

4905 Style Conductivity Cells Installation and Maintenance Manual

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Revision 9

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About This Document

Abstract

This document is intended to support the installation, operation and maintenance of the 4905 Series of Conductivity Cells.

Revision Notes

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

Rev. ID	Date	Notes
0	12/96	This document is the initial Honeywell release of the L&N manual p/n 177667 Rev. M2. There has been no significant changes only format changes to reflect the Honeywell layout.
1	6/99	Edits to add new Model Selection Guide
2	6/03	Removed obsolete info, added DL4000 details.
4	9/05	Edit text and add electrical connection drawings for UDA2182 analyzer
5	7/06	Added Platinizing information to Maintenance/ revised Parts List
6	12/07	Added CRN approval and quick disconnect option
7	June 09	Consolidation
8	Sept 11	Update wiring diagrams for Quick Disconnect cells
9	Nov 11	Mounting dimensions updated

References

Honeywell Documents

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

Document Title	ID #
APT2000CC Transmitter User Manual	70-82-25-95
APT4000CC Analyzer User Manual	70-82-25-104
UDA2182 Analyzer User Manual	70-82-25-119

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	www.honeywell.com
Honeywell Process Solutions	www.honeywellprocess.com

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1. Introduction

1.1 Overview

These cells form the sensing network for industrial analyzers and transmitters designed to make continuous measurements of electrolytic conductivity. The cells are primarily suited to measurements in effluents of ion-exchangers and distillation columns; but appropriate constants are provided for many other applications, including measurements in micro-electronic component washing, plating-rinse effluents and acid/base concentrations. Universal in mounting, any of the cells can be arranged for immersion (for applications where the temperature does not exceed 85°C), insertion (1" NPT) or flow type sampling. The latter can be achieved by use of a flow chamber, such as Honeywell part number 276127 (See Figure 3-2).

ATTENTION

Please note that specific parameters of your process may prohibit the use of nickel elements. For example, use a platinum-element cell if the cell will measure or be exposed to regeneration acids or bases.

ATTENTION

Conductivity Cells are manufactured with an embedded EEPROM that contains the cell constant and cell factor information. When the EEPROM leads (Brown and Blue), junction box head terminals (E) and (F) are connected to a UDA2182 Analyzer these parameters are automatically uploaded into the analyzer.

The cell constant is selected according to the range of the measuring instrument used and the solution measured. In general, a high-constant cell is used for solutions having low electrical resistance (high conductivity) and a low-constant cell is used for solutions having high electrical resistance (low conductivity). Automatic Temperature Compensation (ATC) during the measurement is provided by a built-in temperature sensing network located near the cross-channel or guard-tube holes.

The cells are molded from Polyethersulfone (PES) which is resistant to most corrosive chemicals over a wide range of temperatures. (A common exception is chlorinated hydrocarbons.) Sample solutions come into contact only with the above plastic and the platinum, nickel or Monel electrode surface. Monel is available only on the 0.1 constant cell.

2. Specifications

2.1 Specifications for 04905 Series

Parameter	Description
Cell Constant	04905 Series: 0.01, 0.1, 1.0, 10 and 50 as specified
Electrode Material	Nickel, Platinum or Monel as specified
Maximum Pressure Limit	1724 kPa @ 140°C (250 psig @ 284°F)
Maximum Continuous Temperature Limit	140°C (284°F) For immersion applications: 85°C (185°F)
Materials of Construction	Cell Body: PES (polyethersulfone) Support Fittings: Ryton Electrodes: Nickel, Platinum or Monel as specified Quick Disconnect Receptacle: 316 Stainless Steel
Cable Options	Leadwire: PVC insulated 22 gage cable, 0.245" OD, 20 and 50 feet lengths available. Quick Disconnect Option <i>Mating cables must be purchased from Honeywell</i> Universal Head (Aluminum)
Weight	Approximately 1 lb (0.45 kg) If using universal head: 3 lb (1.35 kg)
Approvals	Manufactured to comply with ASME boiler and pressure vessel code Section III, Div.1, UG-101 CRN #0F11607.5C
Insertion	1" NPT male, Schedule 40
Flow Chamber	Inlet: 3/4" MNPT Outlet: 3/4" FNPT
Insertion Depth	5" to 7" (127 to 178 mm) depending on cell constant
Overall Length	Approximately 6 to 8" (152 to 203 mm) If using universal head: 10 to 12-1/4" (254 to 311 mm)

2.2 Specifications for 276127 Flow Chamber

Parameter	Description
Maximum Flow	2 gpm @ 40psig and atmospheric discharge
Maximum Pressure	200 psig @ 25°C
Maximum Temperature	140°C (284°F) at atmospheric pressure
Dimensions	1-1/2" (3.8 cm) octagon x 8-3/4" (22.2 cm) long. Sample Inlet: 3/4" MNPT Sample Outlet: 3/4" FNPT Cell Inlet: 1" MNPT
Materials of Construction	Polyethersulfone (PES)

3. Installation

3.1 Overview

The conductivity cell is secured permanently to the 1" N.P.T. bushing which is used for all types of mountings. Although the physical appearance of the various cells is the same (except for length), the cell construction differs according to the constant. On the 10 and 50 constant cells, the electrodes are short tubes located midway inside the two parallel tubular channels that run lengthwise through the cell, and are open to the sample at both ends of the cell. The channels are elliptical on the 10 constant cell. The 1, 0.1, and 0.01 constant cells have a removable cell guard which is screwed onto the cell body to protect the electrode surfaces. Electrodes are three disks on the 1 constant cell, parallel plates on the 0.1 constant cell, and wire wound on the cell body on the 0.01 constant cell. Cells must be used with the guard in place or the cell constant may differ from that specified.

Most of the auxiliary parts which enable the user to achieve the various types of mounting are readily obtained from local suppliers. For an immersion mounting (only applicable in applications where the temperature does not exceed 85°C) with 04905 Series cells, only the appropriate length of 1/2 inch pipe (e.g., CPVC) and a 1/2 inch end coupling is needed. For an in-line flow mounting, only a 1" schedule 40 tee is required. The basic cell can be converted to a flow cell for either bypass or in-line arrangements by use of the PES flow-cell housing (Honeywell Part 276127) shown in Figure 3-2. However, the temperature and pressure specifications listed for this flow chamber under Specifications apply.

3.2 Types of Mounting

There are three types of mounting: Flow, Immersion (for use in applications where temperatures do not exceed 85°C) and Insertion. Mounting dimensions for each type of cell assembly are given in Figure 3-4 and Figure 3-5.

3.3 The Differences between the Quick Disconnect and Integral Cable Option

The cable options of quick disconnect and integral cable do not affect the performance of the cell. These options only relate to how the cell is connected to the instrument.

ATTENTION

• There are different electrical connections for these options. Please refer to Section 4 for instructions.

NOTE: The wire colors for the integral cable and quick disconnect option are not the same. Do not use shielded cable except where shown in the following figures.

- Integral cable means the cable is potted into the cell. The cable and cell are one entity and cannot be separated.
- The quick disconnect option means the cell is connected to the cell by a receptacle on the top of the cell. The cell and the cable are separate entities. When the time comes to replace the cell, the cable does not have to be replaced. The cable can simply be mated with another cell that has the quick disconnect option. This option **cannot** be used in immersion applications. *The cable must be purchased from Honeywell.*

3.4 Flow-Type Mounting

The cross-channel or guard-tube hole in the cell must always be covered by the solution and the solution level must be 1-1/2 inches above these holes. When mounting the cell in a pipe tee such as shown in Figure 3-1, have the solution enter the tee from below and exit to the side. As shown, the guard-tube hole is in line with the horizontal pipe run. However, if it is possible that the pipe line will not be full at all times, locate the hole just below the exit pipe to insure flooding of the cell under all conditions. As shown in Figure 3-1, always locate the cell on the pressure side, not the vacuum side of the pump. The flow-cell-housing, an accessory part having 3/4" male inlet and female outlet threads, can be used for an in-line measurement or in a bypass line as shown in Figure 3-1, depending upon the flow volume or pipe size. Adapter bushings are available to convert inlet and outlet fittings to 1/4" female threads. See Section 0 . The cell must be covered by the solution at all times. Therefore, make certain the lowest solution head is higher than the cell location. See that an air bubble does not prevent the cell from filling properly.

Flow-cell housing can be used "in-line" only if a maximum flow of 2 gallons per minute can be tolerated. To avoid cracking the 276127 flow-cell housing, use Teflon tape on cell threads and tighten cell only enough to prevent leakage.

To install, tighten the cell into a 1" schedule 40 pipe tee. If the flow-cell housing is used, assemble the cell and housing and install it in the process flow line or in a bypass line.

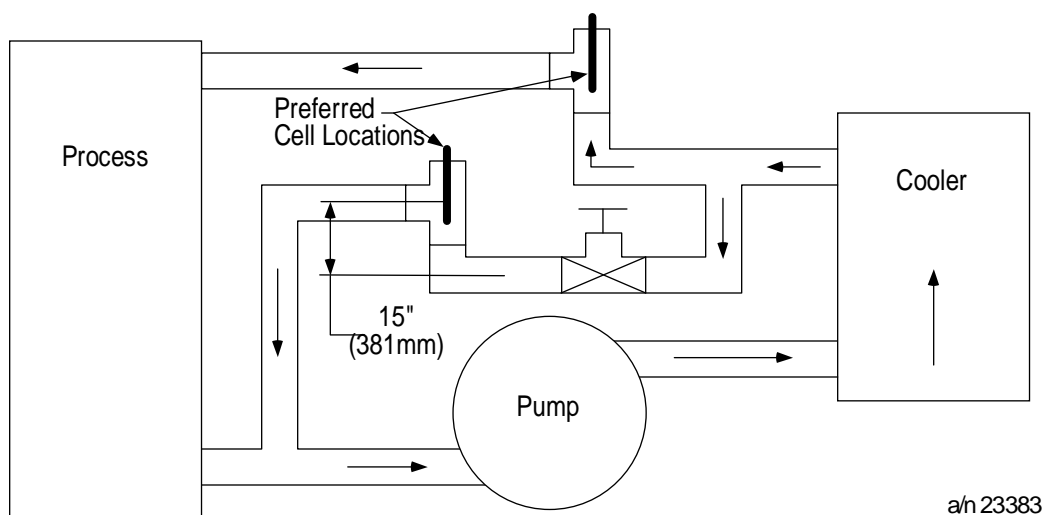


Figure 3-1 Typical Conductivity Measuring Installation

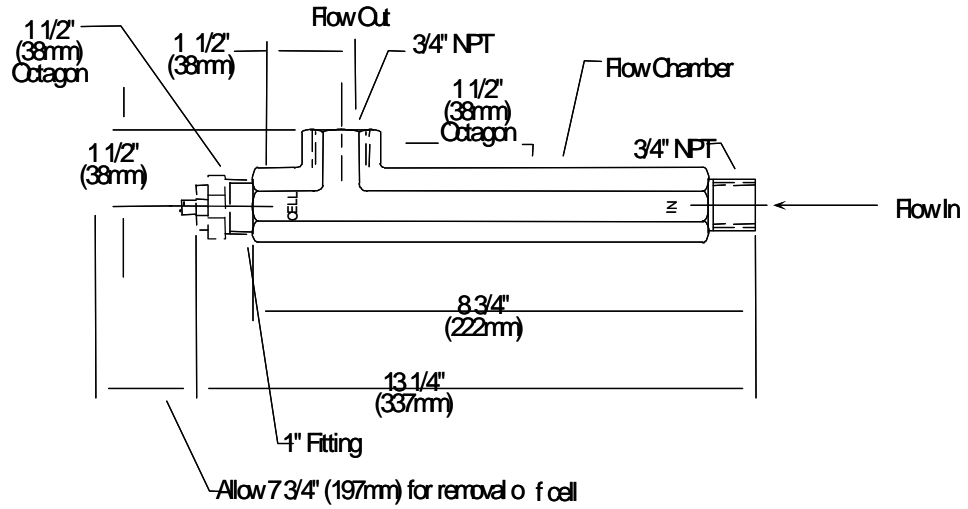
3.5 Immersion-Type Mounting for 04905 Series Cells

For use in applications where temperature does not exceed 85°C. The cell must be immersed to a level above the cross-channel or guard tube hole and must be immersed to 1-1/2 inches above this hole if an integral compensator is used. For most immersion applications, a 1/2" support pipe, preferably CPCV must be threaded into the cell bushing, using Teflon tape to seal the threads, thus permitting adequate immersion. Unless this pipe extension is used, do not immerse the top of the bushing. To insure that a representative sample is measured at all times, the solution must circulate through the channels. In quiescent solutions, provide sufficient agitation.

To install the cell, determine the length of 1/2" pipe required to give the immersion needed to keep the cell completely immersed at all times. Remove the cap bushing at the top of the cell, slide it off the cable, and replace it with a 1/2"-inch coupling and the 1/2-inch pipe. At the top of the pipe install another pipe coupling and the cap bushing back over the leadwire, or install a junction box to terminate the pipe.

3.6 Insertion-Type Mounting

The cell can be inserted into a 1" N.P.T. threaded opening, but it is imperative that the tank or chamber be full under all process conditions. Make certain the liquid head is above the cell location. A vertical insertion (from above) or a horizontal insertion can be used. To install, simply tighten the cell into a 1" N.P.T. threaded opening (using a Teflon thread compound such as Teflon tape) so that the entire electrode is immersed in the measured solution. Allow at least 1/2-inch clearance beyond the end of the cell. In applications where vertical mounting is required, avoid a position with the cell channels pointed up, as this will permit solution to flow down into the open end of the cell and may result in clogging by solids settling in the cell channels. See Figure 3-1.



Notes

1. Mount cell and flow chamber horizontally as shown above with flow exit "up" to eliminate possible air gap around cell body.
2. If cell and flow chamber must be mounted vertically, attach a short length of tubing to flow exit as shown below and form a trap to ensure filling of flow chamber, especially at low flow.

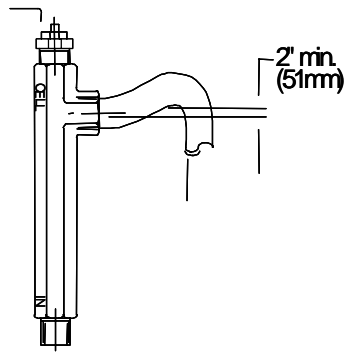


Figure 3-2 Dimension Drawing for 276127 Flow Housing

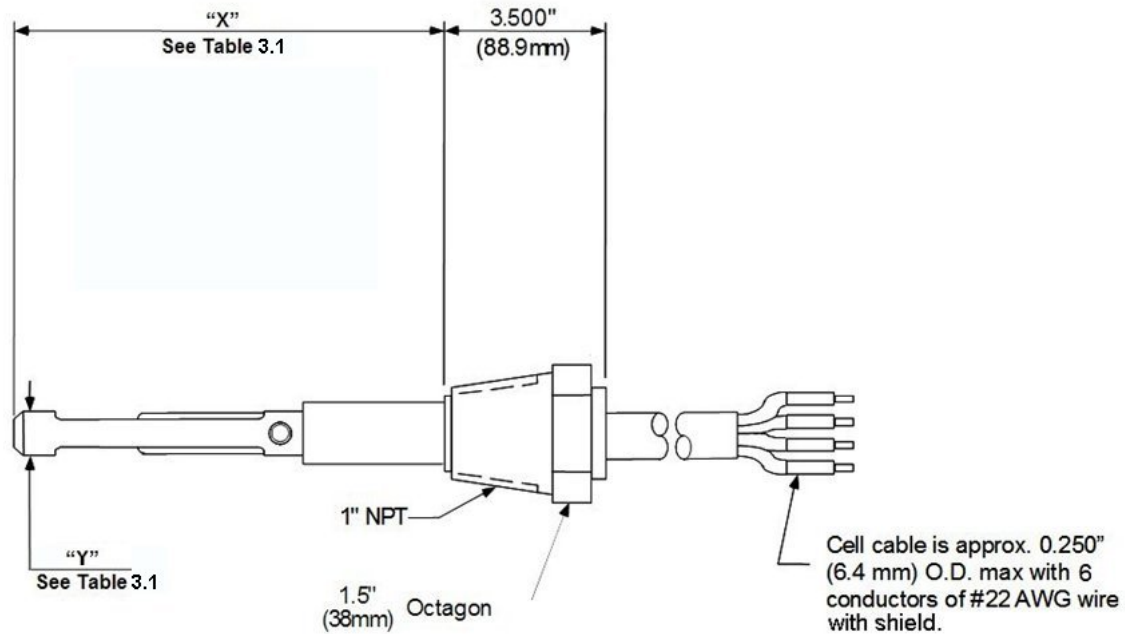


Figure 3-3 Mounting Dimensions for 04905 Series with Integral cable

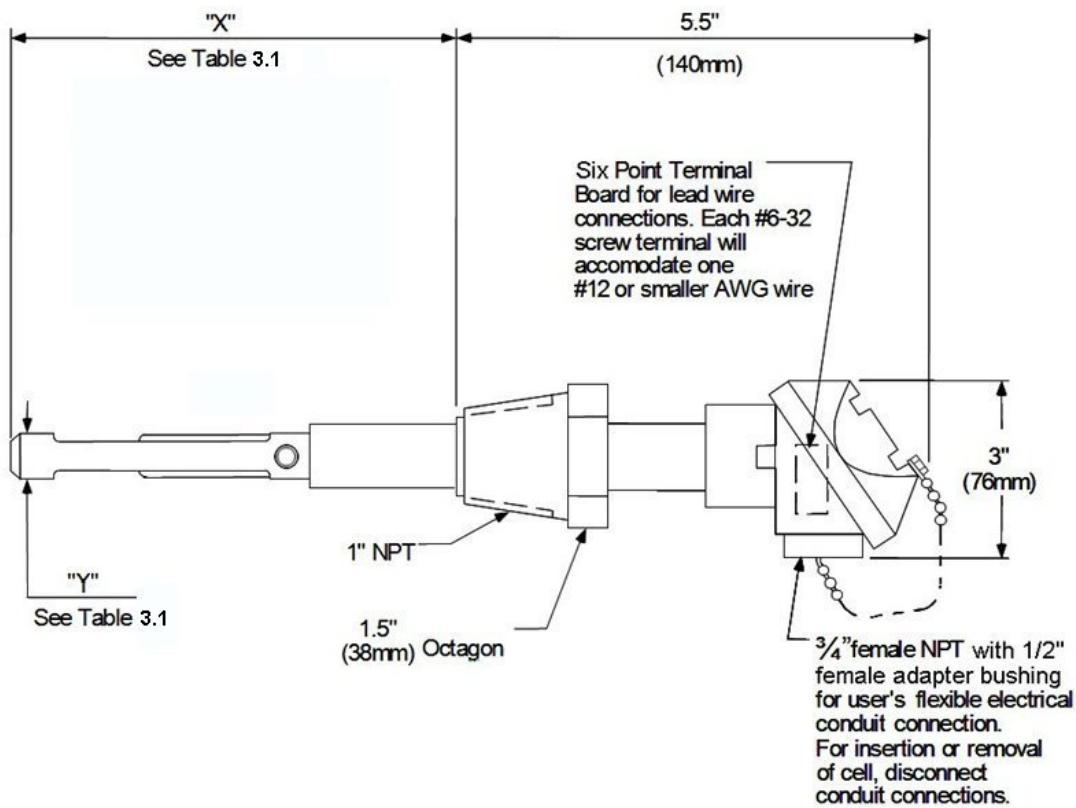


Figure 3-4 Mounting Dimensions for 04905 Series with Junction Box Head

**Table 3-1 Dimensions table for 04905 Series with Integral cable and Junction box head
(All dimensions approximate)**

Cell Constant	"X" inches	mm	"Y" inches	mm
001	5.8"	147	0.94"	23.9
01	5.8"	147	0.94"	23.9
1	5.8"	147	0.94"	23.9
10	6.0"	152	0.84"	21.3
50	7.3"	185	0.84"	21.3

**Table 3-2 Dimensions table for 04905 with Quick Disconnect option
(All dimensions approximate)**

Cell Constant	"X" inches	mm	"Y" inches	mm	"Z" inches	mm
001	5.8"	147	8.7"	221	0.84"	21.3
01	5.8"	147	8.7"	221	0.84"	21.3
0	5.8"	147	8.7"	221	0.84"	21.3
10	6.0"	152	9.1"	231.1	0.94"	23.9
50	7.3"	185	10.2"	259.1	0.94"	23.9

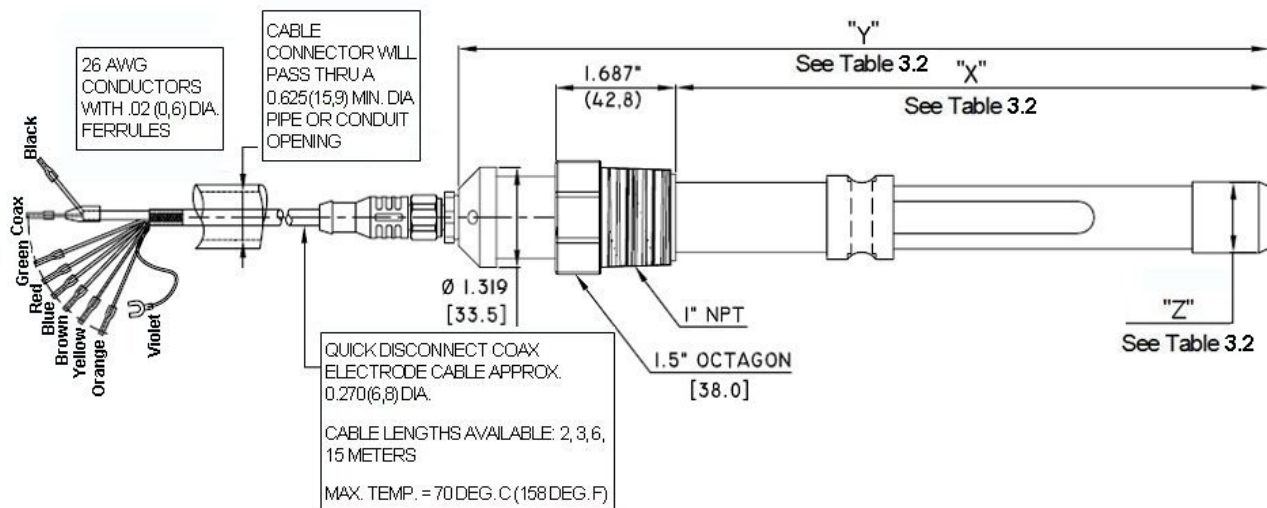


Figure 3-5 Mounting Dimensions for 04905 Series with Quick Disconnect Option

4. Electrical Connections

4.1 Overview

The terminal board connections for the various Honeywell measuring instruments are given in the appropriate Figures in this section.

To avoid the possibility of AC pickup in the cell leads, separate them from all AC line-voltage wiring or run them in a separate grounded conduit.

ATTENTION

Do not use shielded cable except where shown in the following figures.

**WARNING**

EEPROM memory device is ESD sensitive- blue and brown leads; junction box head terminals (E) and (F)

4.2 Instrument Wiring for 4905 Cells with Integral Cable or Junction Box Head

4.2.1 Model 4905 Series with Integral Cable or Junction Box Head to UDA2182 Analyzer

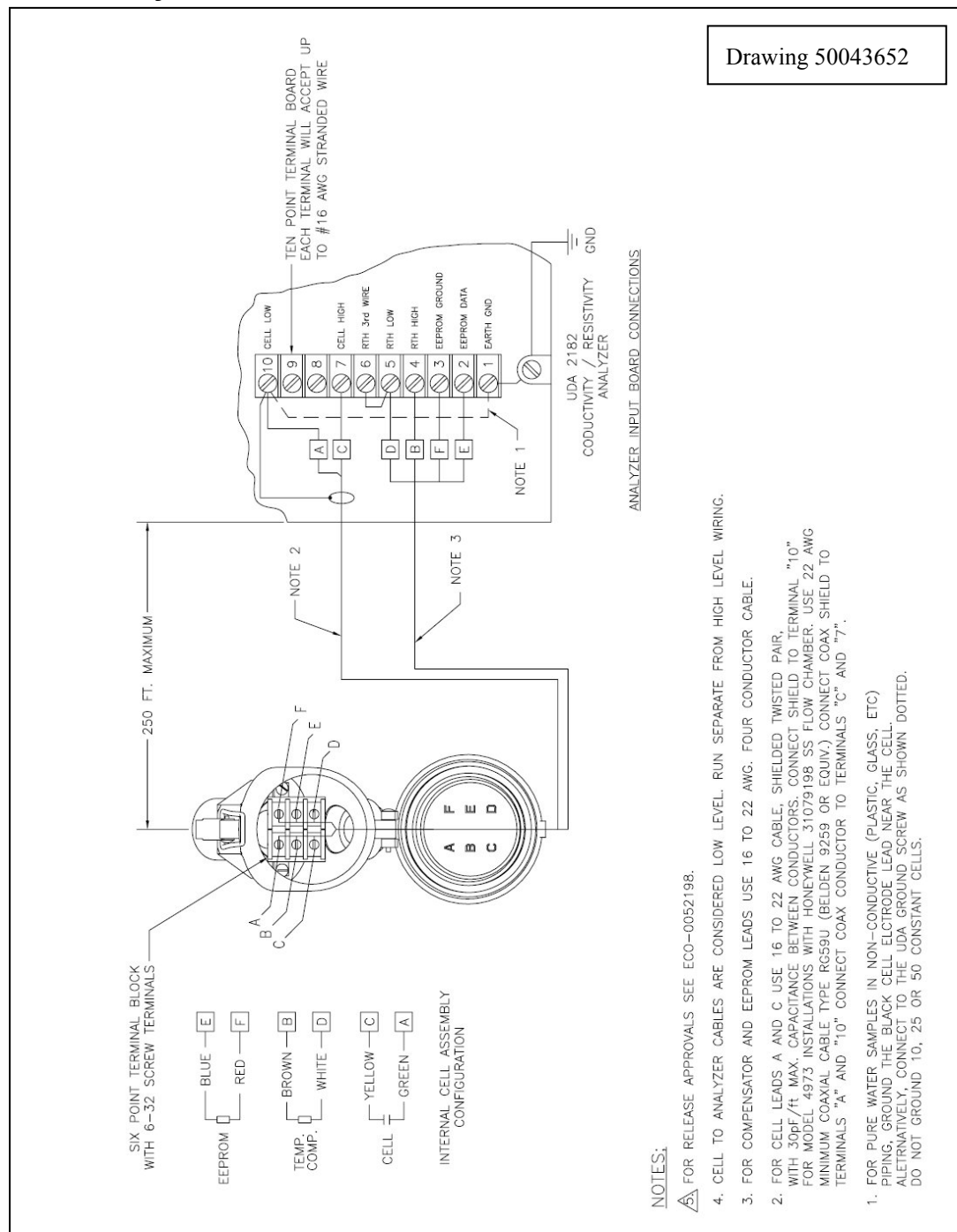


Figure 4-1 Installation Diagram, 4905 Cells, with Junction Box head connected to UDA2182 Analyzer

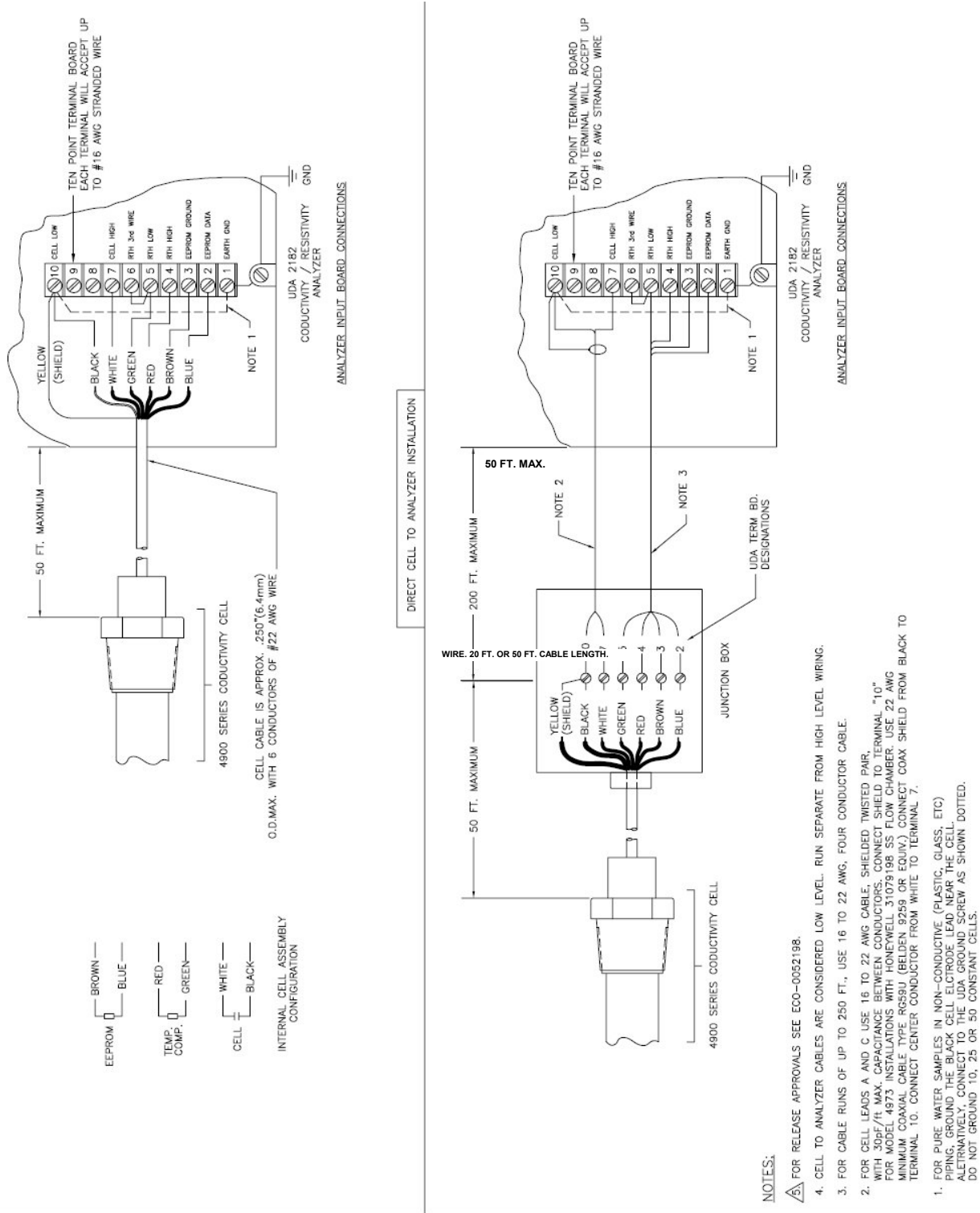
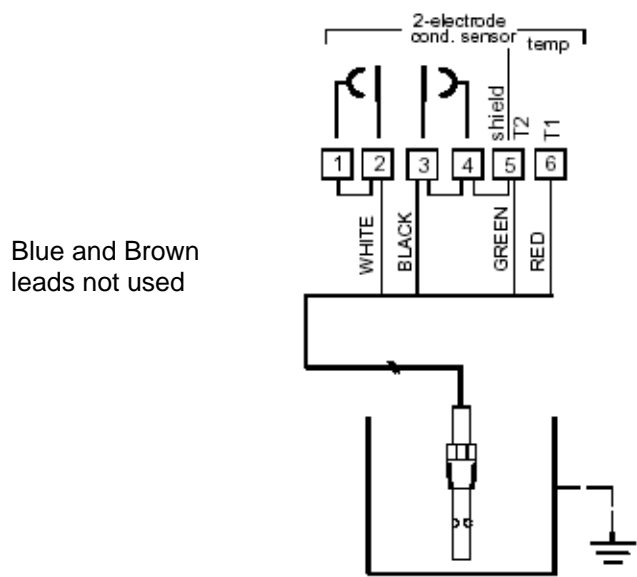
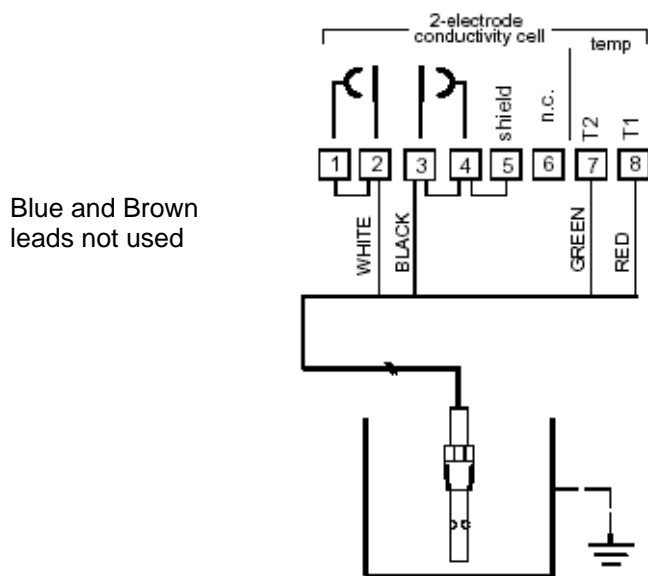


Figure 4-2 Installation Diagram, 4905 Cells, with 20' or 50' leads directly connected to UDA2182 Analyzer or connected to Junction Box

4.2.2 Model 4905 Series with Integral Cable to APT Series Analyzer/Transmitter



04905 series cells with leads connected to an APT4000



04905 series cells with leads connected to an APT2000

Figure 4-3 Model 4905 Series to APT Series Analyzer/Transmitter

4.2.3 Wiring Model 4905 with Quick Disconnect Cable to UDA2182

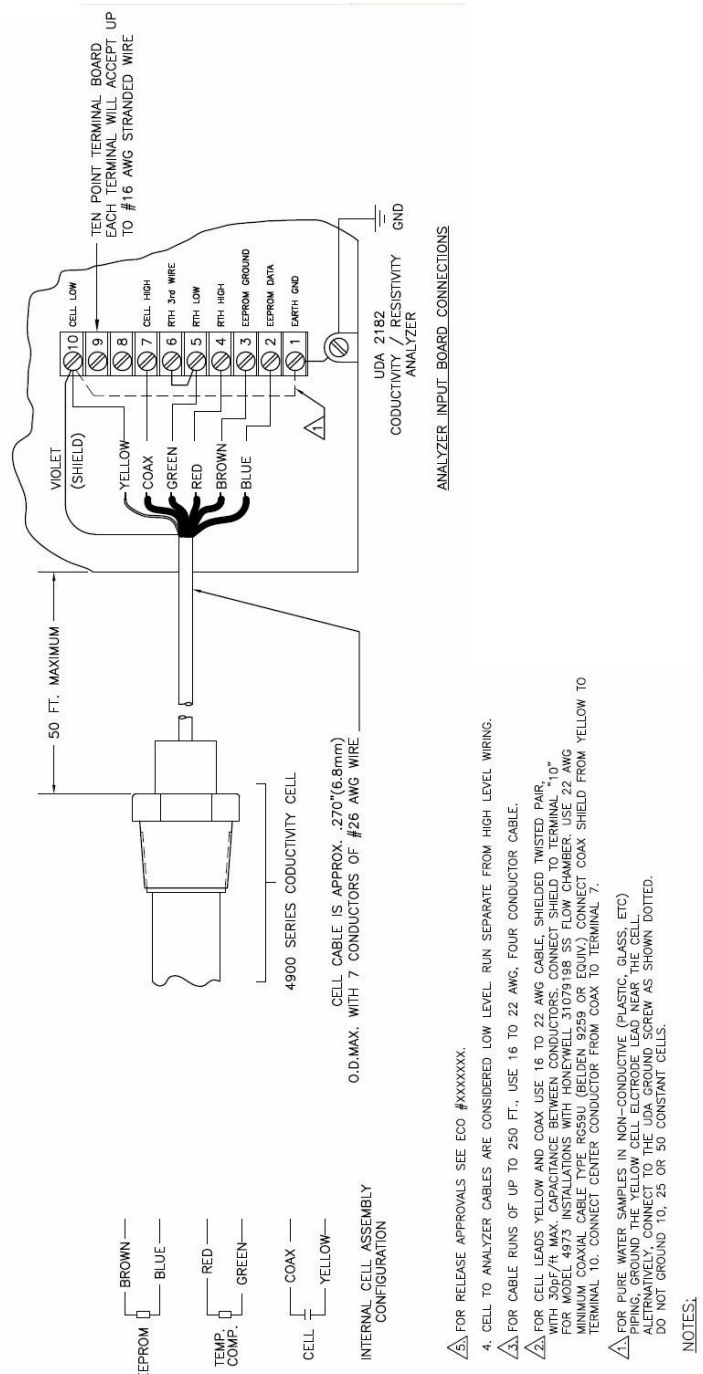


Figure 4-4 Wiring Diagram for 4905 Cells with Quick Disconnect Cable Connected to UDA2182 Analyzer

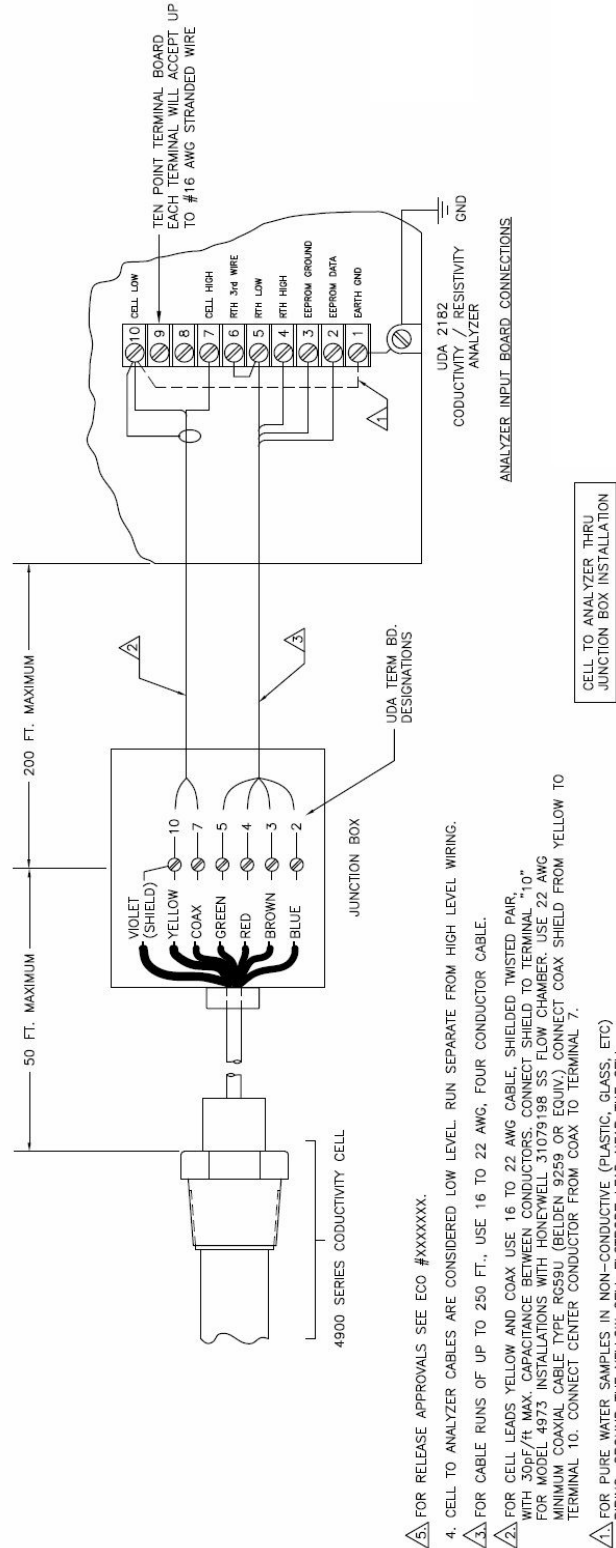


Figure 4-5 Installation diagram for 4905 cells with Quick Disconnect Cable connected to junction box

- 5. FOR RELEASE APPROVALS SEE ECO #XXXXXX.
 - 4. CELL TO ANALYZER CABLES ARE CONSIDERED LOW LEVEL RUN SEPARATE FROM HIGH LEVEL WIRING.
 - 3. FOR CABLE RUNS OF UP TO 250 FT., USE 16 TO 22 AWG, FOUR CONDUCTOR CABLE.
 - 2. FOR CELL LEADS YELLOW AND COAX USE 16 TO 22 AWG CABLE, SHIELDED TWISTED PAIR, WITH 308F/ft. MAX. CAPACITANCE BETWEEN CONDUCTORS. CONNECT SHIELD TO TERMINAL "10". FOR MODEL 4973 INSTALLATIONS WITH HONEYWELL 31079 98 SS FLOW CHAMBER. USE 22 AWG MINIMUM COAXIAL CABLE TYPE RG58U (BELDEN 9259 OR EQUIV.) CONNECT COAX SHIELD FROM YELLOW TO TERMINAL "10". CONNECT CENTER CONDUCTOR FROM COAX TO TERMINAL 7.
 - 1. FOR PURE WATER SAMPLES IN NON-CONDUCTIVE (PLASTIC, GLASS, ETC) PIPING, GROUND THE YELLOW CELL ELECTRODE LEAD NEAR THE CELL. ELECTRODE LEAD, CONNECT TO THE GROUNDING CREW AS SHOWN DOTTED. DO NOT GROUND 10, 25 OR 50 CONSTANT CELLS.
- NOTES:

4.2.4 Wiring Model 4905 with Quick Disconnect Cable to APT

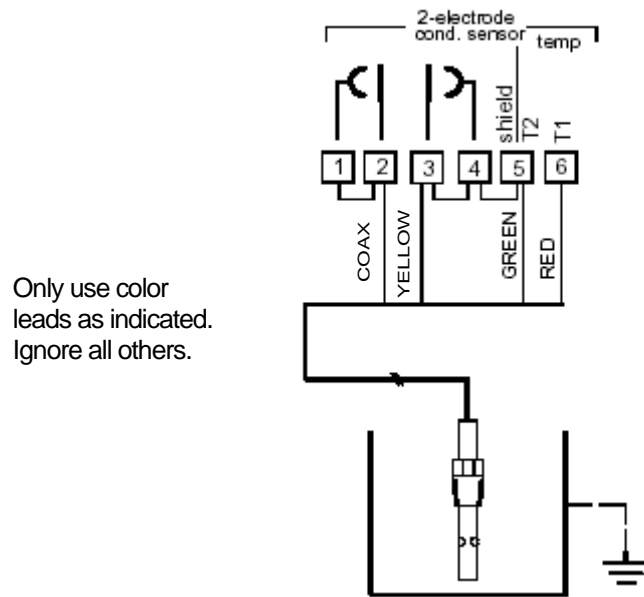


Figure 4-6 Wiring Diagram for 4905 Cells with Quick Disconnect Cable Connected to APT4000

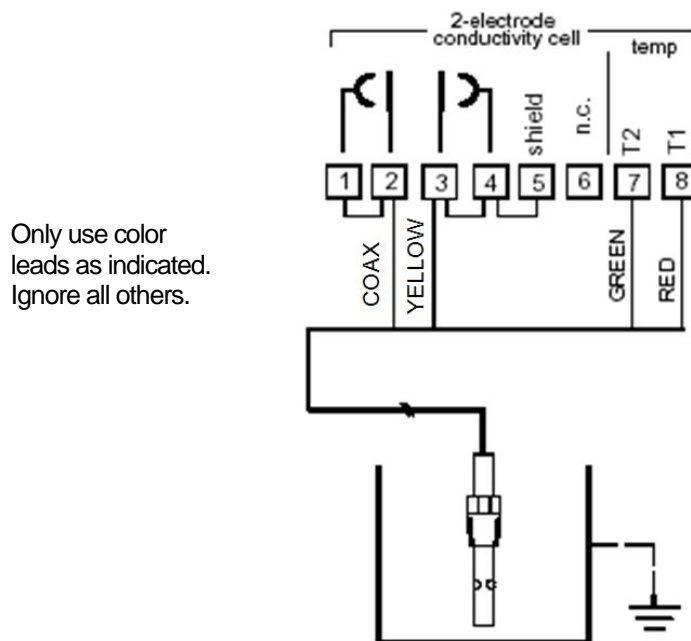


Figure 4-7 Wiring Diagram for 4905 Cells with Quick Disconnect Cable Connected to APT2000

5. Maintenance

5.1 Introduction

If abnormal readings occur, this may indicate poor response because the cell is not filled with process solution. Check the cell installation. Note that a grayish dull surface on the cell plastic (normally glassy) can result from exposure to temperatures above 140°C.

The only maintenance which may be required is occasional cleaning in certain applications.

Cell constants 0.01, 0.1, and 1 cannot be used if solution resistance measures less than 1000 ohms unless the cell is platinized in accordance with Section 5.

5.2 To Clean the Cell

The cell will require cleaning if sludge, slime, etc., accumulates in the flow channels. Since the materials of construction are chemically inert, chemical agents may be used and are recommended for cleaning the cells. The particular cleaning agent used must be selected according to the type of contamination to which the cell is exposed.

CAUTION

The cell housing is PES (Polyethersulfone). DO NOT clean with acetone, chloroform, toluene, benzene, or any other chlorinated hydrocarbon.

In general, soap and hot water are effective and adequate. If necessary, a soft bristle brush of about 1/4" diameter may be used to clean out the tubular channels of the 10 and 50 constant cells. Do not scratch the electrode surfaces. Be especially careful not to bend the electrode plates of the 0.1 constant cell. Rinse the cell thoroughly in tap water and then in distilled water if available.

5.3 To Check Conductivity System

To check the conductivity system comprising conductivity cell, leadwire, and measuring instrument, the user may desire to make a measurement in a reference solution of known conductivity. Control the temperature only within limits consistent with the desired accuracy. The 25°C temperature value is suggested. The solutions may be prepared in the presence of air. The solution must fill the cell during measurement.

For optimum accuracy in acid measurements above 5% concentration, use the "Calibration Trim" function available in the conductivity instrument. See the appropriate Analyzer/Transmitter manuals for details on the trim function.

To check the constant of a cell, use a second cell having the same constant and compare the reading of one against the other.

If the 04905 Series conductivity cell model number contains '333', the normal resistance of the temperature sensor as measured across the red (B) and green (D) leads is 8550 ohms at 25°C.

To check the electrode insulation, connect an ohmmeter across the black (A) and white (C) leads (coax and yellow for QD option). With a dry and clean cell, the resistance should be greater than 50 megohms.

NOTE: Never connect a test instrument across the Blue (E) and Brown (F) leads. Damage to the cell memory device may occur.

5.4 Platinizing the Cell Electrodes

Only the electrodes having constants 10 and 50 must be replatinized if the velvety-black deposit has been rubbed off the electrodes in service or in cleaning or if platinized electrodes are recommended and this black deposit is not present when the new cell is received. Always replatinize if a brush was used in cleaning the electrodes. The indication of a need for replatinization of the electrodes is loss in sensitivity (slow response of measuring instrument), erratic behavior of measuring instrument, or difficulty in balancing. The electrodes of the high constant cells are not visible since they are located near the middle of the flow channels. Therefore the need for platinization is only indicated by the effect on the measuring instrument. Do not platinize cells intended for high purity water measurements.

Before platinizing, clean the cell with detergent and brush as described in Section 5.2.

Support the cell in a cylindrical vessel with the end of the cell raised from the bottom. It is not necessary to remove the cell from the fittings for platinizing. However, the guard tube must be removed from the low constant cells. Pour in a platinizing solution to a level above the cross-channel.

To platinize the 10 or 50 constant cells, immerse an auxiliary platinum electrode in the solution to a point about midway between the cross-channel or tube hole and the open end of the cell. (This third electrode should be chemically pure platinum. Its shape is unimportant. It may be one of the electrodes in another conductivity cell or a platinum strip, sheet, rod, wire, etc.) Both electrodes of the cell are platinized simultaneously by connecting the negative terminal of the battery (see Table 5-1) to both leadwires of the cell. Connect the positive terminal of the battery to the auxiliary platinum electrode. Note the time lapse and continue the platinizing operation for the time in seconds listed in Table 5-1. Then disconnect the battery and remove the cell. Rinse the cell thoroughly in tap water and then rinse in distilled water. During the platinizing operation, move the cell up and down gently to keep the solution stirred.

CAUTION

The preceding procedure produces a barely visible coating of platinum black on the electrode surfaces. Do not attempt to darken electrodes by additional platinization since this will affect the cell performance adversely.

Pour the platinizing solution back into its container as it may be used a number of times.

If the cell is not to be installed immediately after platinizing, it should be kept submerged in distilled water until put into use, as platinum black is not stable when dry.

Table 5-1 Voltage and Time Limits for Platinizing Cells

DC Volts	10	50
6.0	100 sec.	300 sec.
12.0	----	240 sec.

6. Replacement Parts and Accessories

Description	Part Number
Flow Cell Housing, PES	276127
Junction Box	31316260
CPVC Pipe cap	50028816-501
Extension Cables for Sensors with Quick Disconnect Option	
2m (6.56 ft)	50024092-501
3m (9.84 ft)	50024092-502
6m (19.69 ft)	50024092-503
15m (49.21 ft)	50024092-504
30m (98.43 ft)	50024092-505
<i>EXTENSION CABLE MUST BE PURCHASED FROM HONEYWELL</i>	
Cell Extension Leadwire (see Fig 4.1 & 4.2 for required cables)	
18 AWG, Low capacitance shielded twisted pair	BELDEN 8760 or equivalent
22 AWG, Coax RG59U	BELDEN 9259 or equivalent
18 AWG, 4 conductor	BELDEN 8489 or equivalent

Sales and Service

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