

Instruction Sheet

PN 51A-396R/rev.L

January 2011

Model 396R

TUph[™] Retractable pH/ORP Sensor

For additional information, please visit our website
at www.emersonprocess.com/raihome/liquid/.

SPECIFICATIONS	MODEL 396R
Measurements and Ranges	pH: 0-14; ORP: -1500 to 1500 mV*
Available pH AccuGLASS Types	GPLR hemi bulb or GPLR flat bulb
Wetted Materials	Polypropylene, EPDM, titanium, glass, (platinum: ORP only)
Process Connection	None, use 1 inch process connector or ball valve kit (1-1/2 inch or 1-1/4 inch — sold separately)
Temperature Range	0 to 100°C (32 to 212°F)
Pressure Range - Hemi bulb	100 to 1136 kPa (abs) (0 to 150 psig)
Pressure Range - Flat bulb	100 to 790 kPa (abs) (0 to 100 psig)
Maximum Pressure at Retraction or Insertion	Code 21: 542 kPa (abs) (64 psig) Code 25: 343 kPa (abs) (35 psig)
Minimum Conductivity	100 µS/cm, nominal
Preamplifier Options	Remote

Specifications subject to change without notice.

PERCENT LINEARITY FOR MODEL 396R		
pH range	GPLR Hemi bulb	GPLR Flat bulb
0-2	94%	93%
2-12	99%	98%
12-13	97%	95%
13-14	92%	—

ATEX DIRECTIVE

Special Conditions for safe use

1. All pH/ORP sensors have a plastic enclosure which must only be cleaned with a damp cloth to avoid the danger due to a build up of an electrostatic charge.
2. All pH/ORP sensor Models are intended to be in contact with the process fluid and may not meet the 500V r.m.s. a.c. test to earth. This must be taken into consideration at installation.

STORAGE

1. It is recommended that electrodes be stored in their original shipping containers until needed.
2. Do not store at temperatures below -5°C (23°F).
3. Electrodes should be stored with a protective cap containing KCl solution (PN 9210342).
4. For overnight storage, immerse the sensor in tap water or 4 pH buffer solution.
5. A pH glass electrode does have a limited shelf life of one year.

WARNING

System pressure may cause the sensor to blow out with great force unless care is taken during removal. Allow sufficient room for safe retraction and insertion of the sensor. Personnel should have room for stable footing while performing removal or insertion of the sensor.

WARNING

RETRACTABLE SENSORS

Retractable sensors must not be inserted nor retracted when process pressures are in excess of 64 psig (542kPa) for option 21 or 35 psig (343 kPa) for option 25.

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.

ELECTRODE PREPARATION

1. Remove electrode from shipping container.
2. Remove the protective boot covering the electrode bulb.
3. Rinse away salt film with clean water, then gently shake the electrode so that the internal solution fills the bulb, thus removing any air trapped there.

INSTALLATION

For sensor dimensions, see Figures 1 and 2.

For sensor orientation and installation, see Figures 3 - 5.

For wiring, see Figures 6 - 20.

pH SENSOR CALIBRATION AND MAINTENANCE

TWO POINT pH BUFFER CALIBRATION

Select two stable buffer solutions, preferably pH 4.0 and 10.0 (pH buffers other than pH 4.0 and pH 10.0 can be used as long as the pH values are at least two pH units apart).

NOTE

A pH 7 buffer solution reads a mV value of approx. zero, and pH buffers read approximately ± 59.1 mV for each pH unit above or below pH 7. Check the pH buffer manufacturer specifications for millivolt values at various temperatures since it may affect the actual value of the buffer solution mV/pH value.

1. Immerse sensor in the first buffer solution. Allow sensor to equilibrate to the buffer temperature (to avoid errors due to temperature differences between the buffer solution and sensor temperature) and wait for reading to stabilize. Value of buffer can now be acknowledged by analyzer/transmitter.
2. Once the first buffer has been acknowledged by the analyzer/transmitter, rinse the buffer solution off of the sensor with distilled or deionized water.
3. Repeat steps 1 and 2 using the second buffer solution.
4. The theoretical slope value, according to the Nernst equation for calculating pH, is approximately 59.17 mV/pH. Over time the sensor will age, both in the process and in storage, and will result in reduced slope values. To ensure accurate readings, it is recommended that the electrode be replaced when the slope value falls below 47 to 49 mV/pH.

RECOMMENDED pH SENSOR STANDARDIZATION

For maximum accuracy, the sensor can be standardized on-line or with a process grab sample after a buffer calibration has been performed and the sensor has been conditioned to the process. Standardization accounts for the sensor junction potential and other interferences. Standardization will not change the sensor's slope but will simply adjust the analyzer's reading to match that of the known process pH.

MAINTENANCE FOR pH ELECTRODES

Electrodes should respond rapidly. Sluggishness, offsets, and erratic readings are indicators that the electrodes may need cleaning or replacement.

1. To remove oil deposit, clean the electrode with a mild non-abrasive detergent.

2. To remove scale deposits, soak electrodes for 30 to 60 minutes in a 5% hydrochloric acid solution.
3. Temperature effect on life expectancy: If glass electrode life expectancy is 100% @ 25°C (77°F), then it will be approximately 25% @ 80°C (176°F).

ORP SENSOR CALIBRATION AND MAINTENANCE

CALIBRATION

1. After making an electrical connection between the sensor and the instrument, obtain a standard solution of saturated quinhydrone. This can also be made quite simply by adding a few crystals of quinhydrone to either pH 4 or pH 7 buffer. Quinhydrone is only slightly soluble, therefore only a few crystals will be required.
2. Immerse the sensor in the standard solution. Allow 1-2 minutes for the ORP sensor to stabilize.
3. Adjust the standardize control of the instrument to the solution value shown in the table below. The resulting potentials, measured with a clean platinum electrode and saturated KCl/AgCl reference electrode, should be within ± 20 millivolts of the value shown in the table below. Solution temperature must be noted to ensure accurate interpretation of results. The ORP value of saturated quinhydrone solution is not stable over long periods of time. Therefore, these standards should be made up fresh each time they are used.
4. Remove the sensor from the buffer, rinse, and install in the process.

ORP of Saturated Quinhydrone Solution (millivolts)

	pH 4 Solution			pH 7 Solution		
Temp °C	20	25	30	20	25	30
mV Potential	268	264	260	94	87	80

MAINTENANCE FOR ORP ELECTRODES

Electrodes should respond rapidly. Sluggishness, offsets, and erratic readings are indicators that the electrodes may need cleaning or replacement.

1. To remove oil deposit, clean the electrode with a mild non-abrasive detergent.
2. To remove scale deposits, soak electrodes for 30 to 60 minutes in a 5% hydrochloric acid solution.
3. ORP (metallic) electrodes should be polished with moistened baking soda.

NOTE

Remove electrical tape or shrink sleeve from gray reference wire before connecting wire to terminal.

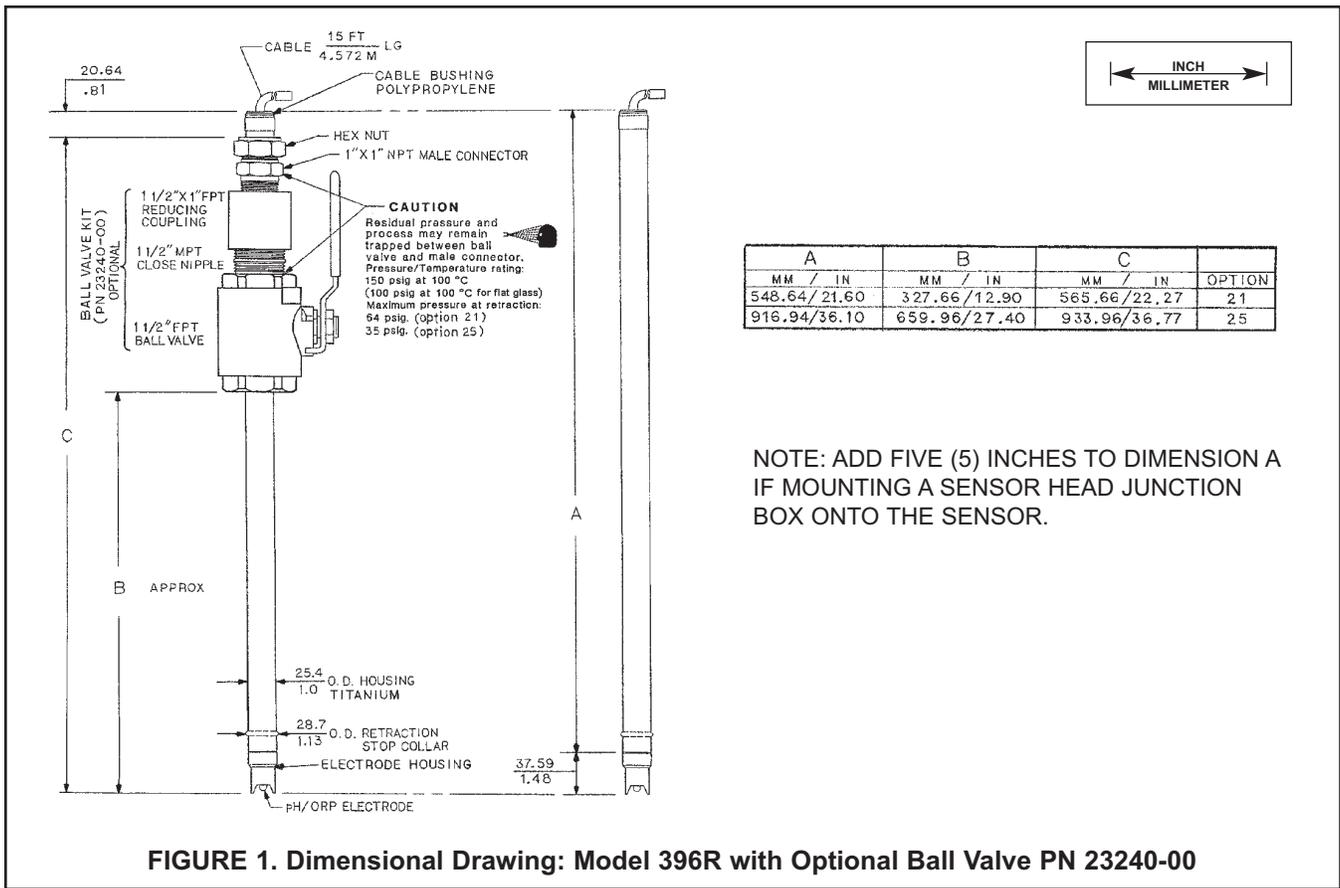


FIGURE 1. Dimensional Drawing: Model 396R with Optional Ball Valve PN 23240-00

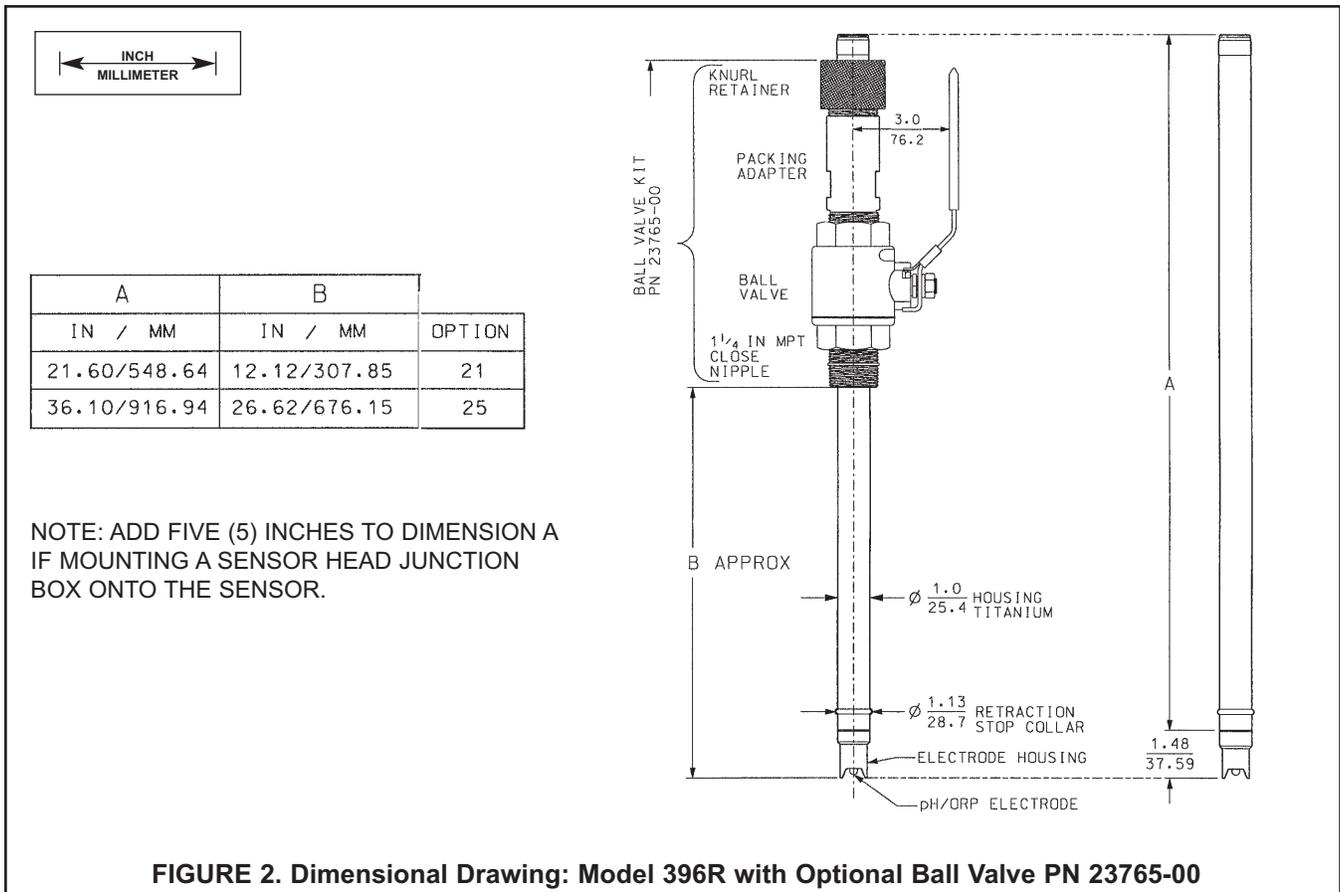


FIGURE 2. Dimensional Drawing: Model 396R with Optional Ball Valve PN 23765-00

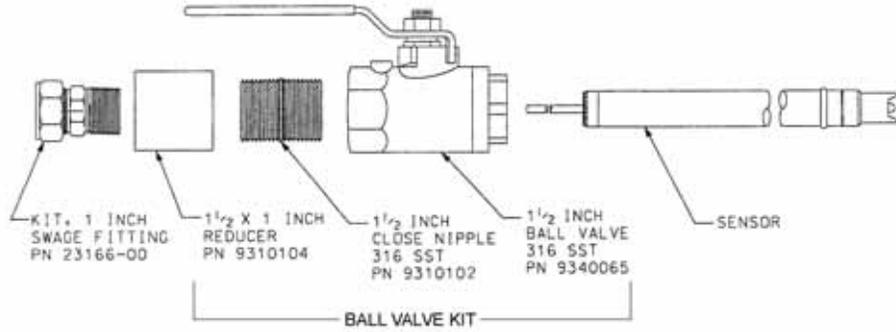


FIGURE 3. Exploded View of Ball Valve Kit PN 23240-00 used with process connector PN 23166-00 (or PN 23166-01) [Ball Valve Kit includes 1-1/2 in. x 1 in. reducer, 1-1/2 in. close nipple, and 1-1/2 in. ball valve]

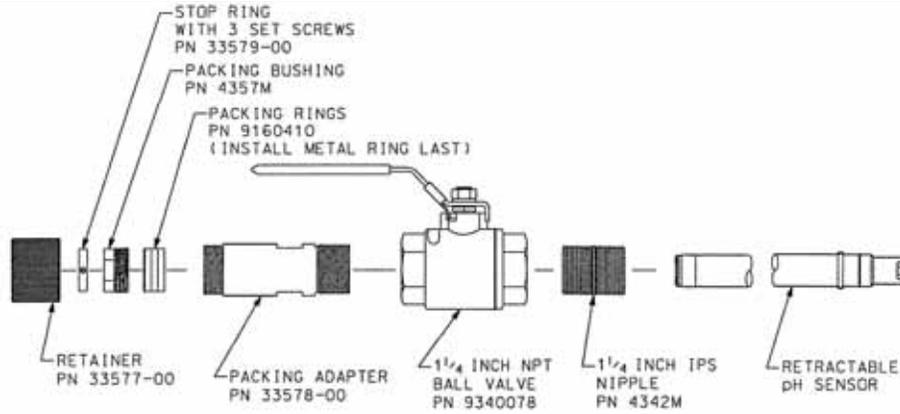


FIGURE 4. Exploded View of Ball Valve Kit PN 23765-00

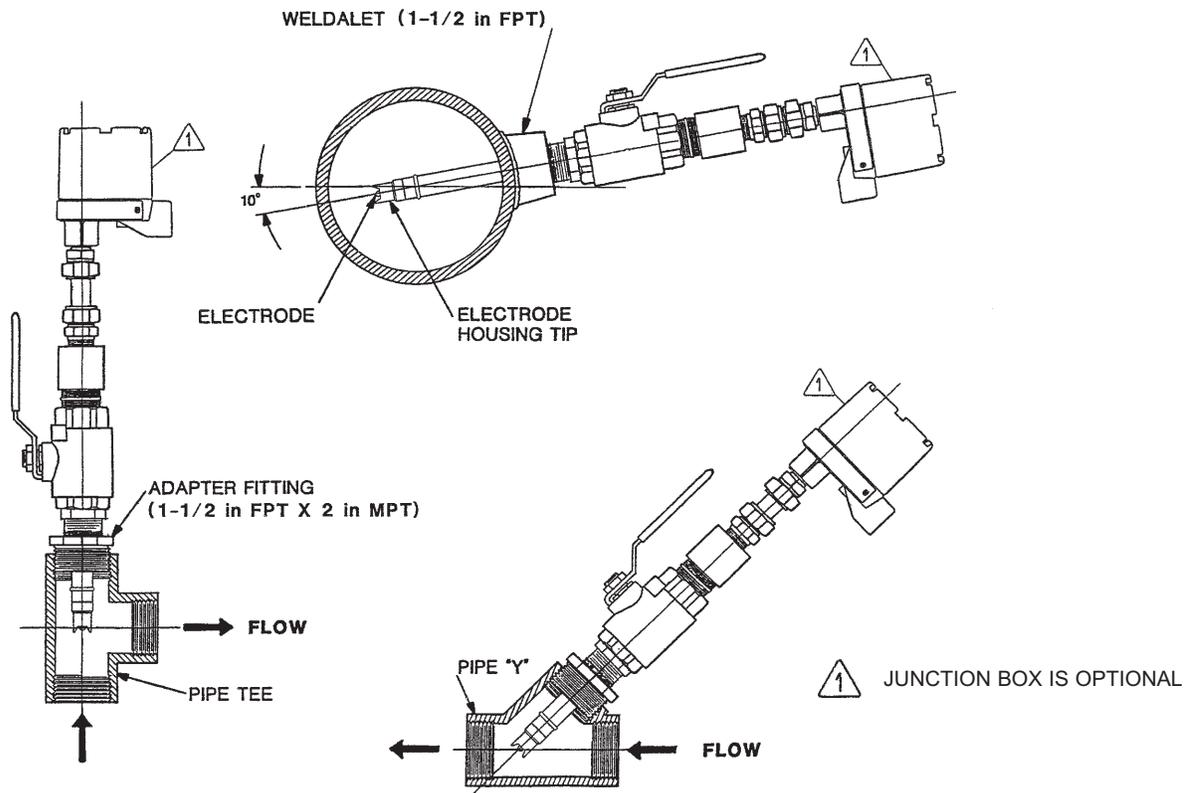
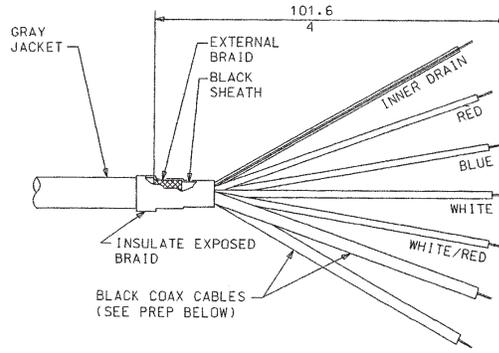


FIGURE 5. Mounting Details - Retraction Version

WHEN INCH AND METRIC DIMS ARE GIVEN

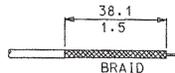


- 1 STRIP BACK OUTER BRAID AND FOIL ABOUT 4 IN FROM END OF CABLE
- 2 STRIP INDIVIDUAL SHEATHS BACK ABOUT 1/4 IN TO EXPOSE THE WIRES
- 3 LOCATE THE 2 COAXIAL CABLES AND PREPARE AS FOLLOWS (SEE BELOW)

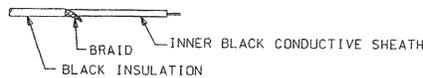


PREPARE THE COAX CABLES AS FOLLOWS

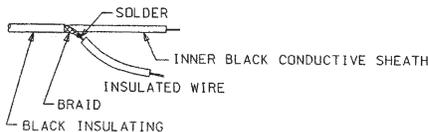
- 3A STRIP INSULATING BLACK SHEATH BACK ABOUT 1 1/2 IN



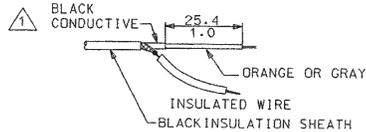
- 3B SEPARATE THE BRAID FROM THE INNER BLACK CONDUCTIVE SHEATH



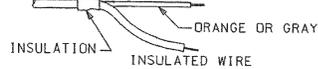
- 3C SOLDER INSULATED WIRE (USER SUPPLIED) TO BRAID IF NEEDED



- 3D STRIP BLACK CONDUCTIVE SHEATH 1 IN TO EXPOSE (ORANGE OR GRAY) DEPENDING ON WHICH COAX YOU ARE PREPARING



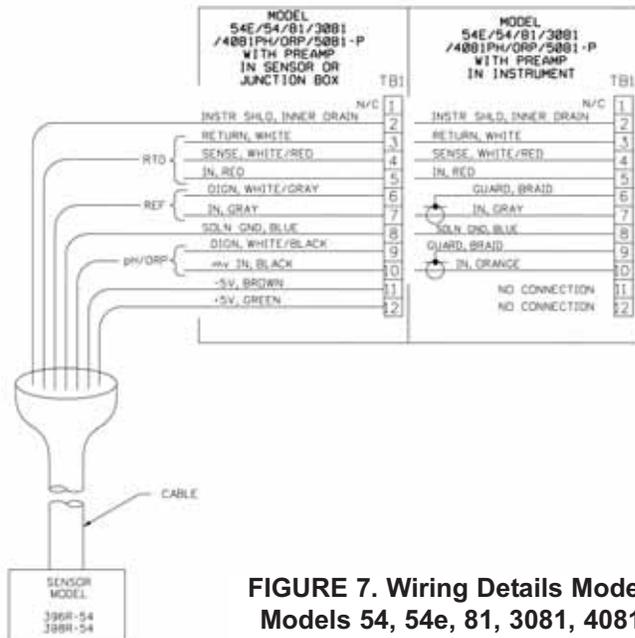
- 3E INSULATE EXPOSED BLACK SHEATH/BRAID AREA



⚠ WARNING: IF INNER BLACK CONDUCTIVE SHEATH IS IN CONTACT WITH THE EXPOSED LEADS, OR IS NOT PREPARED PROPERLY, IT MAY CAUSE AN ELECTRICAL SHORT.

DWG. NO.	REV.
40396R24	A

FIGURE 6. Cable Preparation Instructions (PN 9200274)



6R07	REV.
	C

FIGURE 7. Wiring Details Model 396R-54 for use with Models 54, 54e, 81, 3081, 4081 pH/ORP, and 5081-P

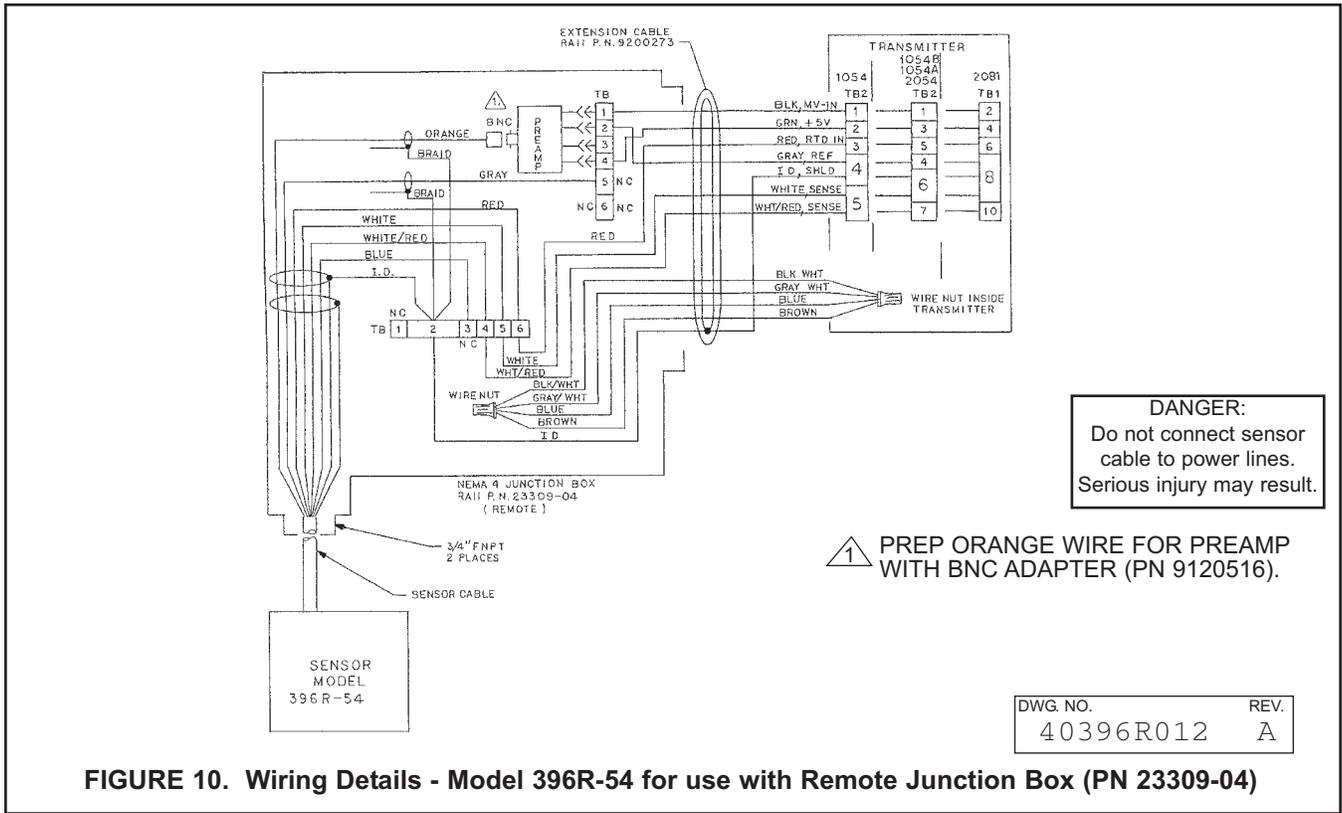


FIGURE 10. Wiring Details - Model 396R-54 for use with Remote Junction Box (PN 23309-04)

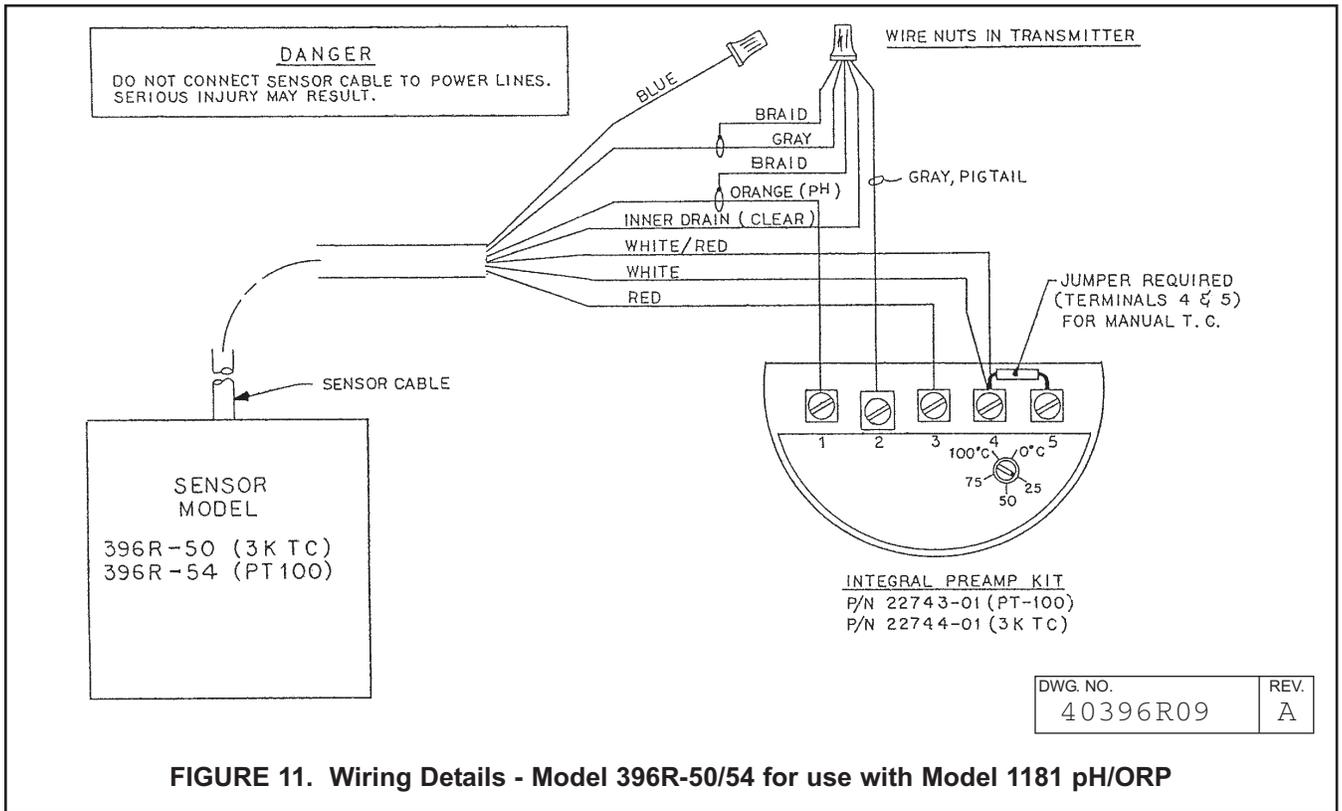
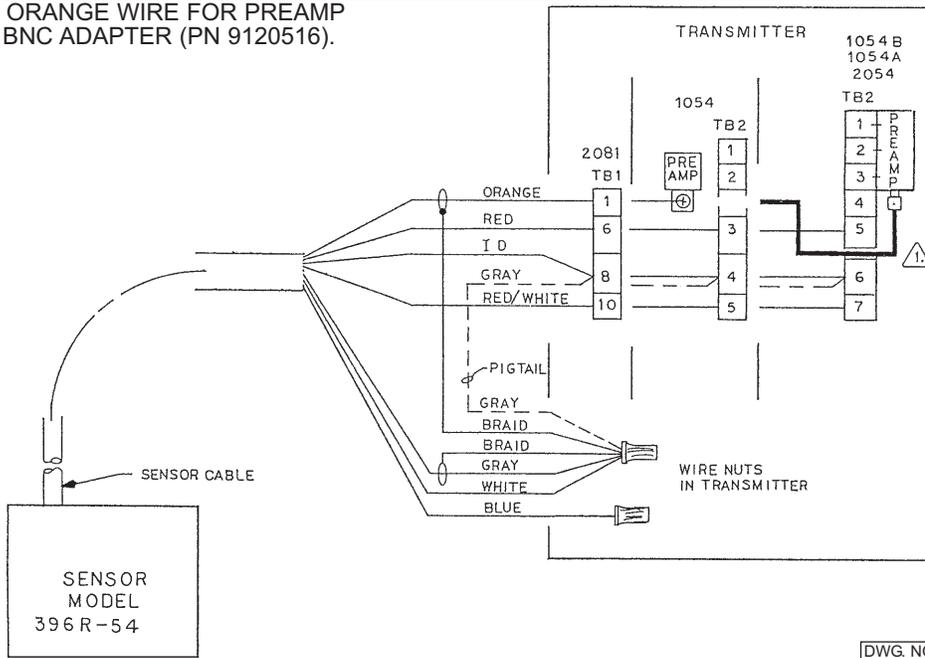


FIGURE 11. Wiring Details - Model 396R-50/54 for use with Model 1181 pH/ORP

1 PREP ORANGE WIRE FOR PREAMP WITH BNC ADAPTER (PN 9120516).



DWG. NO.	REV.
40396R010	A

FIGURE 12. Wiring Details - Model 396R-54 for use with Models 1054A/B pH/ORP, 2054 pH, and 2081 pH/ORP

1 PREPARE ORANGE WIRE FOR PREAMP, USE BNC ADAPTER PN 9120516

DANGER
DO NOT CONNECT SENSOR CABLE TO POWER LINES. SERIOUS INJURY MAY RESULT.

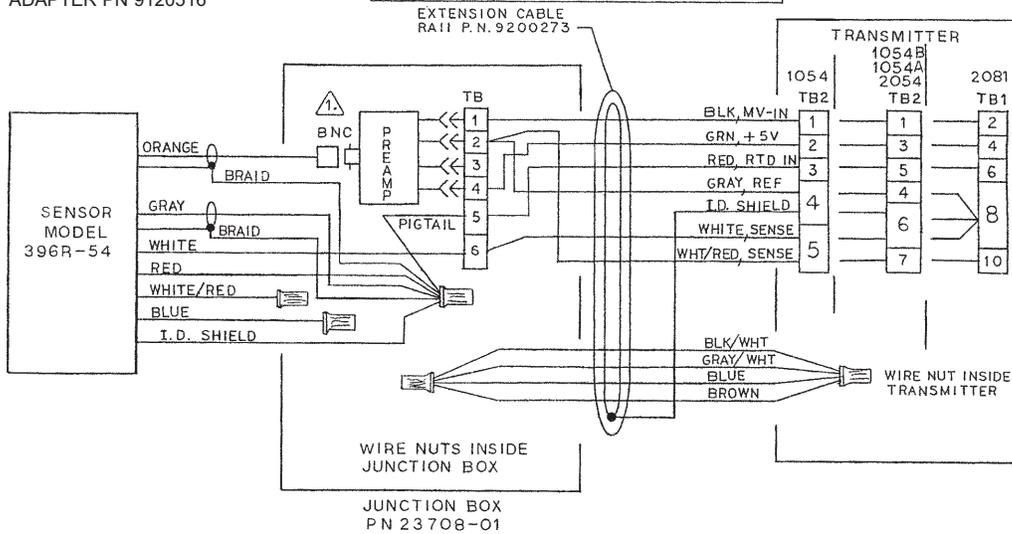
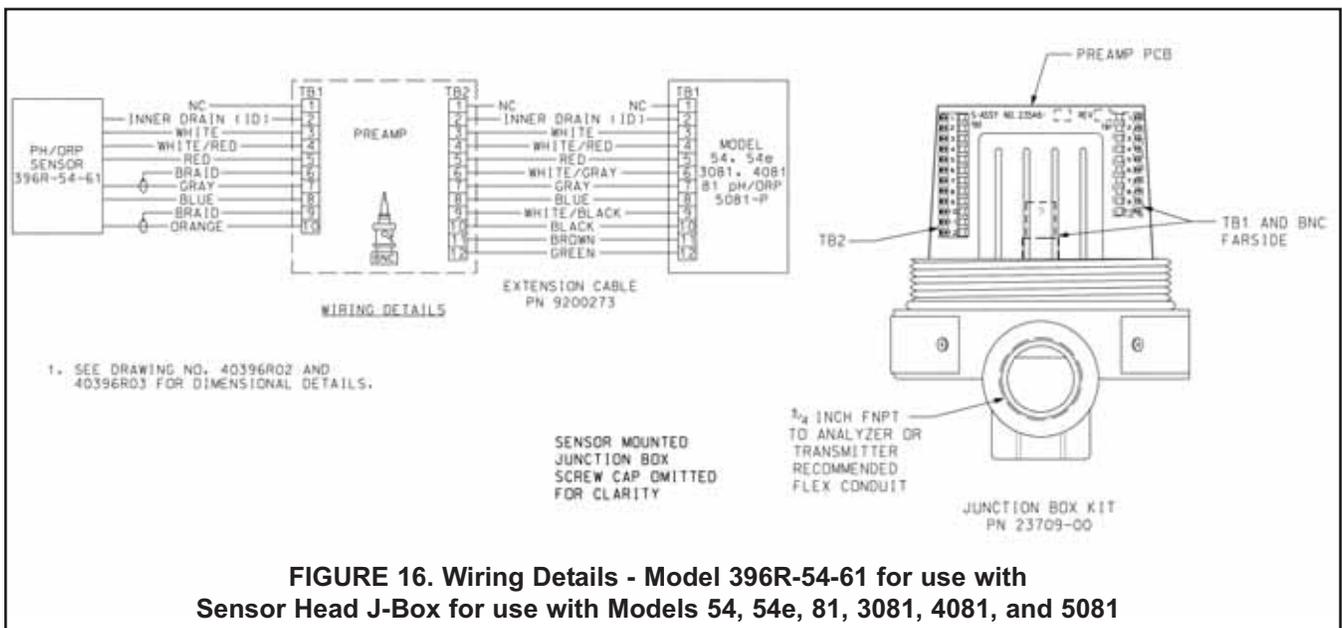
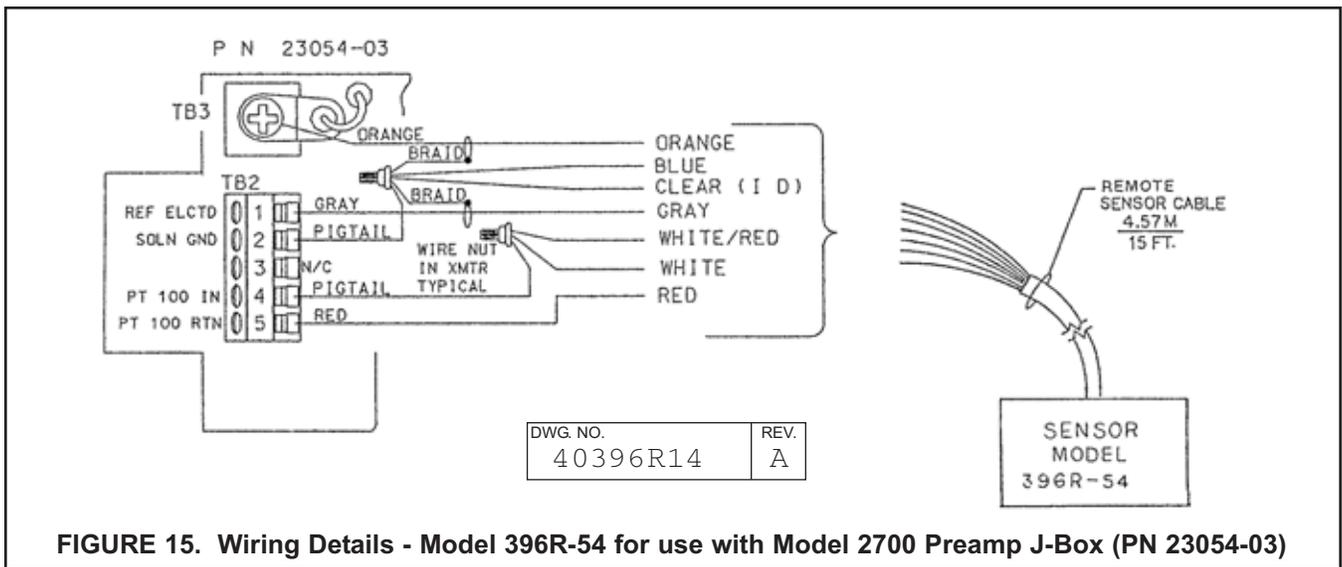
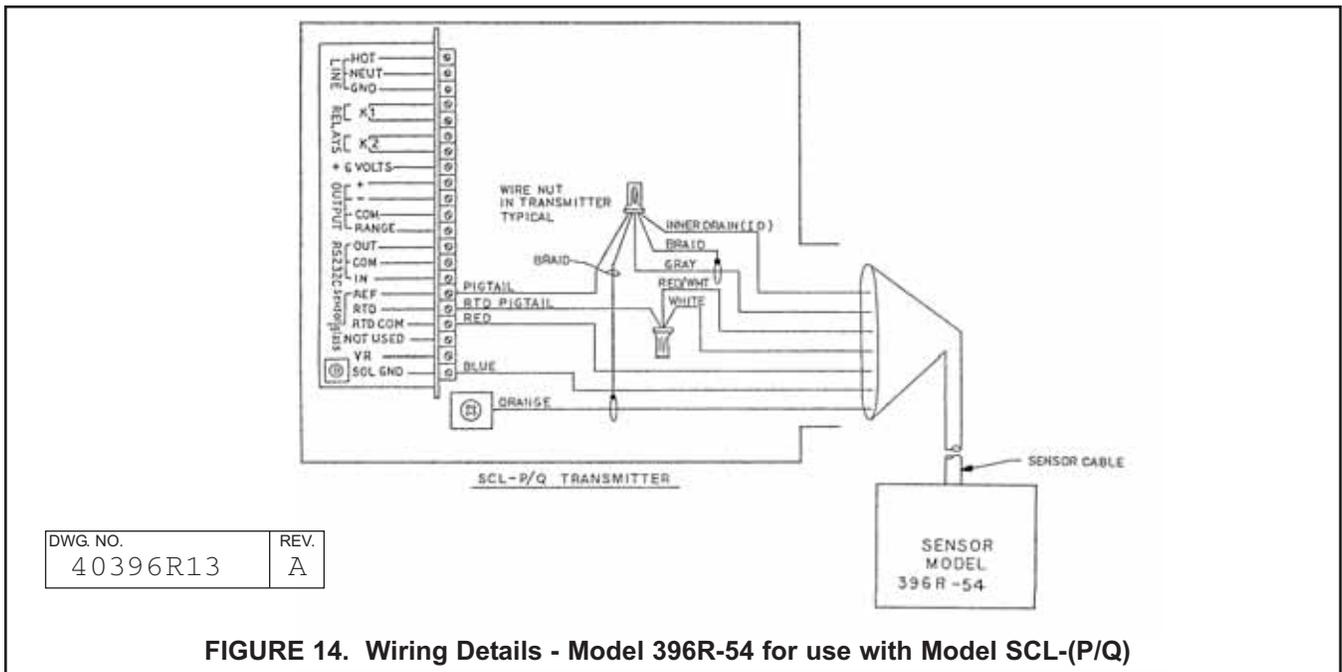


Figure 13. Wiring Details: Model 396R-54 for use with J-Box (PN 23708-01) to Models 1054 Series, 2054, and 2081 pH Transmitters



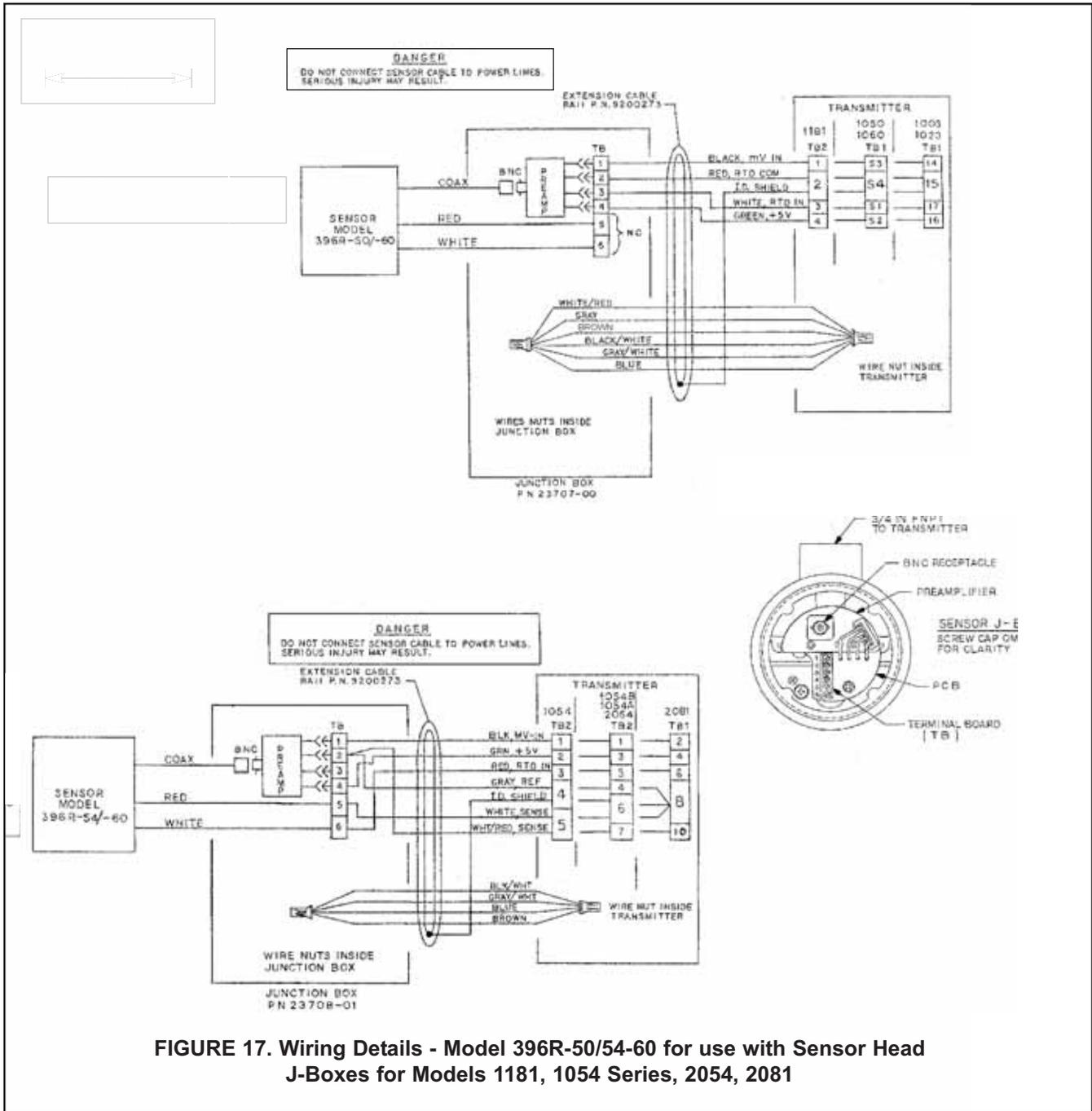


FIGURE 17. Wiring Details - Model 396R-50/54-60 for use with Sensor Head J-Boxes for Models 1181, 1054 Series, 2054, 2081

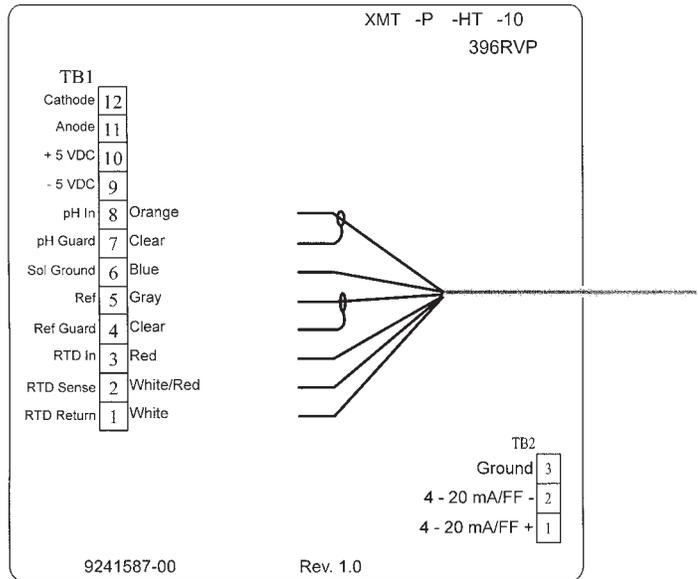


FIGURE 19. Wiring Model 396R-54-61 to Model Xmt-P-HT-10

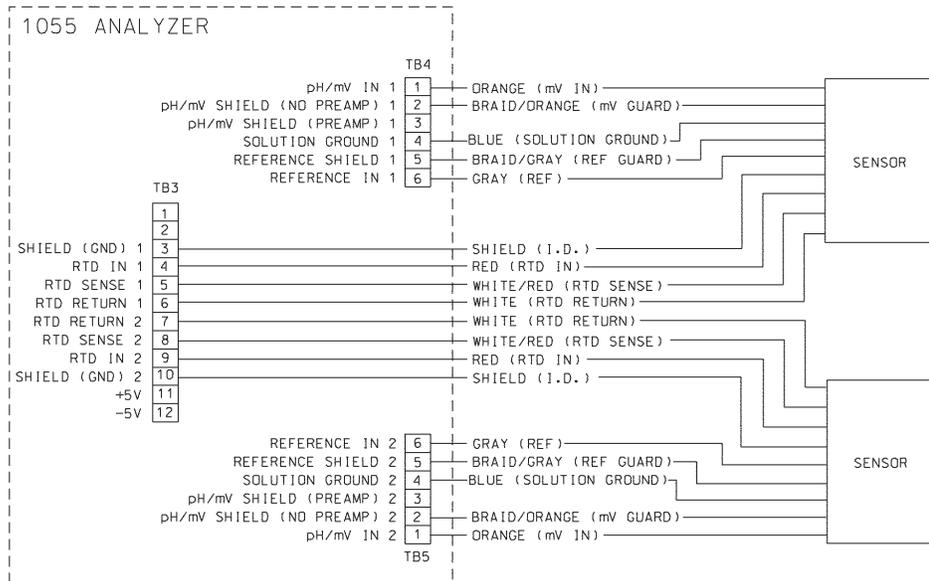


FIGURE 20. Wiring Model 396R-()-54-(61) to Model 1055-01-10-22-32

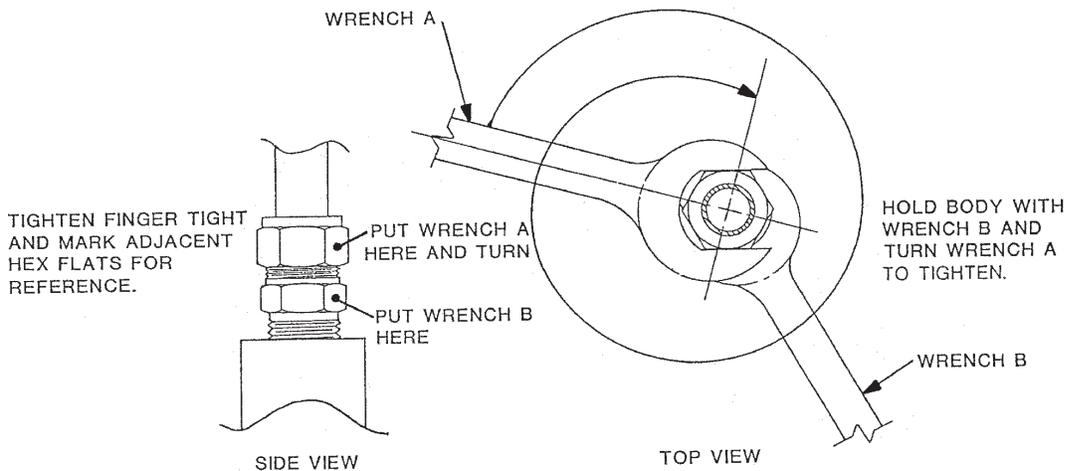


FIGURE 21. Male Connector Tightening Diagram

RETRACTION WITH KIT PN 23240-00

WARNING

System pressure may cause the sensor to blow out with great force unless care is taken during removal. Make sure the following steps are adhered to.



A. Model 396R-21 (21" tube)

1. Be certain system pressure at the sensor is below 64 psig (542 kPa) before proceeding with the retraction. It is also recommended that the personnel wear a face shield and have a stable footing. Refer to Figures 21 and 22. Push in on the sensor end or the top of the J-box and slowly loosen the hex nut (B) of the process end male connector (A).

B. Model 396R-25 (36" tube)

2. Be certain that pressure at the sensor is below 35 psig (343 KPa) before proceeding with the retraction. It is also recommended that the personnel wear a face shield and have a stable footing. Refer to Figures 21 and 22. Push in on the sensor end or the top of the J-box and slowly loosen the hex nut (B) of the process end male connector (A).

CAUTION

Do not remove nut at this time.

3. When the hex nut is loose enough, slowly ease the sensor back completely until the retraction stop collar is reached.

CAUTION

Failure to withdraw the sensor completely may result in damage to the sensor when the valve is closed.

4. Close the ball valve slowly. If there is resistance, the valve may be hitting the sensor. Double check that the sensor has been retracted to the retraction stop collar.

WARNING



Before removing the sensor from the ball valve, be absolutely certain that the ball valve is fully closed. Leakage from the male connector threads may indicate that the male connector is still under pressure. Leakage through a partially open valve could be hazardous, however with the ball valve closed, some residual process fluid may leak from the connector's pipe threads.

5. The Male Connector Body (A) may now be completely unthreaded from the reducing coupling and the sensor removed for servicing.

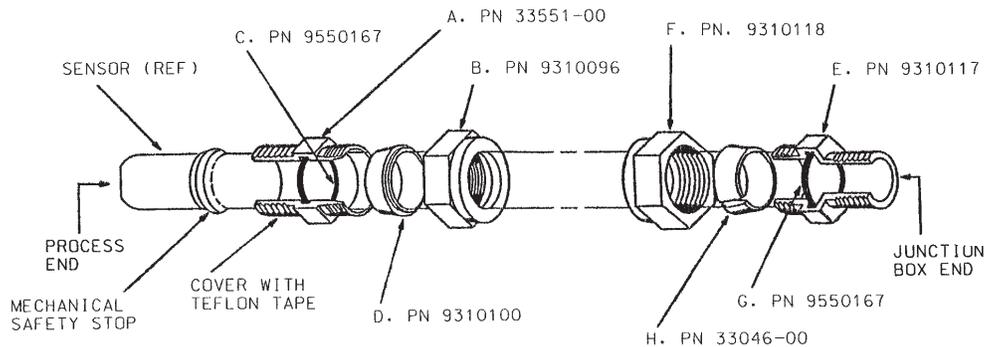
CAUTION

If the male connector leaks during insertion or retraction, replace the O-ring (PN 9550099) in the male connector A.

6. For more detailed instructions, see electronic file 51-396R on the enclosed "Instruction Manuals" CD-rom.

NOTE

Information on Retraction Kit PN 23765-00 can be found in the electronic file 51-396R on the enclosed "Instruction Manuals" CD-rom.



PROCESS END (A,B,C, & D SOLD TOGETHER AS
SST. PROCESS CONNECTOR KIT PN 23166-00 OR
TITANIUM PROCESS CONNECTOR KIT PN23166-01)

A. MALE CONNECTOR BODY
B. HEX NUT
C. O-RING
D. TEFLON FERRULE (SST. FERRULE AVAILABLE AS PN 9310094)

JUNCTION BOX END (E, F, G, & H SOLD TOGETHER AS
SENSOR HEAD JUNCTION BOX FITTING KIT PN 23472-00)

E. MALE CONNECTOR BODY
F. HEX NUT
G. O-RING
H. SST. SPLIT FERRULE

FIGURE 22. Example of Sensor Tube Replacement

Emerson Process Management

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

<http://www.raihome.com>