

ELECTRO-CHEMICAL DEVICES, INC.

PHS10/17 & MVS10/17 SENSORS
INSTALLATION and MAINTENANCE MANUAL
for use with
pH, ORP and SPECIFIC ION SENSORS

YORBA LINDA * CALIFORNIA * 92887 * USA

PREFACE

Your decision to purchase from Electro-Chemical Devices, Inc. has provided you with the finest analytical instrument available. Before you install and commission this product, we highly recommend that you read this instruction manual. If this is your first purchase from ECD, we suggest that you obtain factory authorized training for those products purchased. At ECD, we believe our most knowledgeable customers are our most valuable customers.

PHS10/17 & MVS10/17 Sensors, Installation and Maintenance Manual
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Trademark references:

CV75 is a fluoroelastomer compound developed by E.I. Du Pont De Nemours and International Seal Company, Inc.

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Kalrez is a registered trademark for E.I. Du Pont De Nemours Co's perfluoroelastomer.

Kynar is a registered trademark for Penwalt's PVDF.

Ryton is a registered trademark for Phillips 66's polyphenylene sulfide resin.

Teflon is a registered trademark for E.I. Du Pont De Nemours Co's fluorocarbon resin.

Viton is a registered trademark for E.I. Du Pont De Nemours Co's fluoroelastomer.

Abbreviations used in this manual:

CPVC is an abbreviation for chlorinated polyvinyl chloride.

EPR is an abbreviation for an ethylene propylene elastomer.

NEMA is an abbreviation for the National Electrical Manufacturers Association.

Nylon is a generic name for a polyamide polymer.

PES is an abbreviation for polyethersulfone.

PVDF is an abbreviation for polyvinyl difluoride.

TFE is an abbreviation for Du Pont's Teflon.

316ss is an abbreviation for 316 grade stainless steel.

This manual is available, less the accompanying application drawings in 5-1/4" 3-1/2" disks for use with Word® 5.0. Contact Electro-Chemical Devices, Inc. for further information.

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WARRANTY

Electro-Chemical Devices, Inc. (ECD) warrants all products it manufactures to be free from defect in materials and factory workmanship, and agrees to repair or replace any product that fails to perform, as specified, within one (1) year after date of shipment. This warranty shall not apply to any product that has been:

1. Subjected to misuse, negligence or accident;
2. Connected, installed, adjusted or otherwise used not in accordance with the instructions furnished by ECD;
3. Repaired, modified or altered by persons not authorized by ECD, resulting in injury to the performance, stability or reliability of the product.

This warranty is in lieu of any other warranty, expressed or implied. ECD reserves the right to make changes in the design or construction of its products at any time, without prior notification, and without incurring any obligation to make any changes in previously delivered products.

Seller's sole liabilities and the buyer's sole remedies under this agreement shall be limited to a refund in the purchase price, or at ECD's discretion, to the repair or replacement of any product that proves, upon ECD's examination, to be defective, when returned to the factory, transportation prepaid by the buyer, within one (1) year of the product's original shipment date. Seller shall not be liable for damages consequential or incidental to defects in any product, for failure of delivery in whole or in part, for injuries resulting from its use, or for any other cause.

This warranty and the writing attached constitute the full understanding of seller and the buyer, and no terms, conditions, understanding, or agreement purporting to modify or vary the terms hereof shall be binding unless hereafter made in writing and signed by an authorized official of Electro-Chemical Devices, Inc.

This warranty does not cover pH, ORP or Specific Ion measurement, reference or combination electrodes or electrode cartridges that have been commissioned in service.

IMPORTANT SERVICE INFORMATION

Use only factory authorized components for repair. Tampering or unauthorized substitution of components may adversely affect the operation of this product and **may void the warranty.**

If service or repair is required please obtain the serial number(s) or sales order number of the product(s) in question and call ECD's Service Department at:

(800) 729-1333 or (714) 692-1333

A Return Material Authorization (**RMA**) number must be obtained from the service department before returning any material to ECD. All material returned to ECD shall be shipped prepaid to the factory.

UNPACKING THE SENSOR

Your Electro-Chemical Devices sensor has been carefully packaged to protect it from damage during shipment and dry storage. Upon receipt please follow the procedure outlined below.

1. Before unpacking, inspect the condition of the shipping container to verify proper handling by the carrier. If damage is noted, save the shipping container as proof of mishandling for the carrier.
2. Check the contents of the shipping container with the items and quantities shown on the packing list. Immediately report any discrepancies to ECD.
3. Save the original packing material until you are satisfied with the contents. In the event the sensor must be returned to ECD, the packing material will allow you to properly ship it to ECD.
4. Familiarize yourself with the sensor before installation, and follow proper installation and wiring procedures.

NOTE: pH, ORP and Specific Ion sensors are generally shipped with an electrode cartridge installed in the sensor and stated as a separate line item on the packing list. Carefully inspect the shipping container for all items listed on the packing list.

NOTE: A sensor-sealing plug is shipped with every sensor and should be kept for later use. For protection against moisture intrusion into the internals of the sensor this plug should be installed into the sensor whenever the cartridge is removed.

1.0 GENERAL DESCRIPTION

The PHS10, PHS17, MVS10 and MVS17 model sensors are a modular style process sensor for use in process environments where pH, ORP and Specific Ion are being measured. These sensors incorporate a sensing element, universal housing with signal conditioning and temperature compensation, where appropriate. The modular design allows the sensors to be easily configured for specific applications using different materials of construction and electrode configurations.

Wetted material selections include 316 Stainless Steel, Titanium, Hastelloy C, Polypropylene, and Kynar; with seal selections of Viton, EPR, Teflon, Kalrez, CV75 and Viton75.

Sensing elements are specific to the measured parameter and are configured in a cartridge format for easy service replacement. The cartridge style allows the sensing element to be removed without disassembly of the entire sensor.

S10 and S17 sensors are configured for different service requirements: insertion and valve-retraction applications.

1.1 Model S10

The S10 sensor is configured for insertion service (refer to application drawing 4034035). The S10 can be inserted into a standard ¾" pipe fitting using the gland fitting option with the sensor and can also be inserted into ECD's flow body for flow-through service. The sensor can be installed into a standpipe by reversing the ¾" process fitting.

1.2 Model S17

The S17 is configured for valve-retraction service (refer to application drawing 4034026). The valve-retraction configuration allows removal of the sensor from the process without process shutdown or removal from a tank without draining the tank. This is accomplished by a unique dual o-ring seal gland fitting used in conjunction with a 1" full-port ball valve. A high-pressure valve stop at the front of the sensor housing provides blow-out protection as do the redundant stainless steel safety lanyards.

1.3 Factory Mutual Approvals

These sensors are also approved by Factory Mutual Research Corporation as intrinsically safe for Class I, II and III, Division 1, Groups A, B, C, D, E, F and G hazardous locations outdoors in accordance with entity requirements and Electro-Chemical Devices' document 4015026, rev. 0. Although all PHS10, PHS17, MVS10 and MVS17 sensors are designed intrinsically safe, this approval only applies to sensors for use with ECD models T28 transmitters.

1.4 Identification

Sensors are electro-etched with identifying information on the housing. The information contains the base model number (example: PHS10 or PHS17), the type of signal conditioning (example: C22, T23 or T28), and special designators to identify special housing materials. The o-ring material is noted on the electrode cartridge (example: VIT, EPR, CV75 and VIT75).

The serial number is also branded on the sensor housing and assists ECD customer service personnel identify the original order.

The full model number, as found on the packslip, is a list of alphanumeric characters used to designate certain features of the sensor. The following table (Table 1) lists the designators used for the PHS10/17 and MVS10/17 sensors.

TABLE 1

pH, ORP and Specific Ion Sensor Designators

Base Model Designators:

PHS- pH sensor
MVS- ORP or Specific Ion sensor

Note: An "X" followed by a number identifies an optional sensor length in inches. For example, a PHS10X23 identifies a pH submersion type sensor, 23 inches long.

Signal Conditioner:

T23- for use with model T23 instruments
T28- for use with model T28 instruments
C22- for use with model C22 instruments
E - designates that the above signal conditioners are configured in an "E" module (encapsulated connector module)
CBL- 10' cable extending from sensor. Note: a CBL immediately followed by a number designates the cable to be a specific length; example: CBL20 designates a 20' cable.
CJB- Polymer junction box mounted on sensor.
XJB- Explosion-proof J-box mounted on sensor.

Housing Materials:

T - Titanium (grade 2)
H - Hastelloy C22
K - Kynar (PVDF)
P - Polypropylene

Note: If a housing designator is not used, housing material is 316 Stainless Steel.

Guard Material:

EG- En-Garde

O-Ring Materials:

EPR- Ethylene propylene
SIL- Silicone
FSIL- Fluorosilicone
KLZ- Kalrez
CV75- CV75 compound (generic Kalrez)
VIT75- HF resistant viton
Buna- Buna

Note: If an o-ring designator is not used, o-ring material is Viton.

Process Connection:

75 - 3/4" 316 Stainless Steel gland fitting with Nylon ferrule
75HT- 3/4" 316 Stainless Steel gland fitting with Teflon ferrule
75SF- 3/4" Stainless Steel gland fitting with Stainless Steel ferrule
75TFE- 3/4" all Teflon gland fitting
100- 1" Teflon gland fitting (for use with polymer body sensors)
VSS- 316 Stainless Steel valve-retraction assembly
VKY- Kynar (PVDF) valve-retraction assembly

Note: If a process connection designator is not used, the sensor is being supplied without a process connection.

2.0 FAMILIARIZATION

The S10 and S17 sensors are modularly constructed and consist of an external housing, temperature compensation module, connector module, signal conditioner, and an electrode (refer to application drawing 4035058 in section 4.6). All parts can be interchanged between the S10 and S17 sensors except the connector module and the housing.

2.1 Housings

Unless otherwise specified, sensors are supplied with 316 stainless steel housings. Other standard housing materials available are Titanium (grade 2), Hastelloy C22, Polypropylene and Kynar (PVDF). Metallic housings are .750" OD, polymer housings are .840" OD.

2.2 Temperature Compensation Modules

The temperature compensation module (TC module) is an internal sensor component located approximately 0.5" from the front of the sensor housing with the sensing element located approximately 1.25" from the front of the housing. The front of the TC module is threaded with Acme threads to receive the electrode. The rear of the TC module interfaces with the connector module via a set of gold plated sockets. The Acme threads provide the means to install and remove the electrode for testing and/or replacement. The gold plated sockets are bridged with removable pins to provide the electrical connection between the TC module and the connector module.

The primary function of the TC module is to compensate for the changes in pH glass slope due to process temperature variations. Therefore, it is important to be sure the sensor has been inserted a minimum of 1.5" into the process in order to ensure accurate and responsive temperature compensation. It should be noted that temperature compensation does not compensate for actual pH changes in the solution due to temperature variations. ORP and Specific Ion sensors are not temperature compensated.

ECD uses a 3,000 ohm Balco RTD for pH temperature compensation. As previously stated, ORP and Specific Ion measurements are not temperature compensated; however, TC modules are used in ORP and Specific Ion sensors (model MVS) for use with C22, T23 and T28. In these sensors, the TC module is used to provide temperature information to the transmitters for a temperature display.

Although the TC module is replaceable, the module itself is not field serviceable. Any repairs should be referred to the factory. Field repairs to the TC module are not generally recommended.

2.3 Connector Modules

The connector module provides the internal sensor connections from the TC module, electrode cartridge and solution ground to the signal conditioner. The connector module interfaces with the TC module through a set of gold plated sockets with removable pins. The solution ground is provided through a metal bearing mounted in the connector module that makes contact with the metallic housing. In the case of Kynar body sensors, no solution ground is provided. In the rear of the connector module, the signal conditioner interfaces through a 7-pin keyed connector. The electrode interfaces through the BNC connector which is aligned and locked in place with a snap-on cover and the TC module.

Although the connector module is replaceable, the module itself is not field serviceable. Any repairs should be referred to the factory. Field repairs to the connector module are not generally recommended.

2.4 Signal Conditioners

Various signal conditioners are available depending on the instrument being used. C22, T23 and T28 signal conditioners are some of the common types. The signal conditioner is located in the rear of the sensor housing in front of the strain relief and fitting. Standard signal conditioners are supplied with a 10-foot cable, but other lengths are available in 10-foot increments.

2.5 E-Modules

The encapsulated connector/amplifier module is an optional configuration to be used where sensors are subjected to severe external environmental conditions. The E-Module is a connector module with an encapsulated signal conditioner. Redundant seals at both ends of the E-Module protect the electronics from moisture that may have entered the sensor assembly. When a sensor incorporates the E-Module, the module must be removed from the front of the sensor housing. E-Modules are only available with C22, T23 and T28 signal conditioners. Like signal conditioners, E-Modules have cable lengths available in 10 foot increments.

2.6 En-Garde Electrode Cartridges

Generally, an electrode cartridge accompanies each pH and ORP sensor shipped by ECD. Unless otherwise specified, the sensor is shipped with a general-purpose electrode cartridge (ECD P/N 2005145 for pH, P/N 2005167.OT for ORP). Other electrode cartridges available from ECD are listed in section 8.5. Separate data sheets are available for commonly used electrode cartridges.

Each electrode cartridge has an integral guard. This provides the process seals for the sensor assembly as well as protection of the electrode cartridge. The seal guard has a set of o-rings to prevent process intrusion from entering the sensor. Standard o-rings are Viton; optional o-ring materials include EPR, Kalrez VIT75 and CV75.

3.0 INSTALLATION

Four typical installation configurations are available for ECD sensors: insertion, immersion, flow-through and valve-retraction. Although there are many ways to accomplish these mounting configurations, ECD recommends the following installation configurations. However, before planning the installation, it is important to read the section regarding sensor orientation.

3.1 Sensor Orientation

It is important to understand that some of the sensors are position sensitive, and that correct mounting orientation is necessary to obtain a reliable measurement. This is due to the presence of an air expansion gap located in the liquid fill of the pH glass stem. Because of this air gap, pH sensors must be mounted at a minimum of 10 degrees above horizontal. If the sensor is not oriented properly, the air gap may migrate into the glass bulb, creating an open circuit in the electrode.

For pH applications where the sensor cannot be properly oriented, ECD manufactures an electrode cartridge that will operate inverted. Please consult the factory for applications involving this type of mounting orientation.

ORP and solid-state Specific Ion sensors are not position sensitive.

IMPORTANT

Do not install pH sensors in a horizontal position or with the front of the sensor elevated above the rear of the sensor.

3.2 Insertion Mounting

This mounting configuration is accomplished by using the "75" option on metallic S10 sensors or the "100" option on Kynar S10 sensors (refer to application drawing 4034035 or 4034036, respectively). Loosen the gland fitting nut and slide the gland fitting off the sensor. Install the gland fitting into the mating pipe fitting where the sensor will be installed. Insert the S10 sensor through the fitting and tighten the nut on the gland fitting to secure the sensor.

The minimum insertion depth is 1.5 inches; the maximum insertion depth is 8 inches.

NOTE: Do not over-tighten the gland fitting nut.

The torque specification for the gland fitting is 20-ft/lbs. Over-tightening of the nut may swage the nylon or Teflon ferrules to the housing, making it difficult to remove the internal sensor components for service.

Nylon and Teflon ferrules are recommended for applications where process line pressure is 100 psig or less. In applications where process line pressure exceeds 100 psig, ECD recommends the use of stainless steel ferrules or the installation of an S17 valve-retraction sensor. In all cases, proper tightening procedures should be followed for optimum retention and safety.

If the sensor is in an environment where it is exposed to adverse weather conditions or moisture, see section 3.8

3.3 Submersion Mounting

This configuration is accomplished by using the "75" option on metallic sensors or the "100" option on Kynar S10 sensors (refer to application drawings 4034035 or 4034036, respectively). For submersion service, the gland fitting must be positioned on the sensor housing so that the sensor housing will extend into the standpipe approximately 5 inches. Gland fittings for submersion service should be equipped with nylon or Teflon ferrules, which must be tightened on the sensor housing to prevent process intrusion into the standpipe.

IMPORTANT:

Never submerge the sensor without environmental protection where the cable exits the sensor. Never install a sensor in service where it is supported by its cable.

3.4 Flow-Through Mounting

Although the insertion configuration can be used as a type of flow-through mounting by inserting the S10 sensor into a pipe tee, ECD has various flow bodies available for convenience. The flow body is available in 316 Stainless Steel, PVC and Kynar. Use of ECD's flow body can facilitate a self-cleaning action on the electrode when the sensor is inserted completely into the flow body due to the increased velocity of the process stream.

If the sensor is in an environment where it is exposed to adverse weather conditions or moisture, see section 3.8

3.5 Valve-Retraction Mounting

The S17 sensor is specifically designed for valve retraction service (refer to application drawing 4034026). Normally, mounting is direct in a process line or through a tank wall. ECD recommends the valve-retraction mounting for convenience or in applications where process line pressure exceeds 100 psig. The valve-retraction configuration can be used up to 300 psig; however, as process line pressure increases, so does the insertion force required to push the sensor through the valve and into the process. The following table (Table 2) shows the required insertion force for each process pressure listed. For process pressures greater than 300 psig, contact the factory for recommendations.

TABLE 2
Required Insertion Force for an S17 Sensor at a Particular Process Pressure

Process Pressure (psig)	Required Insertion Force (psig)	Process Pressure (psig)	Required Insertion Force (psig)
25	11.0	150	66.3
50	22.1	175	77.4
75	33.2	200	88.4
100	44.2	225	99.5
125	55.3	250	110.5

The S17 with the stainless steel valve (VSS option), the carbon steel valve (VCS option), and the Kynar valve (VKY option) have a 1 inch MNPT connection. Minimum penetration depth is 1.5 inches. Maximum penetration depth is 8 inches with the VSS and VCS options; 7 inches with the VKY option.

To remove the sensor from the valve for installation of the valve refer to application drawing 4035080 and the following directions: Note: Items in bold are identified on application drawing 4035080.

1. Loosen the small **swage nut** at the rear of the fitting assembly (do not remove the nut from the body of the fitting).
2. Slide the sensor to its stop by pulling it through the ball valve. The **safety lanyards** will be extended, confirming that the sensor is fully retracted. Note: the **safety lanyards** are redundant protection; the sensor will come to a stop when the **high pressure stop** reaches the front of the **retainer fitting**.

3.

CAUTION

*Do not put hands or fingers between the safety lanyard cables and any part of the sensor.
Use the external cable seal/handle to pull or guide the sensor through the valve.*

3. Close the ball valve.
4. Remove the **handle retaining nut** and the valve handle.
5. Remove the **safety lanyards** from the valve stem.
6. For the stainless steel ball valves, loosen and remove the large **retainer nut** from the **retainer fitting**. For Kynar ball valves, loosen and remove the union nut on the sensor side of the ball valve.
7. Firmly pull the **retainer fitting** from the valve. The sensor will be removed with the fitting.

The valve body and nipple can now be installed.

3.6 Flange Mounting

Flange mountings can be accomplished with the insertion and valve-retraction configurations using the desired flange and by mounting the gland fitting or valve-retraction assembly to the flange.

3.7 Flow Velocity Considerations

Process stream velocity may affect the sensor mounting requirements. However, some factors must be considered in determining the maximum flow velocity a sensor can withstand. In a process stream composed mostly of water, such as cooling water, the recommended maximum velocity to which a fully inserted S10 or S17 sensor can be exposed is generally 10 feet per second. However, the recommended maximum velocity will decrease as the viscosity of the process stream increases or as turbulence increases. If a high velocity already exists, caution must be used in determining sensor location. Because velocity is amplified when turbulence exists, this caution applies to locations such as the discharge side of a pump or near a bend in the process piping.

In some cases, velocity may be beneficial in obtaining a "self-cleaning" effect, because the velocity of the process tends to keep solids from accumulating on the sensor and its electrode. This is especially helpful in processes where coating of the glass is common.

If the process is high purity water, flow is an important consideration. At high flow rates, the pH or ORP indications will not be accurate and may exhibit noise. This is due to the fact that pure water acts more like an insulator than a conductor between the glass and reference cells, and a high flow rate tends to wash away the reference electrolyte creating an electrode offset, intermittent operation or even an open circuit. When flow rates vary in high purity water, the results can be one of pH readings that increase and decrease with the flow variations. Because of these phenomena, the flow rate for high purity water should be controlled. This can be accomplished by taking a 1/4" tube side stream from the process line into an ECD flow body or a 1" pipe tee and using a rotameter to control the flow.

3.8 External Cable Seal

The External Cable seal provides a redundant back seal to protect the internal sensor components from the outside environment. The external cable seal also provides the sensor with a handle with which to retract and insert the sensor.

An external cable seal is necessary on sensors located outside or in an environment where the back of the sensor is exposed to moisture. The S10 style external cable seal is detailed in ECD application drawing 4045031.

3.9 Wiring

Wiring connections depend on the sensor and instrument selected. Please refer to the proper sensor wiring diagram and the wiring label installed in your instrument. A list of standard ECD wiring drawings can be found in section 10.0.

3.10 Electrode Cartridge Installation

Unless ordered separately, electrode cartridges are generally shipped installed in a sensor. Sensors ordered without an electrode are shipped with a shipping plug to keep contamination from getting inside the sensor during shipment or storage. The following procedure explains how to install the electrode cartridge in the sensor assembly:

1. Remove the shipping plug by turning it counterclockwise.
2. Remove the electrode cartridge from the protective soaker boot. *Be careful not to flex the electrode body while removing the tape and the protective boot.*
3. Thoroughly wipe the electrode body dry and lubricate the o-ring seals with the included lubricant. *Save the protective soaker boot in the event the electrode must be stored at a future time.*
4. Carefully insert the electrode cartridge into the sensor assembly by turning until hand tight. The first o-ring, closest to the front of the electrode, will be slightly visible if held horizontally.

NOTE: IF EXCESS FORCE IS REQUIRED DURING ELECTRODE INSTALLATION, CHECK FOR PROPER THREAD ENGAGEMENT OR FOR AN OBSTRUCTION.

4.0 MAINTENANCE

4.1 Electrode Cartridge Replacement

Periodic replacement of the electrode cartridge is required for pH, ORP and Specific Ion sensors. The following procedure explains how to replace the electrode cartridge in the sensor assembly:

1. Remove the electrode cartridge from the front of the sensor assembly by turning it counterclockwise.
2. For installation procedure follow steps 2, 3, and 4 in section 3.10 electrode cartridge installation.

4.2 Electrode Cleaning

An important aspect of sensor maintenance is the service of the electrode cartridge. After being in operation, an electrode may begin to exhibit slow response or non-reproducible measurements. This may be due to coating of the measurement electrode or clogging of the reference junction. Regular electrode cleaning reduces problems associated with the coating and clogging. Frequency of cleaning will depend on the process and application. The following procedures are used to clean pH and ORP electrodes.

If possible, the electrode should be cleaned without removing it from the sensor body. However, if the electrode must be removed, the o-rings must be inspected and re-lubricated. See section 3.10.

4.2.1 pH Electrode Cartridge Cleaning

Remove the sensor from the process and carefully wash the wetted end of the electrode cartridge in a mild solution of detergent and water or with methyl alcohol. If the electrode response is not improved, soak the electrode in 0.1 Molar HCl for 5 minutes. Remove and rinse the electrode with tap water and soak in 0.1 Molar NaOH for 5 minutes.

Remove the electrode from the NaOH solution, rinse the electrode and soak in a 4 pH buffer solution for 10 minutes. This should improve the response of the electrode. If not, replace the electrode.

If the electrode must be left out of the process for an extended period of time, store it in a solution of water saturated with KCl or a 4.0 pH buffer solution. *ECD does not recommend the storage of electrodes in distilled or deionized water.*

4.2.2 ORP Electrode Cartridge Cleaning

Cleaning the platinum surface to remove coating can be done using an abrasive cleaner or chemical reagents. Abrasive cleaning is the most common method of cleaning and is usually sufficient to restore the platinum surface; however, some processes can form a hard coating requiring chemical cleaning or polishing.

Abrasive Cleaning Method:

The recommended polishing method is to use a soft material and a non-chlorinated cleanser. Bon Ami[®] cleanser and a wetted paper towel will suffice. The object is to remove any oxidation or coating from the platinum surface and expose the bare platinum. If a non-chlorinated cleanser is not available, a number 400 or finer emery paper can be used.

Chemical Cleaning Method

In more severe cases of coating any one of the three following chemical cleaning methods can be used. In using any of these methods, extreme caution should be exercised when handling the chemicals. ECD recommends the use of goggles and gloves. A fume hood is recommended for mixing the chemicals.

Method 1:

Dip the ORP electrode in a chromic acid solution at room temperature. The chromic acid solution is made by dissolving 5 grams of potassium dichromate in 500 cc of concentrated sulfuric acid.

Method 2:

Dip the ORP electrode in aqua regia at 70 degrees C for 60 seconds. Aqua regia is made by mixing 3 parts of concentrated hydrochloric acid with 1 part of concentrated nitric acid.

Method 3:

Place the ORP electrode in a nitric acid solution. The solution should be 1 part concentrated nitric acid to 1 part water. Heat the solution slowly to just below boiling point and hold the temperature for approximately 5 minutes. Allow the solution and the electrode to cool.

NOTE: IN EACH CASE ABOVE, A THOROUGH RINSING OF THE ELECTRODE WITH A STRONG DETERGENT AND WATER MUST BE PERFORMED AFTER THE CHEMICAL CLEANING.

If the electrode must be left out of the process for an extended period of time, store it in a solution of water saturated with KCl or a 4.0 pH buffer solution. *ECD does not recommend the storage of electrodes in distilled or deionized water.*

4.2.3 Specific Ion Cartridge Cleaning

Because of the variety of Specific Ion cartridges available, this manual does not discuss the cleaning methods for each electrode. Please refer to the Care and Handling Instructions shipped with your Specific Ion electrode cartridge.

4.3 Signal Conditioning Amplifier

Because the signal conditioning amplifier is sealed within the sensor, there is typically no maintenance of this component. However, in the event of water or process intrusion, the signal conditioner may become damaged, requiring replacement. In this case ECD will require the signal conditioner part number as branded on the signal conditioner housing. To remove the signal conditioner from the sensor body, follow the sensor disassembly directions section 4.5.

4.4 Temperature Compensator

Because the temperature compensation (TC) module is sealed within the sensor, there is typically no maintenance of this component. However, in the event of process intrusion, the TC module may become damaged, requiring replacement. In this case, ECD will require the full model number or serial number of the sensor to identify the correct TC for your sensor. To remove the TC module, follow the sensor disassembly directions section 4.5.

Should the removable pins between the TC module and the connector module become lost or damaged, they may be replaced with #22 solid copper wire or buss wire.

4.5 Sensor Disassembly

Refer to application drawing 4035058, an exploded view of the S10 and S17 sensors and drawing 6000002, the strain relief assembly. To disassemble the sensor and remove the connector module and TC module, follow the steps below:

1. Removal of the External Cable "T" or Safety handle
 - a. Loosen the nut on the cord grip (Turn counter clockwise) until the cable is freed.
 - b. Loosen the nut on the 75 fitting and slide the External cable "T" / Safety Handle down the sensor cable.
2. Removal of the Strain Relief / Back Cap (refer to drawing 6000002)
 - a. Unscrew the strain relief tail, slide the strain relief tail, the plastic lock ring, and the rubber ferrule up the cable.
 - b. Using a 6" crescent wrench on the rear cap (the white cap) remove the back cap.
CAUTION: Do not unscrew the body of the black strain relief fitting from the white back cap.
3. Removal of the signal conditioner. (refer to drawing 4035058)
 - a. Gently pull the sensor cable as close to the sensor housing as possible.
 - b. The signal conditioner will pull out of the sensor body with the cable.

IMPORTANT: Do not force the signal conditioner. Force could cause the sensor to sustain further damage.

4. Removal of the Temperature compensation (TC) module and the Connector module. (refer to drawing 4035058)
 - a. Unscrew the electrode cartridge until two o-rings are visible. The threads should still be engaged.
 - b. Grasp the electrode in one hand and the front of the housing in the other hand and firmly pull the electrode away from the housing. The TC and connector module will pull out the front of the housing.
 - c. Fully remove the electrode from the TC module threads.

- d. Lift the TC module away from the connector module to separate them. The pins are held in by sockets and can remain in either component.

4.6 Sensor Assembly

1. Installation of the TC module and the connector module.
 - a. Inspect that both of the TC pins are present and not damaged, plug the TC module onto the connector module. Make sure that both of the pins are making contact between the TC and the connector module.
 - b. Initiate installation of the electrode cartridge by turning it one full turn. The threads should be engaged.
 - c. Inspect the inside of the sensor housing. It should be free of dirt, oil, and water.
 - d. Slide the back of the connector module into the front of the sensor housing. Continue to push the connector module until it bottoms on the inside lip at the rear of the housing.
 - e. Thoroughly inspect (replace if necessary) and lubricate the o-ring seals with a silicone compound.
2. Installation of the signal conditioner
 - a. Slide the signal conditioner into the back of the sensor housing. The signal conditioner is keyed. By turning the signal conditioner you will feel it line up with the connector module.
3. Installation of the back cap / strain relief. Follow section 1 of the disassembly procedure in reverse order.
4. Installation of external cable "T" / safety handle. Follow section 1 of the disassembly procedure in reverse order.

4.7 E-Module Replacement

Because the E-Module is a connector module with an encapsulated signal conditioner, it is necessary to disassemble the sensor in order to replace the E-Module. The following procedure is used to remove the E-Module.

1. Disconnect the sensor wires from the instrument.
2. Remove the strain relief, sliding it completely off the cable. Refer to section 4.5. However, **do not attempt to pull the cable from the rear of the sensor.**
3. Unscrew the electrode cartridge until the first o-ring is visible.
4. Grasp the electrode cartridge in one hand and the front of the housing in the other hand.
5. Firmly pull the electrode cartridge away from the housing. The TC/E-module assembly will pull out the **front** of the housing.
6. Pull the remainder of the cable through the housing.
7. Remove the electrode cartridge. The TC module can now be separated from the E-Module.

4.8 Valve Retraction Assembly

The valve retraction assembly must be periodically inspected and serviced to provide maximum safety and optimum performance. There are two basic valve retraction assemblies: 316 stainless steel full-port ball valve and Kynar (PVDF) true-union ball valves. See procedure in section 3.5 Valve-Retract Mounting.

Service of the valve-retraction assembly includes inspection of the o-rings, high pressure stop and safety lanyards. The o-rings should be lubricated with a silicone grease whenever the sensor is removed from service, before it is reinstalled. Inspect the condition of the o-rings. If they are damaged or show signs of fatigue, replace them with the proper o-ring kit, available from ECD. Please note that in order to inspect the internal o-rings, the safety lanyard fitting must be removed so that the gland fitting can be removed from the sensor.

If the sensor is coated, making it difficult to retract through the valve, the housing should be cleaned and hand polished. After polishing, the housing can be lightly coated with a silicone grease to help keep the internal o-rings lubricated.

The high pressure stop should be inspected every time the sensor is removed from the valve assembly. If the high pressure stop shows signs of fatigue or cracking, replace the housing. Also, if the sensor shows sign of chemical attack, the sensor housing should be replaced.

When inspecting the safety lanyards, look for kinks or fraying of the lanyard. Check to see if the lanyard is properly secured in the lugs and the back fitting. Also look for corrosion of the lanyard and lugs. If an inspection reveals any of the described anomalies, replace the lanyards.

If the safety lanyard fitting must be removed for any reason, inspect the nylon ferrule and replace if damaged. When re-installing the safety lanyard fitting, tighten properly to ensure that it is anchored to the housing. The proper torque specification for retaining the safety lanyard fitting is 20 ft/lbs.

IMPORTANT

To ensure maximum operator safety, the safety lanyards must always be properly installed. Never modify or alter the safety lanyards or the safety lanyard mounting hardware.

5.0 ELECTRODE BUFFER CALIBRATION

Buffer calibrations are necessary to compensate for differences in construction and electrode potentials. When installing a new electrode, a 2-point buffer calibration is recommended. See appropriate transmitter manual for calibration procedures.

6.0 ELECTRODE CARTRIDGE TESTING

Testing of the pH and ORP electrodes can be performed with any pH instrument that can display in millivolts. The ECD model PHA351 portable analyzer/calibrator is a good diagnostic tool for testing pH and ORP electrodes.

6.1 pH Electrode Test

A new pH electrode from ECD will have an asymmetry potential of 0 mV +/- 20 mV in 7.00 pH at 25 degrees C, and a slope of 59.16 mV +/- 1.77 mV per pH unit at 25 degrees C (see note below regarding high value buffer solutions).

Materials required:

- Item 1: 3 ea. 100 ml beakers
- Item 2: pH 4.0 buffer solution (ECD P/N 2010100)
- Item 3: pH 7.0 buffer solution (ECD P/N 2010101)
- Item 4: pH 10.0 buffer solution (ECD P/N 2010103)
- Item 5: ECD model PHA351 calibrator**

Note: Refer to the PHA351 operating manual for proper operation of the PHA351.

Record the electrodes millivolt readings in Appendix A. Compare the recorded electrode data with the specifications of a new pH electrode outlined above.

If the electrode has an offset greater than 0.5 pH (30 mV), ECD recommends electrode cartridge replacement. Also, if the electrode continues to have a slow response after cleaning, replacement is recommended.

The Nernstian response determines the electrode's efficiency. An electrode that is 100% efficient has a slope of 59.16 mV per pH unit at 25 degrees C. If electrode efficiency is less than 90% (approximately 53.5 mV per pH unit), the electrode should be replaced. If the efficiency is greater than 100%, check your procedure and verify the buffer solutions are correct.

If the electrode exhibits noise while it is in the buffer solution, make sure the connectors are clean and dry, and that your hand is away from the cable and connectors. Some electrodes may exhibit noise due to the nature of the glass.

For instance, ruggedized electrodes are inherently noisy when not in a shielded environment. However, if the noise is excessive, the electrode should be replaced.

NOTE: Because ECD electrode cartridges are designed to resist reference contamination, the junction potentials are typically higher than other electrodes. This may result in buffer solutions with values greater than 9 pH indicating 0.1 to 0.15 pH low (5.9 to 8.9 mV).

6.2 ORP Electrode Test

This appendix describes how to make three ORP solutions. The first two solutions use pH buffer solutions and can be made quickly and easily for a one-time use. The third solution is a little more complex but has a longer shelf life.

Solutions # 1 and #2

Materials required:

- Item 1: 2 ea 100 ml beakers
- Item 2: pH 4.0 buffer solution (ECD p/n 2010100)
- Item 3: pH 7.0 buffer solution (ECD p/n 2010101)
- Item 4: Quinhydrone crystals (ECD p/n 2010300)
- Item 5: Stirring rod

Procedure:

1. In a 100 ml beaker, pour approximately 60-80 ml of a pH 7.00 buffer solution.
2. Stir approximately 1 teaspoon of quinhydrone into the buffer until the solution is saturated, which is evidenced by the presence of undissolved crystals.

<u>Temperature (degrees C)</u>	<u>Theoretical Potential (mV) (7.00 buffer)</u>	<u>(4.00 buffer)</u>
20	92	269
25	86	263
30	79	256

If the reading is within +/- 50 mV of the value in the table, record the value in Appendix A of this manual and proceed.

3. Pour approximately 60-80 ml of 4.00 buffer solution in the second 100 ml beaker, add quinhydrone as in step 2.
4. Subtract the reading obtained while in the 7.00 buffer from the reading obtained while in the 4.00 buffer. Theoretically, the difference should be 177 mV, but may differ slightly from this value. If the value is within 170 to 180 mV, the electrode is functional and can be put into service. However, if the values fall outside these guidelines, the electrode may require cleaning or replacement.
5. After testing properly discard the solutions.

Solution #3

Materials required:

- Reagent grade ferrous ammonium sulfate, $\text{Fe}(\text{NH}_4)_2(\text{SO}_4)_2 \cdot 6\text{H}_2\text{O}$
- Reagent grade ferric ammonium sulfate, $\text{FeNH}_4(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$
- Concentrated sulfuric acid, H_2SO_4
- DI water
- 1000-2000 ml glass beaker or flask

Procedure:

1. Dissolve 39.21 grams of the ferrous ammonium sulfate and 48.22 grams of the ferric ammonium sulfate in approximately 700 ml of DI water.
2. Slowly and carefully add 56.2 ml of the sulfuric acid to the solution. Mix thoroughly.
3. Add sufficient DI water to bring the total volume of the solution to 1000 ml. Mix thoroughly.

This ORP solution will provide a nominal standard of + 465 mV +/- 15 mV at 25°C.

Although this ferric-ferrous ammonium sulfate standard solution is more difficult to prepare than the quinhydrone standards, it provides a more stable solution. If stored in a sealed container, this solution will maintain its nominal millivolt value for approximately one (1) year.

7.0 TROUBLESHOOTING GUIDE

- **SYMPTOM** Erratic pH or mV readings.
- **SYMPTOM** Sensor output is off-scale.

POSSIBLE CAUSE

Sensor not wired properly.

POSSIBLE CAUSE

Sensor is not properly submersed in the process.

POSSIBLE CAUSE

Electrode cartridge is not fully engaged

POSSIBLE CAUSE

Cartridge reference junction is dry or plugged.

POSSIBLE CAUSE

Air bubble is trapped in the pH glass bulb.

POSSIBLE CAUSE

Instrument has been improperly calibrated. May have been calibrated with no slope (infinite gain).

SUGGESTED ACTION

Verify the sensor wiring via the appropriate wiring drawing

SUGGESTED ACTION

Verify that the sensor housing is emmersed about 3" into the process.

SUGGESTED ACTION

Check cartridge to see that it is fully engaged in the sensor body.

SUGGESTED ACTION

Clean and or replace the electrode.

SUGGESTED ACTION

Shake air bubble out of the glass bulb. Check the sensor position with respect to horizontal.

SUGGESTED ACTION

Verify instrument calibration electronically, then perform a 2 point buffer calibration. Also verify the value of the buffer solutions.

-
- **SYMPTOM** Readings with the sensor on-line and off line (in the same process) are significantly different.

POSSIBLE CAUSE

A ground loop is present.

SUGGESTED ACTION

Measure the impedance between reference and earth ground. If the ohmmeter measures less than 100 megohms, remove the path.

-
- **SYMPTOM** No span. Sensor output is 0 mV or approximately 7.00 pH.

POSSIBLE CAUSE

Broken glass electrode.

SUGGESTED ACTION

Replace the electrode cartridge.

POSSIBLE CAUSE

Temperature compensator (TC) is open.

SUGGESTED ACTION

Verify that the sensor is properly connected. Check for a damaged TC in the sensor body. Replace if damaged.

-
- **SYMPTOM** Short span or the electrode does not respond to a different or second buffer value.

POSSIBLE CAUSE

Broken glass electrode.

POSSIBLE CAUSE

Coated glass electrode.

SUGGESTED ACTION

Replace the electrode cartridge.

SUGGESTED ACTION

Clean the glass electrode surface. Refer to section 4.2.

POSSIBLE CAUSE

Contaminated connector on the electrode.

SUGGESTED ACTION

Clean the connector on the electrode cartridge and connector module. Use only isopropyl alcohol or acetone.

8.0 RECOMMENDED SPARE PARTS & ACCESSORIES

Recommended spare sensor parts will depend on the sensor configuration and the specific application. However, as a minimum, the following spare parts are recommended:

- 1 each PHA351 analyzer/calibrator
- 1 each electrode cartridge with appropriate o-rings

Select the appropriate spare parts from the following sections. If the required part is not listed, contact the factory or your local factory representative.

8.1 Connector modules and Temperature Compensation (TC)

TC module

P/N Description

2000730 TC module pH, ORP, and Specific Ion and Dissolved Oxygen **Connector Module**

P/N Description

- 2001078 pH, ORP, and Specific Ion, S10, connector module
- 2001079 pH, ORP, and Specific Ion, S17, connector module
- 2002078 pH, ORP, and Specific Ion, S17, connector module (DIAGNOSTIC)
- 2002079 pH, ORP, and Specific Ion, S17, connector module (DIAGNOSTIC)

8.2 Preamplifiers and E-Modules

Preamplifiers

P/N Description

- 2000709 Preamplifier, pH, ORP, and Specific Ion, T23/T28, 10' cable
- 2001098 Preamplifier, pH, ORP, and Specific Ion, T23 (DIAGNOSTIC), 10' cable

E-Modules

- 2000856 pH, ORP, and Specific Ion, S10-T23/T28 "E" module
- 2000857 pH, ORP, and Specific Ion, S17-T23/T28 "E" module

8.3 Sensor Housings

S10 insertion style

P/N Description

- 3300370 Housing, S10, 316 stainless steel
- 3300375 Housing, S10, titanium
- 3300376 Housing, S10, Hastelloy C
- 3500644 Housing, S10, Kynar
- 3500631 Housing, S10 Polypropylene

S17 valve retractable style

P/N Description

- 3300380 Housing, S17, 316 stainless steel
- 3300381 Housing, S17, titanium
- 3300382 Housing, S17, Hastelloy C
- 3500645 Housing, S17, Kynar
- 3500632 Housing, S17, Polypropylene

8.4 Fittings and valve assemblies

S10 sensor fittings

P/N Description

- 2000070 Gland ftg, 3/4" NPT, 316ss, nylon ferrule **(75)**
- 2000072 Gland ftg, 3/4" NPT, 316ss, TFE ferrule **(75HT)**
- 2000075 Gland ftg, 3/4" NPT, 316ss, 316ss ferrule **(75SF)**
- 3600061 Gland ftg, 3/4" NPT, all TFE **(75TFE)**
- 3600064 Gland ftg, 3/4" x 3/4", all polypropylene **(75PP)**
- 3600066 Gland ftg, 1", Teflon **(100)**
- 9360080 Ferrule, 3/4" fitting, Teflon
- 9360081 Ferrule, 3/4" fitting, Nylon

Valve o-ring kits

P/N Description

- 2000305 VSS o-ring kit, (1" x 3/4") Viton
- 2000311 VSS o-ring kit, (1" x 3/4") EPR
- 2000313 VSS o-ring kit, (1" x 3/4") CV-75
- 2000314 VSS o-ring kit, (1" x 3/4") Kalrez
- 2000315 Valve kit, VKY (includes valve seat, 2 Teflon coated o-rings, and stem seal)
- 2000344 VSS o-ring kit, (1" x 3/4") Viton 75 (Gland only)

S17 sensor fittings

P/N Description

- 2000320 Safety lanyard kit, 316ss ftg and lanyards **(SL)**
- 2001050 Cable seal, lanyard and gland fitting for VSS option

8.5 En-Garde Cartridge

pH

P/N Description

2005005. ____ High pH, high temp (130°C), RADEL body, TFE junction, sodium resistant
2005013. ____ pH, antimony, (130°C), RADEL body, TFE junction, (*special order*)
2005130. ____ pH, sulfide resistant, (90°C), RADEL body, TFE junction (*consult factory*)
2005038. ____ pH/ORP (*consult factory*)
2005060. ____ high pH, high temp (130°C), PEEK body, TFE junction, solvent resistant, ruggedized/recessed.
2005061. ____ pH, high temp (130°C), RADEL body, TFE junction, ammonium nitrate reference, ruggedized bulb
2005066. ____ pH, high temp (130°C), PEEK body, TFE junction, ammonium nitrate reference, flat surface
2005103. ____ pH, acid and fluoride resistant (90°C), PEEK body, polymer junction (*for use in ranges < 100ppm*)
2005103HF. ____ pH, acid and fluoride resistant (90°C), PEEK body, polymer junction
(*for use in ranges from 100 ppm to 50,000 ppm*)
2005145. ____ **Standard pH, (90°C), RADEL body, ceramic junction, flat surface**
2005146. ____ pH, high temp (130°C), PEEK body, flat surface, ceramic junction, polymerized reference
2005157. ____ pH, high temp (130°C), PEEK body, TFE junction, sodium resistant, ruggedized bulb
2005169. ____ Full range pH (0 to 14.5 pH), (130°C), PEEK body, polymer junction, hemi bulb
2005008HPW. ____ pH, (80 °C), RADEL body, TFE junction, ruggedized bulb, for use in DI water

ORP

P/N Description

2005167.OT ____ ORP, Platinum tip, PEEK body, polymerized KCL reference (80 °C)

Specific Ion (All ion electrodes require a 4-week lead-time).

P/N Description

2005062. ____ Bromide ion
2005043. ____ Calcium ion (Hardness)
2005008. ____ Chloride ion
2005063. ____ Fluoride ion

P/N Description

** 2005034. ____ Potassium ion
** 2005031. ____ Sodium ion
2005022. ____ Sulfide ion

**** Includes a full crown guard.**

(Unless specified otherwise, all electrodes have a double tine guard.)

En-Garde Cartridge O-Rings

P/N Description

2000326* Cartridge o-ring kit*, Viton
2000328* Cartridge o-ring kit*, EPR
2000329* Cartridge o-ring kit*, Kalrez
2000333* Cartridge o-ring kit*, VIT75

P/N Description

2000331* Cartridge o-ring kit*, CV75
2000437 En-Garde adapter and extraction tool

3200001 En-Garde cartridge wrench
Cartridge O-Ring Kits includes 2 O-Rings of the specified material, 1 O-Ring in Viton (3rd O-Ring on Cartridge), 1 Teflon Backing Ring, and 1 one ounce package of silicone O-Ring lubricant.

8.6 Calibration Solutions

P/N Description

2010100 Buffer, 4.00 pH
2010101 Buffer, 7.00 pH
2010103 Buffer, 10.00 pH
2010104 DI rinse water
P/N Description
2010170 ORP solution, 465 +/-15 mV
2010300 Quinhydrone powder, 1.5 gram
2010163 Chloride solution, 2,000 ppm
9272501 Calcium solution, 100 ppm

All solutions are supplied in 500 ml bottles:

NOTE: Contact ECD for additional specific ion solutions and concentrations.

NOTE: FOR BUFFER ONLY A LOT size of 6 bottles (6-PAK) can be purchased for \$75.00.

NOTE: Check with the factory for a current listing of spare parts. Part numbers not appearing in this manual may represent new additions or updates to the product line.

9.0 Sensor Installation and maintenance manuals

P/N Description

4100002 PHS10/17 & MVS10/17 for pH, ORP, and specific Ion sensors

4100027 DOS10/17 for Dissolved Oxygen sensors used with model T23 transmitters

4100029 CS10/17 conductivity sensors for use with the model T23 transmitter

10.0 Drawings

Drawings included in this manual

P/N Description

4032007 T21 sensor wiring

4032110 Non preamplified sensor wiring

4034026 Dimensions S17 sensor metallic housing and valve

4034035 Dimensions S10 sensor metallic housing

4034036 Dimensions S10 sensor polymer housing

4034115 Dimensions S17 sensor polymer housing and valve

4034119 Dimensions S17 sensor metallic housing polymer valve

4035058 Sensor modular components

4035080 Safety features S17-VSS

4045031 S10 with external cable seal

4045037 Sensor handrail mount

6000002 Sensor strain relief/back cap

APPENDIX A

Electrode Test Data Summary Sheet

PH Electrodes

The following equations are based on using the pH electrode test procedure described in section 6.1

Slope calculation: $(mV_{7 \text{ BUFFER}} - mV_{4 \text{ BUFFER}}) \div 3$, or
 $(mV_{10 \text{ BUFFER}} - mV_{7 \text{ BUFFER}}) \div 3$

Efficiency calculation: $(mV_{7 \text{ BUFFER}} - mV_{4 \text{ BUFFER}}) \div (3 \times 59.16)$, or
 $(mV_{10 \text{ BUFFER}} - mV_{7 \text{ BUFFER}}) \div 3$

<u>Electrode P/N</u>	<u>7 pH buffer</u> (mV)	<u>4 pH Buffer</u> (mV)	<u>10 pH buffer</u> (mV)	<u>SLOPE</u> (mV/pH)	<u>Efficiency</u> (%)
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____

ORP Electrodes

The following equations are based on using solution #1 in section 6.2

Span calibration: $mV \text{ High standard} - mV \text{ low standard}$
Efficiency Calibration $\text{Span} \div 177$

<u>Electrode P/N</u>	<u>Low Standard</u> (mV)	<u>High Standard</u> (mV)	<u>SPAN (mV)</u>	<u>Efficiency (%)</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

REVISIONS

LTR	DESCRIPTION	DATE	APR

TB1 (CHANNEL 1)
 1 - SIG1 (WHT)
 2 - REF (RED)
 3 - +V (GRN)
 4 - -V (BLK)
 5 - TC (YEL)
 6 - TC (BLU)

TB2 POWER
 1 - +24V
 2 - RTN

TB3 (CHANNEL 2)
 1 - SIG 2 (WHT)
 2 - REF (RED)
 3 - +V (GRN)
 4 - -V (BLK)
 5 - TC (YEL)
 6 - TC (BLU)

TB2
 1 - +24V
 2 - RTN

TB3
 1 - +24V
 2 - RTN

2ND 4-20mA (OPTIONAL)

3RD 4-20mA (OPTIONAL)

TB1
 WHT
 RED
 GRN
 BLK
 YEL
 BLU

TB3
 WHT
 RED
 GRN
 BLK
 YEL
 BLU

10 FT CABLE STD

SENSORS COULD BE PH, DO, ORP,
 OR ANY ION SPECIFIC SENSOR

PHS10-T23-CBL-EG

DOS10-T23-CBL-EG

.750 DIA

NOTES; UNLESS OTHERWISE SPECIFIED.

TOL $\frac{XX}{XXX} = \pm .02$
 $\frac{XXX}{XXX} = \pm .010$

SCALE

DRAWN
 PLATT

APPROVED

DATE

DATE



ELECTRO-CHEMICAL DEVICES, INC
 23665 Via Del Rio, Yorba Linda, CA 92887
 714-692-1333, FAX 714-692-1222, www.ecdl.com

APPLICATION DWG, T23,
 SENSOR WIRING

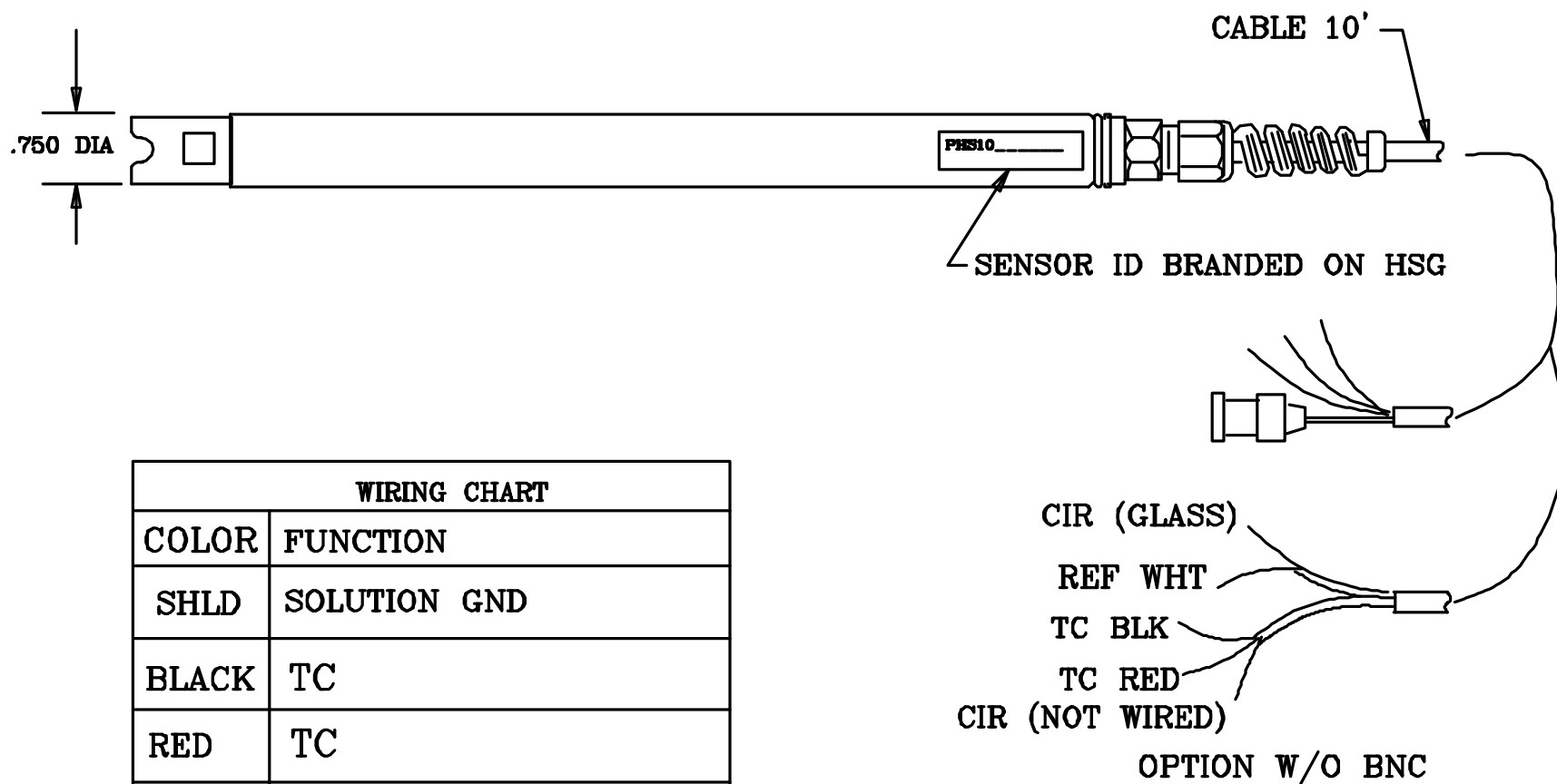
REV

SHT 1 OF 1

DWG NO

4023051

REV	DESC	APR	DATE



WIRING CHART	
COLOR	FUNCTION
SHLD	SOLUTION GND
BLACK	TC
RED	TC
BNC	GLASS (CENTER)
BNC	REF (SHLD)

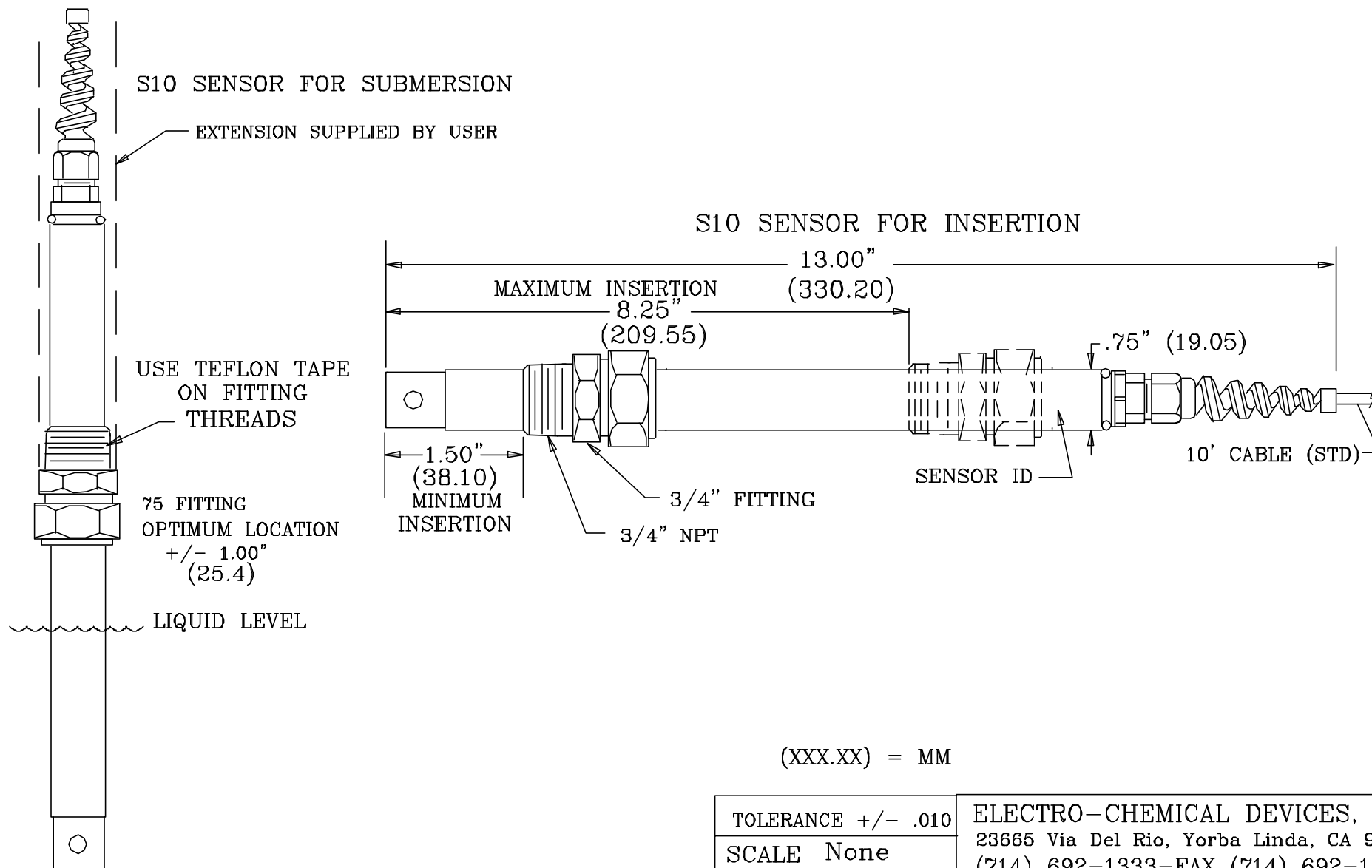


www.ecdi.com

NOTES: UNLESS OTHERWISE SPECIFIED

TOLERANCE +/- .010		ELECTRO-CHEMICAL DEVICES, INC 23665 Via Del Rio, Yorba Linda, CA 92887 (714) 692-1333-FAX (714) 692-1222	
SCALE None			
DRAWN Ch	DATE	WIRING,S10 W/GLASS,REF SOL,GND & TC	REV
CHECKED	DATE		
SHT 1 OF 1		DWG NO. 4032110	

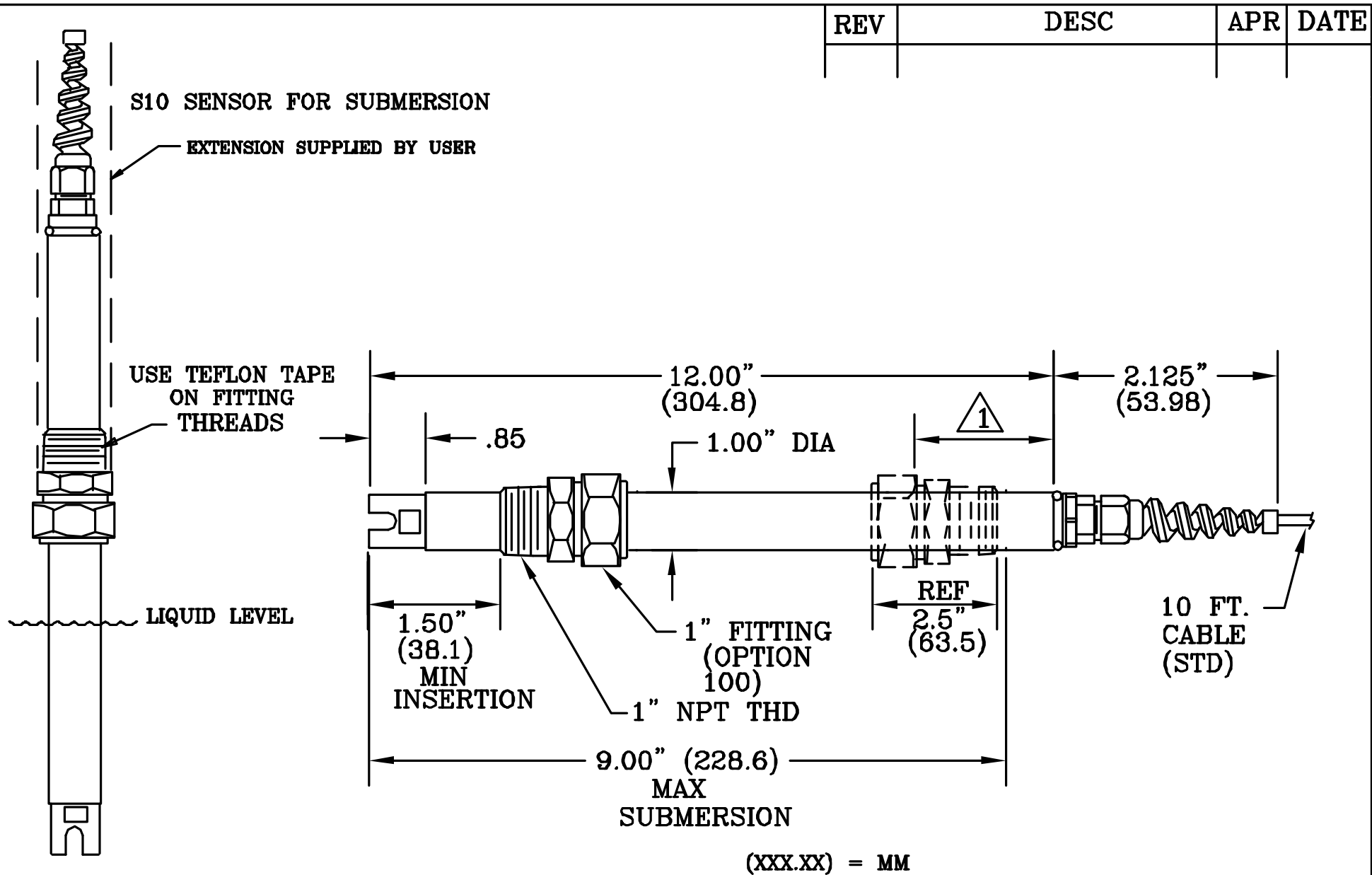
REV	DESC	APR	DATE



(XXX.XX) = MM

NOTES: UNLESS OTHERWISE SPECIFIED

TOLERANCE +/- .010		ELECTRO-CHEMICAL DEVICES, INC 23665 Via Del Rio, Yorba Linda, CA 92887 (714) 692-1333-FAX (714) 692-1222		
SCALE None				
DRAWN Ch	DATE	DIMENSIONS, S10 SENSOR INSERTION & IMMERSION		REV D
CHECKED	DATE			
SHT 1 OF 1		DWG NO. 4034035		



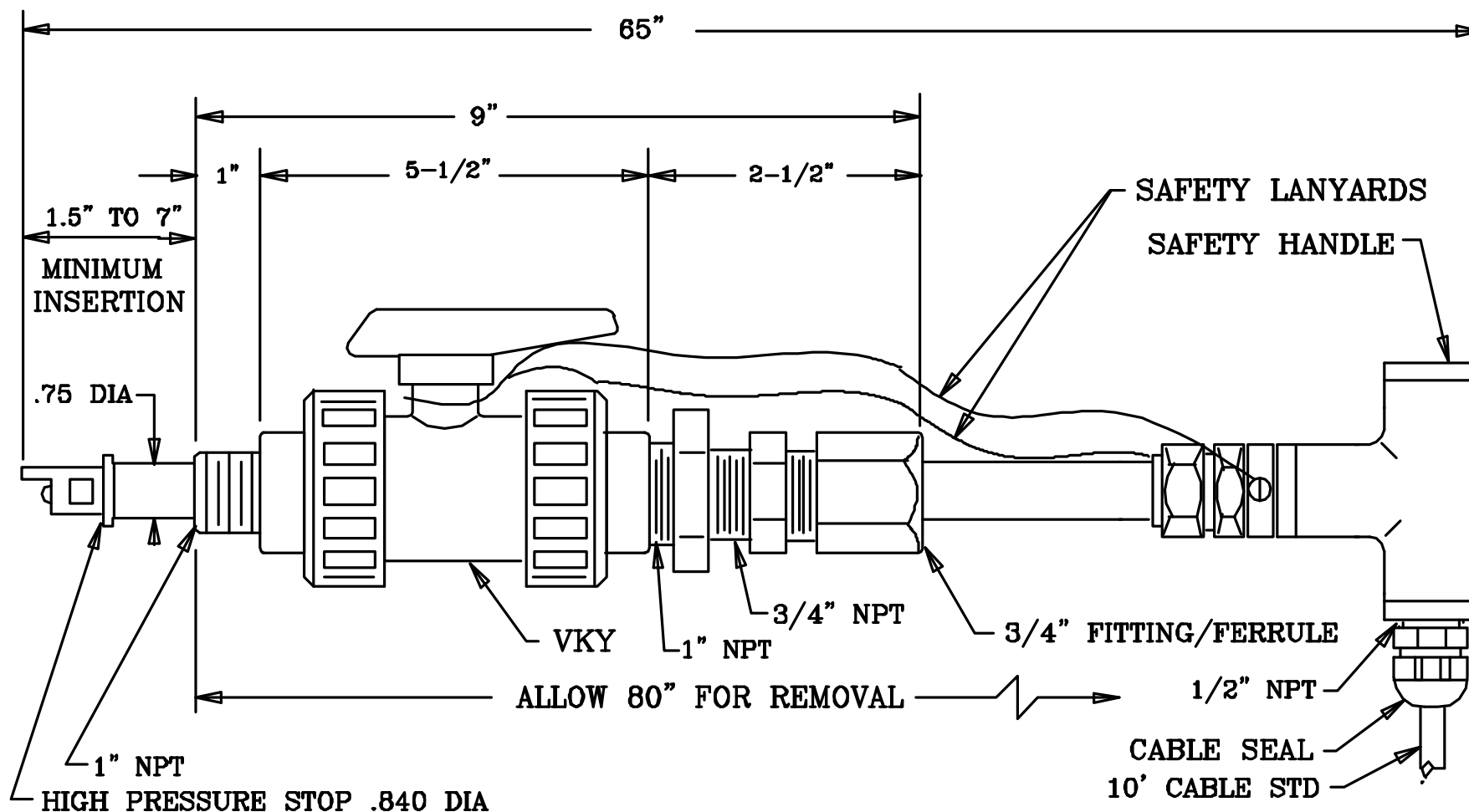
2. AVAILABLE MATL: POLYPROPYLENE
KYNAR (PVDF)

△ FOR SUBMERSION APPL, SENSOR SHOULD
EXTEND INTO STANDPIPE A MIN OF 5.0"

NOTES: UNLESS OTHERWISE SPECIFIED

TOLERANCE +/- .010		ELECTRO-CHEMICAL DEVICES, INC 23665 Via Del Rio, Yorba Linda, CA 92887 (714) 692-1333-FAX (714) 692-1222	
SCALE None			
DRAWN	DATE	INSERTION & SUBMERSION DIM'S, POLYMER S10 SNSR	REV
CHECKED	DATE		
SHT 1 OF 1		DWG NO.	4034036

REV	DESC	APR	DATE

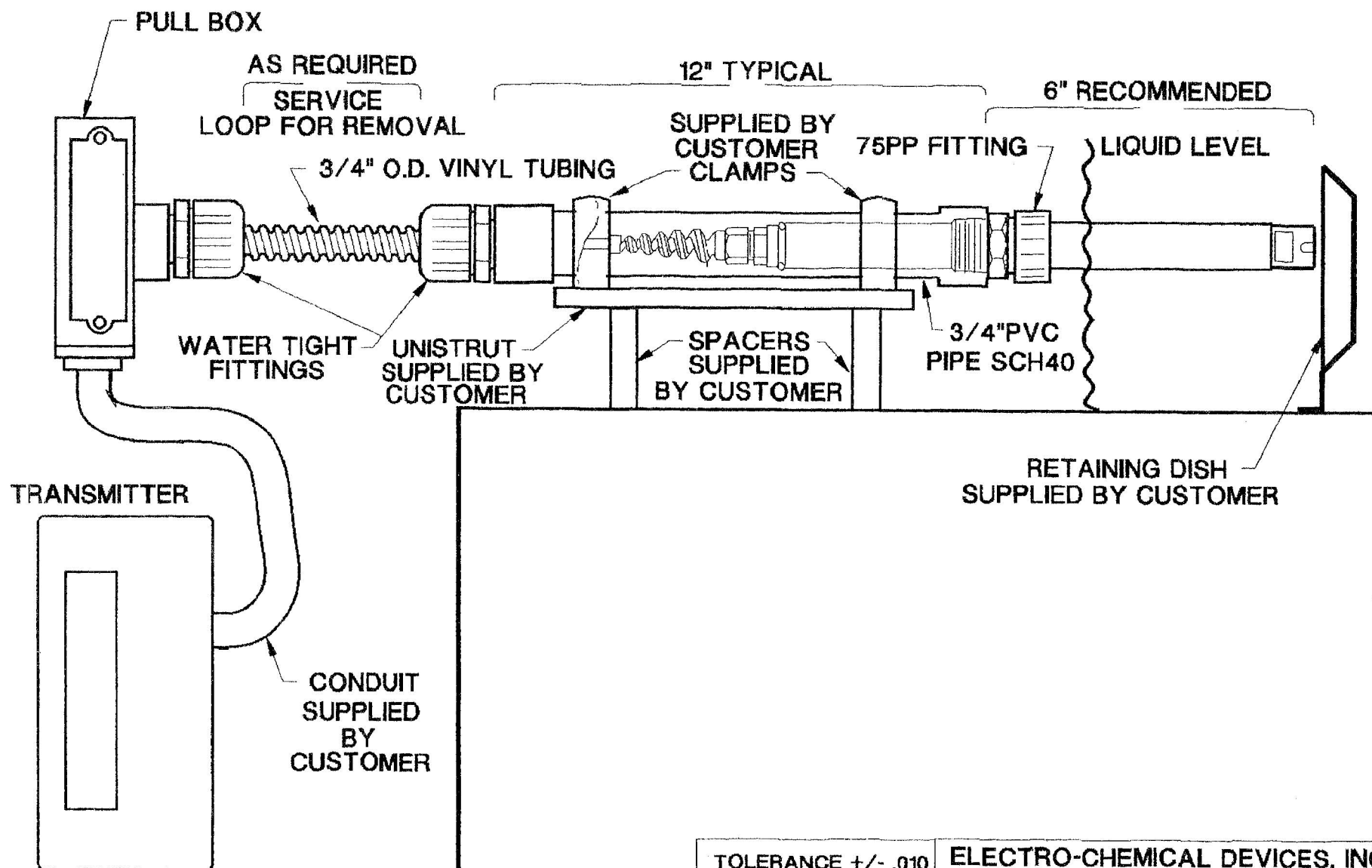


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TOLERANCE +/- .010			ELECTRO-CHEMICAL DEVICES, INC	
SCALE None			23665 Via Del Rio, Yorba Linda, CA 92687 (714) 692-1333, FAX (714) 692-1222	
DRAWN Ch	DATE	SENSOR DIMENSIONS		REV
CHECKED	DATE	PHS17X60-T23-CBL-H-EG-TFE-VKY		
		SHT 1 OF 1	DWG NO. 4034119	

NOTES: UNLESS OTHERWISE SPECIFIED

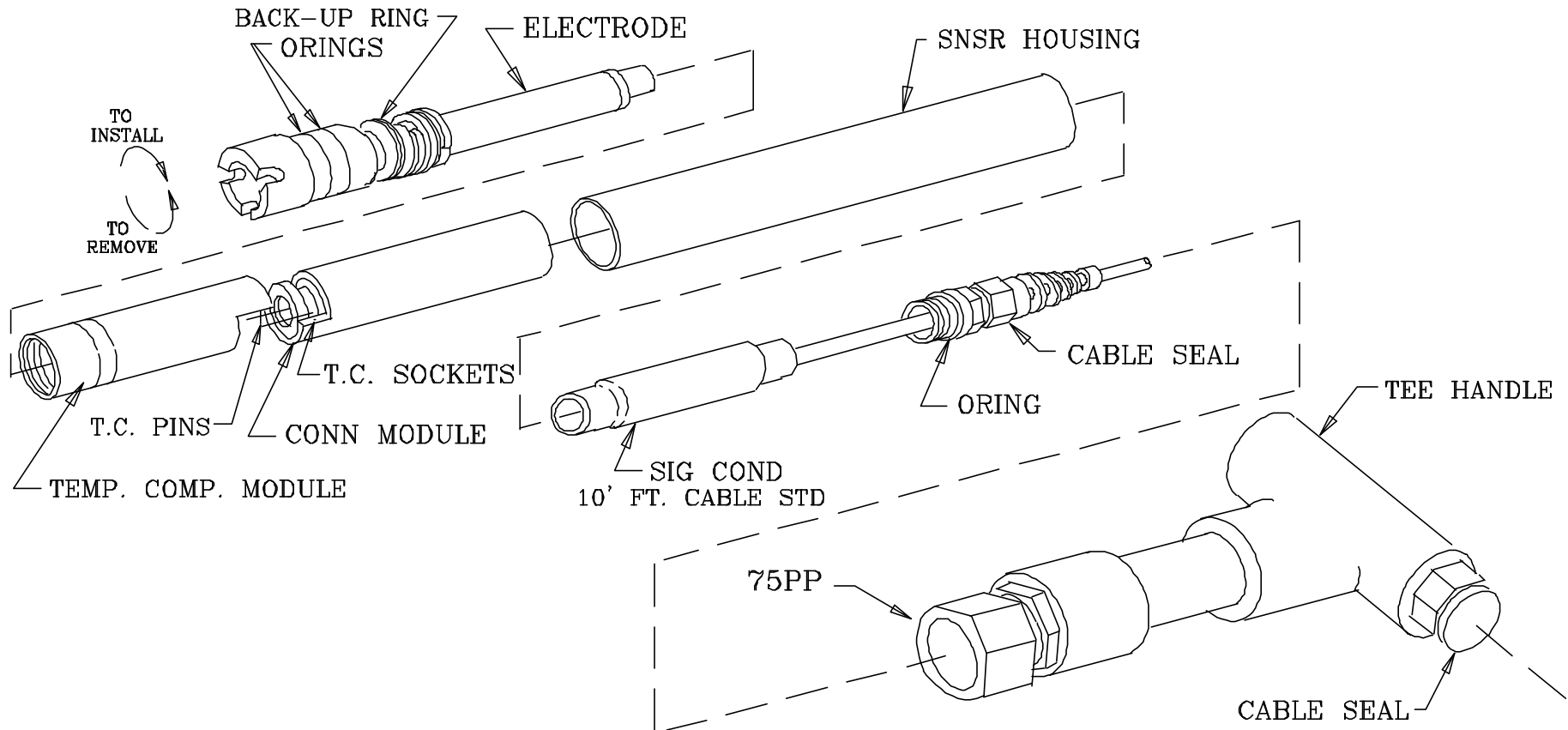
REV	DESC	APR	DATE



RECOMMEND KEEPING PROCESS FITTING
ABOVE LIQUID LEVEL
NOTES: UNLESS OTHERWISE SPECIFIED

TOLERANCE +/- .010		ELECTRO-CHEMICAL DEVICES, INC 23665 Via Del Rio, Yorba Linda, CA 92887 (714) 692-1333-FAX (714) 692-1222		
SCALE None				
DRAWN RON	DATE	SENSOR INSTALLATION SUBMERSION		REV D
CHECKED	DATE			
SHT 1 OF 1		DWG NO. 4035010		

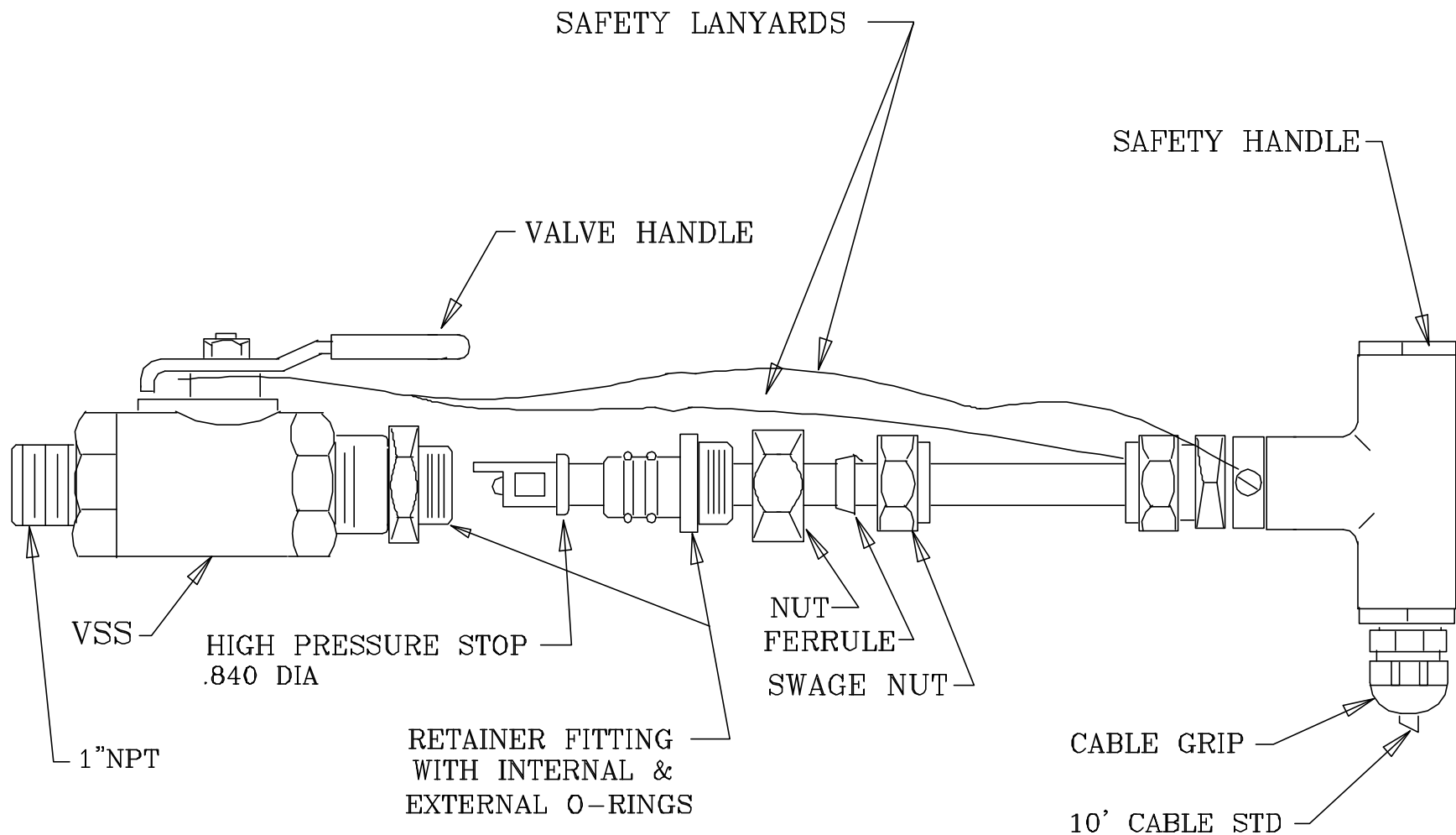
REV	DESC	APR	DATE



TOLERANCE +/- .010		ELECTRO-CHEMICAL DEVICES, INC 23665 Via Del Rio, Yorba Linda, CA 92887 (714) 692-1333-FAX (714) 692-1222		
SCALE None				
DRAWN Ch	DATE	S10 & S17 SENSOR MODULAR COMPONENTS		REV
CHECKED	DATE			
		SHT 1 OF 1	DWG NO.	4035058

NOTES: UNLESS OTHERWISE SPECIFIED

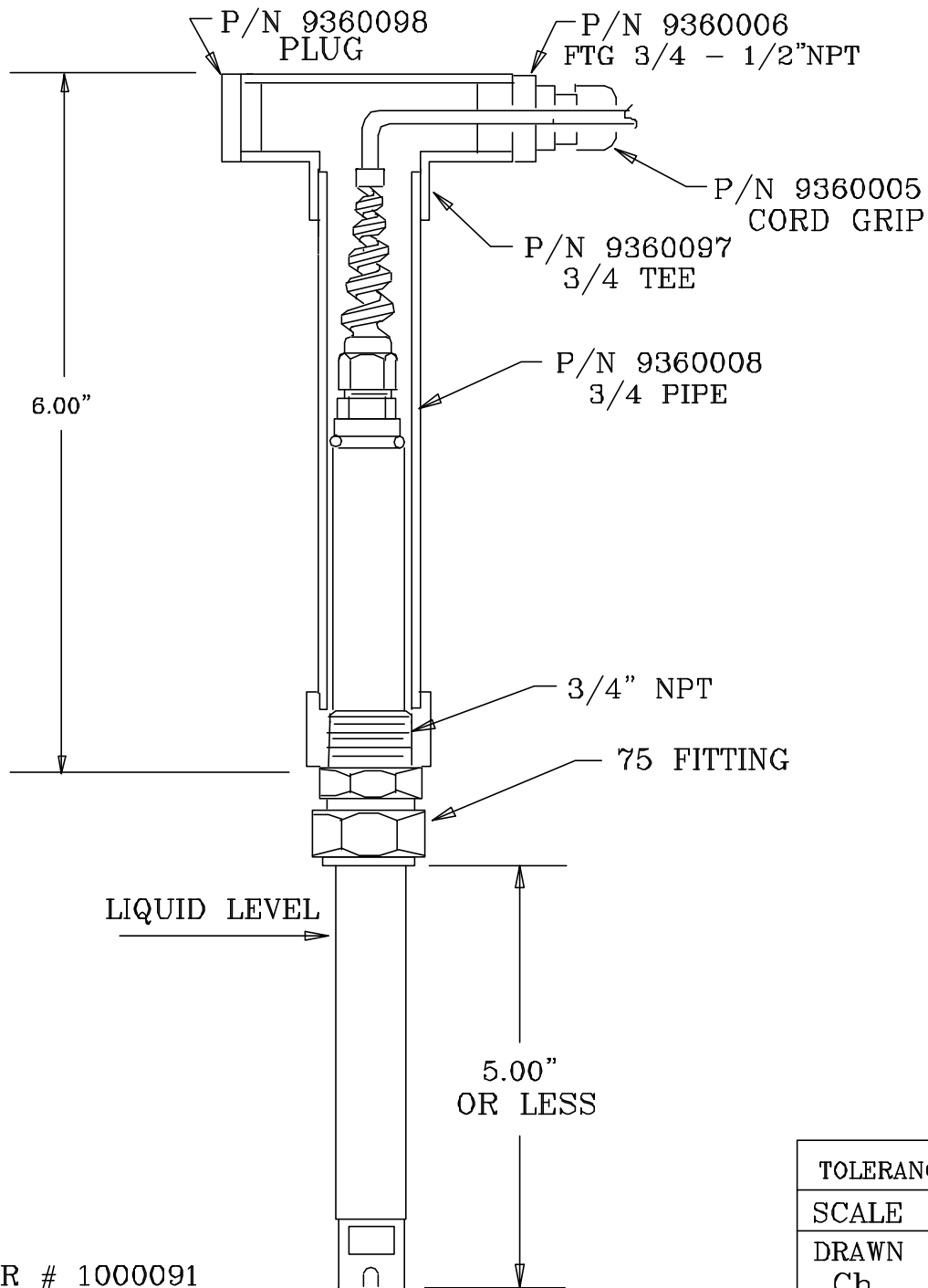
REV	DESC	APR	DATE



FOR OTHER BALL VALVE MATERIALS
CONSULT FACTORY

NOTES: UNLESS OTHERWISE SPECIFIED

TOLERANCE +/- .010		ELECTRO-CHEMICAL DEVICES, INC 23665 Via Del Rio, Yorba Linda, CA 92887 (714) 692-1333-FAX (714) 692-1222		
SCALE None				
DRAWN Ron	DATE	SAFETY FEATURES S17-VSS		REV
CHECKED	DATE			
		SHT 1 OF 1	DWG NO.	4035080



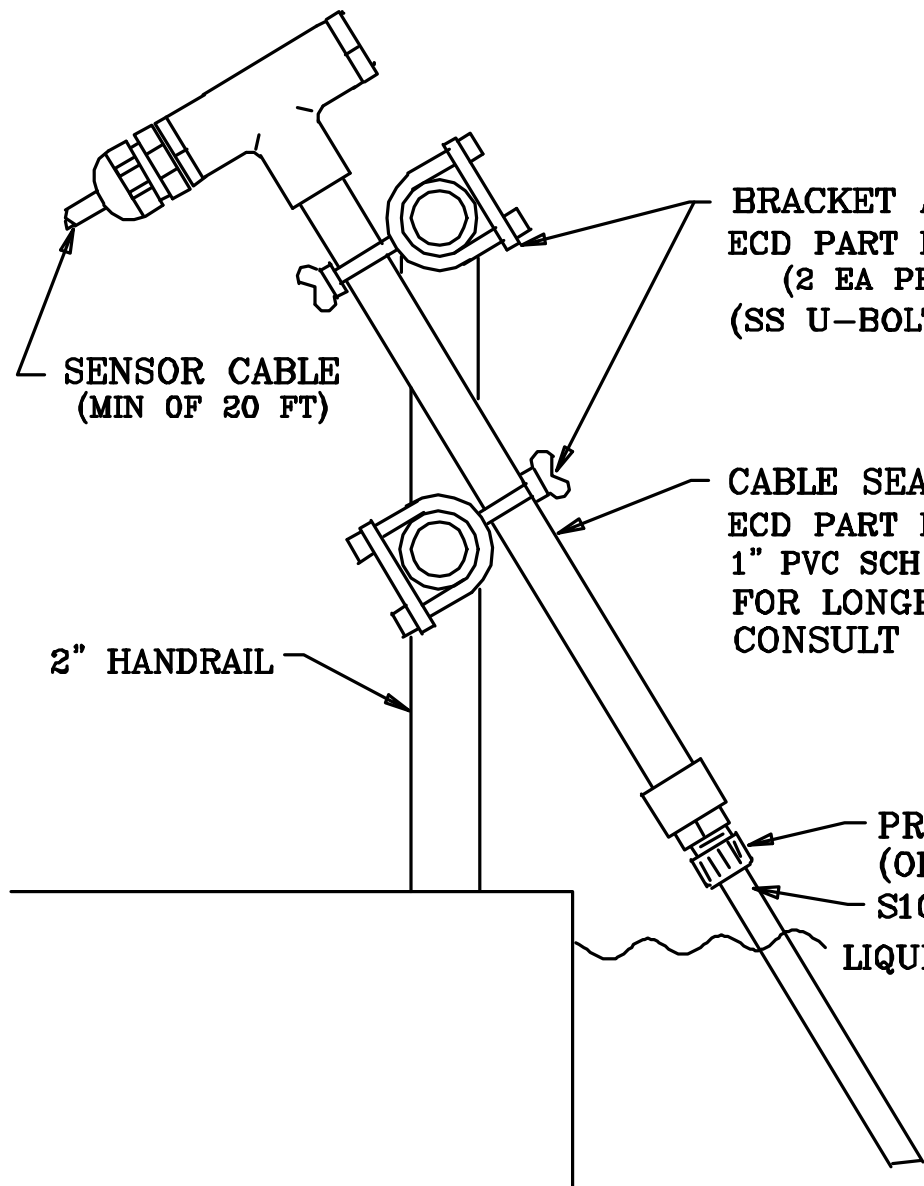
REV	DESC	APR	DATE

ORDER # 1000091

RECOMMEND KEEPING PROCESS FITTING ABOVE LIQUID LEVEL.

NOTES: UNLESS OTHERWISE SPECIFIED

TOLERANCE +/- .010		ELECTRO-CHEMICAL DEVICES, INC 23665 Via Del Rio, Yorba Linda, CA 92887 (714) 692-1333-FAX (714) 692-1222		
SCALE None				
DRAWN Ch	DATE	CABLE SEAL,S10 TYPICAL SUBMERSION		REV
CHECKED	DATE			
		SHT 1 OF 1	DWG NO.	4045031

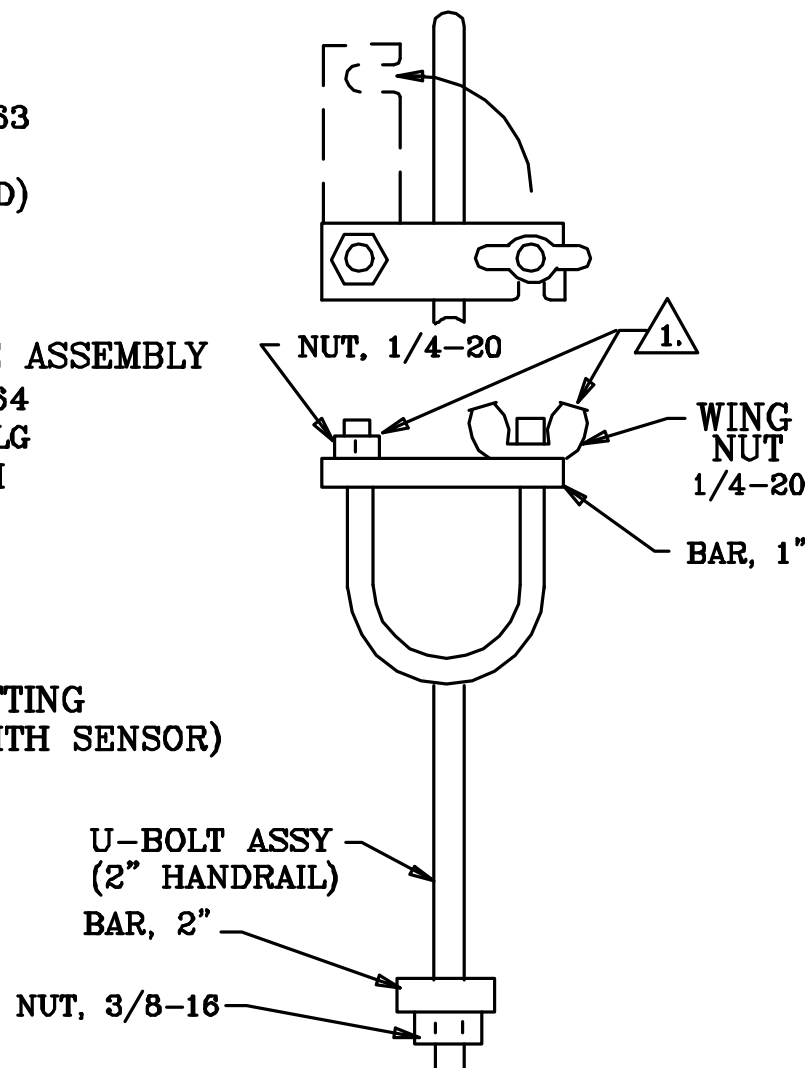


BRACKET ASSEMBLY
ECD PART NO. 2000263
(2 EA PER P/N)
(SS U-BOLTS, WELDED)

CABLE SEAL/HANDLE ASSEMBLY
ECD PART NO. 2000264
1" PVC SCH 80, 5 FT LG
FOR LONGER LENGTH
CONSULT FACTORY

PROCESS FITTING
(ORDERED WITH SENSOR)
S10 SENSOR

LIQUID LEVEL



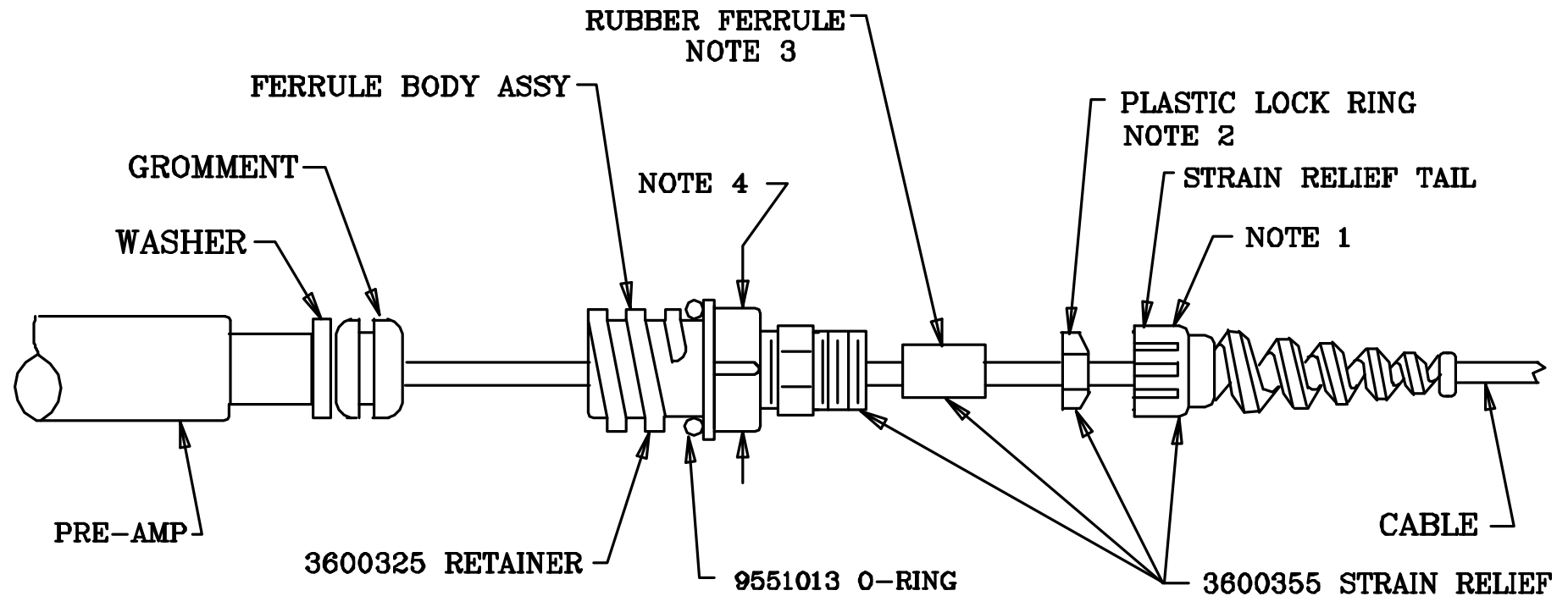
2. RECOMMEND KEEPING PROCESS FITTING
ABOVE LIQUID LEVEL.

1. HARDWARE TO SECURE SENSOR IS
CAPTIVE TO THE BRACKET ASSEMBLY

NOTES: UNLESS OTHERWISE SPECIFIED

TOLERANCE +/- .010		ELECTRO-CHEMICAL DEVICES, INC 23665 Via Del Rio, Yorba Linda, CA 92887 (714) 692-1333-FAX (714) 692-1222		
SCALE None				
DRAWN Ch	DATE	SENSOR MOUNTING 2" HANDRAIL, U-BOLTS		REV
CHECKED	DATE			
		SHT 1 OF 1	DWG NO.	4045037

REV	DESC	APR	DATE



1. Un-screw strain relief tail & slide up the cable.
2. Slide plastic lock ring up the cable.
3. Slide rubber ferrule up the cable.
4. Using 6" crescent wrench on surface designated by NOTE 4's arrows.
Un-screw ferrule body assembly.

NOTES: UNLESS OTHERWISE SPECIFIED

TOLERANCE +/- .010		ELECTRO-CHEMICAL DEVICES, INC 23665 Via Del Rio, Yorba Linda, CA 92887 (714) 692-1333-FAX (714) 692-1222		
SCALE None				
DRAWN Ch	DATE	HOW TO REMOVE STRAIN RELIEF ASSEMBLY 2000911		REV
CHECKED	DATE			
		SHT 1 OF 1	DWG NO.	6000002