’ integral cable, 8550 ohm temperature sensor	51205554-006
3/4” NPT body, immersion, 8’ integral cable, 8550 ohm temperature sensor	51205554-007
3/4" NPT body, in-line, cable connector, 100 ohm RTD temperature sensor	51205554-008
3/4" NPT body, in-line, cable connector, 1000 ohm RTD temperature sensor	51205554-009
3/4" NPT body, immersion, cable connector, 100 ohm RTD temperature sensor	51205554-010
12 mm body, combination electrode cable connector, 8550 ohm temperature sensor	51204976-001
12 mm body, measuring only, cable connector, 8550 ohm temperature sensor	51204976-002
12 mm body, combination electrode, 12’ integral cable, 8550 ohm temperature sensor	51204976-003
12 mm body, combination electrode, 20’ integral cable, 8550 ohm temperature sensor	51204976-004
12 mm body, combination electrode, 50’ integral cable, 8550 ohm temperature sensor	51204976-005
12 mm body, combination electrode, cable connector, 100 ohm RTD temperature sensor	51204976-006
12 mm body, combination electrode, cable connector, 1000 ohm RTD temperature sensor	51204976-007
12 mm body, measuring only electrode, cable connector, 100 ohm RTD temperature sensor	51204976-008
12 mm body, measuring only electrode, cable connector, 1000 ohm RTD temperature sensor	51204976-009
Storage Caps for Electrodes	
Electrode Number	
51204975-001, -003, -004, -005	31080229
5120554-001	31074355
51205554-002, -003, -004, -005, -006, -007	31074335
51204976-002	31080229
Connector Cap – All Models	51204977-001
Connector O-ring – All Models	51198302-001

Description	Part Number
Standard Buffer Reference Solution (1 pint)	
4.01 pH	31103001
6.86 pH	31103002
9.18 pH	31103003
Connection Cable for Electrodes with Quick Disconnect Feature	
Durafet II Electrode to Honeywell 31079288, 31079290, 31080239 or 31084755 Preamp Modules and 3107923 Preamp:	
6 inch length	51205578-001 (Catalog 7773 only)
12 foot length	51204782-001
20 foot length	51204782-002
30 foot length	51204782-003
40 foot length	51204782-004
50 foot length	51204782-005
Durafet II Electrode with Quick Disconnect and Integral Cap Adapter:	
12 foot length	51205965-001
20 foot length	51205965-002
50 foot length	51205965-005
4 foot length	51205965-006
8 foot length	51205965-007
3/4" Plastic Pipe Tee for 5120554-001Electrode	31120167

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