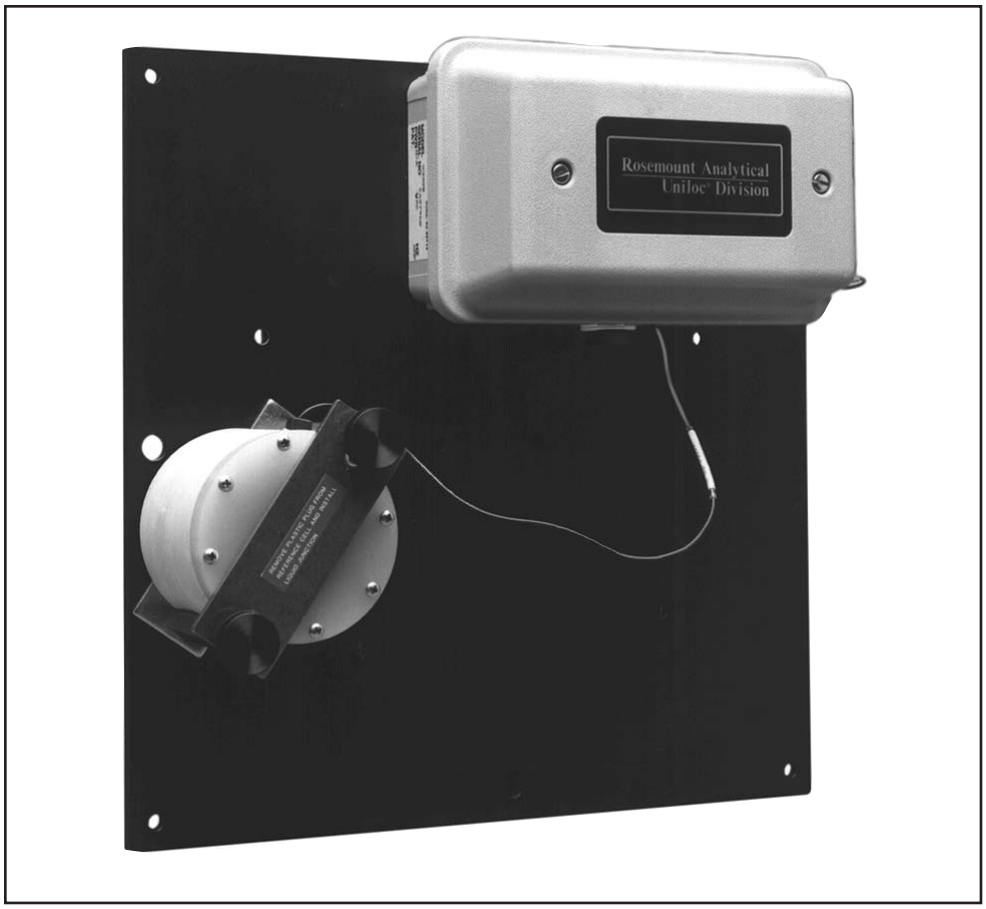
Instruction Manual
PN 51-320B/330B/rev.D
March 2005

Model 320B/330B

Flow Through pH/ORP Sensors



ROSEMOUNT® Analytical

EMERSON™ Process Management

ESSENTIAL INSTRUCTIONS

READ THIS PAGE BEFORE PROCEEDING!

Rosemount Analytical designs, manufactures, and tests its products to meet many national and international standards. Because these instruments are sophisticated technical products, you must properly install, use, and maintain them to ensure they continue to operate within their normal specifications. The following instructions must be adhered to and integrated into your safety program when installing, using, and maintaining Rosemount Analytical products. Failure to follow the proper instructions may cause any one of the following situations to occur: Loss of life; personal injury; property damage; damage to this instrument; and warranty invalidation.

- Read all instructions prior to installing, operating, and servicing the product. If this Instruction Manual is not the correct manual, telephone 1-800-654-7768 and the requested manual will be provided. Save this Instruction Manual for future reference.
- If you do not understand any of the instructions, contact your Rosemount representative for clarification.
- Follow all warnings, cautions, and instructions marked on and supplied with the product.
- Inform and educate your personnel in the proper installation, operation, and maintenance of the product.
- Install your equipment as specified in the Installation Instructions of the appropriate Instruction Manual and per applicable local and national codes. Connect all products to the proper electrical and pressure sources.
- To ensure proper performance, use qualified personnel to install, operate, update, program, and maintain the product.
- When replacement parts are required, ensure that qualified people use replacement parts specified by Rosemount. Unauthorized parts and procedures can affect the product's performance and place the safe operation of your process at risk. Look alike substitutions may result in fire, electrical hazards, or improper operation.
- Ensure that all equipment doors are closed and protective covers are in place, except when maintenance is being performed by qualified persons, to prevent electrical shock and personal injury.

DANGER
HAZARDOUS AREA INSTALLATION

This sensor is not Intrinsically Safe. or Explosion Proof. Installations near flammable liquids or in hazardous area locations must be carefully evaluated by qualified on site safety personnel.

To secure and maintain an intrinsically safe installation, an appropriate transmitter/safety barrier/sensor combination must be used. The installation system must be in accordance with the governing approval agency (FM, CSA or BASEEFA/CENELEC) hazardous area classification requirements. Consult your analyzer/ transmitter instruction manual for details.

Proper installation, operation and servicing of this sensor in a Hazardous Area Installation is entirely the responsibility of the user.

CAUTION
SENSOR/PROCESS
APPLICATION COMPATIBILITY

The wetted sensor materials may not be compatible with process composition and operating conditions. Application compatibility is entirely the responsibility of the user.

About This Document

This manual contains instructions for installation and operation of the Models 320B/330B Flow-Thru pH/ORP Sensors. The following list provides notes concerning all revisions of this document.

Rev. Level	Date	Notes
0	3/95-4/97	This is the initial release of the product manual. The manual has been reformatted to reflect the Emerson documentation style and updated to reflect any changes in the product offering.
A	2/02	Added 1055 wiring drawings.
B	7/02	Updated multiple drawings throughout manual.
C	3/04	Deleted ultrasonic cleaner option references.

Emerson Process Management

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EMERSON™
Process Management

MODEL 320B/330B
FLOW THROUGH pH/ORP SENSOR

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MODEL 320B/330B pH/ORP SENSOR

LIST OF FIGURES

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SECTION 1.0
DESCRIPTION AND SPECIFICATIONS

- CHOICE OF PVC, KYNAR[1], TEFLON[2], STAINLESS STEEL To handle most industrial applications.
- BUILT-IN PREAMPLIFIER Permits up to 3 miles (4.8 km) between sensor and most analyzers.
- UP TO ONE YEAR BETWEEN RECHARGING due to large volume reference cell.
- MINIMIZE FOULING PROBLEMS with large area reference junction and optional ultrasonic or flow powered cleaner.

1.1 GENERAL DESCRIPTION

The Rosemount Analytical Model 320B pH Sensor measures the pH of a flowing aqueous fluid. Typical applications include pH monitoring or control in boiler feed water, process water, chemical processes, municipal water treatment, and many other applications. The Model 330B measures oxidation reduction potential (ORP), and has applications in chromate waste treatment, bleaching operations, chemical processes and municipal water treatment. Depending on the application, the sensor may be installed directly in the process line or in a by-pass line.

The sensor consists of a flow chamber, measuring electrode, reference electrode, temperature compensator (where applicable) and an ABS junction box containing a preamplifier.

These components are mounted on an ABS backplate which may be attached to a wall or, with selection of Code 30, clamped to a 2 in. pipe. The ABS plate is designed to allow quick and simple field installation of explosion-proof conduit (Code 90).

The flow chamber contains the measuring electrode and, except for the Model 330B, an automatic temperature compensation element. The unique design electrode gland fitting allows the measuring electrode to be easily removed for maintenance or replacement. The design of this fitting prevents overtightening of the gland nut thus preserving the integrity of the O-ring process seal. The removable reference chamber includes electrolyte and large-area liquid junction and double junction reference electrode. The sealed reference chamber requires no pressurization, and the large supply of saturated gel solution of KNO_3 electrolyte will last up to one year, in most applications, without refilling. This is especially useful for processes containing ferric chloride, sulfide (such as H_2S and Na_2S), cyanide, silver, lead, mercury, chlorine, sugar or ammonia.

OPTIONS

A number of options are available which adapt the sensor to a variety of uncommon applications. For installation in Class I, Division 2, Group D explosion-proof areas, Code 90 may be selected.

Code 06 features a flow-powered cleaner, with teflon balls, driven by a minimum flow of 4 GPM, to impinge on the pH measuring electrode to prevent it from coating.

[1] A registered trademark of Elf Atochem North America, Inc.
[2] A registered trademark of E.I. du Pont de Nemours and Company.

1.2 PHYSICAL SPECIFICATIONS

Materials of Construction:
MOUNTING PLATE: ABS
PREAMPLIFIER ENCLOSURE: ABS
MATERIALS: (Choice of)
Kynar
Teflon
Stainless steel
CPVC (flow powered cleaner)
Tefzel[1]

Electrical Classification: Standard: General purpose
Code 90: Class I, Division 2, Group D

Process Connections: 1/2 in. MNPT available in Kynar or Teflon, 1in. MNPT available in 316 SST or CPVC

Mounting: Standard: Wall mount
Code 30: 2 in. pipe mounting bracket

Dimensions: See Figure 1-1

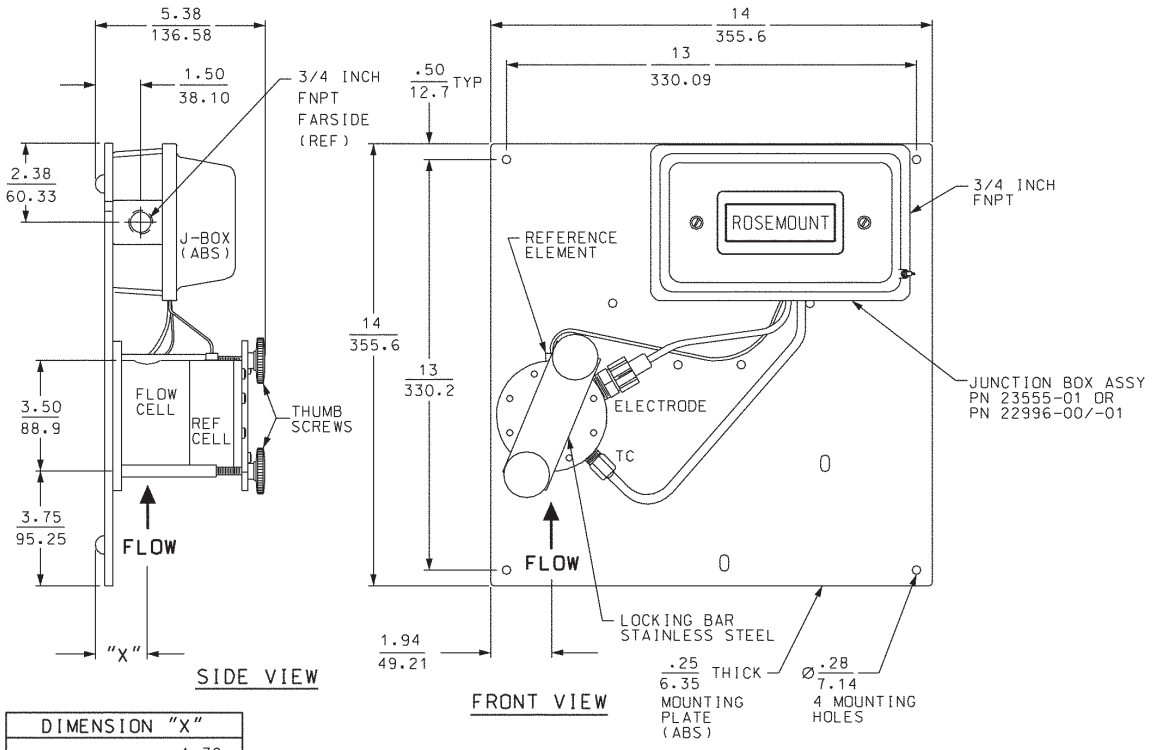
Temperature Compensation: Automatic, 0 to 100 °C (32 to 212 °F), Plug supplied for 330B when used with 1181ORP, 1060 or 1023

Pressure/Temperature Rating: (See Figure 1-3)

Interconnecting Cable:
Cable, P/N 9200000 (Belden 8722)

Weight/Shipping Weight: 2.72 kg/3.63 kg (6 lb/8 lb)

[1] A registered trademark of E.I. du Pont de Nemours and Company.



DIMENSION "X"	
1/2 IN FNPT	1.38 / 34.93
1 IN FNPT	1.74 / 44.30

ELECTRICAL WIRING DIAGRAM		
DRAWING NO.	JUNCTION BOX	PREAMP
40320B36	PN 23555-01	PN 23557-00
40320B39	PN 22996-00 OR PN 22996-01	PN 22698-00
		PN 22698-02
		PN 22698-03
		PN 22698-06 OEM
		PN 22698-07 OEM

FIGURE 1-1. OUTLINE and MOUNTING DIMENSIONS

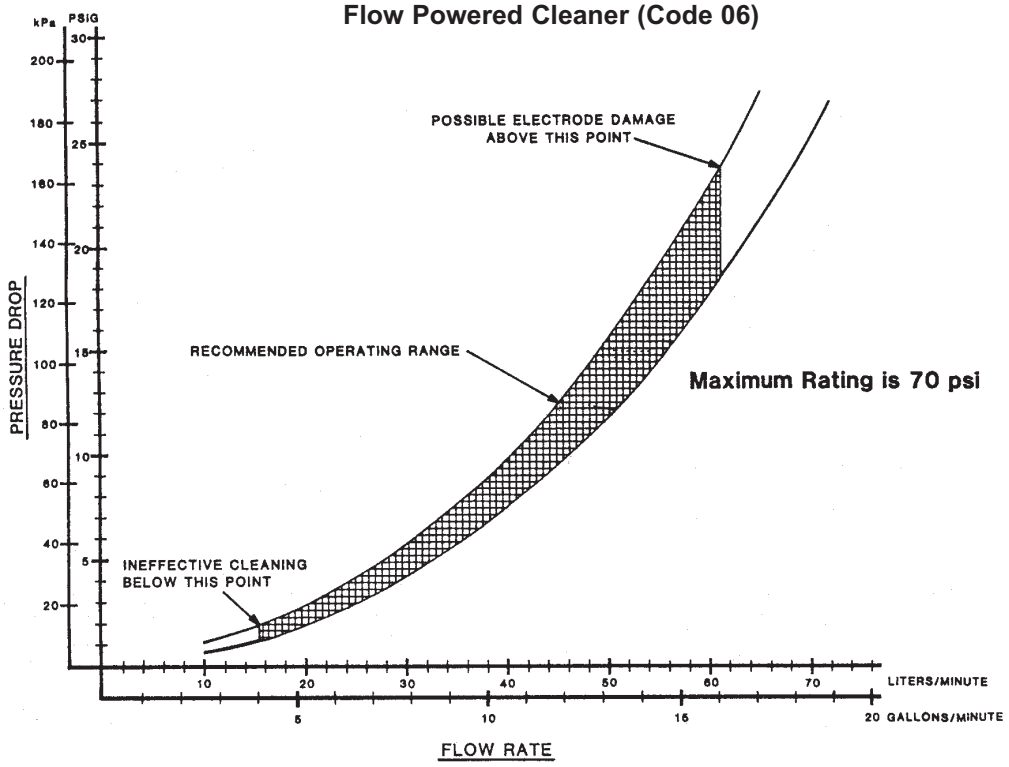


FIGURE 1-2

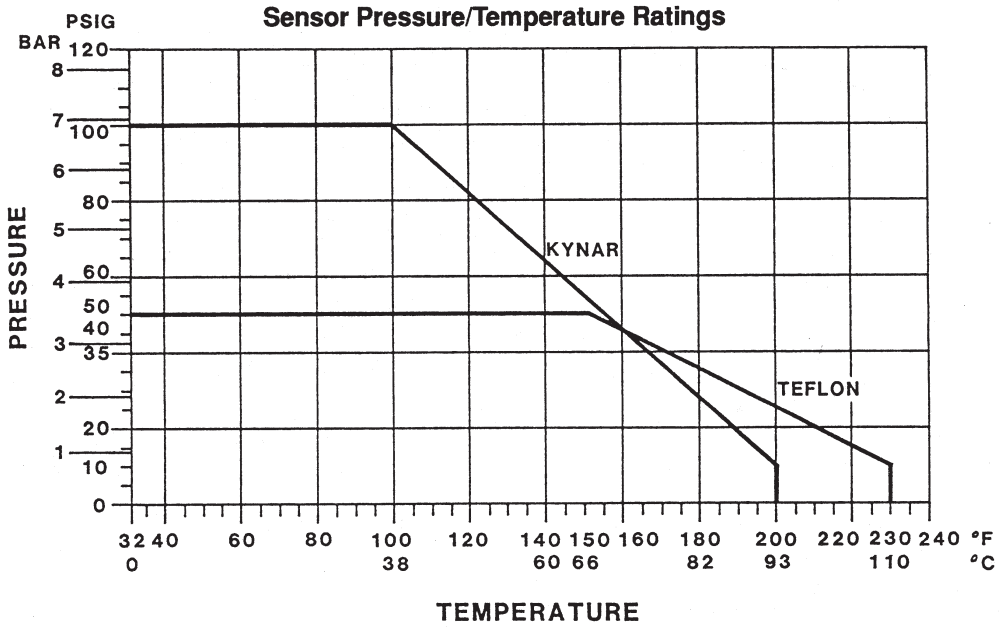


FIGURE 1-3

1.3 ORDERING INFORMATION

The Model 320B Flow Through pH Sensor: Standard features include measurement electrode, double-junction reference cell, temperature compensator and preamplifier housed in a weatherproof junction box, mounted on an ABS plate.

The Model 330B Flow Through ORP Sensor: Standard features include platinum ORP electrode, double-junction reference cell, and preamplifier housed in a weatherproof junction box, mounted on an ABS plate.

MODEL 320B 330B	FLOW THROUGH pH SENSOR[1] FLOW THROUGH ORP SENSOR[2]
CODE	MATERIALS OF CONSTRUCTION (Required Selection)
01	Kynar 1/2 in. FNPT process connections
03	Teflon 1/2 in. FNPT process connections
05	316 SS, 1 in. FNPT process connections & Teflon reference cell. (Not available for 330B)
06	CPVC flow powered cleaner, 1 in. MNPT and Kynar reference cell

CODE	MEASURING ELECTRODE (Required Selection)
10	General Purpose pH
11	High pH
12	Ruggedized pH
13	Platinum ORP

CODE	PREAMPLIFIER AND TEMPERATURE SENSOR (Required Selection)
50	For use with Models 1181 pH/ORP
52	For use with remote preamplifier for Models 1181 (includes 15 ft of coax cable)
53	For use with remote preamplifier (includes 15 ft of coax cable) for Models 1054 Series, 2054, 2081
54	For use with Models 1054, 1054A, 2054, 2081

CODE	OPTIONS
20	Ceramic/Kynar liquid junction
21	Ceramic/Teflon liquid junction
30	2 in. pipe/wall mounting bracket
40	Stainless steel tag (specify marking)
90	Division 2 enclosure for preamplifier

320B	01	10	50	20	EXAMPLE

NOTES: 1. Interconnecting cable is required as follows: Specify length. P/N 9200000 (Belden 8722).
2. Model 330B: Not available with Codes 05, 06, 10, 11, 12.
Model 330B: Temperature sensor not included with option 50, or 52.

SECTION 2.0
INSTALLATION

2.1. GENERAL

The sensor requires some customer assembly, therefore care should be taken that the instructions are followed carefully to ensure all parts are properly installed.

2.2. UNPACKING

Inspect the shipping container. If evidence of damage is noted, contact the carrier. If no damage is evident, open the container and inspect the sensor for damage. Again, if damage is apparent, notify the carrier. Save the shipping container and all packing material. This will help prevent damage during transit should the sensor ever require factory servicing.

2.3. PREPARATION FOR INSTALLATION

Prepare the sensor for installation as follows:

1. Remove the reference cell by loosening the screws (or removing the plastic knobs on applicable models) on the reference lockbar assembly (see Figure 2-1) then turning it about ten degrees clockwise and pulling it straight out. Hold the cell in the position shown in Figure 2-2 and remove the solid plug from the reference cell body. Gently break away any salt crust which may have formed around or inside the opening. Top off the reference cell with reference gel solution (P/N 9210233) or distilled water, tapping the cell gently to dislodge any air bubbles.

   Install the liquid junction supplied (P/N 2000734 or 2000735). It is not necessary to use thread sealants. Teflon tape may be used if a loose fit is observed. The use of sticky "pipe dope" compounds should be strictly avoided. Use care not to get any greasy materials on the surface of the liquid junction. As the plug is installed, beads of water should appear on the surface of the liquid junction as water is forced through the porous material. If water beads are not present on the junction surface, but water is forced out around the edges of the wood or ceramic material, the liquid junction should be replaced (P/N 2000734 or 2000735).

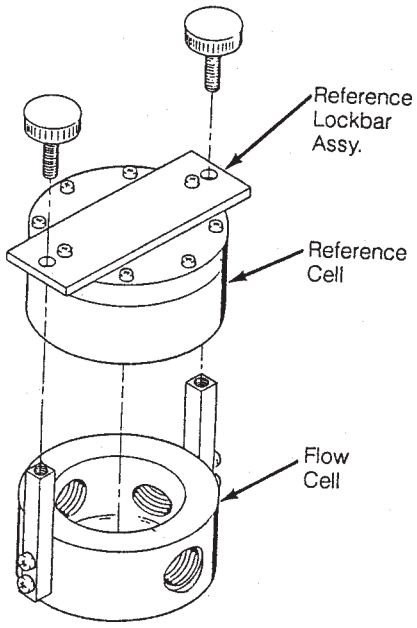


Figure 2-1 Reference Cell Assembly

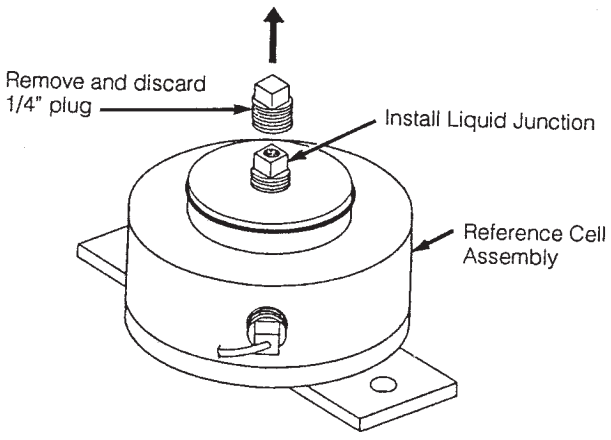


FIGURE 2-2. Liquid Junction Installation

2. Lubricate the o-ring on the reference cell using the o-ring lubricant supplied (P/N 2001928). Place the reference cell back on the flow cell. Rotate it counterclockwise ten degrees and tighten the lock bar screws (replace the plastic knobs on applicable models).
3. Install sensor panel so the process flow will enter at the bottom of the cell and exit from the top (Figure 2-3). Make sure that the panel is securely attached to the mounting surface. If the Pipe Mounting bracket (Option 30) is used, refer to Figure 2-4 for details.

2.3.1 Plumbing. Plumb the sensor as follows:

1. Set up plumbing arrangement as shown in Figure 2-3 to ensure the system can be shut down and pressure relieved during maintenance. This diagram is schematic and can be deviated from as long as the purpose is accomplished.
2. Install the appropriate sized plumbing fitting to the sensor.

NOTE

Make sure the system pressure is shut down when connecting the plumbing to the system.

3. Plumb the sensor process fitting to the process stream or to the bypass line. Be careful not to over tighten these connections; plastic flow cell bodies can be cracked by such excessive force. The distance between the actual process and the sensor should be as short as possible to ensure minimum lag time in control applications.

2.3.2 Electrical. Refer to Figure 2-5 and Proceed as follows:

1. Make sure the conduit fittings are properly attached to the enclosure (junction box).
2. Make the required connections to the instrument, using care to dress the wires so they are not exposed and susceptible to shorting or grounding. Recommended cable is Belden #8722, (Rosemount P/N 9200000)

NOTE

Do not run signal cable next to A.C. lines.

3. Install the pH electrode into the sensor's flow cell as shown in Figure 2-5.
4. Plug the preamplifier into the junction box (Figure 2-5).
5. Connect the pH electrode to the preamplifier (Figure 2-5).
6. Connect the temperature compensator (where applicable) (Figure 2-5).
7. Attach the junction box cover, making sure the gasket seal keeps moisture out of the box.

Refer to Figure 2-6 for wiring to Model 1055.

2.4. INSTALLATION INSPECTION

Prior to operating the sensor and attempting to standardize the instrument, inspect the sensor installation as follows:

1. Verify that the sensor is securely attached to the wall, pipe, or other mounting surface.
2. Check all plumbing connections for leaks. If any are evident, repair them.
3. Check all electrical connections for security. Make sure all wires are properly dressed so they do not short or ground. Make sure the instrument is wired as illustrated in Figure 2-5.
4. If all of the above have been satisfied, proceed to the next section.

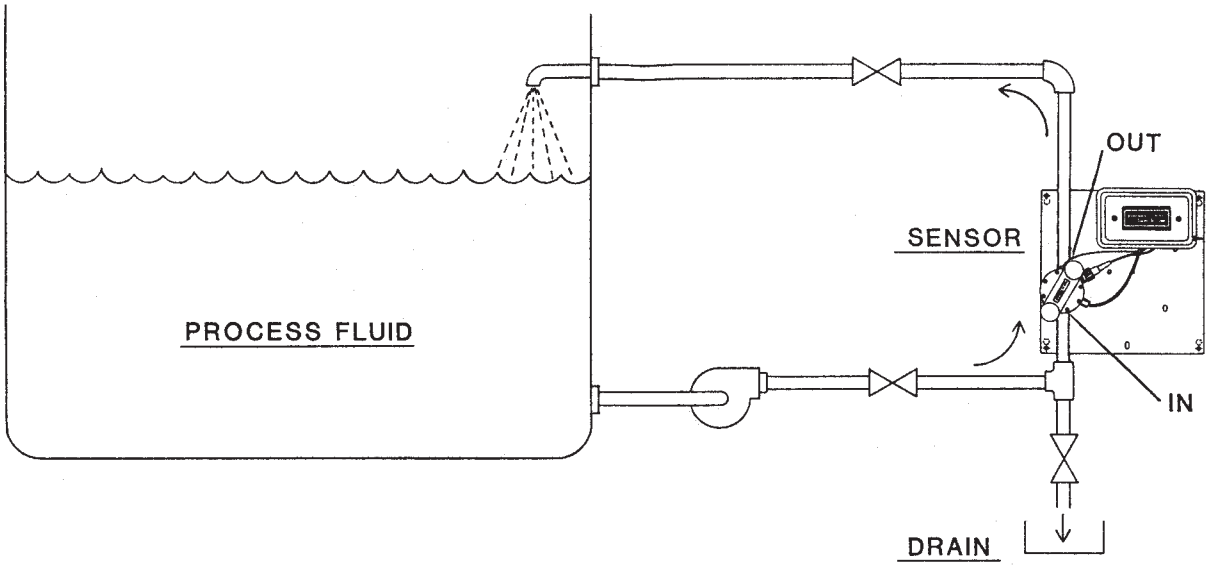


FIGURE 2-3. Typical Installation Configuration

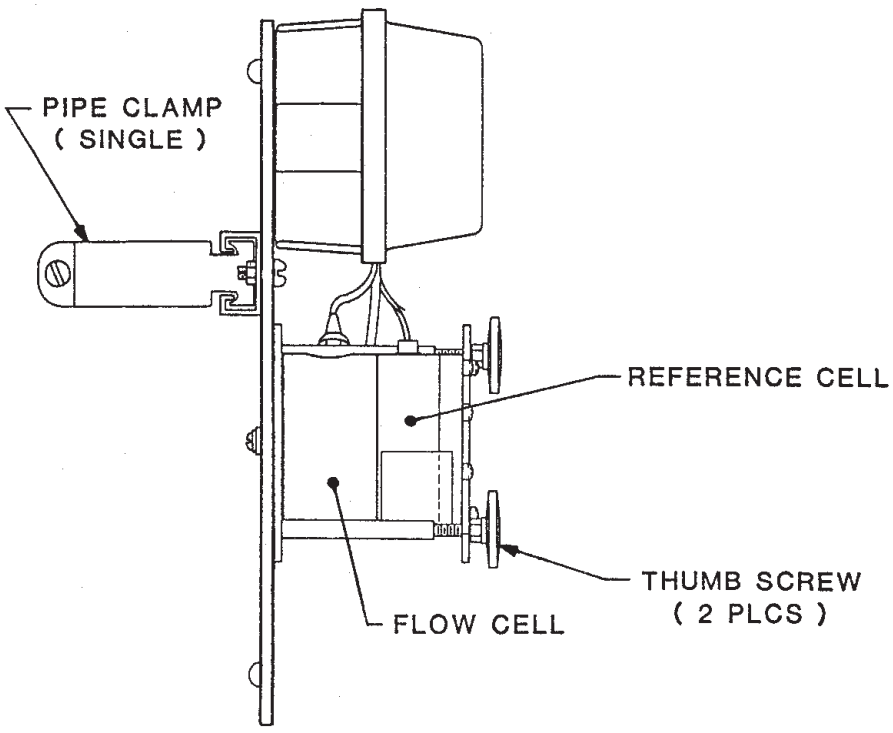
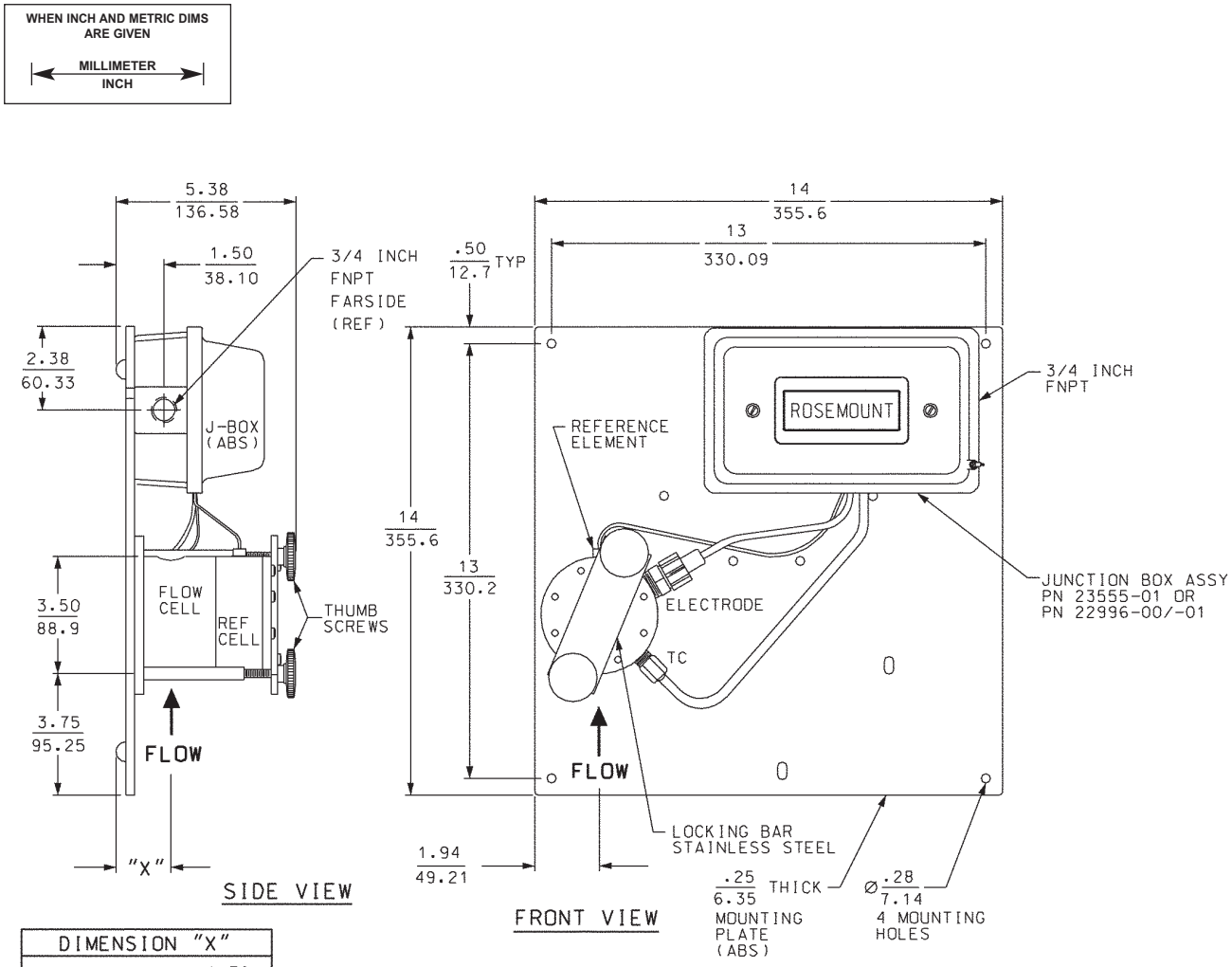


FIGURE 2-4. Pipe Mounting Bracket (Option 30)



DIMENSION "X"	
1/2 IN FNPT	1.38 / 34.93
1 IN FNPT	1.74 / 44.30

ELECTRICAL WIRING DIAGRAM		
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40320B39	PN 22996-00 OR PN 22996-01	PN 22698-00
		PN 22698-02
		PN 22698-03
		PN 22698-06 OEM
		PN 22698-07 OEM

DWG. NO.	REV.
40320B01	J

FIGURE 2-5. Model 320B/330B-01/03/05 Dimensional and Wiring

SECTION 3.0
OPERATION

3.1 GENERAL.

This section contains instructions to put the sensor in operation. The sensor is completely automatic and may require only an occasional electrode cleaning. See Maintenance, Section 5.0 for instructions.

3.2 STANDARDIZATION.

The Model 320B pH sensor may be standardized using two (2) different methods. Either method is satisfactory and will give the desired results.

1. Buffer Solution Method.

a. Obtain pH buffers of 7.0 (P/IN 9210035) and at least one other value (available from Rosemount Analytical are P/N 9210034 and P/N 9210036 with pH values of 4 and 10 respectively).

b. Remove the reference cell assembly from the flow cell. With the reference lockbar assembly down, install the buffer cup fixture as shown in Figure 3-1. Make sure the reference cell is completely full of electrolyte. If any air bubbles are in the cell, they will migrate to a position directly below the liquid junction when the cell is in the position shown. This will effectively open the circuit between the reference element and glass electrode, and make standardization impossible.

c. Fill the buffer cup approximately 3/4 full of pH 7.0 buffer. Remove the pH electrode from the flow cell and immerse the electrode's tip in the solution. Allow a few seconds for the reading to stabilize. It is best to start with both the sensor and the buffer at the same temperature.

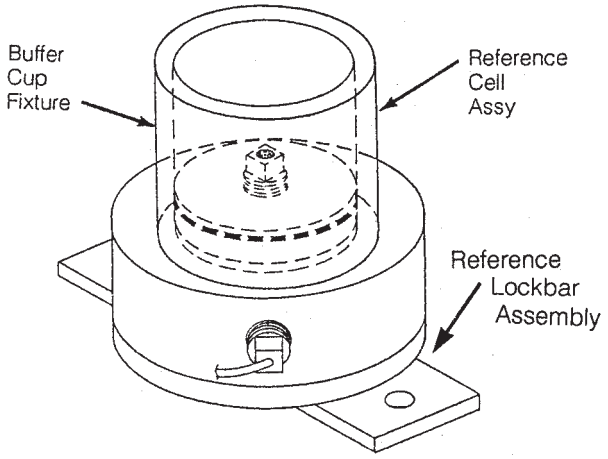


FIGURE 3-1. Buffer Cup Fixture

NOTE

For pH analyzers with temperature compensation capabilities, set the AUTO/MAN T.C. Switch in the pH transmitter to MAN.

d. When the pH reading is stable, adjust the pH analyzer for an indication of 7.0. Refer to your pH analyzer manual for the correct procedure.

e. Remove the glass electrode from the buffer cup and dispose of the 7.0 buffer. Rinse both the buffer cup and the glass electrode with clean water.

f. Fill the buffer cup 3/4 full with a second value buffer solution and immerse the pH electrode's tip in the solution. The analyzer should quickly stabilize at the correct value. If there is an offset, refer to the analyzer's instruction manual.

NOTE

The error may be due to a temperature difference between the sensor and solution. Therefore, allow ample time for the sensor and the buffer solution to come to thermal equilibrium, to avoid offset.

g. Check in a third buffer solution if desired. If there is a slight discrepancy, make adjustments as indicated in the analyzer's instruction manual. Should the discrepancy be more than 0.2 pH, look for a defective glass electrode, reference cell, or contaminated buffer solution.

2. Grab sample method. a. Place the sensor on-stream. Wait 2-3 minutes for the reading to stabilize, particularly in a very hot or cold stream. When the reading is stable, note its value and immediately obtain a sample of the solution NEAR THE SENSOR.

b. Check this sample on a bench meter. Standardize the process instrument as necessary to obtain agreement with the bench meter. Take more than one sample to assure maximum accuracy.

c. The automatic temperature compensator and associated circuitry will correct only for changes in the output of the glass electrode with changes in temperature. Many solutions undergo a real change in pH with temperature change. Therefore, if a change in the bench meter is noted despite a re-adjustment of the bench meter T.C. dial, the grab sample should be kept at a temperature near that of the operating temperature.

d. If the grab sample method is not practical, reasonable accuracy can be obtained by following the buffer solution method. Exceptions to this general rule are:

   1. pH values below 3.0 and above 10.0.
   2. Stream with rapid or highly variable flow rates.
   3. Very high chemical concentration in the stream regardless of pH value. These situations can cause stray potentials, which can be as large as 5.0 pH or more, to develop at the liquid junction or glass electrode.

e. Errors noted in 1 and 3 above can be minimized by buffering the sensor in a solution that approximates the chemical makeup of the actual sample stream. Consult a chemical handbook to find recipes for buffers below 4 or above 10. These buffers are usually not stable in storage and must be made fresh just prior to use.

3.3 STANDARDIZATION PROCEDURE.

The standardization procedure for the Model 330B ORP sensor and transmitter amounts to an actual electronic check of the circuit to verify that it is operating. The Rosemount Analytical Model pHC-1 Signal Generator was designed for this purpose. Consult Model pHC-1 Instruction Manual for specific calibration instructions.

3.3.1 Quinhydrone Solution.

A commonly used ORP standard solution is a saturated quinhydrone solution. This can be made by simply adding a few quinhydrone crystals to either a 4 pH or a 7 pH buffer. Quinhydrone is only sightly soluble so only a few crystals will be required. The solution will have a yellow color. The resulting potentials should be within ±20 millivolts of the value shown in Table 3-1. The ORP value of saturated quinhydrone solution is not stable for long periods of time and therefore new solutions should be made each time.

3.3.2 Ferric-Ferrous Ammonium Sulfate Solution. This solution offers a much more stable solution which will maintain its millivolt value for approximately one year when stored in a glass container. Rosemount Analytical offers this ORP standard as spare part number R508-16OZ for your convenience. Otherwise you can prepare the solution with the formula below.

CAUTION

The solution used during the following check is an acid and should be handled with care. Follow the directions of the acid manufacturer. Wear the proper equipment. Do not let the solution come in contact with skin or clothing. If contact with skin is made, immediately rinse with clean water.

To prepare solution, dissolve 39.2 grams of reagent grade ferrous ammonium sulfate [$Fe(SO_4) \cdot (NH)_2SO_4 \cdot 6H_20$] and 48.2 grams of reagent grade ferric ammonium sulfate [$FeNH_4(SO)_2 \cdot 12H_20$] in approximately 700 milliliters of water (distilled water is preferred, but tap water is acceptable). Slowly and carefully add 56.2 milliliters of concentrated sulfuric acid. Add sufficient water to bring the total solution volume up to 1,000 milliliters. This solution (ferric-ferrous ammonium sulfate) will produce a nominal ORP of 476 ±20 mV at 25 C. Some tolerance in mV values is to be expected due to the rather large liquid reference junction potentials which can arise when measuring this strongly acidic and concentrated solution. However, if the measuring electrodes are kept clean and in good operating condition, consistent repeatable calibrations can be achieved.

NOTE

Most industrial applications have a number of ORP reactions occurring in sequence or simultaneously. There can be several components that are oxidized or reduced by the reagents that are used. Theoretically, the ORP potential is absolute because it is the result of the oxidation-reduction equilibrium. However, the actual measured potential is dependent on many factors, including the condition of the surface of the ORP platinum electrode. Therefore, the sensor should be allowed 1-2 hours to become “conditioned” to the stream to be measured when first setting up or after being cleaned.

TABLE 3-1. ORP of Saturated Quinhydrone Solutions

	pH 4			pH 7		
Temperature °C	20	25	30	20	25	30
Millivolt Potential	268	264	260	94	87	80

SECTION 4.0
OPTIONS

4.1. GENERAL

This section describes the options available for the zmodels 320B pH and 330B ORP sensor and gives any installation, operation, or maintenance instructions necessary for each option.

4.2. FLOW POWERED CLEANER (OPTION -06)

This option provides continuous cleaning of the electrode, liquid junction, and internal surface of the flow cell via a flow powered cleaner. Since these options are modifications to the flow cell and the basic model is not changed, the information in the following paragraphs will be supplemental to the information in Sections 1.0 thru 3.0.

4.2.1 Specifications. The flow powered cleaner consists of specially designed CPVC (option 06) flow cell which directs the process flow in a circular path. The process flow carries three Teflon balls which strike the pH electrode, reference junction and inside surfaces of the flow cell, thus preventing accumulation of coating materials. Flow powered cleaning is suitable for all hazardous area applications. See Figure 1-2 for flow rate and pressure drop.

4.2.2 Installation. See Figure 4-1 (option 06) for dimensional information.

4.2.3 Operation. The teflon balls (quantity three) are supplied in a separate package. All three should be placed in the flow cell prior to installation of the reference cell. Process flow must be maintained within the rates shown in Figure 1-2.

4.2.4 Maintenance. The flow powered cleaner requires no special maintenance. The flow powered cleaner should greatly reduce the need for periodic cleaning. However, periodic inspection of the sensor is recommended.

4.2.5 Replacement Parts. Refer to the parts list that accompanies Figure 6-3 for replacement parts.

4.3. GLASS ELECTRODE (OPTIONS -10, -11, -12, -13)

Electrodes are shipped in a separate container. Please refer to Section 2.0 for installation instructions. Please refer to Figure 6-4 and its accompanying parts list.

4.4. PREAMPLIFIER (OPTIONS -50 TO -54)

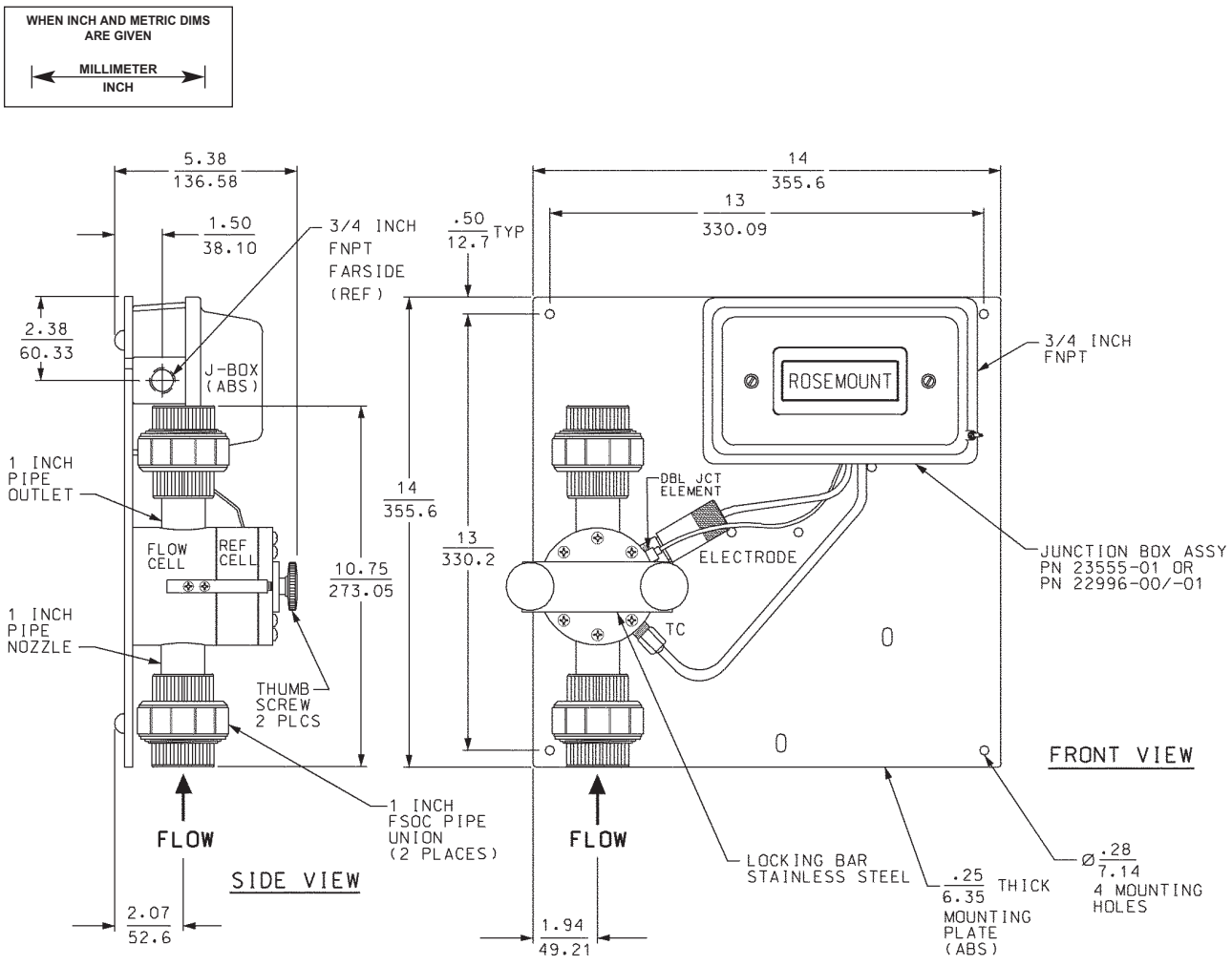
The preamplifier and T.C. are shipped in a separate container. Refer to Section 2.0 for installation instructions.

4.5. 2-INCH PIPE MOUNTING BRACKET (OPTION -30)

This option provides a mounting bracket to attach to the mounting plate and to a 2 in. pipe. Instructions for installing the mounting bracket are found in Section 2.0.

4.6. DIVISION 2 (OPTION -90)

This option provides a preamplifier enclosure suitable for Div. 2 installations. The installation, operation, and maintenance of this option is the same as the basic model except for the configuration of the J-box and Div. 2 enclosure. Refer to Figure 4-2 for details.



ELECTRICAL WIRING DIAGRAM		
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		PN 22698-02
		PN 22698-03
		PN 22698-06 OEM
		PN 22698-07 OEM

DWG. NO.	REV.
40320B03	K

FIGURE 4-1. Model 320B with Flow Powered Cleaner Dimensional and Wiring (option 06)

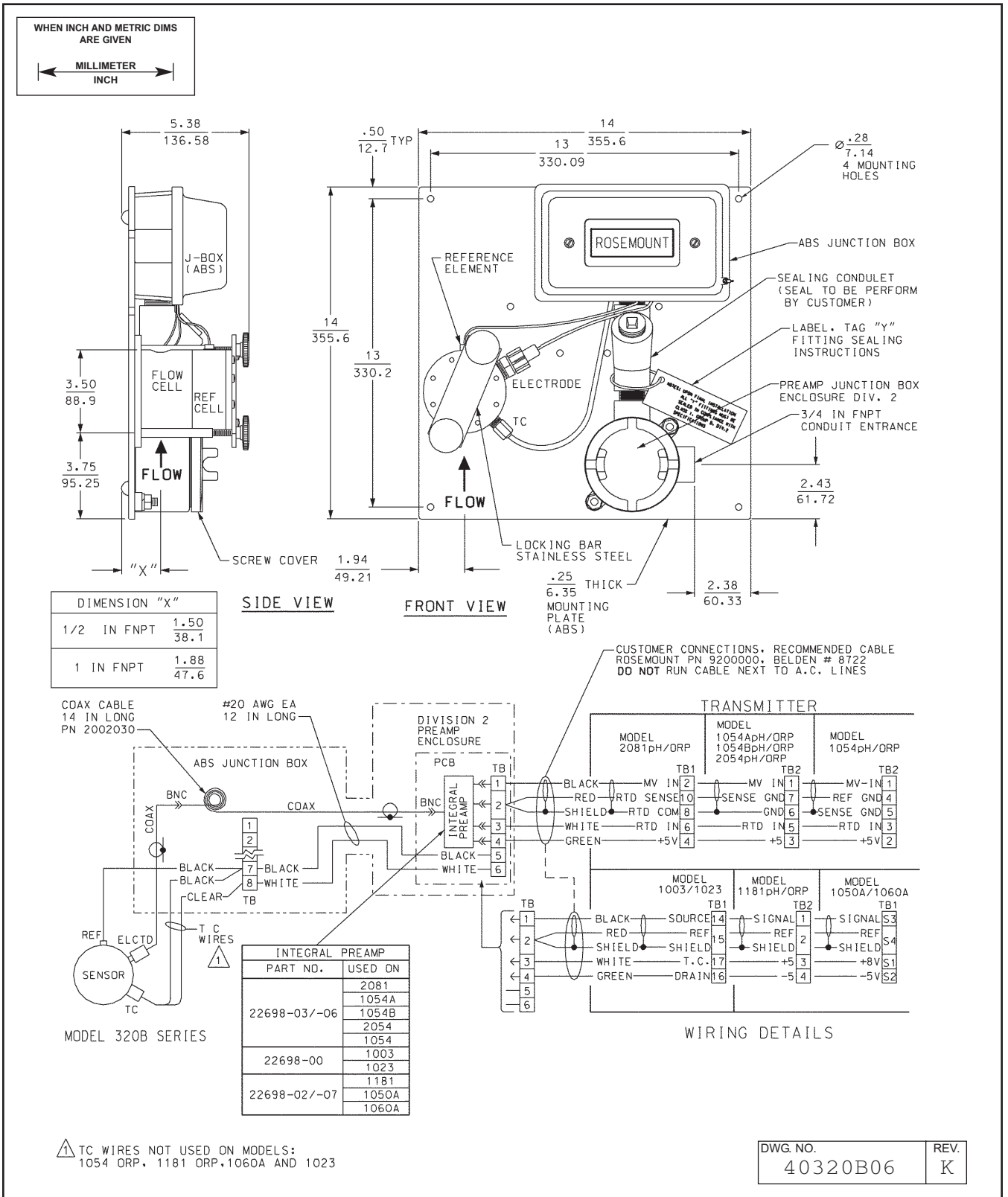


FIGURE 4-2. Model 320B with Division 2 Preamplifier Enclosure (option 90)

SECTION 5.0
MAINTENANCE AND TROUBLESHOOTING

5.1. GENERAL

This section contains the scheduled preventative maintenance and troubleshooting for the sensor. The intent of this section is to furnish the user with the ability to maintain his own equipment, and to provide a guide for keeping the sensor in good operating condition, and returning the sensor to operation in the least possible time and expense, in the event of a malfunction.

5.2. SCHEDULED PREVENTIVE MAINTENANCE

Perform the following maintenance as specified to prevent malfunctions which could occur due to deterioration or contamination of the active measuring elements. The scheduled time period could be varied to meet your particular operating conditions and should be established with that in mind. The following schedule is only a recommendation and has been set considering a normal operation system.

NOTE

Make sure system pressure is shut down or the stream line has been cut off from system pressure prior to removing the electrode assembly, or reference cell.

5.2.1 Every 30 Days.

1. Shut off the sample flow and drain the cell to relieve the hydrostatic seal. Remove electrode assembly by unscrewing the electrode housing gland nut and pulling the electrode straight out.
2. Clean the electrode with a soft cloth or tissue. If this does not remove the accumulated deposit, wash the electrode with dilute hydrochloric acid (5-10%) and rinse with clean water.
3. Check the O-ring for chemical attack, distortion, etc.
4. When reinstalling the electrode, apply lubricant (P/N 2001928) to O-ring and make sure the lubricant does not contact the glass electrode tip area. This could interfere with its operation. Place the O-ring on the shoulder in the gland fitting and then insert the electrode (with washer) into the gland.
5. Replace the electrode in the cell and secure by tightening the gland nut on the housing finger tight (do not use pliers or a wrench).

5.2.2 Every 6 Months. (Certain applications may require complete recharge of the fill solution more often due to process contamination of the reference cell. Refer to Section 5.2.3 for the recharging procedure).

1. Shut off the sample flow and drain the flow cell and remove the reference cell (refer to Section 5.2.1).
2. Remove the liquid junction and inspect the interior of the flow cell for air pockets. If the liquid level is down, top it off with reference gel solution (P/N 9210233). Install the liquid junction. Do not use pipe compound or thread sealant on the liquid junctions threads. If a loose fit is observed, Teflon tape may be used.
3. Use O-ring lubricant and position the reference cell in place on the flow cell. Secure the reference cell to the flow cell with screws (or plastic knobs as applicable).
4. Restore the system pressure or turn the shut-off valve to the on position.

5.2.3 Every Year. Reference cell recharging. Recharge the reference cell as follows:

1. The standard reference cell mixture consists of a gelled, saturated $KN0_3$ solution, P/N 9210233.
2. Shut off the sample flow and drain the flow.
3. Remove the reinforcement bar assembly (refer to Figure 6-1 and 6-2 for parts identification) by unscrewing the retaining screws (or plastic knobs on some models).
4. With the liquid junction and reference electrode in place, remove the cover (held in place with eight [8] screws). Discard all liquid or slurry material and flush the cell with clean water. Hot water may be used if some of the crystals have caked into a solid mass. Carefully remove the O-ring from its groove and inspect for nicks, cracks, or excessive flatness. Clean the O-ring groove if foreign material is present. Dry the groove and install the O-ring (a new one if defects were noted [see Figure 6-1 and 6-2 for part number]), lightly lubricated with O-ring lubricant (P/N 2001928).

5. Replace the microjunction (P/N 22994-00).
6. Add enough gel to fill the reference cell approximately 90% full. Be careful not to spill any of the electrolyte on the O-ring or surrounding surfaces. Replace the reference cell cover, tightening the screws uniformly and without excess force. Make sure that no electrolyte is forced across the O-ring sealing surfaces while installing the reference cell cover. Turn the cell over and remove the liquid junction. Tap the cell firmly to remove any remaining bubbles, and top off the electrolyte by adding gel solution through the liquid junction opening. Replace the liquid junction. Do not use thread sealants or pipe dope. Teflon tape may be used if the plug is obviously loose. Calibrate the sensor and instrument as described in Section 3.2 (for Model 320B) or Section 3.3 (for Model 330B).

5.2.4 The glass or platinum electrode has a limited process life dependent on process conditions. It is Rosemount Analytical's recommendation that the electrode be checked and replaced as required to insure the proper operation of the system. (See Section 3.2 or 3.3).

5.3. TROUBLESHOOTING

In the event of a malfunction, refer to Table 5-1. This is intended as a guide and lists the troubles in order of probable frequency of occurrence. Do not be misled by the troubles; always look for the cause before trying the remedy.

5.4 MAINTENANCE.

This section consists of replacing defective parts and making necessary checks to determine if the sensor is operational. The following determines if the part being checked is operable and should be used in conjunction with the Troubleshooting Table.

5.4.1 Preamplifier Check. To determine if the preamplifier is operable, proceed as follows:

1. Using a BNC Shorting Cap (refer to Figure 5-1) or a paper clip, short the preamplifier connection.
2. With the STANDARDIZATION knob on the transmitter (not on Model 1181 pH/2081 pH or 1054A pH/2054 pH) in a nearly vertical position, the meter should be able to be made to read 7.0 pH for Model 320B and zero (O) millivolts for Model 330B.
3. If the meter/display can not be made to read 7.0 pH or zero (O) millivolts, replace the old preamplifier with a new one and perform the check again.

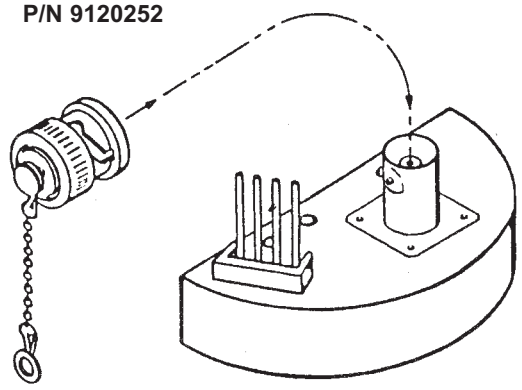


FIGURE 5-1. Preamplifier Check

TABLE 5-1. Troubleshooting

TROUBLE	CAUSE	REMEDY
a. Meter reads off scale.	Short from reference to earth ground (100 megohms minimum).	Repair wiring; check for ground loops. Refer to Figure 5-3 for alternate wiring methods to reduce effect of ground loop current on measuring electrode by producing sacrificial “solution ground”.
	Temperature Compensator shorted, with solution below or above 7.0 pH (in AUTO T.C. mode).	Check T.C. resistance (see Section 5.4.6).
	Reference and drain leads shorted, (mis-wired).	Correct wiring.
	Broken glass electrode.	Replace glass electrode.
	Plugged liquid junction.	Recharge reference cell.
	Drain and source leads between preamp and transmitter open (broken wires).	Correct wiring.
	Broken Reference Electrode. Glass, platinum or reference lead open.	Replace and recharge reference cell. Repair wiring; check for coated or plugged liquid junction (wood or ceramic).
	Electrodes not in solution.	Make sure flow cell is full, there should not be any air pockets. Make sure flow is from bottom to top of cell.
	Liquid junction not installed shipping plug in reference cell.	Replace shipping plug with liquid junction.
	Defective preamplifier (Figure 6-1 and 6-2).	Check preamplifier as instructed in Section 5.4.1 and replace if defective.
b.Meter reads center scale (7 pH or O mV) only, will not move or only a small distance (±1 pH for 320B).	Source and reference leads shorted (mis-wired).	Repair wiring.
	T C open or disconnected AUTO T.C. mode.	Check T.C. per Section 5.4.6.
	Badly coated or internally damaged (cracked) glass electrode.	Clean or replace electrode.
c.Indication is stable between 3 and 6 pH, regardless of actual sample pH.	Glass electrode cracked.	Replace glass electrode.
d.Span between buffers extremely short in AUTO T.C. mode.	Temperature Compensator open.	Check T.C. resistance (see Section 5.4.6).

TABLE 5-1 Continued

TROUBLE	CAUSE	REMEDY
e. Meter indication swings widely (may swing full scale in AUTO T.C. mode.	Temperature Compensator shorted.	Check T.C. resistance (see Section 5.4.6).
f. Sluggish, slow indication on meter for real change in pH or ORP.	Glass or platinum electrode coated.	Clean electrode as instructed in Section 5.2.1.
	Poisoned platinum electrode	Clean electrode as instructed in Section 5.2.1. Check electrode as instructed in Section 5.4.4.
	Defective glass electrode.	Replace electrode.
g. Electrode cannot be standardized (STANDARDIZE control in transmitter at end of rotation).	Glass electrode bad or coated.	Replace electrode.
	Reference electrode contaminated.	Recharge and inspect per Section 5.2.2.
	Defective preamplifier (Figure 6-1 and Figure 6-2).	Check preamplifier as instructed in Section 5.4.1; replace if defective.
	Bias control in instrument improperly set or mistakenly adjusted. (Models 1003 or 1023 only).	Consult transmitter manual.
	Platinum electrode coated.	Clean electrode as instructed in Section 5.2.1.
	Platinum electrode poisoned.	Clean electrode as instructed in Section 5.2.1. Check electrode as instructed in Section 5.4.4.

TABLE 5-2
Test Unit Output Voltage in pH Mode at Four Temperatures

Output voltage in millivolts

pH	15°C	25°C	50°C	80°C
0	396	410	444	486
	340	351	381	416
2	283	293	317	347
3	226	234	254	277
4	170	176	1 90	208
5	113.2	117.1	127.0	138.7
6	56.6	58.6	63.5	69.4
7	0	0	0	0
8	-56.6	-58.6	-63.5	-69.
9	-113.2	-117.1	-127.0	-138
10	-170	-176	-190	-208
1 1	- 226	- 234	- 254	- 277
12	-283	-293	-317	-347
13	-340	-351	-381	-416
14	-396	-410	-444	-486

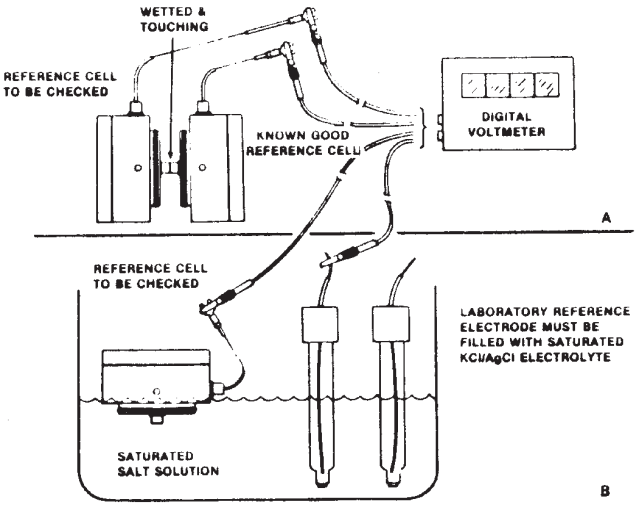


FIGURE 5-2. Reference Electrode Check

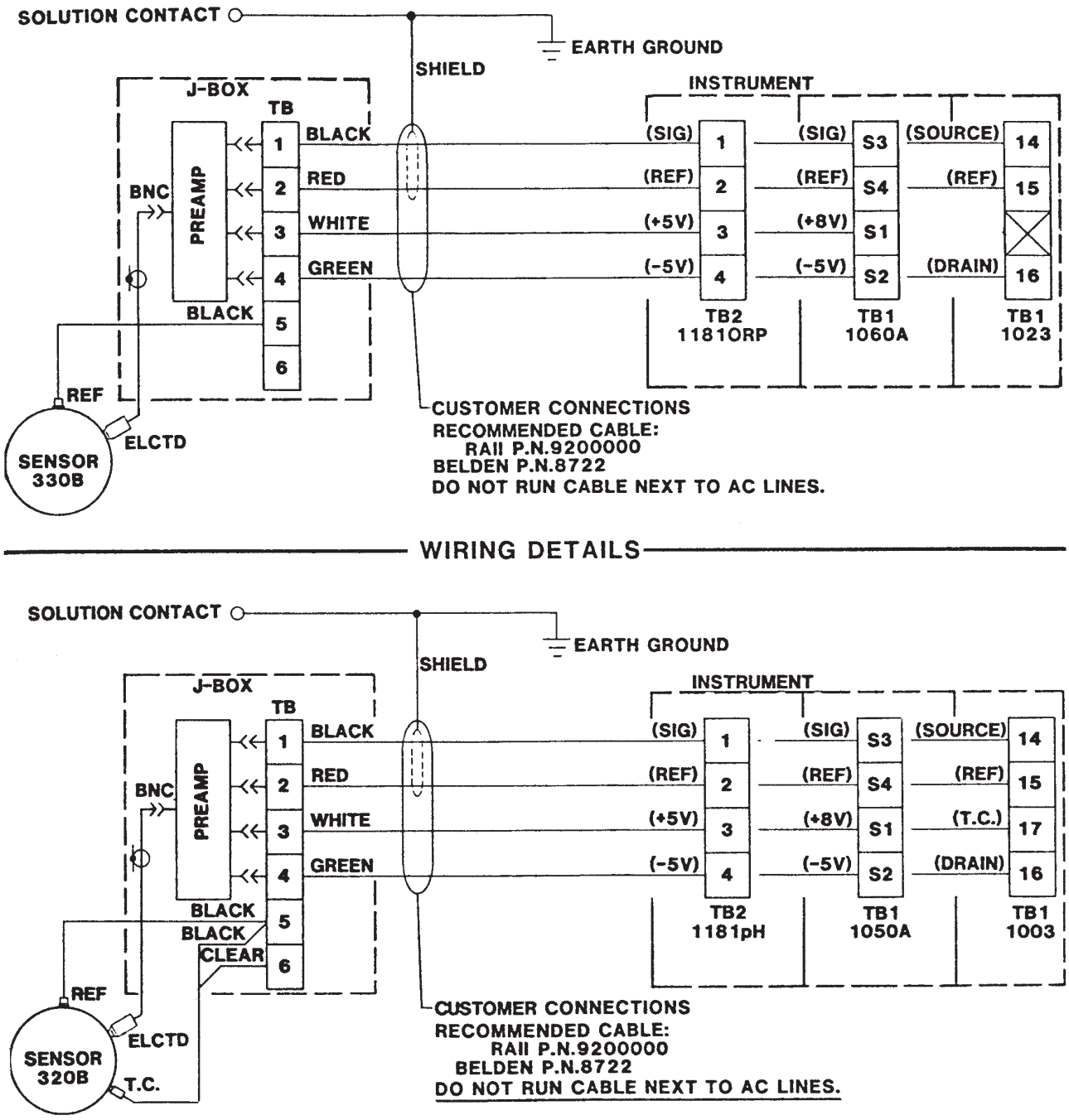


FIGURE 5-3. Solution Shield Diagram

NOTE

A Model PHC-1 Test Box provides a complete electrical simulation of any pH or ORP value, giving virtually 100% assurance that the preamplifier and transmitter are operating properly (see Table 5-2 for output voltages in millivolts).

5.4.2 Reference Cell Check. There are two methods which can be used to check the reference cell. One requires the use of a known good reference cell and the other, the use of a laboratory reference electrode filled with a saturated KCl/AgCl electrolyte. Proceed as follows:

1. Using a known good reference cell (Uniloc P/N 22993-00 kynar or 22995-00 teflon) and a digital voltmeter, set up as shown in Figure 5-3.
2. Wet the liquid junction on both reference electrodes and touch them together at the flat surface of the liquid junctions (make sure there is direct contact and the surfaces are wet.)
3. Meter should indicate less than 10 millivolts.
4. If meter does not indicate less than 10 millivolts, replace the reference cell as instructed in Section 5.2.3.

To check the electrode using a laboratory reference electrode proceed as follows:

1. Make sure the laboratory reference electrode is filled with a saturated KCl/AgCl electrolyte.
2. Place the reference cell and the laboratory reference electrode in a beaker filled with a saturated salt solution as shown in Figure 5-2.
3. Meter should indicate less than 10 millivolts.
4. If meter does not indicate less than 10 millivolts, repair the reference electrode as instructed in Section 5.2.3.

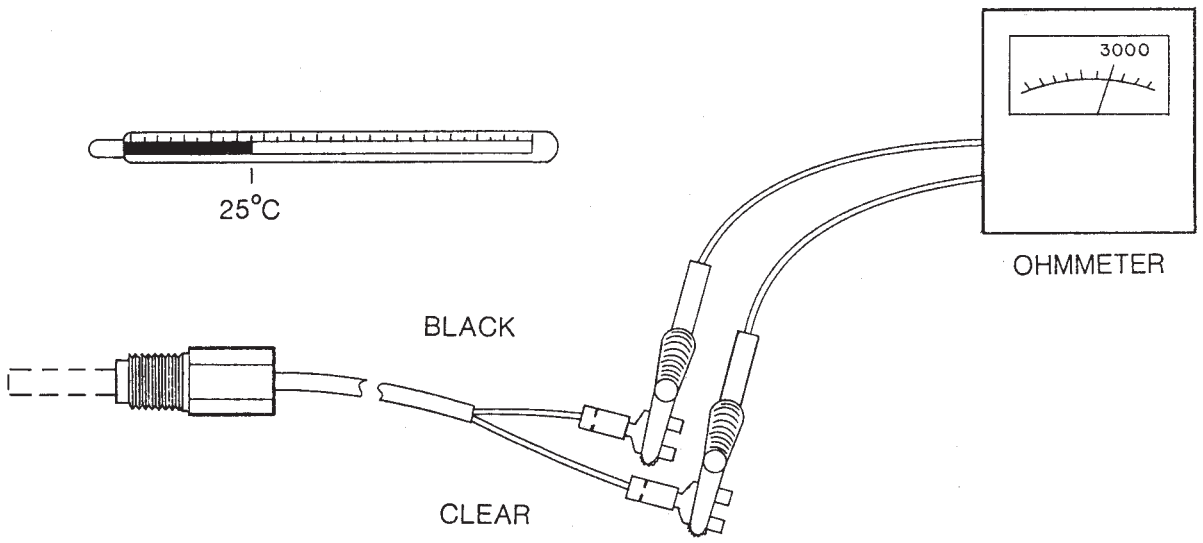


FIGURE 5-4. Temperature Compensator Check Set Up

5.4.3 Glass pH Electrode Check. If the electrode is coated or dirty, clean as follows:

1. Remove the sensor from process.
2. Wipe the glass bulb with a soft, clean, lint free cloth or tissue. If this does not remove the dirt or coating, go to Step 3. (Detergents clean oil and grease; acids remove scale.)
3. Wash the glass bulb in a strong detergent solution and rinse it in clean water. If this does not clean the glass bulb, go to Step 4.

> **CAUTION**
> The solution used during the following check is an acid and should be handled with care. Follow the directions of the acid manufacturer. Wear the proper protective equipment. Do not let the solution come in contact with skin or clothing. If contact with skin is made, immediately rinse with clean water.

4. Wash the glass bulb in a dilute 5% hydrochloric acid solution and rinse with clean water. Soaking the sensor overnight in the acid solution can improve cleaning action.

> **NOTE**
> Erroneous pH results may result immediately after acid soak, due to reference junction potential build-up.
>
> Replace the sensor if cleaning does not restore sensor operation.

5.4.4 Platinum Electrode Check. Electrode may be checked according to Section 3.3.

5.4.5 Cleaning Platinum Electrode. The electrode can be restored to normal operation by simply cleaning the platinum electrode with baking soda. Polish it by rubbing, with a damp paper towel and baking soda until a bright, shiny appearance is attained.

5.4.6 Liquid Junction (Wood or Ceramic). The liquid junction must remain clean and free of debris to maintain a stable reference potential. As the reference junction coats the reference signal becomes noisy and may result in sensor drift. To check the junction:

1. Remove the plug and clean.
2. Completely fill the reference cell with clean water.
3. Dry the plug and screw it back into the cell, while watching the tip.
4. Do not use thread sealants other than Teflon tape on the plug threads.
5. Water beads should appear through the wood or ceramic, not just around the edges or threads.
6. If the junction appears clogged, replace it.

5.4.7 Automatic Temperature Compensator. The temperature compensator element is temperature sensitive and can be checked with an ohmmeter. Resistance increases with temperature.

The 3K element will read 3000 ohms ±1% at 25°C (77°F) and a Pt-100 will read 110 ohms. Resistance varies with temperature for a 3K and Pt-100 element and can be determined according to Table 5-4 or the following formula:

$$R_T = R_o [I + R_1 (T-20)]$$

Where R_T = Resistance
T = Temperature in °C

Refer to Table 5-3 for R_o and R_1 values

TABLE 5-3

R_o and R_1 VALUES FOR TEMPERATURE COMPENSATION ELEMENTS

Temperature Compensation Element	R_o	R_1
3K	2934	.0045
PT-100	107.7	.00385

TABLE 5-4
TEMPERATURE vs RESISTANCE OF AUTO T.C. ELEMENT

Temperature °C	Resistance (Ohms) ±1%	
	3K	PT-100
0	2670	100.0
10	2802	103.8
20	2934	107.7
25	3000	109.6
30	3066	111.5
40	3198	115.4
50	3330	119.2
60	3462	123.1
70	3594	126.9
80	3726	130.8
90	3858	134.6
100	3990	138.5

SECTION 6.0
PARTS LIST

This section provides illustrations and listings of replacement parts for the Model 320B and 330B Sensor. The illustrations and listings are coded with item numbers to aid in locating parts. If you are looking for a part number, look at the drawing of the assembly which contains that part and follow the arrow leading from that part to the item number (see Figure 6-1). Then look for that item number on the accompanying parts list. This will give you the part number, description and quantity recommended for spares of that part. Some parts of the assembly are not listed in the parts list. These parts are not normally furnished as replacement parts.

TABLE 6-1. Replacement Parts for Model 320B/330B -01, -90

Item No.	Replacement Part No.	Description	Qty.
1	32910-00	Reinforcement Bar	1
	32914-00	1/4 in. Flow Cell, Kynar	1
3	22993-00	Reference Cell, Kynar	1
4	2001572	General Purpose Electrodes w/Gland Nut	1
	2001566	Ruggedized Electrode W/Gland Nut	1
	2001574	High pH Electrode w/Gland Nut	1
	2001568	Platinum ORP Electrode w/Gland Nut	1
5	22996-00	J-Box Assembly	1
	22719-02	J-Box Assembly (for Code 90)	1
6	3001907	ABS Mounting Plate	1
7	22814-00	PCB-Preamplifier Mounting	1
8		Bumper	4
9	22698-02	Preamplifier For Use w/1181 pH, 1050A, 1060A	1
	22698-00	Preamplifier For Use w/1003, 1023	1
	22698-03	Preamplifier For Use w/1054/1054A pH, 2054 pH and 2081 pH	1
10	9550041	O-Ring, BUNA N (Process Seal) 2-226	1
11	9550010	O-Ring, BUNA N (Reference Cover) 2-038	1
12	2000734	Liquid Junction (Wood)	1
	2000735	Liquid Junction (Ceramic)	1
13	22994-00	Double Junction Reference Electrode	1
16	23132-00	Temperature Sensor (320B) 3K	1
	23132-01	Temperature Sensor (320B) Pt-100	1
17		J-Box Base	1
18		J-Box Cover	1
19		J-Box Gasket	1
20	32598-00	J-Box Div. 2 (For Code 90)	1
21	9140030	Condulet Seal Assembly	1
22	9320036	3/4 in. Nipple	1
23	2002030	Interconnecting Coaxial Cable	1
24	32910-00	Reinforcement Bar	1
25	9560253	Standoff Assembly	1
26	9120050	Terminal Strip	1
27	22983-00	Thumb Screw for 1/4 in. Flow Cell	2
	22983-01	Thumb Screw for 1 in. Flow Cell	2

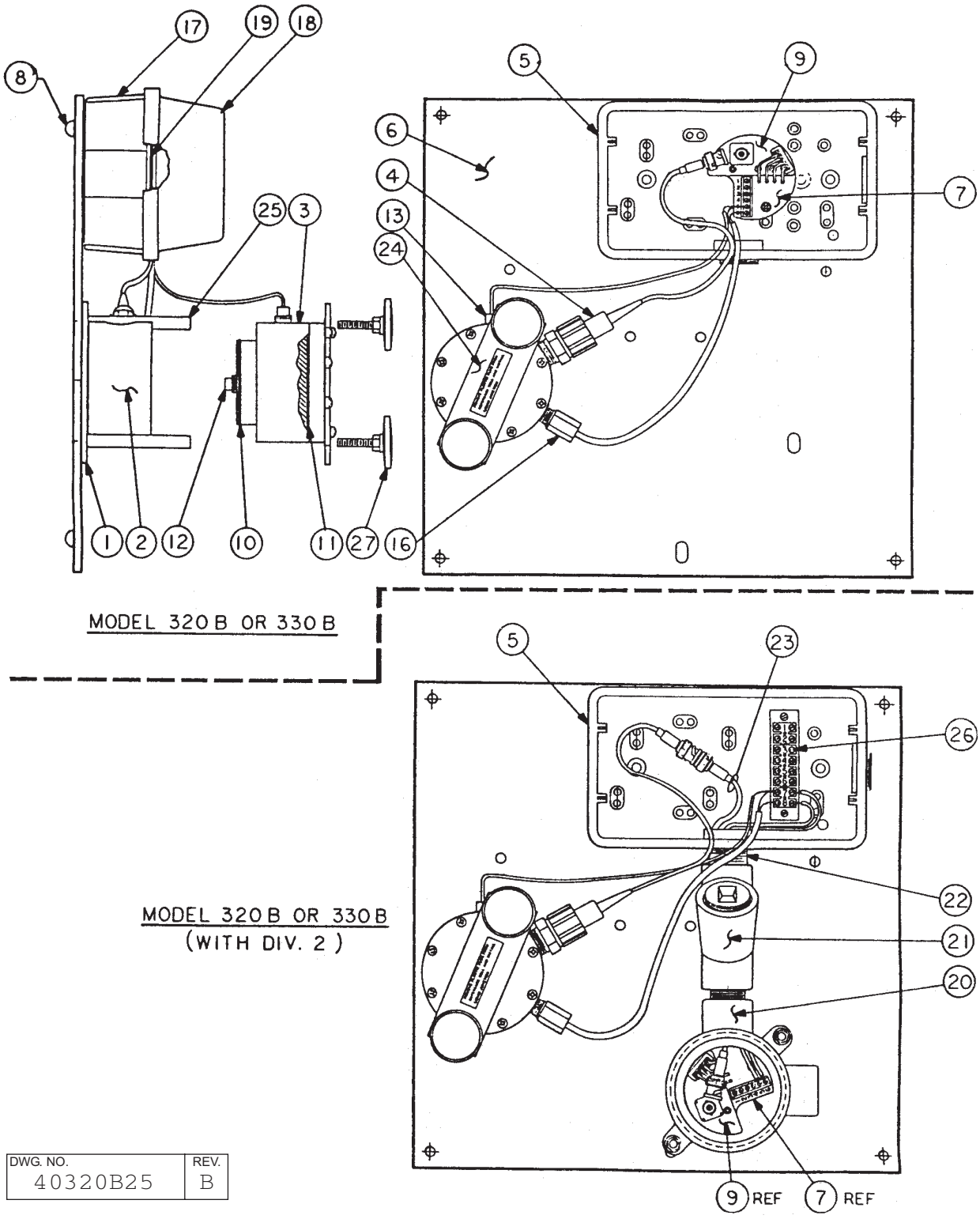


FIGURE 6-1. Detail Kynar Flow Sensor Model 320B or 330B

TABLE 6-2. Replacement Parts for Model 320/330B-03, -05, -90 (see Figure 6-2)

Item No.	Replacement Part No.	Description	Qty.
1	3000251	Support plate	1
2	3000826	1/4 in. Flow Cell, Teflon	1
	3000870	1 in. Stainless Steel Flow	1
3	22995-00	Reference Cell Assembly	1
4	2001572	General Purpose Electrodes w/Gland Nut	1
	2001566	Ruggedized Electrode w/Gland Nut	1
	2001574	High pH Electrode w/Gland Nut	1
	2001568	Platinum ORP Electrode w/Gland Nut	1
5	22996-00	J-Box Assembly	1
	22719-02	J-Box Assembly (for Code 90)	1
6	3001907	ABS Mounting Plate	1
7	22814-00	PCB-Preamplifier Mounting	1
8		Bumper	4
9	22698-00	Preamplifier For Use w/1003	1
	22698-02	Preamplifier For Use w/1181pH, 1050A	1
	22698-03	Preamplifier For Use w/1054/1054A pH, 2054 pH and 2081 pH	1
10	9550044	O-Ring Viton (Process Seal) 2-226	1
11	9550038	O-Ring Viton (Ref. Cell Cover) 2-230	1
12	2000734	Liquid Junction (Wood/Kynar)	1
	2000648	Liquid Junction (Ceramic/Teflon)	1
13	22994-00	Double Junction Reference Electrode	1
16	23132-00	Temperature Sensor Teflon (3K)	1
	23132-01	Temperature Sensor Teflon (PT100)	1
	33024-00	Temperature Sensor Teflon Plug (For option 50/51 330B)	1
17		J-Box Base	1
18		J-Box Cover	1
19		J-Box Gasket	1
20	32598-00	J-Box Div. 2 (For Code 90)	1
21	9140030	Condulet Seal Assembly	1
22	9320036	3/4 in.Nipple	1
23	2002030	Interconnecting Coaxial Cable	1
24	3000252	Reinforcement Bar	1
25	3000253	Standoff	2
26	9120050	Terminal Strip	1

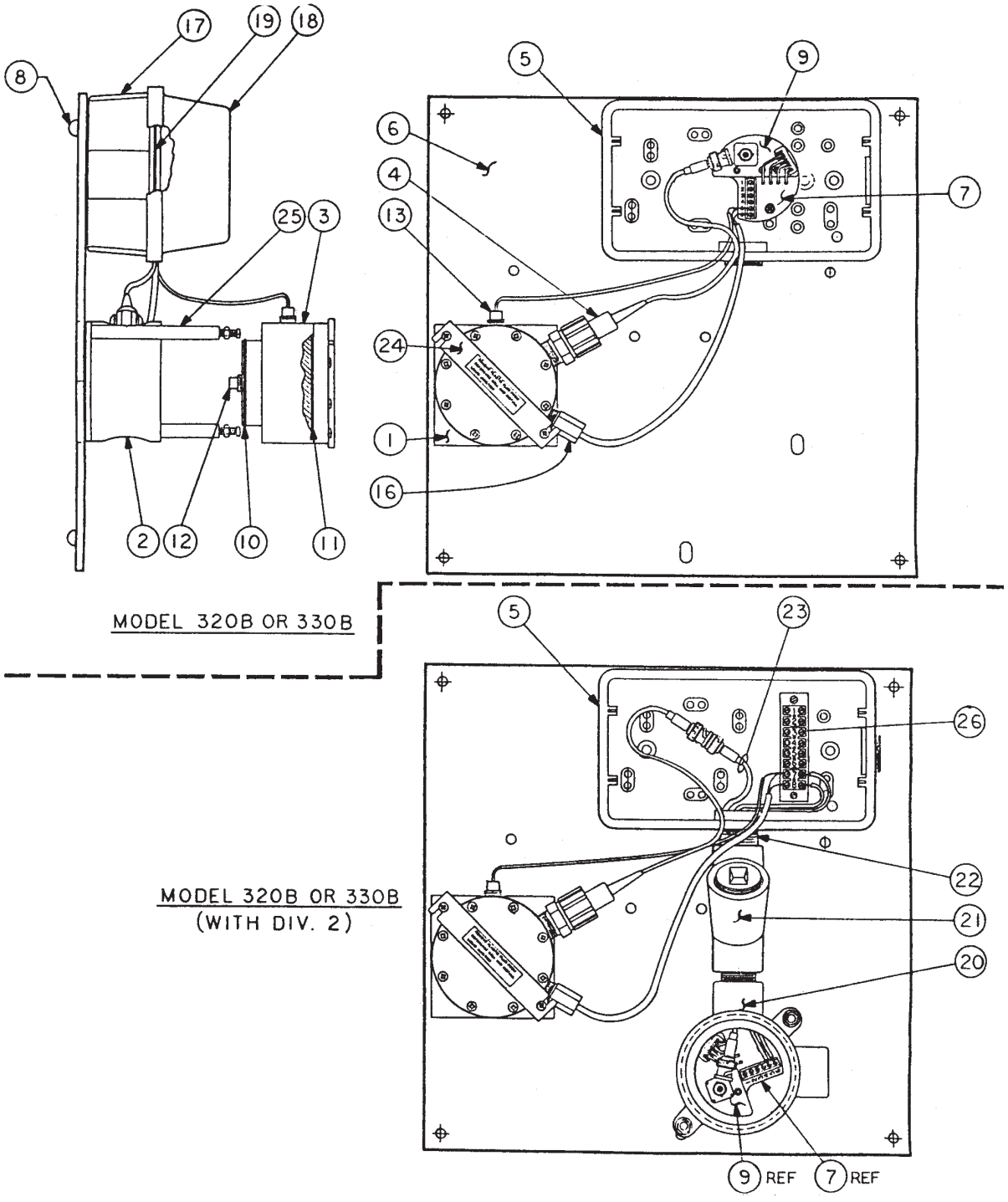


FIGURE 6-2. Detail Teflon Flow Sensor Model 320B or 330B

TABLE 6-3. Replacement Parts for Model 320B with Flow Powered Cleaner (Option 06) (see Figure 6-3)

Item No.	Replacement Part No.	Description	Qty.
1	2001553	Electrode	1
2	32532-00	Nut	1
3	32532-01	Spacer	1
4	3001839	Washer	1
5	9550106	O-Ring	1
6	3001840	Body 1/2 in.	1
7	22750-00	Flow Chamber CPVC	1
8	22750-01	Flow Chamber SST. w/MNPT	1
9	23132-00	Temperature Compensator (3K)	1
	23132-01	Temperature Compensator (PT100)	1
	23132-00	Temperature Compensator Teflon (3K)	1
	23132-01	Temperature Compensator Teflon (PT100)	1
10	22723-00	Teflon Ball, Kit	9
11	32912-00	STDF w/Side Holes	2
12	9320057	UNION, 1 in. (2 pieces) CPVC only	2
13	22983-00	Thumb Screw	2

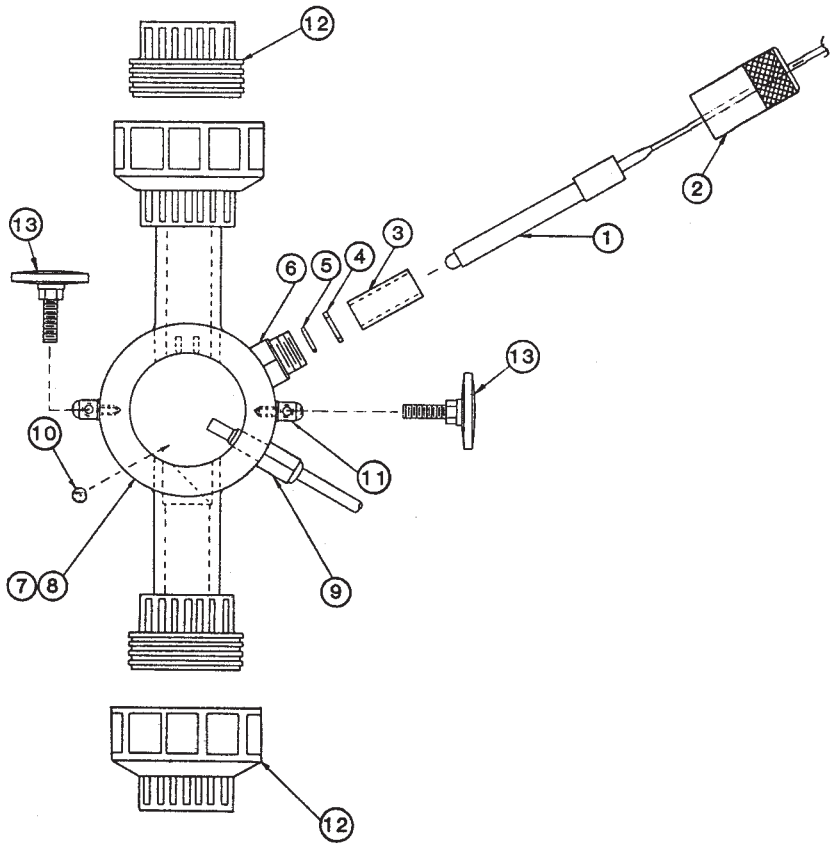
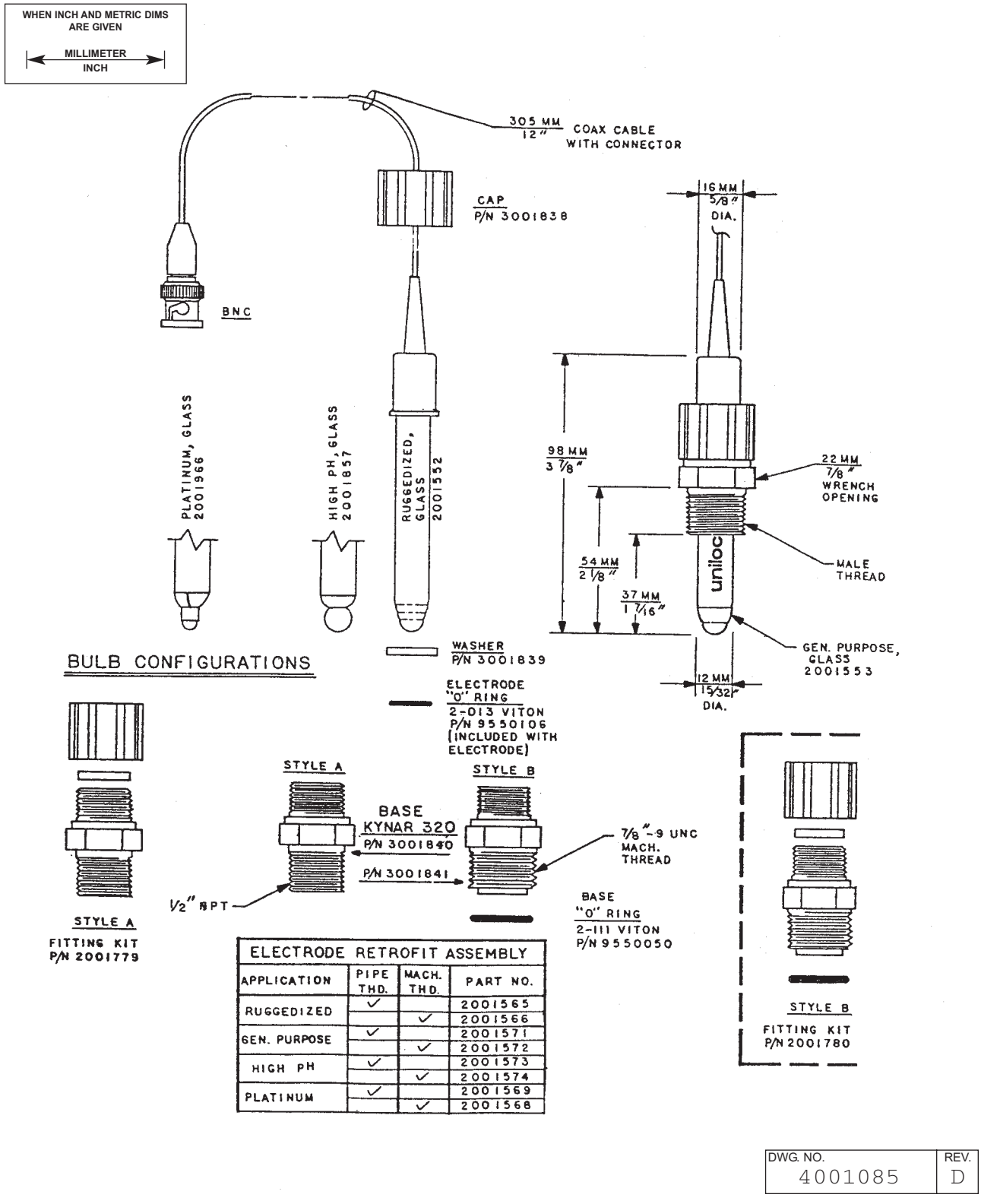


FIGURE 6-3. Model 320B with Flow Powered Cleaner (option 06 shown)



ELECTRODE RETROFIT ASSEMBLY

APPLICATION	PIPE THD.	MACH. THD.	PART NO.
RUGGEDIZED	✓		2001565
		✓	2001566
GEN. PURPOSE	✓		2001571
		✓	2001572
HIGH PH	✓		2001573
		✓	2001574
PLATINUM	✓		2001569
		✓	2001568

FIGURE 6-4. Sensor Electrodes with Retrofit Assembly

SECTION 7.0
RETURN OF MATERIAL

7.1 GENERAL. To expedite the repair and return of instruments, proper communication between the customer and the factory is important. The "Return of Materials Request" form is provided for you to copy and use in case the situation arises. The accuracy and completeness of this form will affect the processing time of your materials. Call 1-949-757-8500 for a Return Materials Authorization (RMA) number.

7.2 WARRANTY REPAIR. The following is the procedure for returning instruments still under warranty.

1. Contact the factory for authorization.
2. Complete a copy of the "Return of Materials Request" form as completely and accurately as possible.
3. To verify warranty, supply the factory sales order number or the original purchase order number. In the case of individual parts or sub-assemblies, the serial number on the unit must be supplied.
4. Carefully package the materials and enclose your "Letter of Transmittal" and the completed copy of the "Return of Materials Request" form. If possible, pack the materials in the same manner as it was received.

IMPORTANT

Please see second section of "Return of Materials Request Form". Compliance to the OSHA requirements is mandatory for the safety of all personnel. MSDS forms and a certification that the instruments have been disinfected or detoxified are required.

5. Send the package prepaid to:

   Emerson Process Management
   Liquid Division
   2400 Barranca Parkway
   Irvine, CA 92606

   Attn: Factory Repair

   RMA No. _____

   Mark the package: Returned for Repair

   Model No. ____

7.3 NON WARRANTY REPAIR.

1. Contact the factor for authorization.
2. Fill out a copy of the "Return of Materials Request" form as completely and accurately as possible.
3. Include a purchase order number and make sure to include the name and telephone number of the right individual to be contacted should additional information be needed.
4. Do Steps 4 and 5 of Section 7.2.

NOTE

Consult the factory for additional information regarding service or repair.

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Uzbekistan
Venezuela
Yemen

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_____	_____	_____

NOTICE TO SENDER

CUSTOMER/USER MUST SUBMIT MATERIAL SAFETY SHEET (MSDS) OR COMPLETE STREAM COMPOSITION, AND/OR LETTER CERTIFYING THE MATERIALS HAVE BEEN DISINFECTED AND/OR DETOXIFIED WHEN RETURNING ANY PRODUCT, SAMPLE OR MATERIAL THAT HAVE BEEN EXPOSED TO OR USED IN AN ENVIRONMENT OR PROCESS THAT CONTAINS A HAZARDOUS MATERIAL **ANY OF THE ABOVE THAT IS SUBMITTED TO ROSEMOUNT ANALYTICAL WITHOUT THE MSDS WILL BE RETURNED TO SENDER C.O.D.** FOR THE SAFETY AND HEALTH OF OUR EMPLOYEES. WE THANK YOU IN ADVANCE FOR COMPLIANCE TO THIS SUBJECT.

SENSOR OR CIRCUIT BOARD ONLY:
(Please reference where from in MODEL / SER. NO. Column)

1. PART NO._____	1. MODEL_____	1. SER. NO._____
2. PART NO._____	2. MODEL_____	2. SER. NO._____
3. PART NO._____	3. MODEL_____	3. SER. NO._____
4. PART NO._____	4. MODEL_____	4. SER. NO._____

REASON FOR RETURN

PLEASE CHECK ONE:

☐ REPAIR AND CALIBRATE
☐ EVALUATION
☐ REPLACEMENT REQUIRED? ☐ YES ☐ NO
☐ DEMO EQUIPMENT NO. _____
☐ OTHER (EXPLAIN) _____

DESCRIPTION OF MALFUNCTION:

_____
_____
_____

REPAIR STATUS

WARRANTY REPAIR REQUESTED:

☐ YES-REFERENCE ORIGINAL ROSEMOUNT ANALYTICAL ORDER NO. _____
CUSTOMER PURCHASE ORDER NO. _____
☐ NO-PROCEED WITH REPAIRS-INVOICE AGAINST P.O. NO. _____
☐ NO-CONTACT WITH ESTIMATE OF REPAIR CHARGES: LETTER ☐ _____
PHONE ☐ _____

NAME _____ PHONE _____
ADDRESS _____
_____ ZIP _____

RETURN AUTHORITY FOR CREDIT ADJUSTMENT [Please check appropriate box(s)]

☐ WRONG PART RECEIVED
☐ DUPLICATE SHIPMENT
☐ RETURN FOR CREDIT
☐ REPLACEMENT RECEIVED
REFERENCE ROSEMOUNT ANALYTICAL SALES ORDER NO._____
RETURN AUTHORIZED BY: _____
WARRANTY DEFECT_____
_____

24-6047

Emerson Process Management

Rosemount Analytical Inc.
2400 Barranca Parkway
Irvine, CA 92606 USA
Tel: (949) 757-8500
Fax: (949) 474-7250

http://www.raihome.com

EMERSON™
Process Management

WARRANTY

Seller warrants that the firmware will execute the programming instructions provided by Seller, and that the Goods manufactured or Services provided by Seller will be free from defects in materials or workmanship under normal use and care until the expiration of the applicable warranty period. Goods are warranted for twelve (12) months from the date of initial installation or eighteen (18) months from the date of shipment by Seller, whichever period expires first. **Consumables, such as glass electrodes, membranes, liquid junctions, electrolyte, o-rings, catalytic beads, etc., and Services are warranted for a period of 90 days from the date of shipment or provision.**

Products purchased by Seller from a third party for resale to Buyer ("Resale Products") shall carry only the warranty extended by the original manufacturer. Buyer agrees that Seller has no liability for Resale Products beyond making a reasonable commercial effort to arrange for procurement and shipping of the Resale Products.

If Buyer discovers any warranty defects and notifies Seller thereof in writing during the applicable warranty period, Seller shall, at its option, promptly correct any errors that are found by Seller in the firmware or Services, or repair or replace F.O.B. point of manufacture that portion of the Goods or firmware found by Seller to be defective, or refund the purchase price of the defective portion of the Goods/Services.

All replacements or repairs necessitated by inadequate maintenance, normal wear and usage, unsuitable power sources, unsuitable environmental conditions, accident, misuse, improper installation, modification, repair, storage or handling, or any other cause not the fault of Seller are not covered by this limited warranty, and shall be at Buyer's expense. Seller shall not be obligated to pay any costs or charges incurred by Buyer or any other party except as may be agreed upon in writing in advance by an authorized Seller representative. All costs of dismantling, reinstallation and freight and the time and expenses of Seller's personnel for site travel and diagnosis under this warranty clause shall be borne by Buyer unless accepted in writing by Seller.

Goods repaired and parts replaced during the warranty period shall be in warranty for the remainder of the original warranty period or ninety (90) days, whichever is longer. This limited warranty is the only warranty made by Seller and can be amended only in a writing signed by an authorized representative of Seller. Except as otherwise expressly provided in the Agreement, THERE ARE NO REPRESENTATIONS OR WARRANTIES OF ANY KIND, EXPRESS OR IMPLIED, AS TO MERCHANTABILITY, FITNESS FOR PARTICULAR PURPOSE, OR ANY OTHER MATTER WITH RESPECT TO ANY OF THE GOODS OR SERVICES.

RETURN OF MATERIAL

Material returned for repair, whether in or out of warranty, should be shipped prepaid to:

Emerson Process Management
Liquid Division
2400 Barranca Parkway
Irvine, CA 92606

The shipping container should be marked:

Return for Repair
Model _____

The returned material should be accompanied by a letter of transmittal which should include the following information (make a copy of the "Return of Materials Request" found on the last page of the Manual and provide the following thereon):

1. Location type of service, and length of time of service of the device.
2. Description of the faulty operation of the device and the circumstances of the failure.
3. Name and telephone number of the person to contact if there are questions about the returned material.
4. Statement as to whether warranty or non-warranty service is requested.
5. Complete shipping instructions for return of the material.

Adherence to these procedures will expedite handling of the returned material and will prevent unnecessary additional charges for inspection and testing to determine the problem with the device.

If the material is returned for out-of-warranty repairs, a purchase order for repairs should be enclosed.

The right people, the right answers, right now.

ON-LINE ORDERING NOW AVAILABLE ON OUR WEB SITE
http://www.raihome.com

Specifications subject to change without notice.

Credit Cards for U.S. Purchases Only.

Emerson Process Management

Liquid Division
2400 Barranca Parkway
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Fax: (949) 474-7250

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