

Dissolved Oxygen Sensor



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

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

To secure and maintain an intrinsically safe installation, the certified safety barrier, transmitter, and sensor combination must be used. The installation system must comply with the governing approval agency (FM, CSA or BASEEFA/CEN-ELEC) 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 Model 430 Dissolved Oxygen Sensor. The following list provides notes concerning all revisions of this document.

<u>Rev. Level</u>	<u>Date</u>	<u>Notes</u>
A	5/96	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.

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MODEL 430 DISSOLVED OXYGEN

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SECTION 1.0 GENERAL DESCRIPTION AND SPECIFICATIONS

- **LARGE ELECTROLYTE RESERVOIR** allows up to twelve months and often longer between refills.
- **OPTIONAL MOUNTING BRACKET** allows easy removal of the sensor from an aeration basin without the use of tools.
- **MODULAR PRESSURE COMPENSATOR AND MEMBRANE RETAINER** simplify recharging and membrane replacement.
- **MEMBRANE RETAINER REPLACEMENT AND RECHARGING** require no tools.

1.1 FEATURES AND APPLICATIONS

The Rosemount Analytical® Model 430 Dissolved Oxygen Sensor, used with the Model 1181 Dissolved Oxygen Transmitter, measures oxygen levels in a variety of applications. The most widely used application is the secondary phase of the waste treatment process where a critical dissolved oxygen level must be maintained for the digestive process to occur. Other applications include water quality monitoring in natural bodies of water such as rivers and streams, or any location where adequate oxygen content is important to sustain aquatic life.

The Model 430 Dissolved Oxygen Sensor is constructed of PVC with an oxygen permeable Teflon¹ membrane .

1.2 OPERATION

As oxygen passes through the Teflon membrane an oxygen dependent electrochemical reaction takes place between the gold cathode and silver anode in the presence of the electrolyte. The resultant current flow between these elements is proportional to the quantity of oxygen which has entered the sensor.

Temperature and pressure compensation are both standard features on the Model 430. Temperature compensation is necessary for two reasons: First, the solubility of oxygen in water decreases with an increase in temperature; secondly, the permeability of the Teflon membrane and the oxygen diffusion rate increase as the temperature increases. For these reasons, it is

important for a dissolved oxygen measurement to be accompanied by an accurate temperature measurement. Temperature compensation is accomplished by means of a thermistor located in the sensor housing, and its associated circuitry in the analyzer.

Pressure compensation is a mechanical rather than electronic correction. It is important for the tension on the Teflon membrane to remain constant at all times, even with sample pressure changes. Fluctuations in membrane tension affect its diffusion characteristics. By means of a pressure compensator the pressure on the sample side of the compensator membrane is transmitted to the electrolyte reservoir so the pressure on both sides of the membrane remains equal. In this manner, sample pressure changes do not affect the diffusion rate of oxygen through the membrane.

The Teflon membrane is held in place by a retainer. A water-tight seal is made with an O-ring between the membrane and sensor reservoir. Membrane replacement is rarely required, but in those situations when it is necessary, the procedure can be performed quickly and easily.

Since oxygen diffuses through the Teflon membrane at a faster rate than through the sample, it is necessary to continuously maintain a fresh sample in front of the membrane. A stream velocity of approximately 1.5 feet per second (0.5 m/s) is required to ensure that a fresh sample is in contact with the membrane at all times.

¹ Reg. U.S. Pat. Office for du Pont's fluorocarbon resins.

1.3 AVAILABLE MODELS

The Model 430-01 and -02 Sensor is a flow through assembly. The sensor is supplied in a 1-1/2 inch PVC tee for installation into a process line.

The Model 430-03 Submersible Sensor is for use in those applications where the required flow velocity can be maintained without the use of an agitator. When the measurement is being made in a stagnant pond or other media where the minimum flow rate of 1.5 FPS cannot be obtained, the Model 430-04 must be selected. This model is designed for submersible use and is provided with its own agitator to ensure adequate flow velocity at the membrane.

The Models 430-03 and 04 may be provided with an optional mounting bracket assembly. This bracket is constructed of light weight aluminum and can be adjusted to satisfy virtually any aeration basin mounting requirement. Once installed, the probe can be removed without the use of tools. A single locking pin holds the assembly rigidly in place but allows it to be easily removed for inspection or cleaning.

1.4 SPECIFICATIONS

Process Connection:

430-00/01 1-1/2 inch socket fitting

Wetted Materials: HOUSING - PVC

MEMBRANE - Teflon

PRESSURE COMPENSATOR - Neoprene

Temperature Compensation:

0 to 50°C (32 to 122°F) Automatic

Sample Pressure: 0-50 psig (345 kPa abs)

Submersible to 200 ft. (61 m).

Agitator Power Requirement: Model 430-04 only)

115 Vac, ±10 60 Hz (0.2 amp)

Cable Length (standard):

6.1 meters (20 ft) on sensor and agitator

Maximum Cable Length:

305 meters (1000 ft)

Operating Time Between Electrolyte Recharge:

Approximately 12 months or longer, depending upon application

Sample Flow Requirements for Models 430-01-02-03:

1.5 feet per seconds (0.5 m/s)

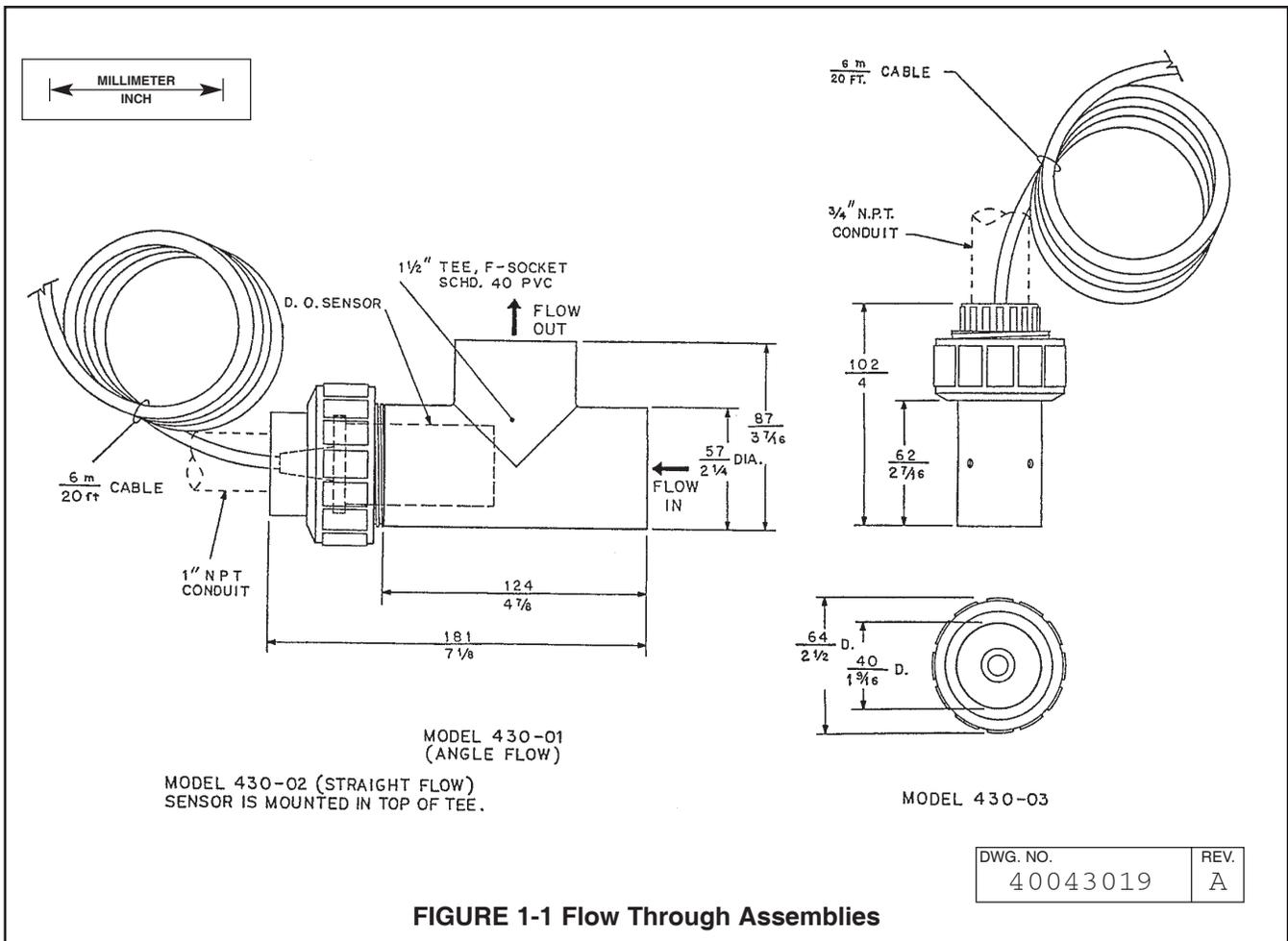


FIGURE 1-1 Flow Through Assemblies

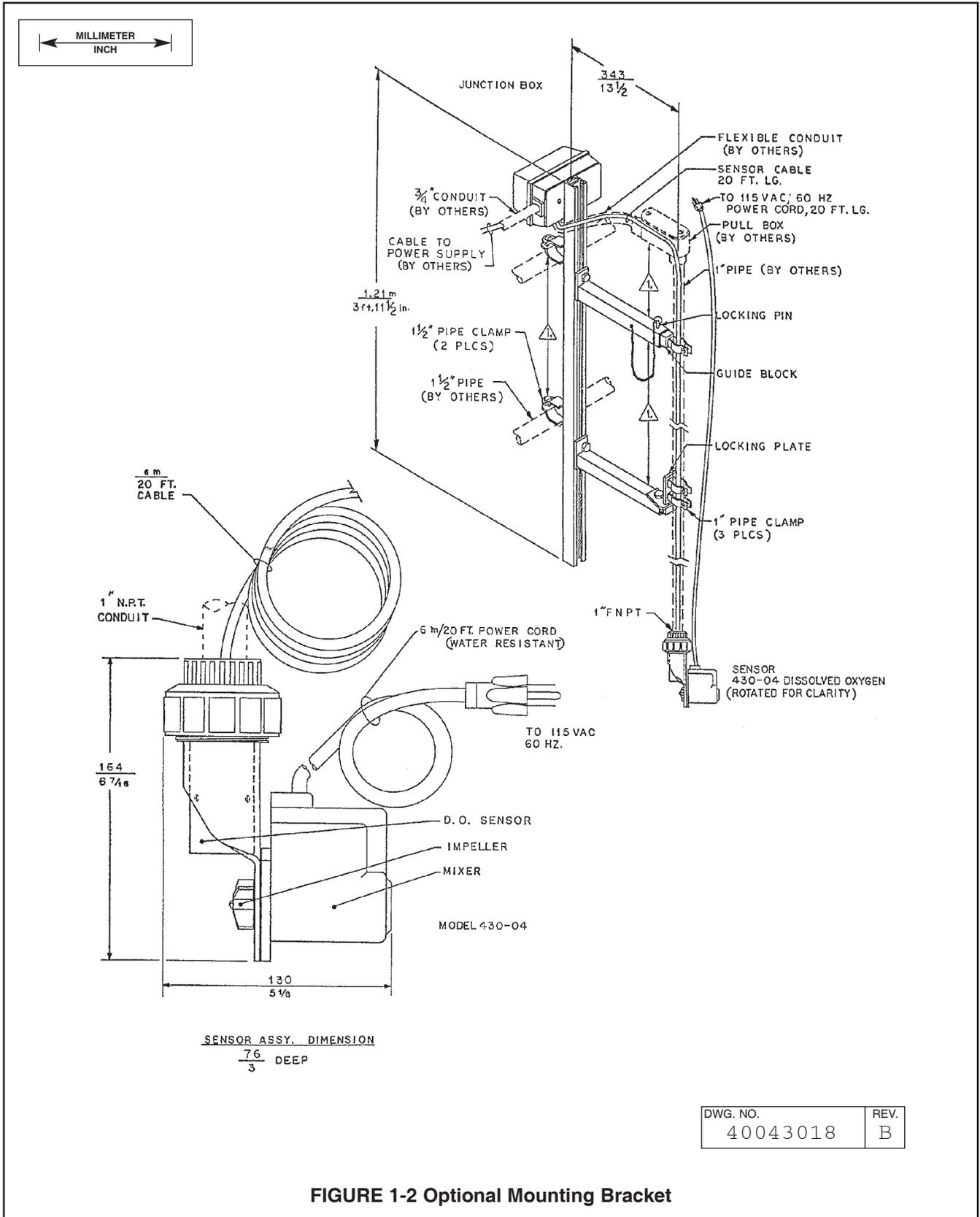


FIGURE 1-2 Optional Mounting Bracket

1.5 ORDERING INFORMATION. The Model 430 Dissolved Oxygen Sensor: Includes PVC body with integral, oxygen-permeable membrane of Teflon¹. Temperature and pressure compensators included. Compatible with Model1181DO.

MODEL 430 DO DISSOLVED OXYGEN SENSOR	
CODE	MOUNTING HARDWARE
01	1-1/2" PVC flow cell, 90° flow
02	1-1/2" PVC flow cell, 180° flow
03	PVC union with 3/4" FNPT for submersion service
04	PVC union with 1" FNPT and agitator with 20 foot cable for submersion. Agitator motor requires 115 VAC power only.

CODE	MOUNTING HARDWARE
11	Stainless steel tag (specify marking)
14	Handrail mounting bracket (P/N 1000857) for use with junction box (see Code 17 below).
15	Handrail mounting bracket (P/N 1000856) for use with Model 803
17	Weatherproof, NEMA 4X junction box (P/N 22719-02)

499 DO	01	16	EXAMPLE
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NOTES:

Recommended interconnecting cable from sensor to transmitter is Belden 8434 or equivalent, available from Rosemount Analytical as P/N 9200074. Specify length.

¹Reg. U.S. Pat. Office for du Pont's fluorocarbon resins.

SECTION 2.0 INSTALLATION

2.1 GENERAL. This section provides instructions for the Model 430 Dissolved Oxygen Sensor.

2.2 UNPACKING AND INSPECTION. Inspect the shipping container and remove the sensor. Carefully check the sensor and its associated hardware for any damage. Report any damage to the carrier immediately.

2.3 MECHANICAL INSTALLATION. The sensor comes in four different configurations. Follow the instruction for the configuration being installed. See Figure 2-2 for dimensions. Figure 1-2 illustrates optional bracket assembly for sensor installation in tanks or ponds.

2.4 Electrical Installation. Connect the sensor to the transmitter as shown in Table 2-1.

2.3.1 Codes 01 and 02 (see Figure 2-1). These configurations are for flow through measurements. Install the tee using 1-1/2 inch PVC. For the angle flow (Code 01), make sure the flow enters at the opening opposite the sensor, so that the sample flows directly into the membrane.

2.3.2 Codes 03 and 04 (see Figure 5-3 and Figure 5-4). These configurations are for submersion into a tank or pond. The Code 03 configuration requires a flow past the sensor of 1.5 feet per second (0.5 m/s). The Code 04 configuration is for stagnant or still tanks and ponds.

TABLE 2-1 Electrode Connections

Sensor Lead	Model 1181DO
1. (Red) silver anode	TB2-4
2. Shield	TB2-2
3. (White) T.C. element	TB2-1
4. (Green) T.C. element	TB2-3
5. (Black) gold cathode	TB2-3

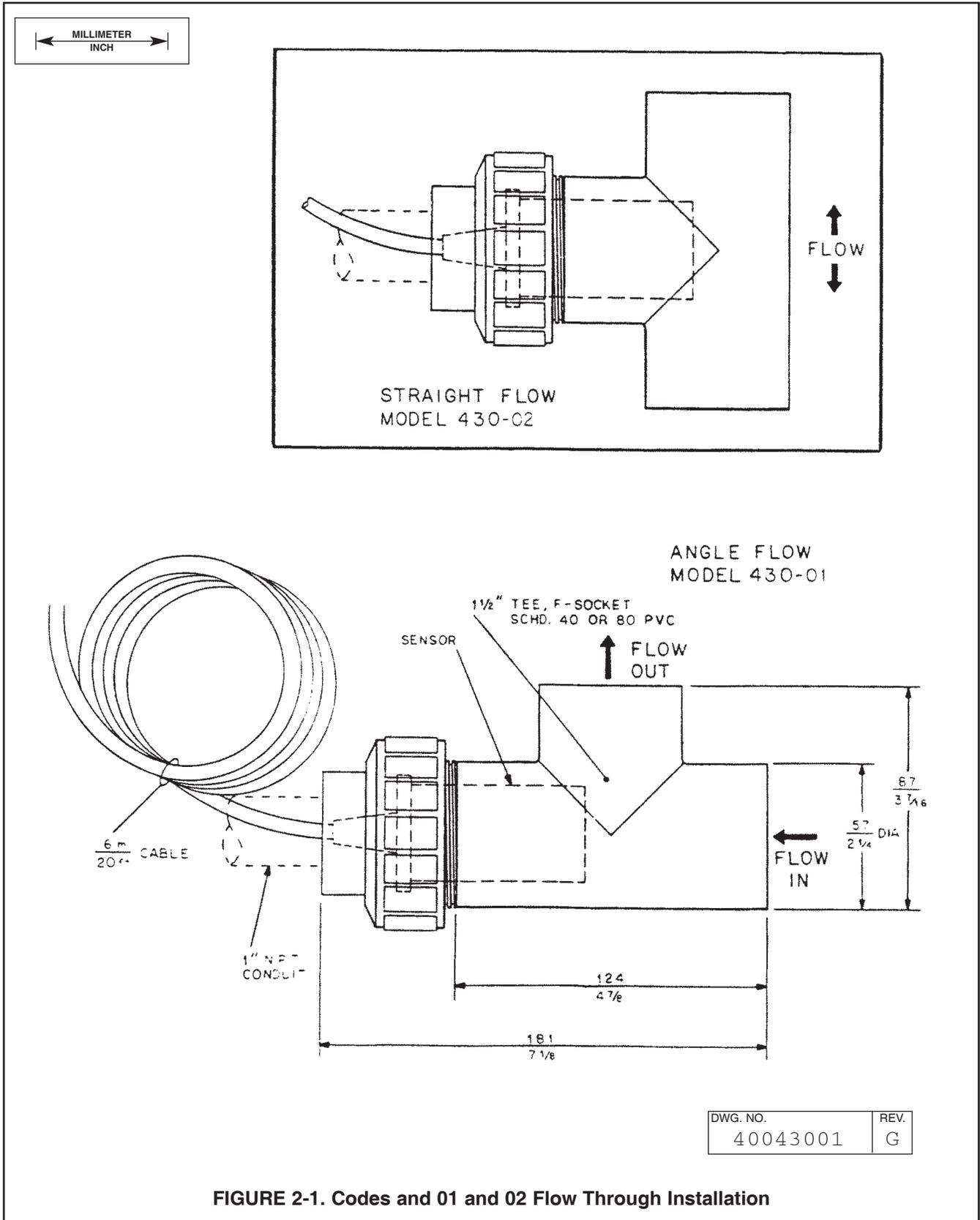


FIGURE 2-1. Codes and 01 and 02 Flow Through Installation

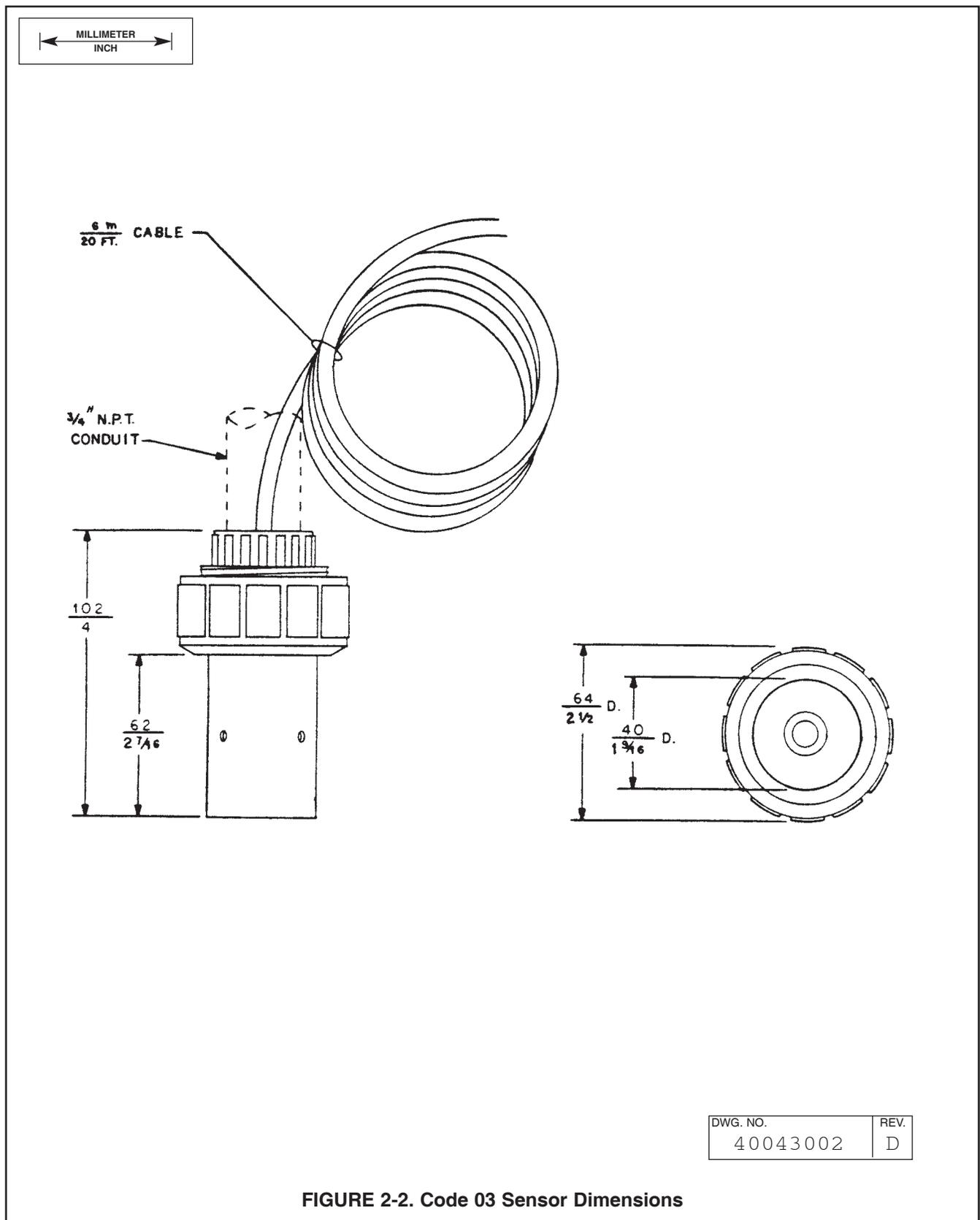


FIGURE 2-2. Code 03 Sensor Dimensions

SECTION 3.0 MAINTENANCE

3.1 GENERAL. Sensor maintenance consists of keeping the sensor clean, recharging the sensor and replacing the membrane. The sensor should be cleaned with clean water and a soft cloth. Make sure the membrane area is kept clean and free of any accumulation of dirt, algae, fungus, hair, etc.

3.2 RECHARGING THE SENSOR. A recharge kit (Rosemount analytical P/N 2002473) is required to service the sensor.

Recharge the sensor as follows (see Figure 5-2):

1. Remove the sensor from its mounting.
 2. Loosen the vent screw approximately 1-1/2 turns. **DO NOT REMOVE IT**
 3. Unscrew and remove the reservoir retainer from the base. Use a strap wrench if the retainer is too tight to remove by hand.
 4. Pull the reservoir housing assembly from the base **WITHOUT** rotating it. Hold sensor in a base-up position to keep electrolyte from spilling out. If the reservoir housing assembly is locked onto the base, use a screwdriver at the parting lines to dislodge the base from the reservoir housing assembly. Do not damage the mating surfaces with the screwdriver while separating the base from the reservoir housing assembly.
- CAUTION**

The electrolyte (KCl) is a corrosive liquid which could damage some materials and may irritate the skin or eyes. If the electrolyte comes in contact with the skin or eyes, wash immediately with clean water.
5. Discard the O-ring, electrolyte, and reservoir housing assembly.
 6. Prepare the electrolyte solution as follows:
 - a. Pour electrolyte crystals into a beaker containing 100 milliliters of distilled or demineralizer water. Stir until crystals are dissolved.
 - b. If it is desired to forego the stabilization period of two hours, a dilution of the electrolyte may be done by adding NaOH or KOH to adjust the pH of the solution to 12 or greater.
 - c. The unused electrolyte solution can be saved for future use. The pH should be rechecked prior to use if the solution has been stored.
 7. Fill the new reservoir housing assembly with electrolyte to the hole in the inner wall of the reservoir (approximately 3/4 full). Tap the reservoir lightly to remove any air bubbles.
 8. Rinse all parts of the base in distilled or deionized water. To remove silver chloride from the silver anode, use a fine grit sandpaper or a pencil eraser and rub lightly until the coating is removed. Rinse the silver anode in distilled water until all traces of grit are removed.
 9. Lightly lubricate the O-rings with O-ring lube and install the O-ring in the groove of the base.
 10. Hold the reservoir housing assembly in an upright position and carefully slide the base into the reservoir housing assembly, making sure the tip of the post enters the membrane retainer. Some electrolyte should seep out through the vent screw while the reservoir housing assembly is being pushed onto the base. Do not grip the pressure compensator while pushing the reservoir housing assembly onto the base.
- CAUTION**

In the following step, do not push the reservoir housing assembly onto the base too fast. The orifices in the base vent screw are very small and a quick surge of pressure could damage the membrane. A stream of electrolyte solution could be forced through the vent screw while the reservoir housing assembly is being installed.
11. Push the reservoir housing assembly onto the base until the threads of the base and the reservoir retainer can be engaged. After the threads are engaged, turn the reservoir retainer until it is finger-tight. Caution, over finger-tight may damage membrane or base post.
- NOTE**

Do not touch or apply pressure to the membrane.
12. Tighten the vent screw. Rinse the sensor with clean water and dry with a lint-free cloth or towel.
 13. The sensor is now ready for use.

SECTION 4.0 TROUBLESHOOTING

4.1 GENERAL. This section contains troubleshooting data for the Model 430 Sensor Assembly.

4.2 TROUBLESHOOTING THE MODEL 430 DISSOLVED OXYGEN SENSOR. The majority of problems encountered in DO systems are because the sensor is either improperly maintained or has an internal leakage causing improper temperature compensator resistance and high impedance current paths between elements of the sensor.

Disassemble the sensor completely by unscrewing the reservoir retainer and pulling the reservoir housing assembly straight out (refer to Figure 5-2). The membrane may have dried onto the gold cathode. Soak this loose with water as scraping will damage the gold tip. Clean all the parts with clean water and dry them. Check for visible damage (i.e., cracks, deep cuts, broken silver wires). Perform the following checks with an ohmmeter. Check T.C. resistance between the green and white wires. It should be 100K ohms at 25°C or per the Temperature/Resistance Chart. Check continuity between the red wire and the silver anode, and between the black wire and the gold cathode (be careful not to scratch the gold). Perform a high meg check between the following (100 meg ohms minimum): Shield to Black or Red or Green. If everything checks O.K., the sensor should function after a proper recharge. If the silver anode appears oxidized, it may be cleaned with wet or dry 400 sandpaper. Also brush the gold tip two or three times with the 400 sandpaper in one direction only. Follow the recharge directions in Section 3.2.

4.3 BENCH TESTING. Soak the electrode for 24 hours with polarizing voltage applied (instrument), then air calibrate to check for a response.

CAUTION

Care should be taken not to damage the membrane made of "Teflon".

1. Low readings and inability to calibrate are generally the result of a coated membrane and usually can be restored to service by cleaning the sensor. Clean a coated membrane by gently wiping the membrane with a soft cloth or tissue.

2. Readings offscale and inability to calibrate are usually caused by a damaged membrane. If this is the case, replace the membrane.
3. To check the membrane made of "Teflon", connect the negative (—) lead of an ohmmeter to the cathode (black) lead and place water saturated with salt on the membrane. Touch the positive (+) lead to the water. The meter should read open (100 megohms or more). If the meter indicates a short (less than 100 megohms), replace the membrane (refer to Section 3.2).
4. To check the resistance of the temperature compensator, connect an ohmmeter to the green and white leads of the sensor. The resistance should be as indicated at the temperature listed below: If the resistance as specified above cannot be achieved, replace the sensor (Figure 5-2).

Temperature Resistance Chart

TEMPERATURE	RESISTANCE (ohms)
0°C	371.40K
10°C	214.50K
20°C	128.00K
25°C	100.00K
30°C	78.00K
40°C	49.80K
50°C	32.36K

5. To check for shorted sensor leads, measure the resistance between one temperature compensator wire (green or white) and the cathode (black) lead and anode (red) lead. The meter should indicate an open circuit (100 megohms or more). Repeat the measurement using the other temperature compensator wire. If the sensor shows a short circuit, the sensor is defective and should be replaced.

¹ Reg. U.S. Pat. Office for du Pont's fluorocarbon resins.

SECTION 5.0 PARTS LISTS

5.1 GENERAL. This section contains the replacement parts lists and illustrations for the Model 430 Sensor Assembly. Parts are keyed with an item number. Use the illustration to locate the item number for the part in question. Then refer to the accompanying parts list for the part number, description and quantity needed. The Usage Code column, where used, identifies parts used on more than one assembly. If there is no code letter, the item is used on all assemblies in that parts list.

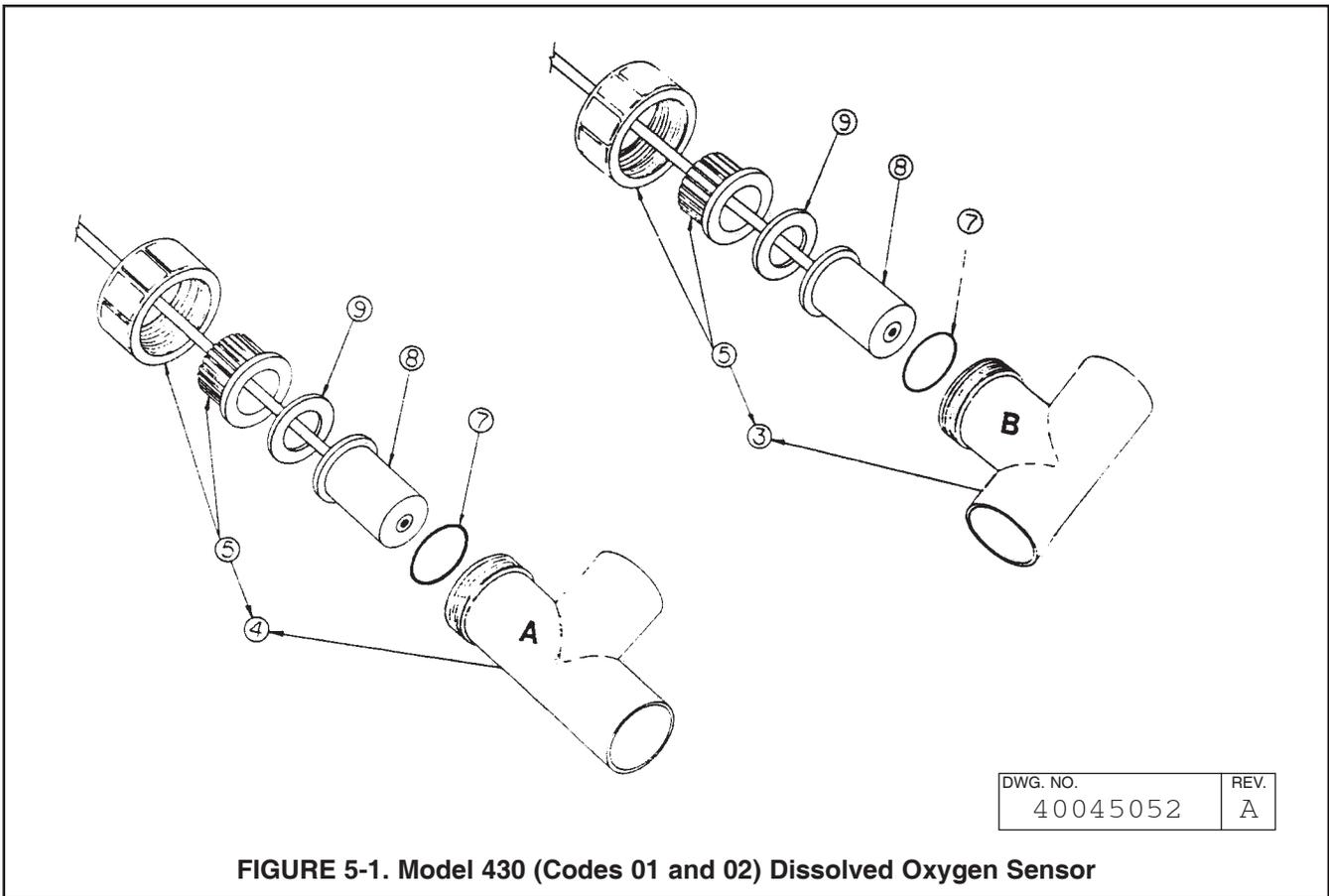


Figure & Item No.	Part Number	Description	Usage Code	Qty.
5-1 A		SENSOR ASSY, Model 430 Dissolved Oxygen, angle flow (Code 01)	A	RF
B		SENSOR ASSY, Model 430 Dissolved Oxygen, straight flow (Code 02)	B	RF
3	2002566	Tee Assy, angle flow	A	
4	2002567	Tee Assy, straight flow	B	
5		Union, 1" NPT		
7	9550090	O-ring (Buna-N, 2-029)		
8	1001021	Sensor Assy (see Figure 5-2 for details)		
9	3001197	Gasket		

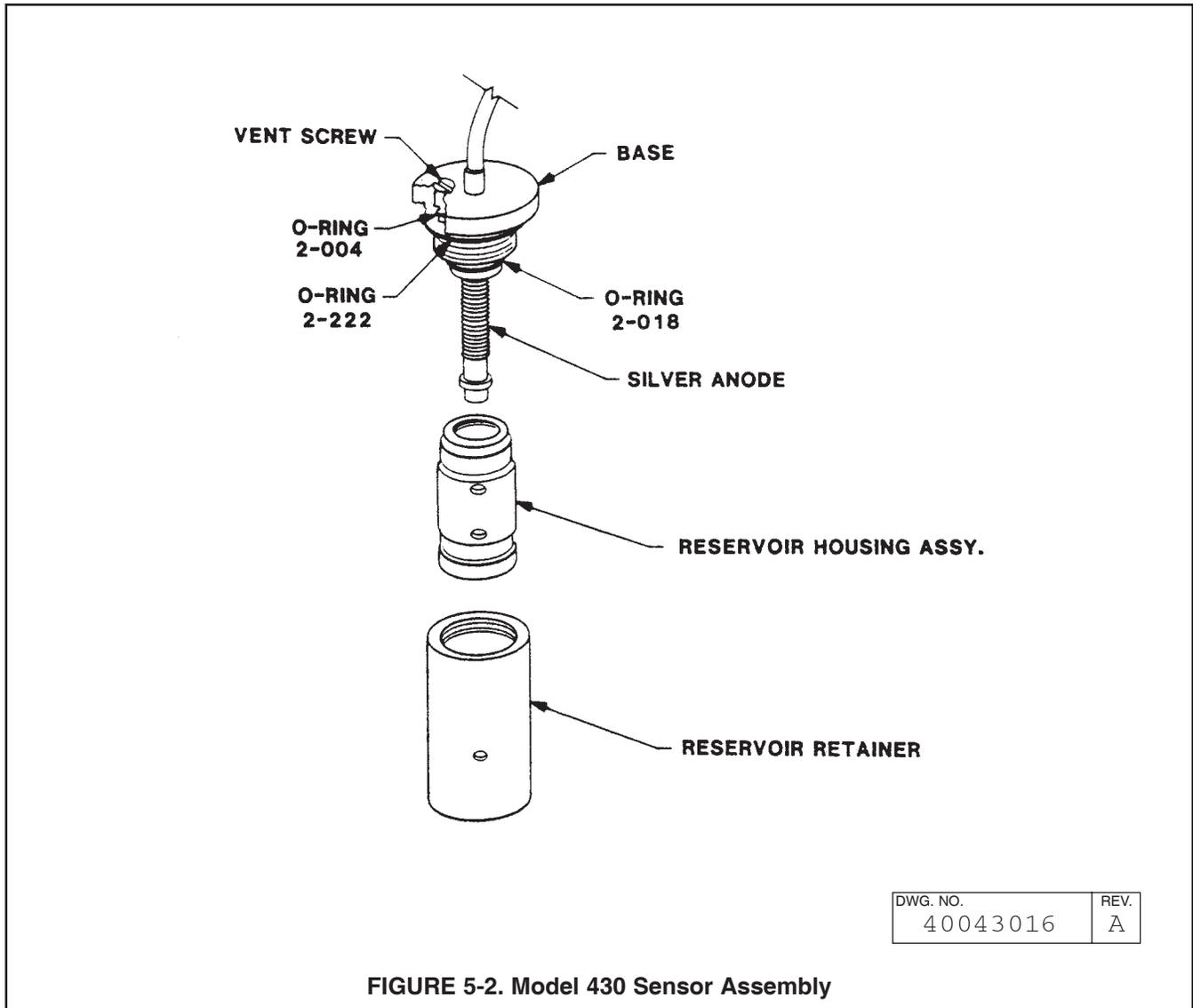


FIGURE 5-2. Model 430 Sensor Assembly

Part Number	Description	Qty.
3002384	Base	1
9550116	O-ring (2-018)*	1
2002572	Reservoir housing assembly with membrane*	1
3002385	Retainer ,reservoir	1
9550133	O-ring (2-004)	1
3002382	Screw, vent	1
2002473	Recharge Kit	1

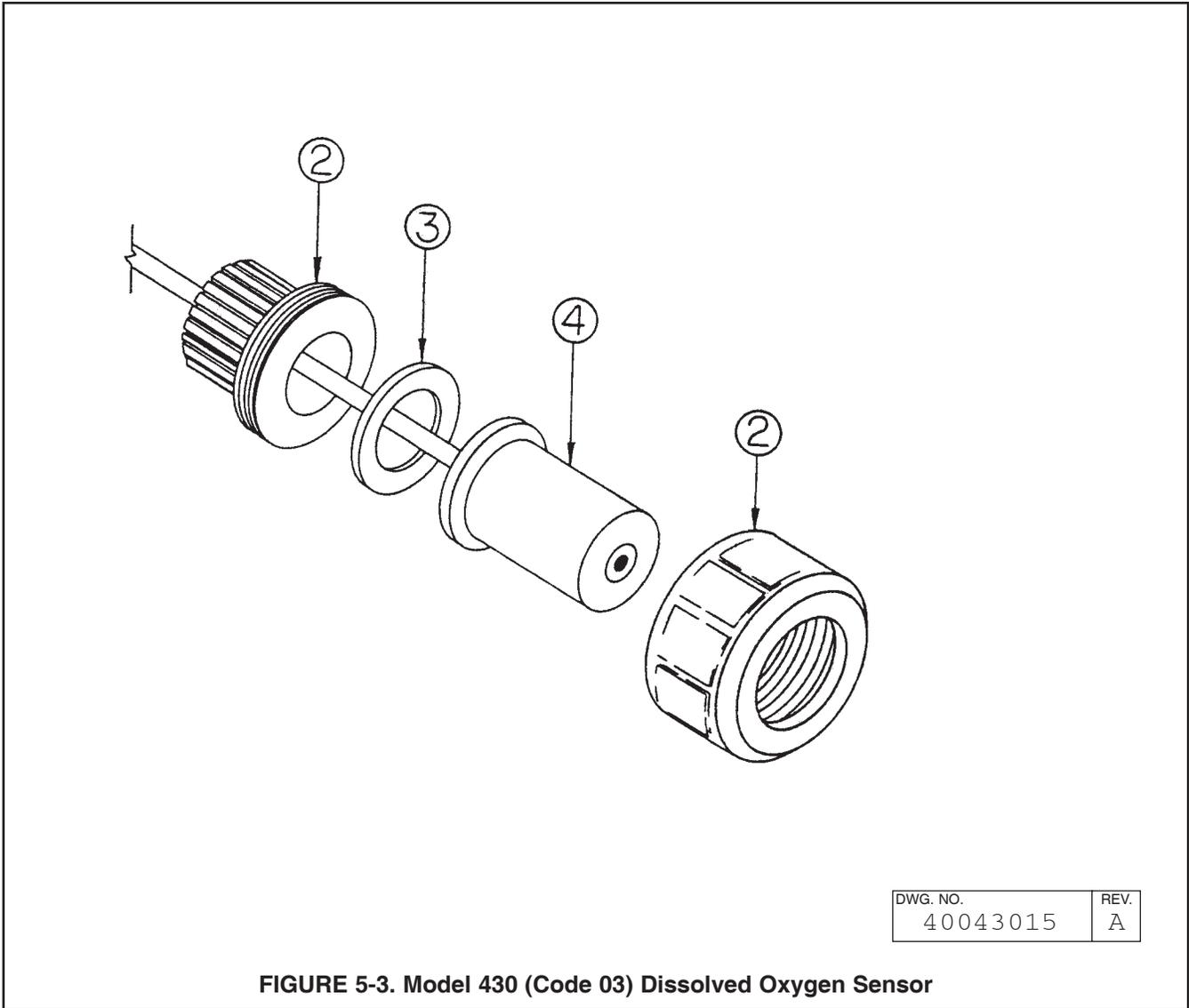


Figure & Item No.	Part Number	Description	Qty.
5-3		SENSOR ASSY, Model 430 Dissolved Oxygen, submersion (Code 13)	RF
2	9330020	Union, 3/4" NPT	RF
3	3001617	Gasket	1
4	1001021	Sensor Assy (see Figure 5-2 for details)	1

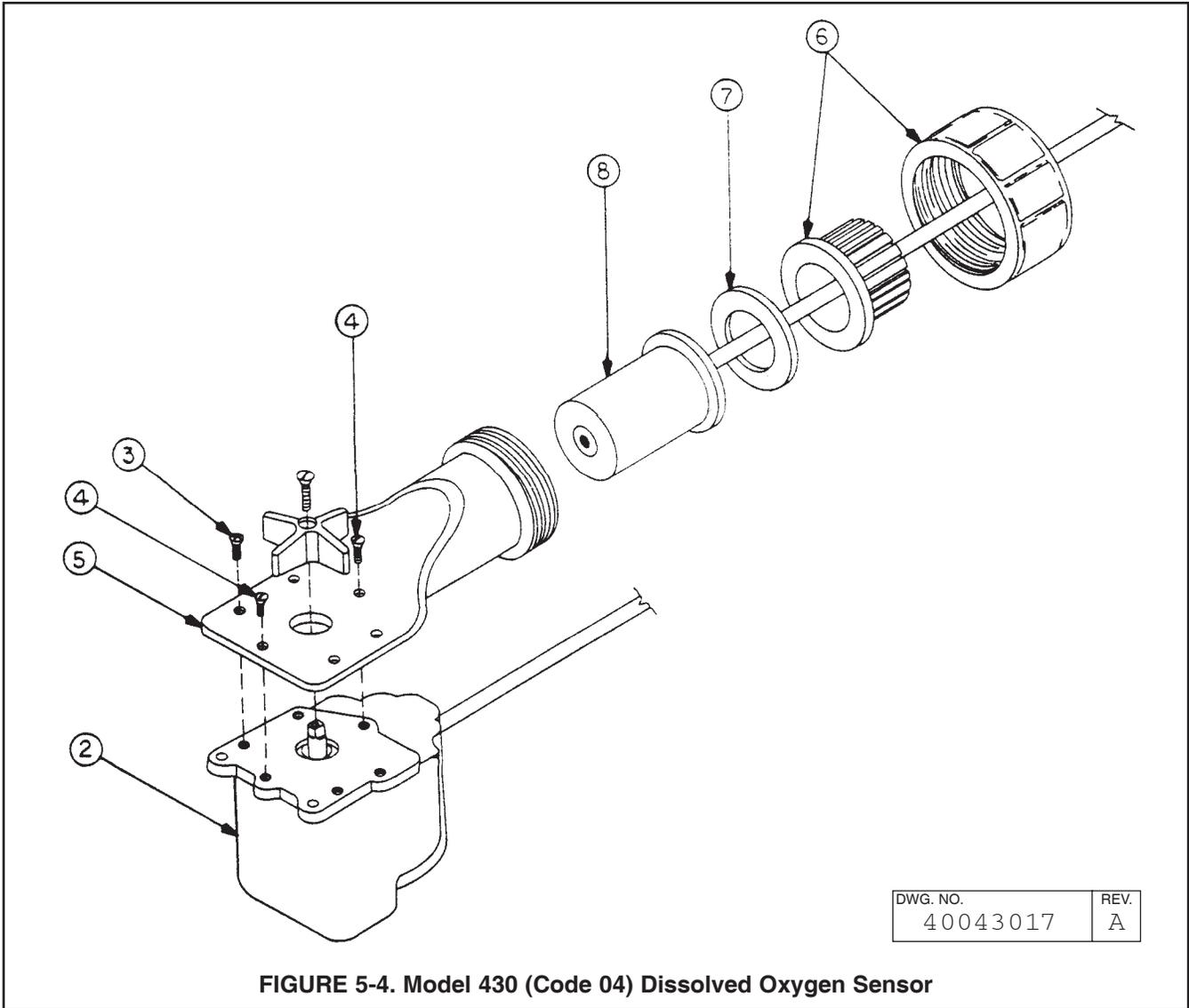


FIGURE 5-4. Model 430 (Code 04) Dissolved Oxygen Sensor

Figure & Item No.	Part Number	Description	Qty.
5-4		SENSOR ASSY, Model 430 Dissolved Oxygen, with agitator (Code 04)	1
2	9380053	Pump, submersible Attaching parts for item 2:	1
3		Screw, SPH SS (#8-32x3/8)	4
4		Screw, SPH SS (#8-32x3/8)	2
5	3001150	Holder Assy	1
6	9320057	Union, 1" NPT	1
7	3001197	Gasket	1
8	1001021	Sensor assy (see Figure 5-2 for details)	1

SECTION 6.0 RETURN OF MATERIAL

6.1 GENERAL. To expedite the repair and return of instruments, proper communication between the customer and the factory is important. A return material authorization (RMA) number is required. Call (949) 757-8500. 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.

6.2 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 mother 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:

Rosemount Analytical Inc.
2400 Barranca Parkway
Irvine, CA 92606

Attn: Factory Repair

Mark the package: Returned for Repair RMA#

Model No. _____

6.3 NON WARRANTY REPAIR. Contact Factory For Authorization

1. Contact the factory 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 6.2.

NOTE

Consult the factory for additional information regarding service or repair.



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Germany	Poland	Yemen
Greece	Portugal	
Hong Kong	Puerto Rico	
Hungary	Qatar	

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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.*

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