1 YEAR
WARRANTY

OMEGA®

User's Guide

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PHE-2724/2726 SERIES
ORE 2725 SERIES
pH/ORP Electrodes

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Contents

1. Description

The Omega PHE-2724/26 and ORE-2725 series of pH/ORP electrodes are designed to minimize maintenance time and maximize value.

- The unique dry lock connector provides quick assembly and a secure connection featuring gold-plated contacts and an O-ring seal.
- The patented design features a lengthened reference chamber pathway to extend the operational life of the electrode.
- Wetted materials are selected to withstand a wide array of industrial applications.
- Multiple mounting features address the need for installation flexibility. These electrodes can be threaded into ¾ in. NPT or ISO 7/1 R¾ pipe fittings, submerged in a tank, or mounted into familiar Omega installation fittings.
- To support the PHTX-271 series of pH/ORP Transmitters combine the PHE-2724/26 or ORE-2725 electrodes with a PHE-2761-PA (-ISO) pH/ORP Preamplifier.
- Combine PHE-2724/26 or ORE-2725 electrodes with the PHE/PHEH/PHTX pH Sensor Electronics to provide a 4 to 20 mA loop to a Programmable Logic Controller (PLC), SCADA system, or datalogger.
- For more flexibility and unique features, pair the PHE-2724/26 or ORE-2725 electrodes with a PHEH/PHTX pH/ORP Sensor Electronics and the new DPU91 Transmitter.

2. Specifications

General

Compatibility.....PHEH-275x and PHTX-275x pH/ORP Sensor Electronics, PHE-276x pH/ORP Preamplifier

pH Temp Sensor:

3 KΩ Balco .....Compatible with PHEH-276x preamplifier

Connection to.....PHTX-271 pH/ORP Transmitter

Process Connection .....¾ in. NPT or ISO 7/1 R¾ threads or Omega flow fittings

Wetted Materials:

pH.....PPS, glass, UHMW PE, FPM

ORP.....PPS, glass, UHMW PE, FPM, Platinum

Shipping Weight: .....0.25 kg (0.55 lb)

Performance

Efficiency.....> 97% @ 25 °C (77 °F)

- Efficiency indicates the "wellness" of a new electrode.
- Efficiency is measured by comparing the actual slope (mV/pH) at 25 °C to the theoretical output of 59.16 mV/pH.
- An efficiency of 97% to 100% is equivalent to a slope of 57.39 to 59.16 mV/pH.

Measuring Range:

pH.....0 to 14

ORP.....±2000 mV

PHE-2726-LC .....Low Conductivity fluids (20 to 100 µS/cm)

≤ 20 µS/cm.....Flow must be less than 150 ml/min. in a properly grounded system

PHE-2726-HF .....Hydrofluric acid resistant glass, pH 6 or below; trace HF ≤ 2%

For applications where hydrofluoric acid, **in concentrations of 2% or less**, will attack standard pH glass in levels of pH 6 and below, or in situations where process upsets may temporarily drop to these pH levels.

Environmental Requirements

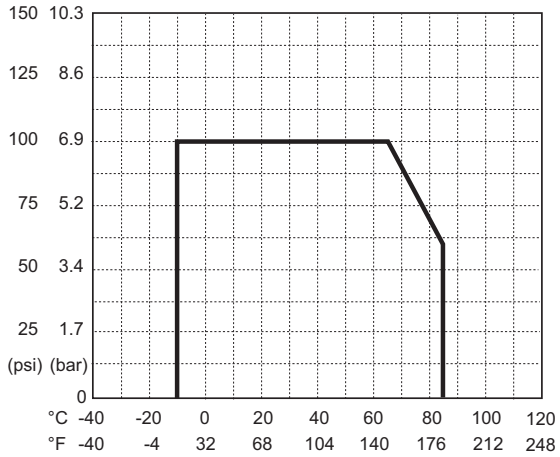
Max. Temperature/Pressure Rating

Operating Temperature* ..... -10 °C to 85 °C (14 °F to 185 °F)

*Best performance for PHE-2726-HF(-ISO) is above 10 °C (50 °F)

Operating Pressure Range:

- 0 to 6.9 bar (0 to 100 psi) @ -10 °C to 65 °C (14 °F to 149 °F)
- Linearity Derated 6.9 to 4.0 bar (100 to 58 psi) @ 65 °C to 85 °C (149 °F to 185 °F)



Recommended storage temperature

PHE/ORE electrodes.....0 °C to 50 °C (32 °F to 122 °F)

- The electrode glass will shatter if shipped or stored at temperatures below 0 °C (32 °F).
- The performance life of the electrode will be shortened if stored at temperatures above 50 °C (122 °F).

3. Safety Information

1. Use appropriate eye, face, hand, body and/or respiratory protection when using chemicals or solvents.
2. Prior to installation or removal:
   - Depressurize and vent system
   - Drain below sensor level.
3. Confirm chemical compatibility before use.
4. Do not exceed the max. temperature/pressure specifications.
5. Do not alter product construction.

If installing into a threaded connection:

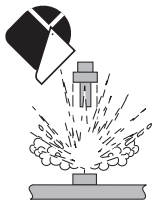
6. Inspect threads to ensure integrity.
   Do not install a sensor that has damaged threads.
7. Apply PTFE tape to the process connection threads in accordance with industry practices.
8. **HAND TIGHTEN** the sensor into the process connection. **DO NOT USE TOOLS.**

	**Warning / Caution / Danger** Indicates a potential hazard. Failure to follow all warnings may lead to equipment damage, injury, or death
	**Personal Protective Equipment (PPE)** Always utilize the most appropriate PPE during installation and service of Omega products.
	**Pressurized System Warning** Sensor may be under pressure, take caution to vent system prior to installation or removal. Failure to do so may result in equipment damage and/or serious injury.
	**Hand Tighten Only** Overtightening may permanently damage product threads and lead to failure of the retaining nut.
	**Do Not Use Tools** Use of tool(s) may damage product beyond repair and potentially void product warranty.
	**Note / Technical Notes** Highlights additional information or detailed procedure.
	**Do Not Freeze** Products are temperature sensitive and may contain freezable liquids. Freezing damage to pH, ORP, and Chlorine electrodes voids product warranty.

4. Chemical Compatibility

The retaining nuts of pH and ORP sensors are not designed for prolonged contact with aggressive substances.

Strong acids, caustic substances and solvents or their vapor may lead to failure of the retaining nut, ejection of the sensor and loss of the process fluid with possibly serious consequences, such as damage to equipment and serious personal injury.

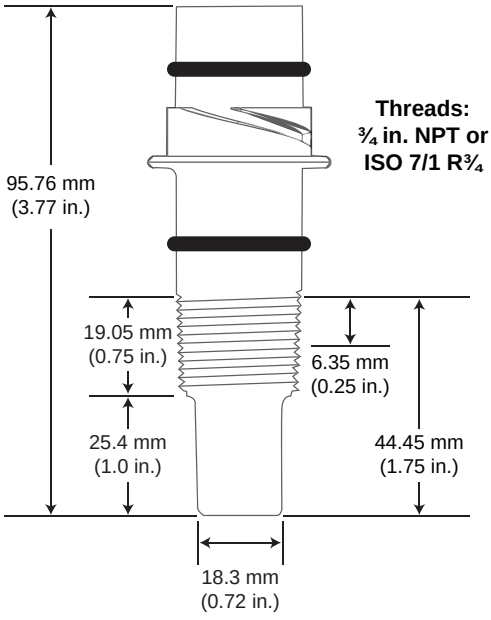


Retaining nuts that may have been in contact with such substances, e.g. due to leakage or spilling, must be replaced.

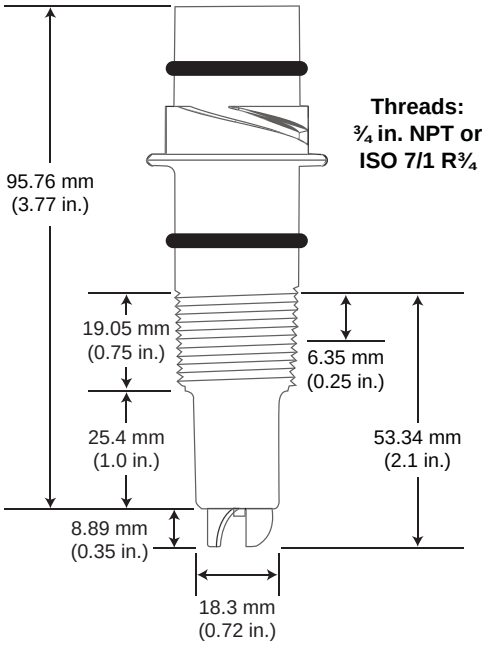
- The use of this product assumes operators are trained and familiar with this type of device.
- Operators should be knowledgeable of the potential risks associated with pressurized piping systems.
- Operators MUST follow all necessary safety procedures.

5. Dimensions

PHE-2724 & ORE-2725 Flat Glass Electrode

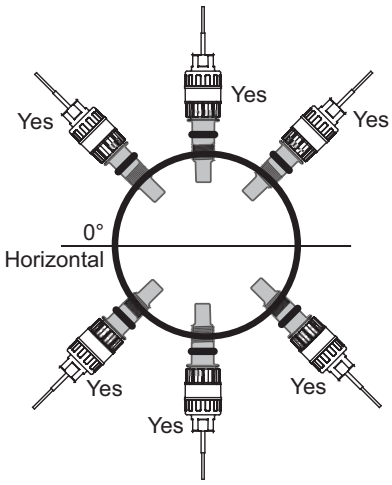


PHE-2726 Protected Bulb Glass Electrode

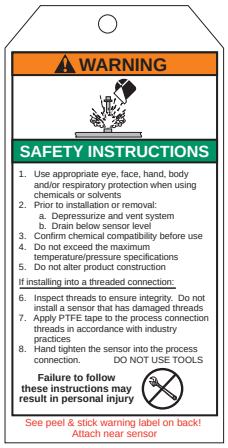


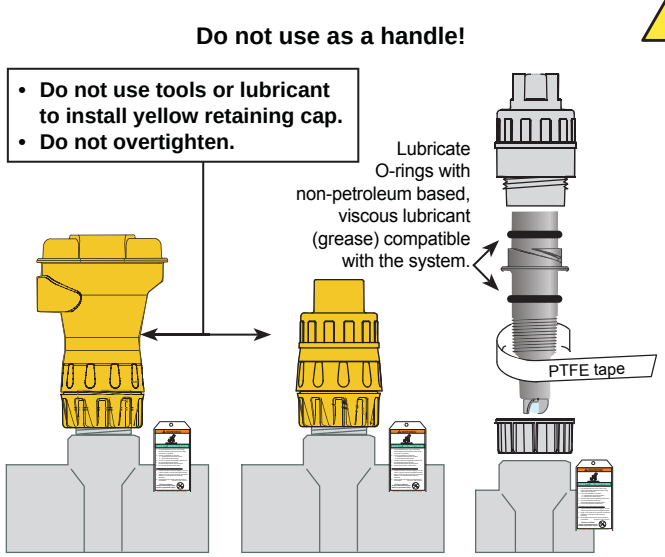
6. In-Line Installation

1. The electrode can be mounted at any angle.
2. Avoid air pockets and sediment.
3. The fitting must place the electrode in the flow but must not bottom out in the pipe.
4. Select an Omega installation fitting for convenience.
5. Use the ¾ in. threads on the electrode body to install the electrode into reducing tee fittings.
6. Inspect threads to ensure integrity. Do not install an electrode with damaged threads.
7. Apply PTFE tape to the process connection threads, in accordance with industry standards.
8. Use piping installation hardware with smooth, well-finished threads to facilitate the installation.
9. If necessary, the pipe should be plumbed with a depression (trap) so liquid is maintained around the electrode tip.
10. Hand-tighten the electrode into the process connection.
    Do not use any tools to install the electrode. The use of wrenches, pliers or similar may over-stress the sensor body and lead to breakage and subsequent spillage of the process liquid.
11. The safety instructions have an adhesive label and should be placed near the sensor.

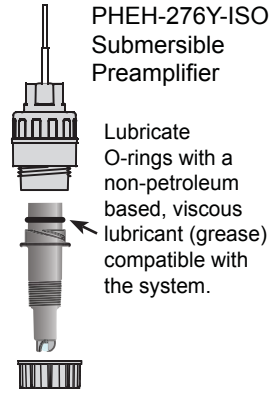


CAUTION:
A broken sensor may be ejected forcefully from the fitting and can cause severe injury.

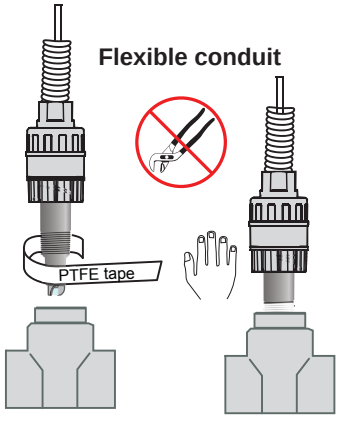




PHEH-275G
PHEH-275G-ISO
PHEH-276Y
PHEH-276Y-ISO
Submersible Preamplifier

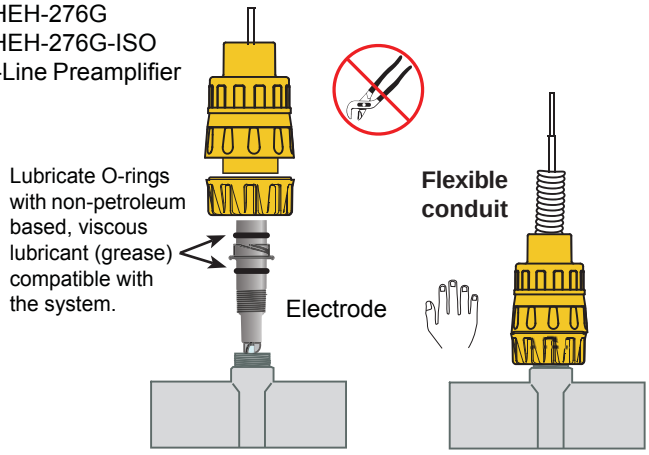


Electrode



Fitting (customer supplied)

PHEH-275Y
PHEH-275Y-ISO
PHEH-276G
PHEH-276G-ISO
In-Line Preamplifier



Omega Installation Fitting DN15 to DN100 (½ in. to 4 in.)

7. Low Conductivity Installation

- The PHE-2726-LC and PHE-2726-LC-ISO pH electrodes can be used in low conductivity water of less than 100 µS.
- When used in the range of 20 to 100 µS, the flow range must not exceed 1 m/s (3 ft/s) velocity.
- When used in liquids of less than 20 µS, the flow range must not exceed 150 ml/min
- The sensor should also be mounted in a well grounded cell.

8. Omega Installation Fittings

Type	Description
Plastic tees 	• Available in ½ in. to 4 in. sizes • PVC, CPVC w/solvent cement socket • PVDF or PP w/union end fittings
PVC saddles 	• Available in 2 in. to 4 in. sizes • Requires 1-7/16 in. hole in pipe
Iron strap-on saddles 	• Available in 2 in. to 4 in. sizes • Requires 1-7/16 in. hole in pipe

Type	Description
Carbon steel weldolets 	• Available in 2 in. to 4 in. sizes • Requires 1-7/16 in. hole in pipe • Install by certified welder only
Carbon steel threaded tees 	• Available in ½ in. to 2 in. sizes • Female NPT ends
Universal pipe adapters 	• Use for installation in pipes >4 in. (1¼ in. NPT) • PVC, CPVC, or PVDF versions • Specify socket or 1¼ inch NPT male threads

9. Removing from In-Line Installations

- The use of this product assumes that operators are trained and are familiar with this type of device.
- They should be knowledgeable of the potential risks associated with pressurized piping systems.
- Operators MUST follow all necessary safety procedures.

In-line removal Instructions:

1. Depressurize and vent the piping system.
2. Drain the system to below sensor level.
3. Wear safety goggles or face shield during removal.Use all appropriate eye, face, hand, body and/or respiratory protection when working with chemicals or solvents.
4. Place a Lockout tag on the pipe when the sensor is removed for maintenance to prevent accidental opening and exposure to potentially hazardous chemicals.

10. Submersible Installations

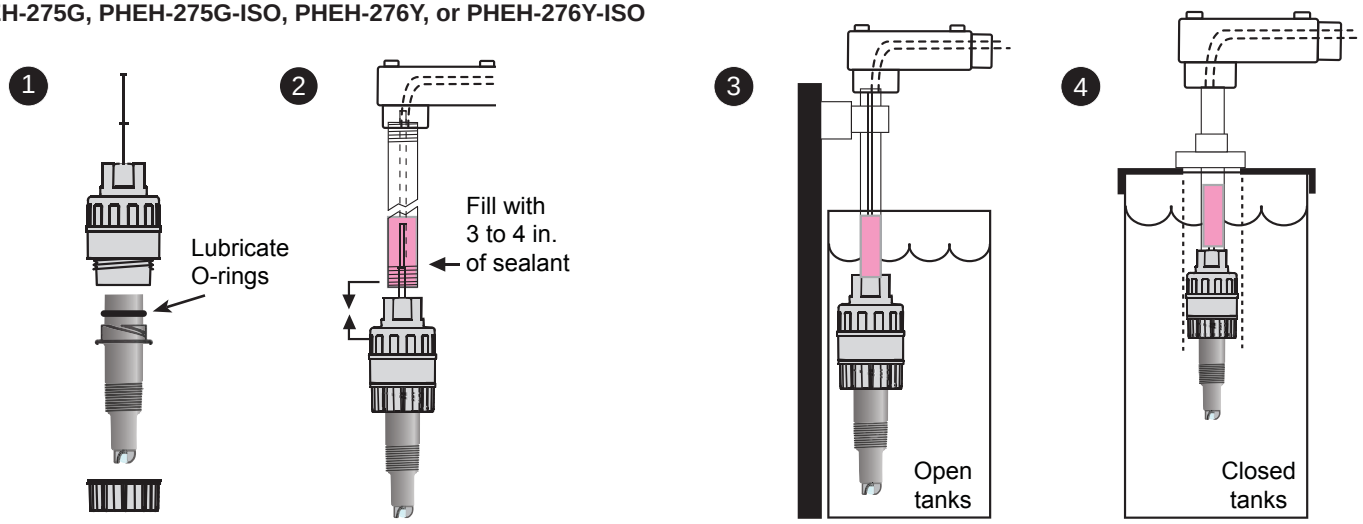
The user must supply the following hardware to complete a submersible installation:

- ¾ in. NPT threaded pipe or conduit
- Wiring junction box
- Pipe clamps (quick-release type recommended)
- Tank flange for closed tanks

Technical Note:

- Mount the electrode near tank outlets, away from reagent addition areas.
- Use the ¾ in. threads at the top of the preamplifier to run the cable inside pipe or conduit.
- Place the electrode tip in pH 4 buffer during system maintenance or storage to avoid dehydration.

PHE/ORE electrode with:
PHEH-275G, PHEH-275G-ISO, PHEH-276Y, or PHEH-276Y-ISO



The Omega PHE-2724 and PHE-2726 pH electrodes are designed to install in tanks by attaching conduit to the ¾ in. threads at the top of the accompanying preamplifier or sensor electronics:

1. The O-ring at the top of the electrode fits very tightly into the preamplifier. Use a small amount of non-petroleum based lubricant to assist the assembly.
2. To prevent moisture from migrating into the preamplifier, backfill the conduit with 3 in. to 4 in. of sealant.
3. Mount electrodes in a location with ample clearance to remove them for periodic cleaning and recalibration.
4. Choose a location that keeps the electrode glass completely submersed at all times.

11. ORP System Calibration

ORP electrodes do not incorporate a temperature sensor.
The only system calibration required is the electrochemical adjustment.

Electrochemical ORP vs. mV Ratio

- ORP measurements are relative values, and single-point adjustments are sufficient for most applications.
- Calibration should be done using ORP test solutions such as Zobell's solution, Light's solution, or in pH buffers that have been saturated with quinhydrone (Table 3). Quinhydrone is the oxidizer that is measured by the ORP electrode.
- Zobell's solution and Light's solution are not compatible with the AutoCal function in Omega pH instrumentation.
- A new ORP electrode measures the listed values ±15 mV.
- The ORP electrode is functional until the offset exceeds 50 mV.
- An electrode whose offset measures greater than 50 mV should be cleaned and replaced if necessary.
- ORP solutions made with quinhydrone are very unstable and may not read properly after being exposed to air for a prolonged time. These solutions must be discarded after a few hours.
- Dispose of all calibration solutions in accordance with local, state and federal guidelines.
- Use clean water to rinse buffer solutions from the sensors.

Table 3: ORP test solutions

*Saturate 50 mL of pH 4 or pH 7 buffer with 1/8 g quinhydrone

	Zobell's solution	Light's solution	4 pH buffer w/quinhydrone*	7 pH buffer w/quinhydrone*
ORP at 20 °C			268 mV	92 mV
ORP at 25 °C	228 mV	469 mV	263 mV	86 mV
ORP at 30 °C			258 mV	79 mV

12. pH System Calibration

There are two functions in a pH electrode that require the system to be calibrated:

Temperature

- The temperature output of the electrode (from a 3K Balco) must be calibrated only once. When a new electrode is installed, it does not need to be repeated.
- Because the temperature measurement has a significant influence on the electrochemical measurement, the temperature output in new pH electrodes should always be calibrated before the pH/mV calibration.

  NOTE: All Omega transmitters and controllers incorporate automatic temperature compensation.

Table 1

pH error due to temperature changes in fluid											
°C	**pH 2**	**pH 3**	**pH 4**	**pH 5**	**pH 6**	**pH 7**	**pH 8**	**pH 9**	**pH 10**	**pH 11**	**pH 12**
15	0.15	0.12	0.09	****0.06**	0.03	0	0.03	0.06	0.09	0.12	0.15
25	0	0	0	*** 0**	0	0	0	0	0	0	0
35	0.15	0.12	0.09	0.06	0.03	0	0.03	0.06	0.09	0.12	0.15
45	0.3	0.24	0.18	0.12	0.06	0	0.06	0.12	0.18	0.24	0.3
55	0.45	0.36	0.27	0.18	0.09	0	0.09	0.18	0.27	0.36	0.45

As the pH value moves away from neutral (7 pH) or the temperature moves away from 25 ºC, the electrochemical output is affected.

***** Example: At pH 5 the mV output of the electrode is not affected if the temperature is at 25 °C.

****** The electrode output will be shifted by 0.06 pH units if the temperature is reduced to 15 °C.

Electrochemical pH vs. mV Ratio

- The mV output from the electrode is created by the interaction of the electrode and the fluid.
- The electrode contains a gel that depletes over time, so the instrument must be readjusted periodically to maintain system accuracy.
- The need for recalibration varies with each application, but the life of the electrode is usually consistent.
- Keep a maintenance log to establish a depletion trend in new systems.
- The mV calibration is a two-point procedure.
- Omega offers pH buffer solutions prepared specifically for this purpose.
- pH buffer solutions can be used for calibrating more than one sensor within a day provided that the solutions are protected from debris and are not diluted by rinse water from the calibration procedure.
- Use clean water to rinse buffer solutions from the electrode.
- Dispose of all buffer solutions at the end of the day.
- If the pH sensor will not calibrate within acceptable limits, clean the electrode and recalibrate.
- If the calibration results remain outside of acceptable limits, the sensor is depleted and must be replaced.
- Follow the guidelines of local waste disposal regulations when discarding buffer solutions and spent electrodes.

Theoretical mV Values @ 25 °C	
pH	mV
2	+295.8
3	+236.64
4	+177.48
5	+118.32
6	+59.16
7	0
8	–59.16
9	–118.32
10	–177.48
11	–236.64
12	–295.8

Table 2

Electrode slope is the ratio of mV to pH units. At 25 °C the theoretical slope is 59.16 mV per pH.

13. Electrode Care and Application

pH/ORP electrodes are similar to batteries; they age with time and usage.
The following information will help maximize electrode life.

General Tips:

- To ensure uninterrupted operation of critical pH systems, replacement electrodes should be available.
- Store boxed electrodes flat or upright (electrode tip down) to maximize hydration of the glass surface.
- Keep the glass surface wet at all times.
- Soak the sensor tip in pH 4.0 buffer during system maintenance intervals.
- If the sensor dehydrates, soak the sensor tip in pH 4 buffer for 24 to 48 hours, then visually inspect the electrode for surface cracks, swelling, or discoloration.
- It may not be possible to restore severely dehydrated electrodes to normal operation.
- High temperatures, strong acids or caustics will increase electrochemical reactions and speed electrode aging.
- Coatings (e.g. grease) on the glass or junction surfaces cause extended response time and inaccurate measurement.
- Never store the electrode tip in deionized (DI) water. Use pH 4 buffer solution to keep the glass wet when out of the process.
- Never store the electrode at temperatures below 0 °C (32 °F) or allow it to dehydrate.
- Never scrape or sand the glass electrode surface.
- Treat glass electrode surfaces with care to prevent accidental breakage.

14. Cleaning

Problem	Suggested Solution
Hard Coatings	Use a dilute acid solution (HCl solution of 5% or less). If the electrode has been used in applications with a pH value higher than 7 pH, soak the electrode for 2 to 5 minutes.
	Use a dilute alkaline solution (NaOH solution at 5% or less) if the electrode has been used in applications with pH values less than 7 pH, soak the electrode for 2 to 5 minutes.
	Alternating immersion in acidic and alkaline solutions may be necessary for thorough cleaning.
Soft Coatings	Spray or vigorously stir the electrode with a mild detergent, such as dishwashing liquid. Chlorine bleach can also be used.
Oily or Organic Coatings	Spray or vigorously stir the electrode with a mild detergent or an appropriate solvent that will not attack the materials of construction. (isopropyl alcohol or similar)
ORP Platinum Coating	Gently wipe the electrode surfaces with a paper towel.
After Cleaning	Always rinse the electrode with water after cleaning.
	Soak the electrode in a pH 4 buffer (with KCl if available) for at least 10 minutes after cleaning.

15. Ordering Information

PHE/ORE pH/ORP Electrodes

Mfr. Part No.	Description
PHE-2724	Electrode, pH, flat glass, 3K Balco, ¾ in. NPT
PHE-2724-ISO	Electrode, pH, flat glass, 3K Balco, ISO 7/1 R¾
PHE-2726	Electrode, pH, bulb glass, 3K Balco, ¾ in. NPT
PHE-2726-ISO	Electrode, pH, bulb glass, 3K Balco, ISO 7/1 R¾
PHE-2726-HF	Electrode, pH, bulb glass, HF resistant, 3K Balco, ¾ in. NPT
PHE-2726-HF-ISO	Electrode, pH, bulb glass, HF resistant, 3K Balco, ISO 7/1 R¾
PHE-2726-LC	Electrode, pH, bulb glass, Low Cond, 3K Balco, ¾ in. NPT
PHE-2726-LC-ISO	Electrode, pH, bulb glass, Low Cond, 3K Balco, ISO 7/1 R¾
ORE-2725	Electrode, ORP, flat glass, 10 KΩ ID, ¾ in. NPT
ORE-2725-ISO	Electrode, ORP, flat glass, 10 KΩ ID, ISO 7/1 R¾

Accessories and Replacement Parts

Mfr. Part No.	Description
PHTX-275Y	In-line Sensor Electronics with EasyCal
PHEH-275Y	In-line Sensor Electronics, 15 ft cable, ¾ in. NPT threads
PHEH-275Y-ISO	In-line Sensor Electronics, 15 ft cable, ISO 7/1 R¾ threads
PHEH-275G	Submersible Sensor Electronics, ¾ in. NPT threads
PHEH-275G-ISO	Submersible Sensor Electronics, ISO 7/1 R¾ threads
PHEH-276Y	Submersible Preamplifier, ¾ in. NPT threads
PHEH-276Y-ISO	Submersible Preamplifier, ISO 7/1 R¾ threads
PHEH-276G	In-line Preamplifier, ¾ in. NPT threads
PHEH-276G-ISO	In-line Preamplifier, ISO 7/1 R¾ threads
PHE-2700-DLA	Dry lock Adapter Cable (for use with PHEH and PHTX)

WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components in which wear is not warranted, include but are not limited to contact points, fuses, and triacs.

OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by the company will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive, and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.

CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY/DISCLAIMER language, and, additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

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- Industrial pH & Conductivity Equipment

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- Data Logging Systems
- Wireless Sensors, Transmitters, & Receivers
- Signal Conditioners
- Data Acquisition Software

HEATERS

- Heating Cable
- Cartridge & Strip Heaters
- Immersion & Band Heaters
- Flexible Heaters
- Laboratory Heaters

ENVIRONMENTAL MONITORING AND CONTROL

- Metering & Control Instrumentation
- Refractometers
- Pumps & Tubing
- Air, Soil & Water Monitors
- Industrial Water & Wastewater Treatment
- pH, Conductivity & Dissolved Oxygen Instruments

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