

Submersion/Insertion Toroidal Sensor

For additional information, please refer to the Instruction Manuals CD shipped with this product, or visit our website at www.emersonprocess.com/raihome/liquid/.

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.



CAUTION



BEFORE REMOVING THE SENSOR, be absolutely certain the process pressure is reduced to 0 psig and the process temperature is at a safe level!

SPECIFICATIONS - SENSORS

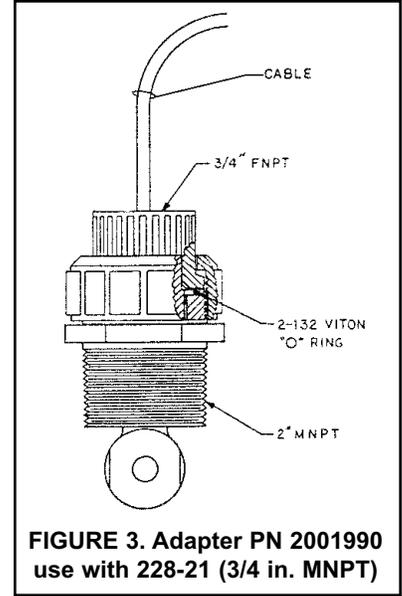
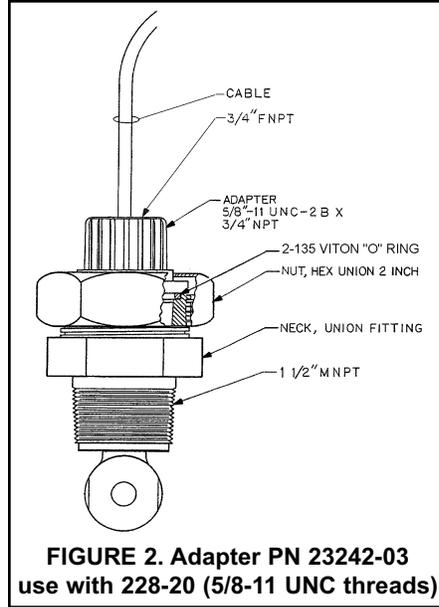
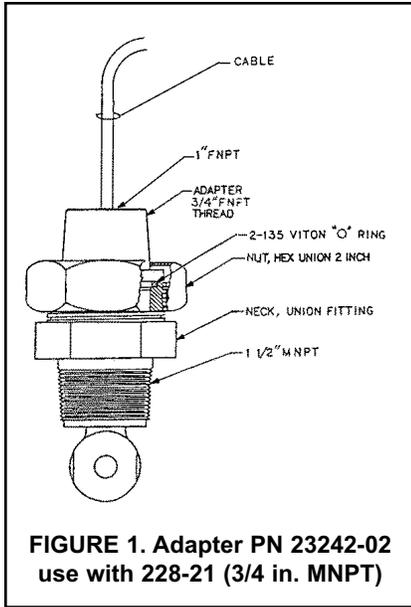
MODEL	Wetted Materials	Temperature	Pressure
228-02	PEEK (glass-filled)	248°F (120°C)	295 psig (2135 kPa abs)
228-03	PEEK (glass-filled)	392°F (200°C)	295 psig (2135 kPa abs)
228-04	Tefzel (glass-filled)	248°F (120°C)	200 psig (1480 kPa abs)

SPECIFICATIONS - RETRACTION ASSEMBLIES

PN	Wetted Materials	Operating Conditions		Retraction/Insertion Conditions	
		Temperature	Pressure	Temperature	Pressure
23311-00 (mechanical)	316 SS, Teflon, EPDM	392°F (200°C)	295 psig (2135 kPa abs)	392°F (200°C)	295 psig (2135 kPa abs)
23311-01 (manual)	316 SS, Teflon, EPDM	392°F (200°C)	295 psig (2135 kPa abs)	266°F (130°C)	35 psig (343 kPa abs)

SPECIFICATIONS - ADAPTERS

PN	Wetted Materials	Temperature	Pressure
23242-02	PEEK, Viton, 316 SS	392°F (200°C)	295 psig (2135 kPa abs)
23242-03	PEEK, Viton, 316 SS	392°F (200°C)	295 psig (2135 kPa abs)
2001990	CVPC, PEEK, Viton	100°F (38°C) 185°F (85°C)	100 psig (791 kPa abs) 45 psig (412 kPa abs)

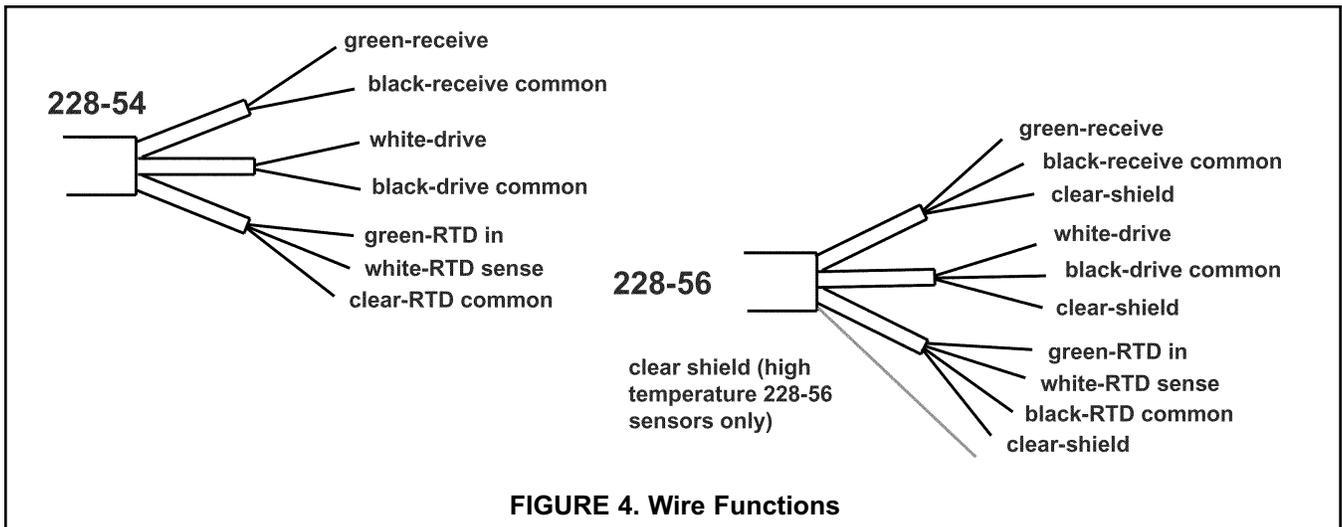


INSTALLATION

Keep at least 1 in. (2.5 cm) between sensor and pipe wall. If clearance is too small, calibrate the sensor in place. Ensure that the sensor is completely submerged in liquid. Horizontal mounting is best.

WIRING

Keep sensor wiring away from ac conductors and high current demanding equipment. **Do not cut cable.** Cutting the cable may void the warranty.



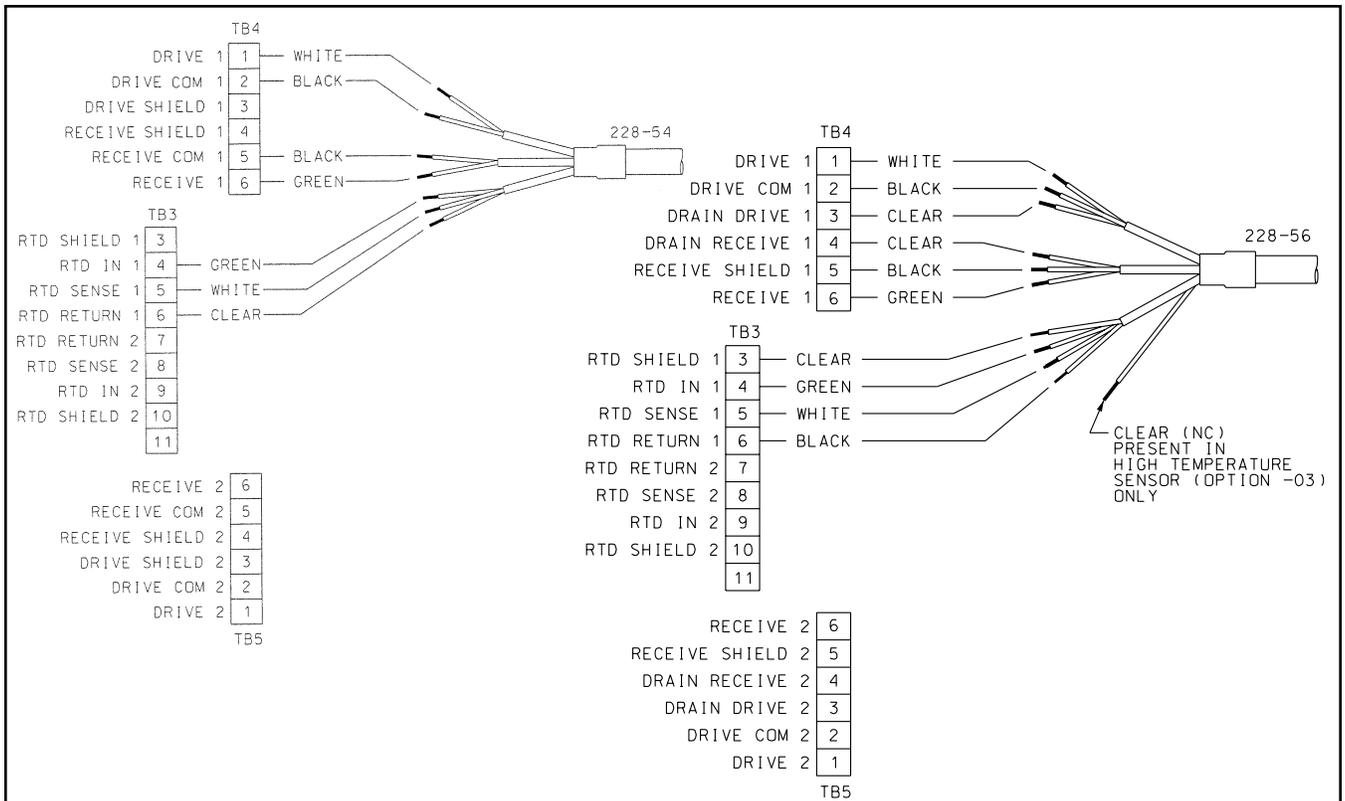


FIGURE 5. Wiring Model 228-54 and 228-56 sensors to single input panel mount 1055 analyzer

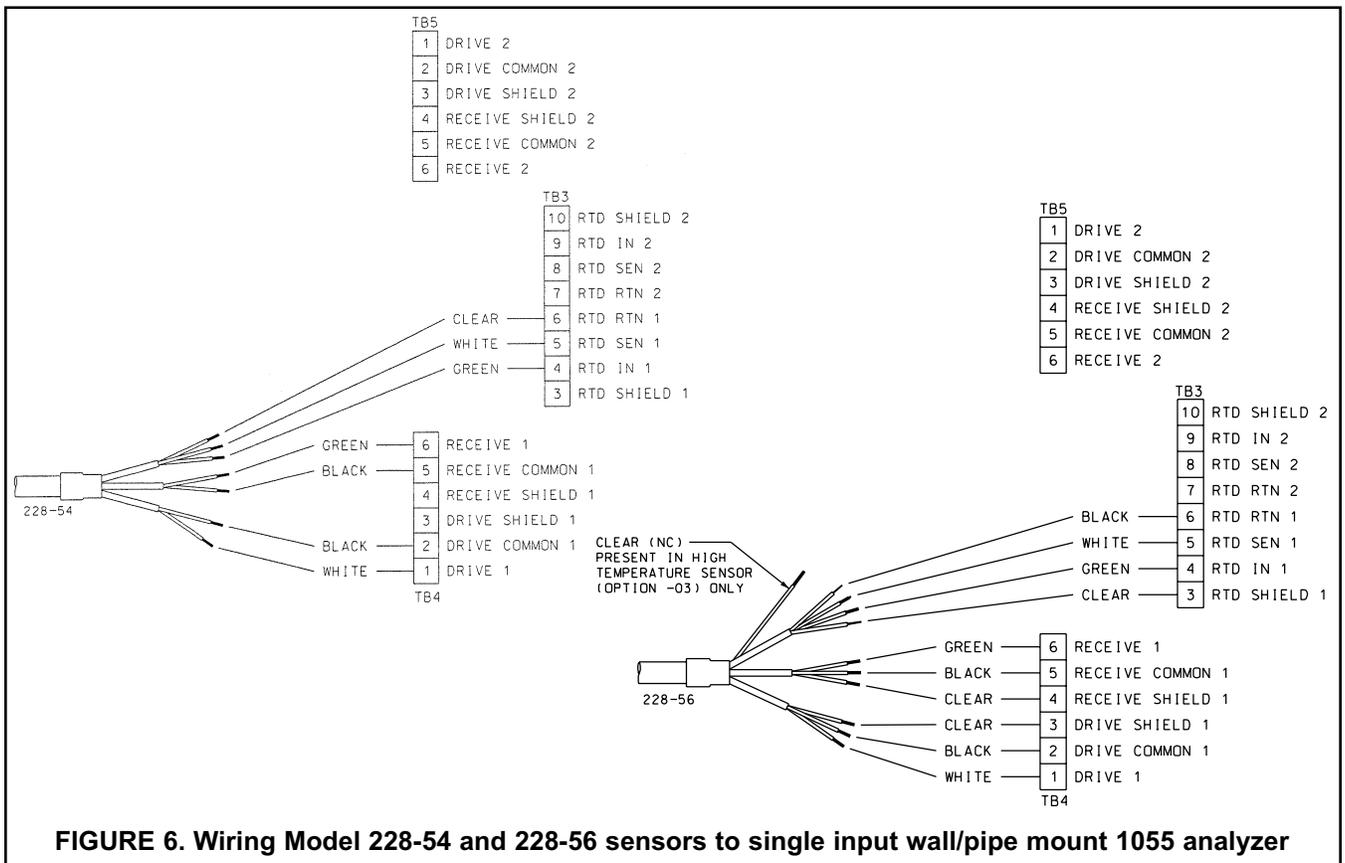


FIGURE 6. Wiring Model 228-54 and 228-56 sensors to single input wall/pipe mount 1055 analyzer

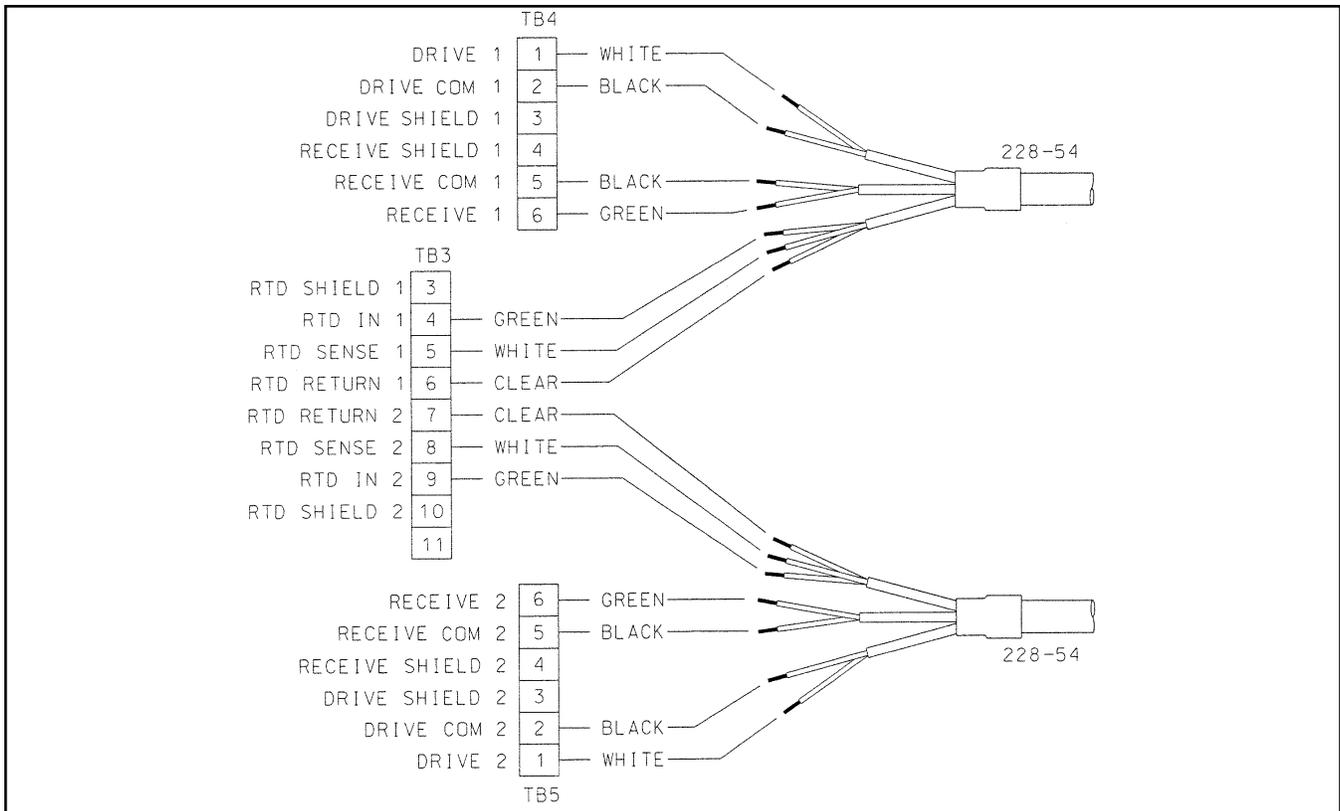


FIGURE 7. Wiring 228-54 sensors to dual input panel mount 1055 analyzer

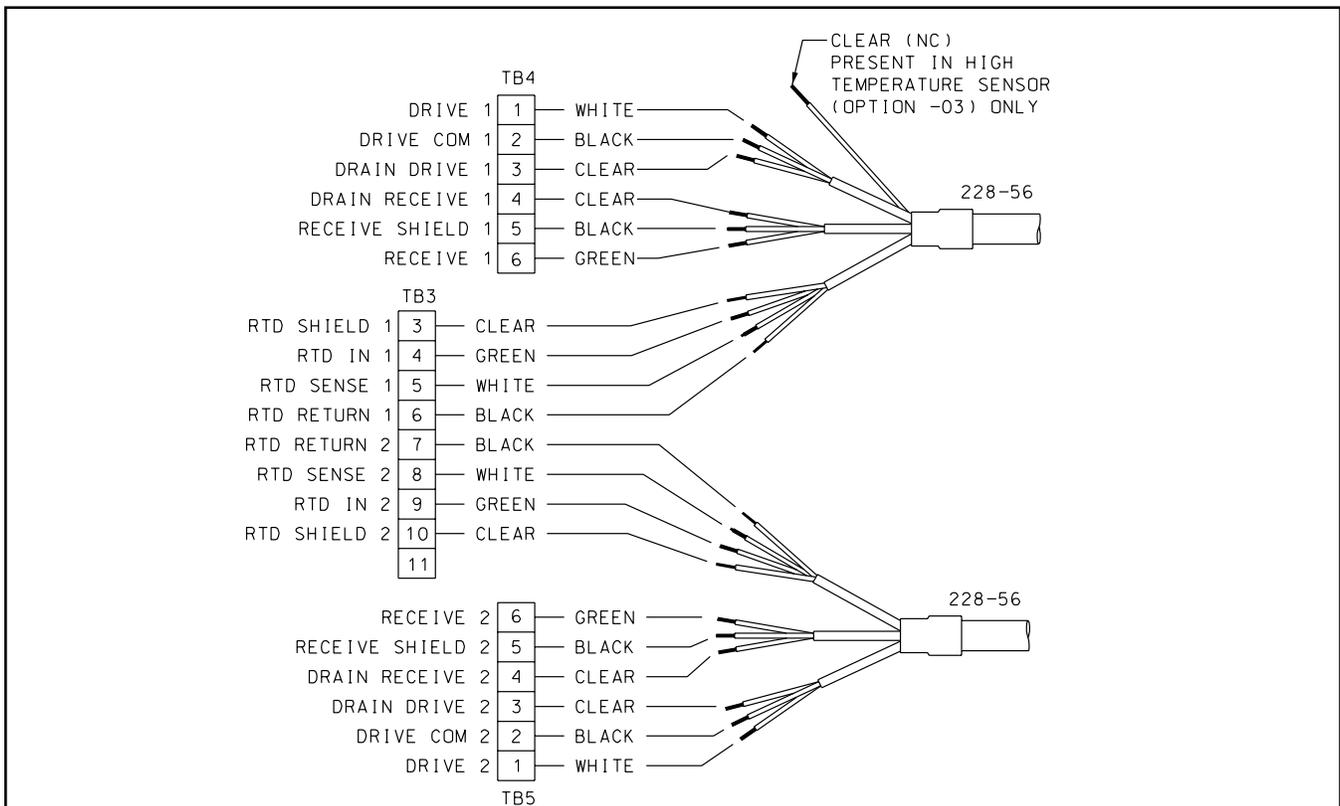


FIGURE 8. Wiring 228-56 sensors to dual input panel mount 1055 analyzer

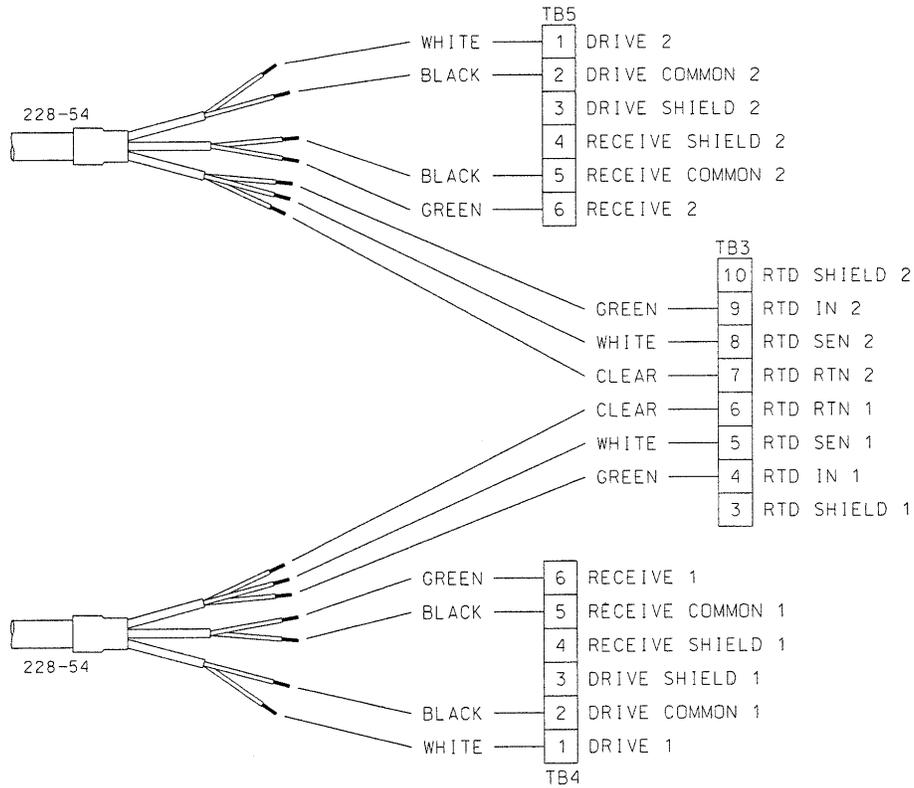


FIGURE 9. Wiring 228-54 sensor to dual input wall/pipe mount 1055 analyzer

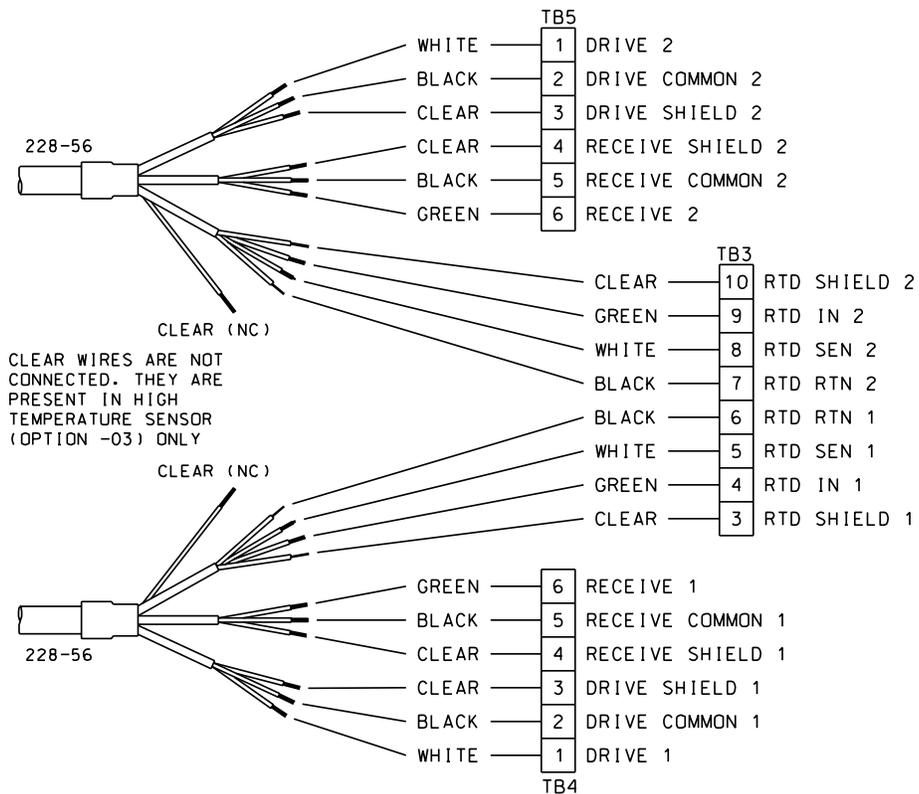


FIGURE 10. Wiring 228-56 sensor to dual input wall/pipe mount 1055 analyzer

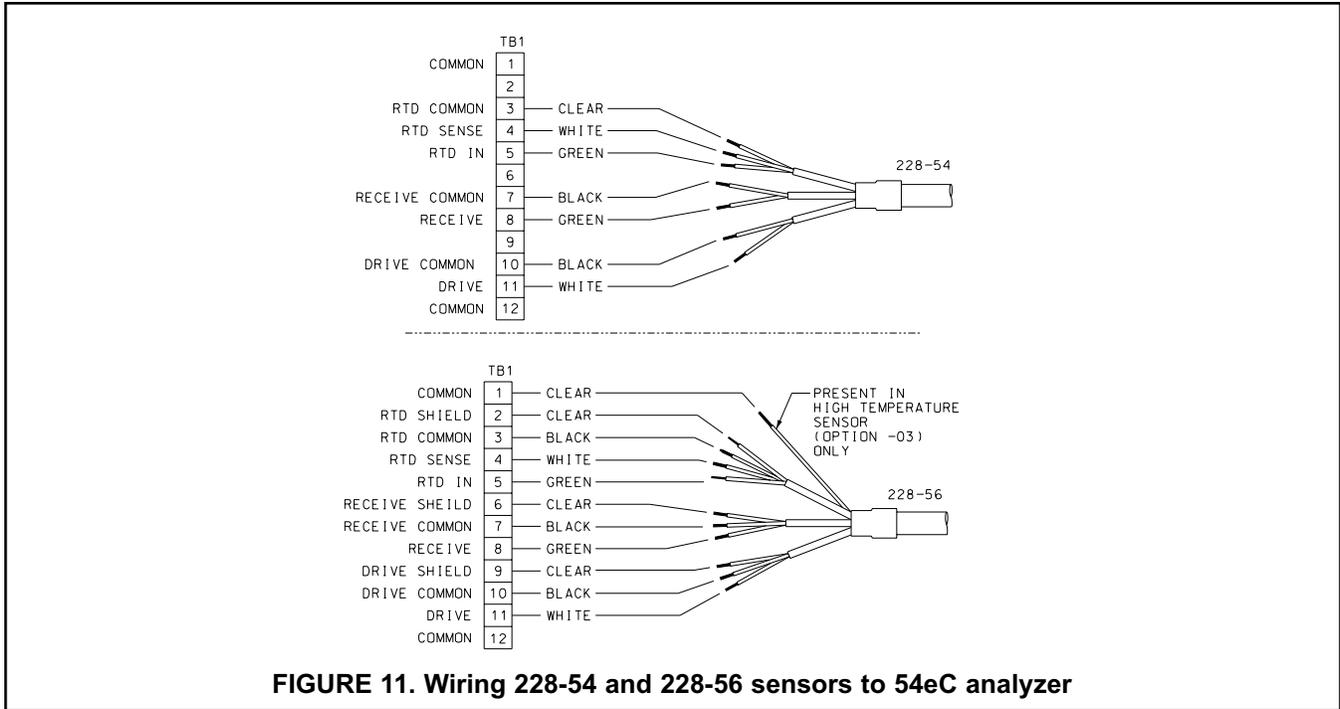


FIGURE 11. Wiring 228-54 and 228-56 sensors to 54eC analyzer

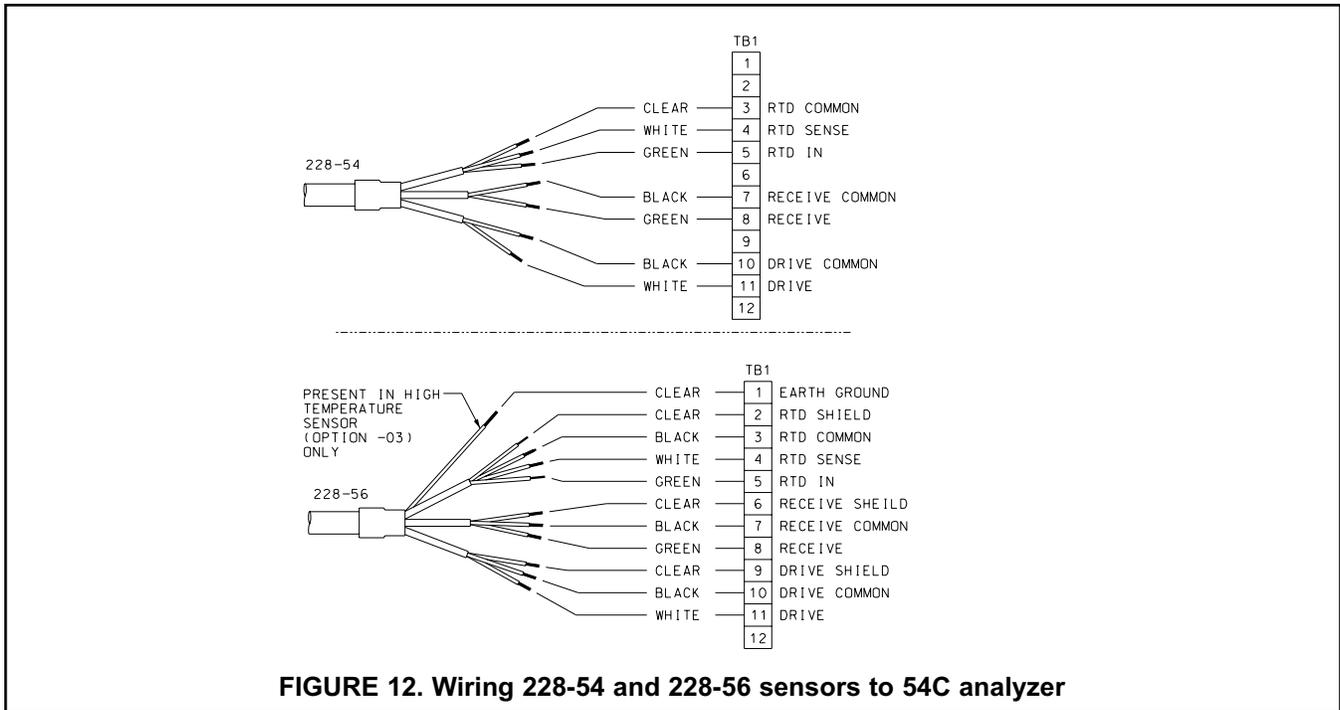


FIGURE 12. Wiring 228-54 and 228-56 sensors to 54C analyzer

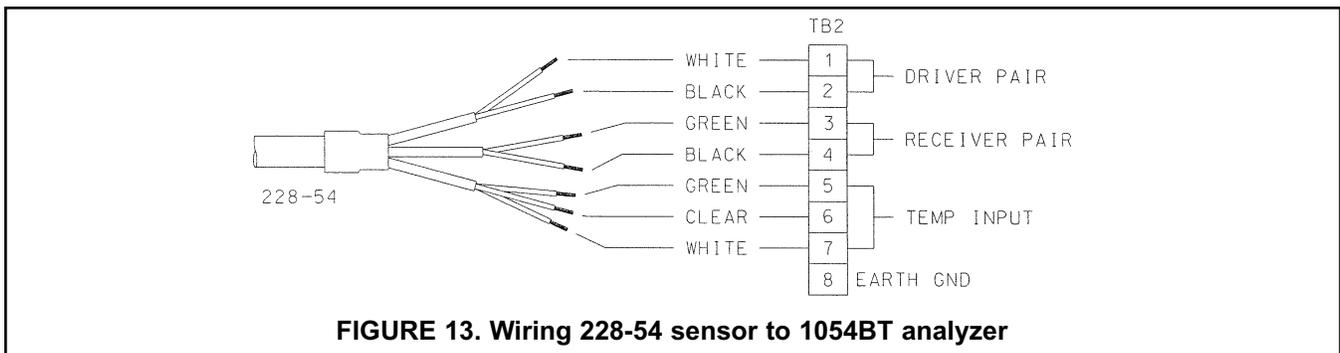


FIGURE 13. Wiring 228-54 sensor to 1054BT analyzer

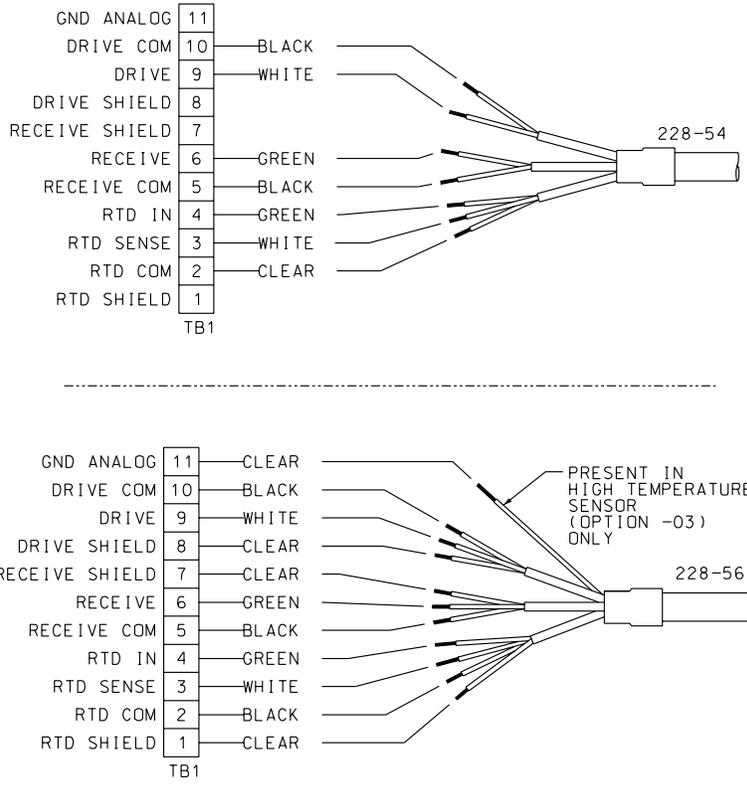


FIGURE 14. Wiring 228-54 and 228-56 sensors to Xmt-T panel mount transmitter

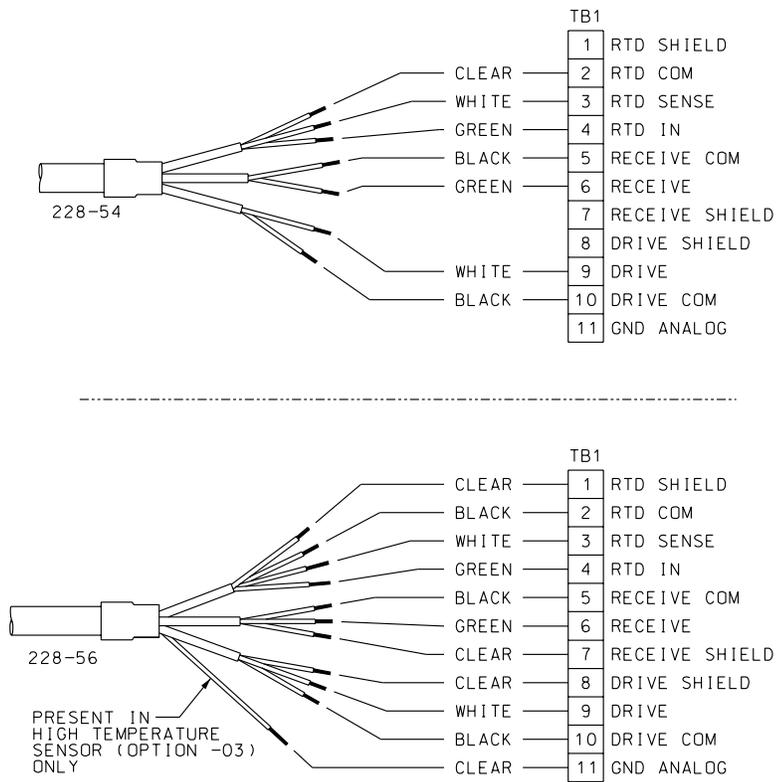


FIGURE 15. Wiring 228-54 and 228-56 sensors to Xmt-T pipe/wall mount transmitter

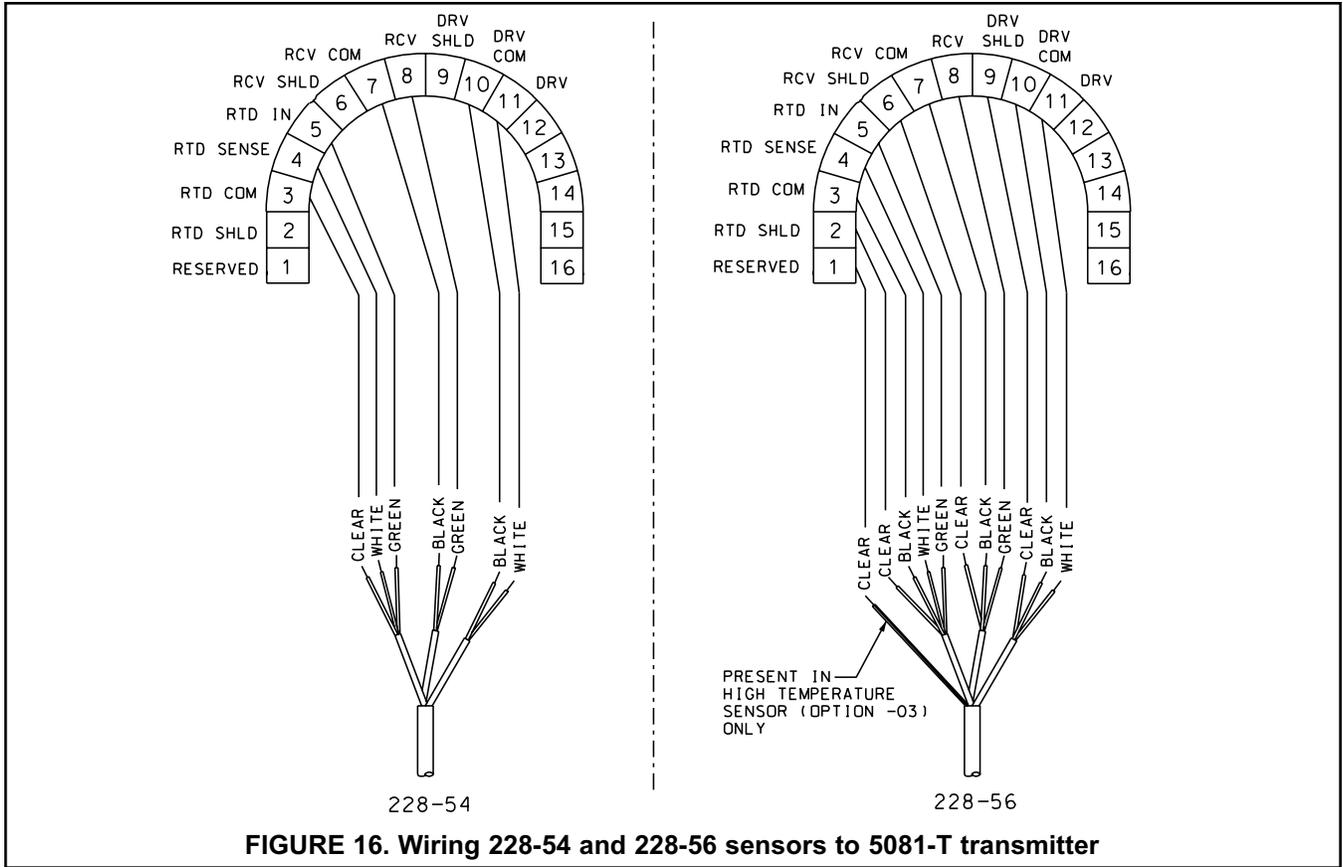


FIGURE 16. Wiring 228-54 and 228-56 sensors to 5081-T transmitter

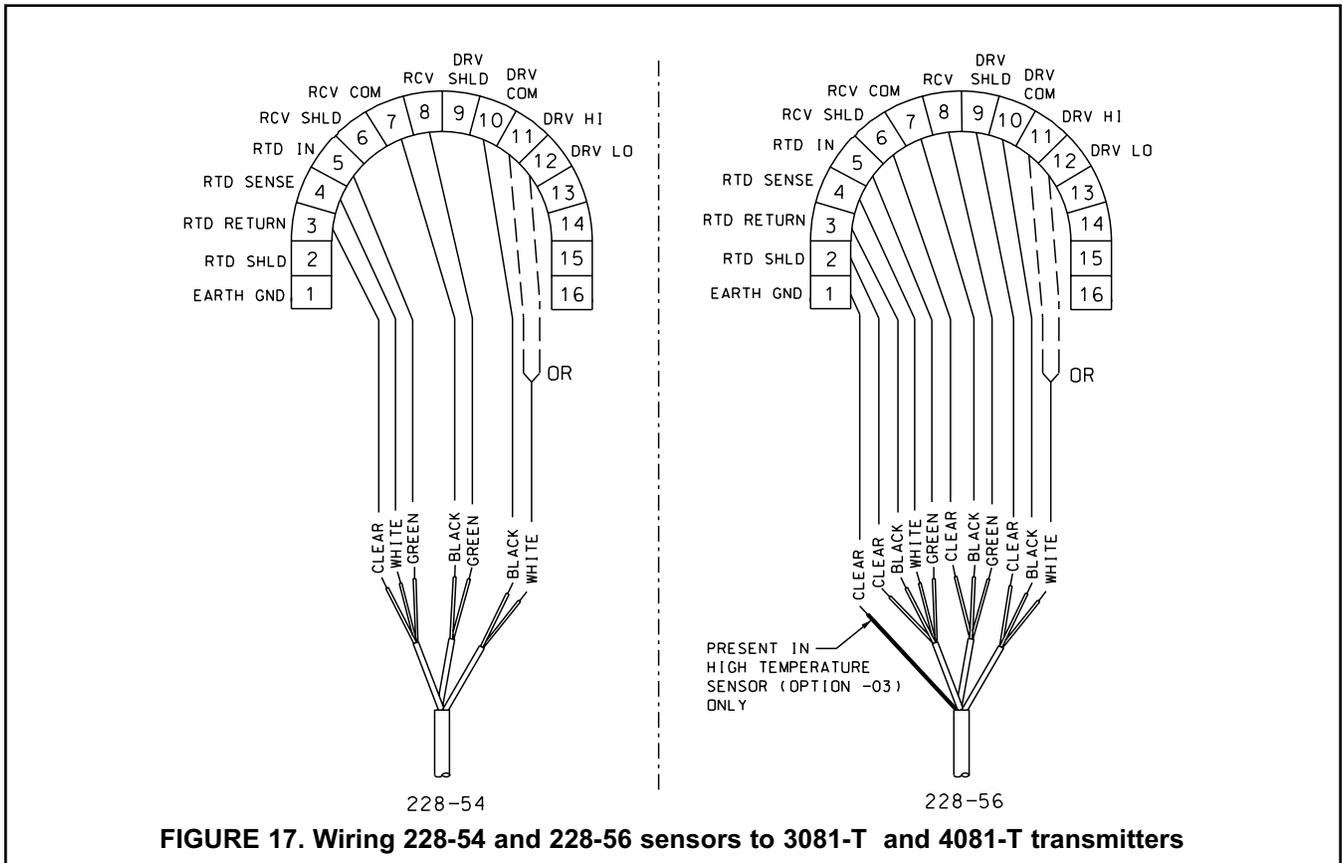


FIGURE 17. Wiring 228-54 and 228-56 sensors to 3081-T and 4081-T transmitters

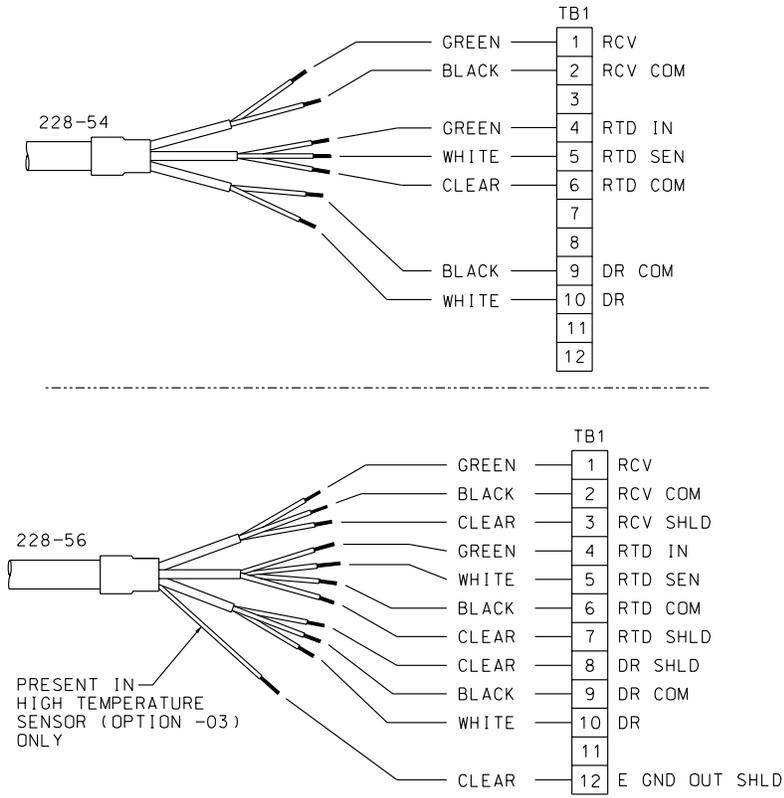


FIGURE 18. Wiring 228-54 and 228-56 sensors to 2081T transmitter

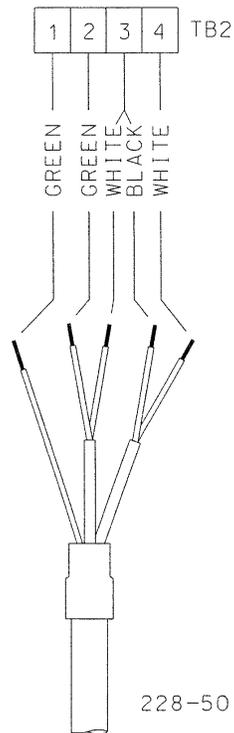
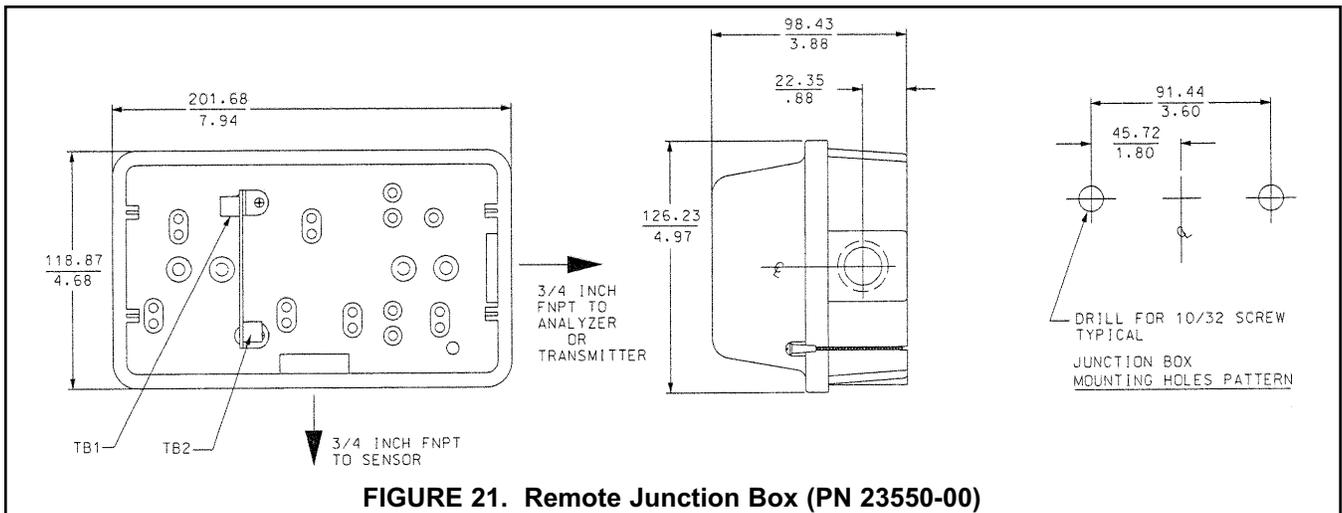
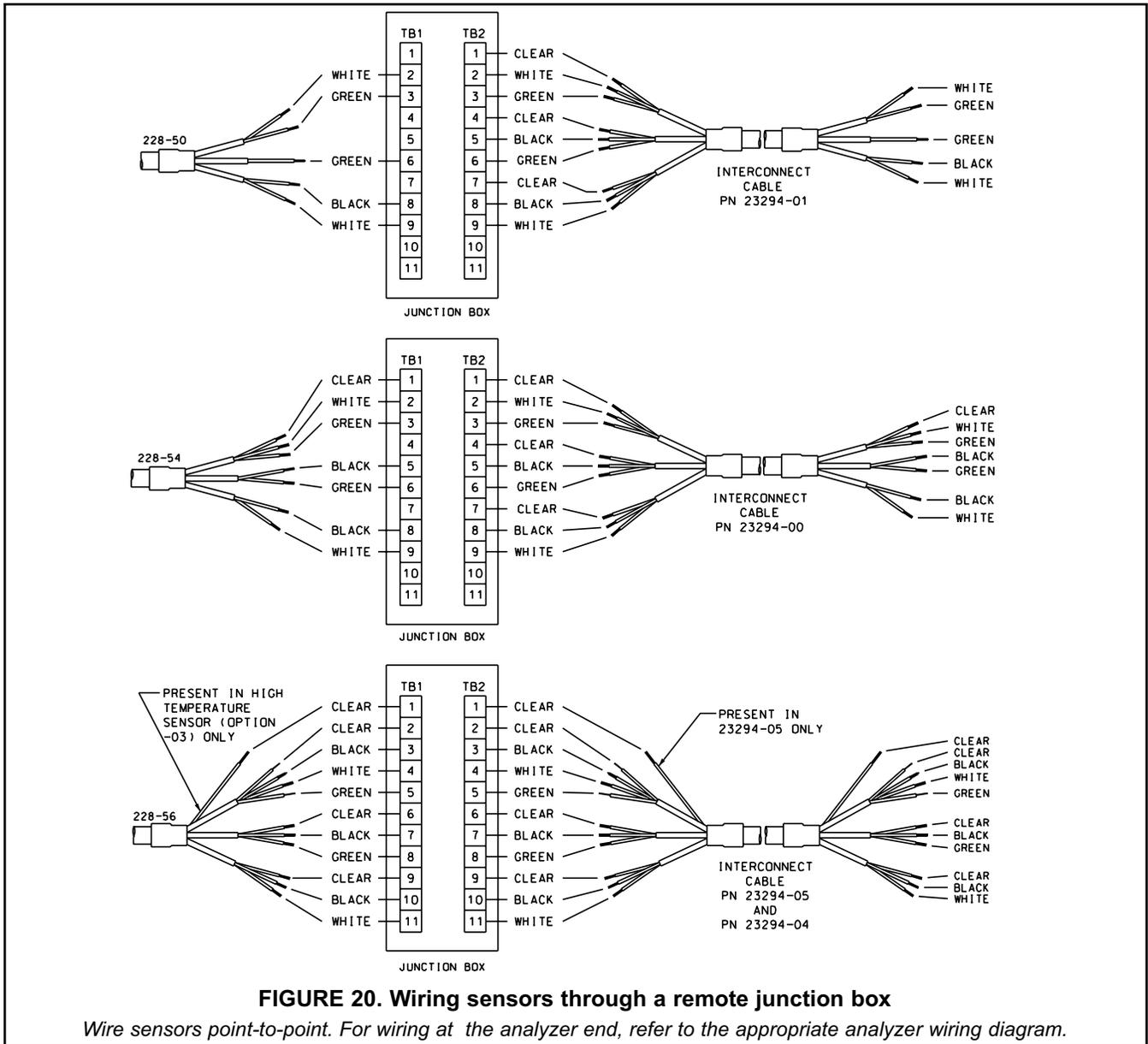


FIGURE 19. Wiring 228-50 sensor to 1181T transmitter

WIRING THROUGH A REMOTE JUNCTION BOX



INSERTION - RETRACTION ASSEMBLIES

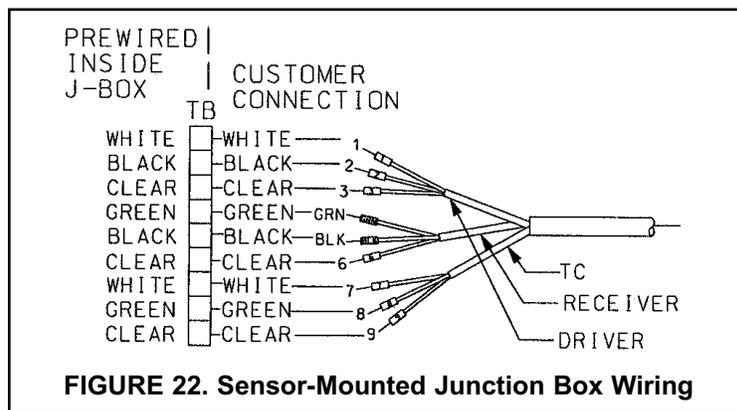
INSTALLATION REQUIREMENTS

1. Process connection: 1-1/2 inch. Larger openings may keep the sensor from inserting far enough into the process liquid.
2. Line size: 3 in.; 2-in. line requires in-place calibration.
3. Valve: 1-1/2 NPT full port ball valve (PN 9340065).
4. Retraction clearance: 2 ft (0.6 m).
5. Provide mechanical support if excess vibration is expected.
6. Flush water: provide 1/8 in. valves in inlet and outlet flush ports. Position flush ports so that retraction chamber can be drained.

MANUAL RETRACTION ASSEMBLY (PN 23311-01)

INSTALLATION

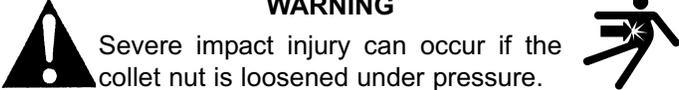
1. Loosen the collet nut and retract the sensor tube into the retraction chamber. See Figure 23.
2. Loosen the union nut and separate the retraction chamber from the assembly.
3. Install the retraction chamber on the 1-1/2 in. NPT full port ball valve mounted on the process line or vessel.
4. Thread the sensor cable through the tube into the junction box. Screw the sensor into the tube. Hand tighten the sensor an additional half turn once the gasket is seated.
5. Terminate the sensor wiring in the junction box. See Figure 22 for wiring details.
6. Insert the sensor and tube assembly into the retraction chamber.
7. Tighten the union nut.
8. Open the ball valve, check for leaks, and manually insert the sensor into the process.
9. Position the sensor at least 1/2 in. (13 mm) away from any wall of the vessel or pipe.
10. Tighten the collet nut.



RETRACTION

1. Make certain that the system pressure is less than 35 psig (342 kPa abs). Push in on the sensor using the top of the junction box. Slowly loosen the collet nut.

WARNING



Severe impact injury can occur if the collet nut is loosened under pressure.

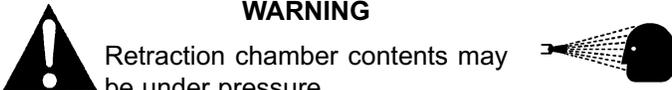
2. When the collet nut is loose enough, slowly ease the sensor back so that it clears the ball valve. Close the valve to the process line.
3. Drain the retraction chamber contents using the 1/8 in. flush ports.
4. Loosen the 3 in. hex union nut. Remove the sensor and tube assembly.
5. **Replace the 3 in. hex nut O-ring.** Place the sensor and tube assembly back in the retraction assembly. Tighten the 3 in. hex union nut. Verify that the 1/8 in. flush ports are closed.

NOTE

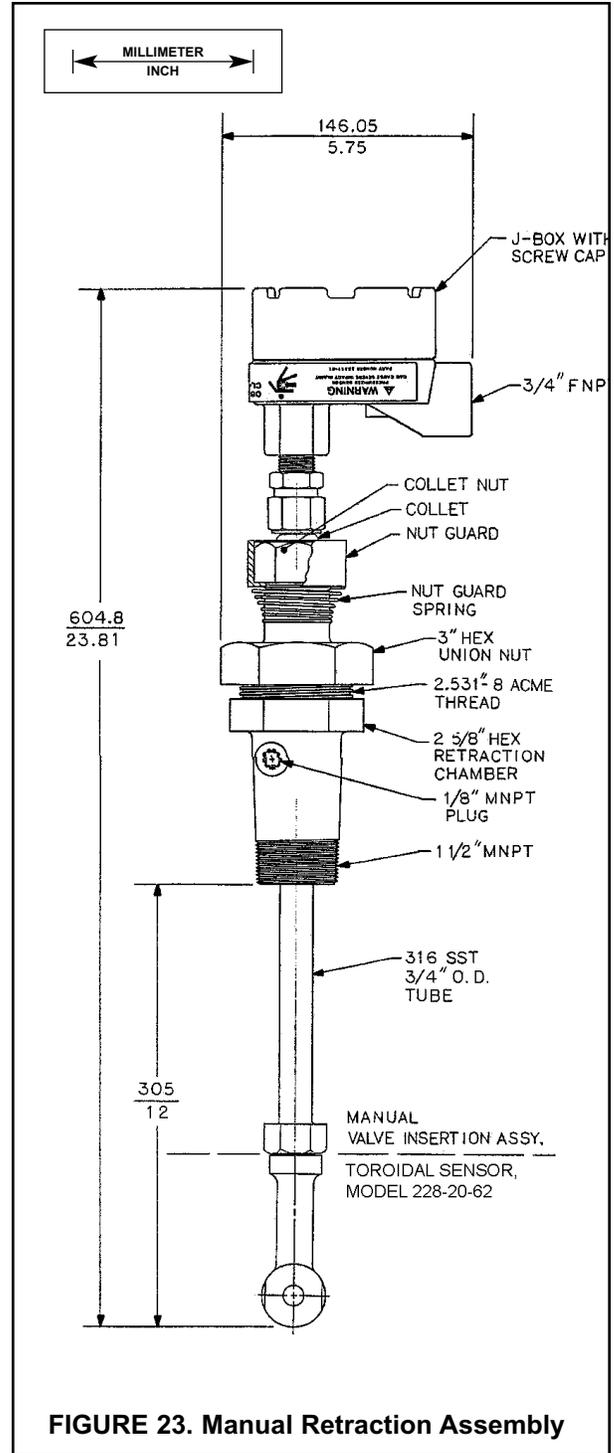
With the ball valve closed and the retraction chamber 1/8 in. flush ports open, some residual process fluid may leak from the 3 in. hex union nut female ACME threads. This leakage is normal and to be expected.

6. Before opening the ball valve, make sure that the process pressure is less than 35 psig (342 kPa abs). Open the ball valve and check for leaks. Insert the sensor into the process. Tighten the collet nut.

WARNING



Retraction chamber contents may be under pressure.



MECHANICAL RETRACTION ASSEMBLY (PN 23311-00)

INSTALLATION

1. Thread the sensor cable through the tube into the junction box. Screw the sensor into the tube. Hand tighten the sensor an additional half turn once the gasket is seated. See Figure 24.
2. Terminate the sensor wiring in the junction box. See Figure 22 for wiring details.
3. Using a 1/2 in. (13 mm) socket wrench, retract the sensor into the retraction chamber.
4. Install the assembly on the 1-1/2 in. NPT full port ball valve mounted in the process line or vessel.
5. Tighten the union nut.
6. Open the ball valve and check for leaks.
7. Using a 1/2 in. (13 mm) socket wrench, insert the sensor into the process line or vessel.
8. Position the sensor at least 1/2 in. (13 mm) away from any wall of the vessel or pipe. Set the travel stop collar "A" next to the nut housing.

WARNING

Do not loosen cap screws or collar when pressurized.

RETRACTION

1. Make certain that the system pressure is less than 295 psig (2135 kPa abs) before retracting the sensor.
2. Retract the sensor using a 1/2 in. (13 mm) socket wrench. When the sensor clears the ball valve, close the valve.

WARNING

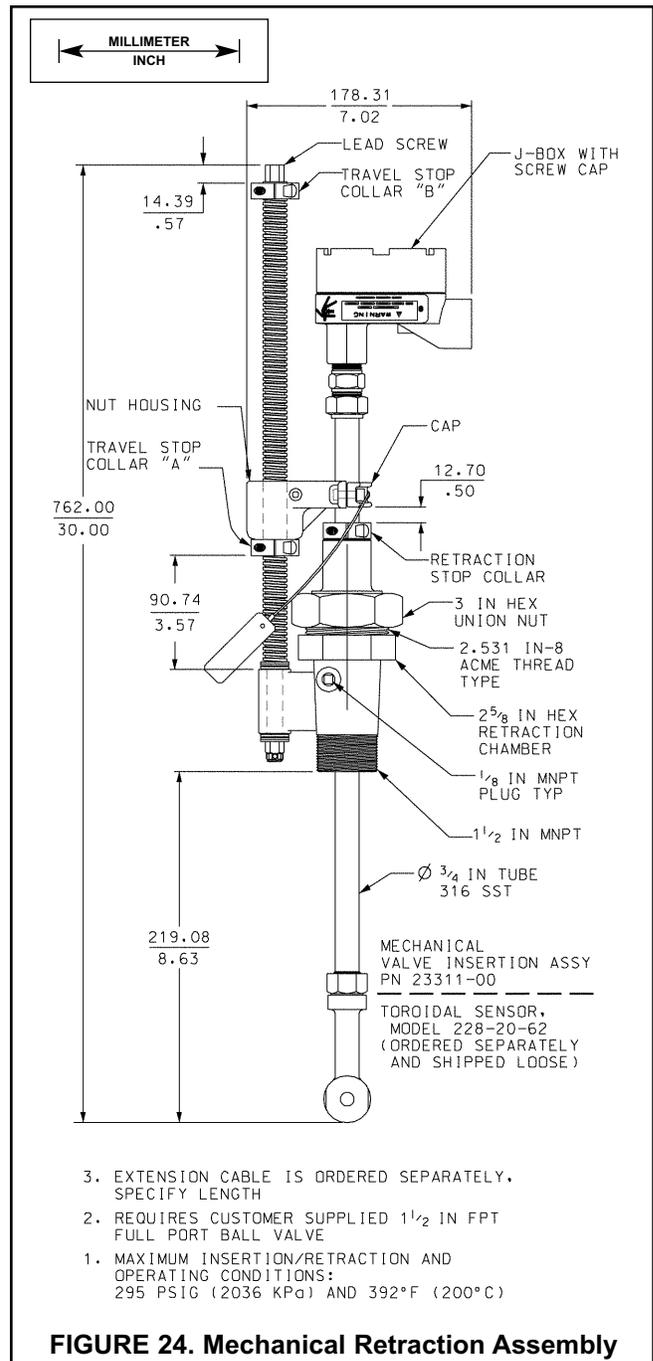
Retraction chamber contents may be under pressure.

3. Drain the retraction chamber contents using the 1/8 in. flush ports.
4. Loosen the 3 in. hex union nut, and remove the retraction stop collar and orange clamp top. Remove the sensor and tube assembly.
5. **Replace the 3 in. hex nut O-ring.** Place the sensor and tube assembly back in the retraction assembly. Replace the retraction stop collar about 1/2 in. in front of the clamp. Tighten the clamp screws, retraction stop collar, and 3-in. hex union nut. Verify that the 1/8 in. flush ports are closed.

NOTE

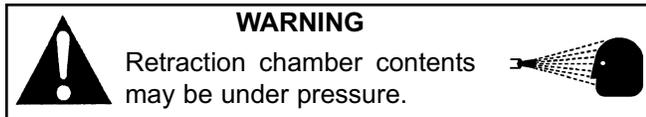
With the ball valve fully closed and the retraction chamber 1/8 in. flush ports open, some residual process fluid may leak from the 3 in. hex union nut female ACME threads. This leakage is normal and to be expected.

6. Before opening the ball valve, make sure that the process pressure is less than 295 psig (2135 kPa abs). Open the valve, check for leaks, and insert sensor into the process.

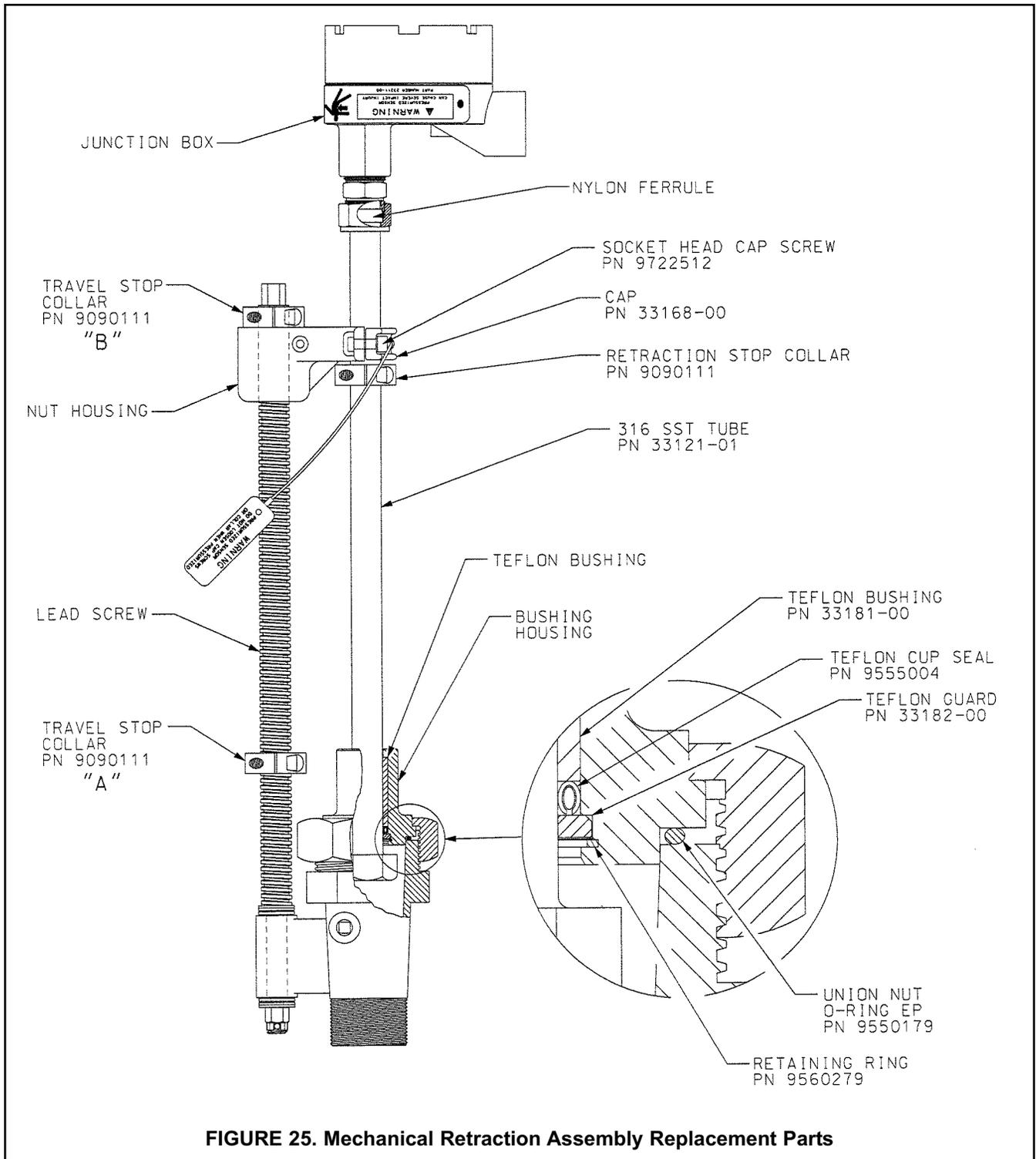


REPLACING SEALS IN MANUAL AND MECHANICAL RETRACTION ASSEMBLIES.

1. Retract the sensor into the retraction chamber and fully close the ball valve.
2. Drain the retraction chamber contents using the 1/8 in. flush ports.



3. (Mechanical) Mark the location of the nut housing cap and retraction collar on the sensor tube. Remove both socket head cup screws from the nut housing and loosen the retraction stop collar.
4. Remove the 3 in. Hex Union nut.
5. Withdraw the sensor from the retraction chamber.
6. Open the junction box and disconnect the sensor wires from the terminal block.
7. Remove the compression fitting just below the junction box and remove the junction box from the sensor tube.
8. (Manual) Pull down the nut guard and remove the collet nut from the bushing housing.
9. Slide all hardware including the bushing housing off the sensor tube.
10. Remove the retaining ring from the bottom of the bushing housing.
11. Remove the Teflon guard.
12. From the top of the bushing housing press out the Teflon bushing. This will also push out the Teflon cup seal.
13. Replace all damaged parts with replacement parts from Figure 25 or 26. Replace the sensor tube if the surface is damaged. A rough or uneven surface will prevent the Teflon cup from sealing.
14. Rebuild the bushing housing. The open end of the cup seal (spring visible) faces the process.
15. Carefully slide the bushing housing onto the sensor tube. Do not damage the Teflon bushing or the Teflon cup seal.
16. (Manual) Slide the 3 in. Hex Union nut, collet nut with nut guard, junction box compression nut, and plastic ferrules onto the sensor tube.
17. (Mechanical) Slide the 3 in. Hex Union nut, retraction stop collar, junction box compression nut, and plastic ferrules onto the sensor tube.
18. Connect the junction box to the sensor tube and wire the sensor leads to the appropriate terminals.
19. (Mechanical) Lock the retraction stop collar into position (see Figure 24 or previously marked position for proper location).
20. Place the Union nut O-ring on the bottom of the bushing housing. Insert the sensor assembly into the retraction chamber and tighten the 3 in. Hex Union nut.
21. (Mechanical) Install the nut housing cap (see Figure 24 or previously marked position for proper location).



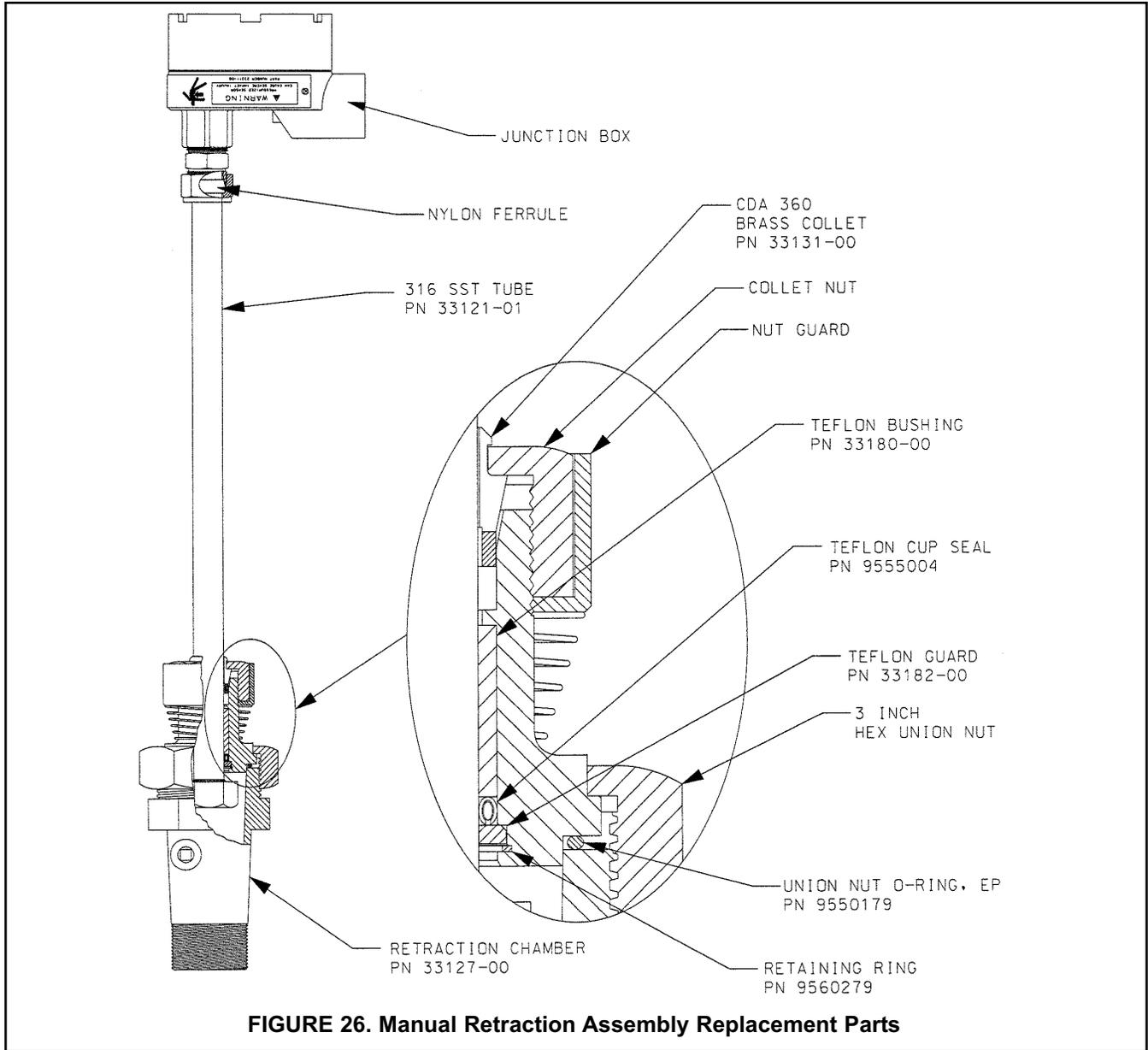


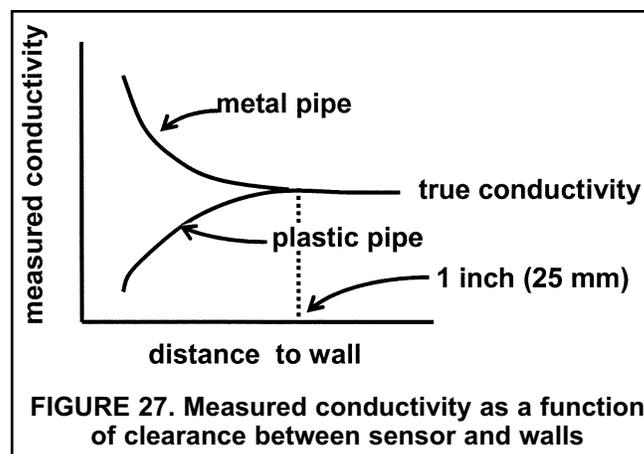
FIGURE 26. Manual Retraction Assembly Replacement Parts

CALIBRATION

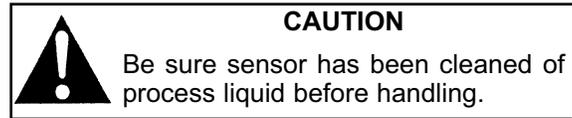
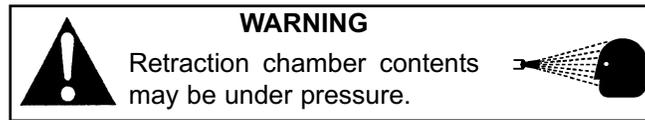
The nominal cell constant of the 228 sensor is 3/cm. The accuracy of the nominal constant is no more than about $\pm 10\%$, so conductivity readings made using the nominal constant will have an error of at least $\pm 10\%$. For higher accuracy, calibrate the sensor against a solution of known conductivity. A good source of information about how to prepare standards having relatively high conductivity is IEC Publication 746-3 "Expression of performance of electrochemical analyzers. Part 3: Electrolytic conductivity, Appendix B." Conductivity standards are also commercially available.

To do the calibration, submerge the sensor so that the top of the toroids are at least one inch (25 mm) below the surface of the standard solution. Keep at least one inch (25 mm) clearance between the sensor and the walls and bottom of the beaker. Allow adequate time for temperature equilibration before making the final reading. For more information, refer to the Calibration section of the analyzer manual.

The distance between the sensor and the walls of the pipe has a profound effect on the apparent cell constant of the sensor. See Figure 27. If the distance between the sensor and pipe walls is less than one inch (25 mm), the SENSOR MUST BE CALIBRATED IN PLACE against the results of a grab sample test.

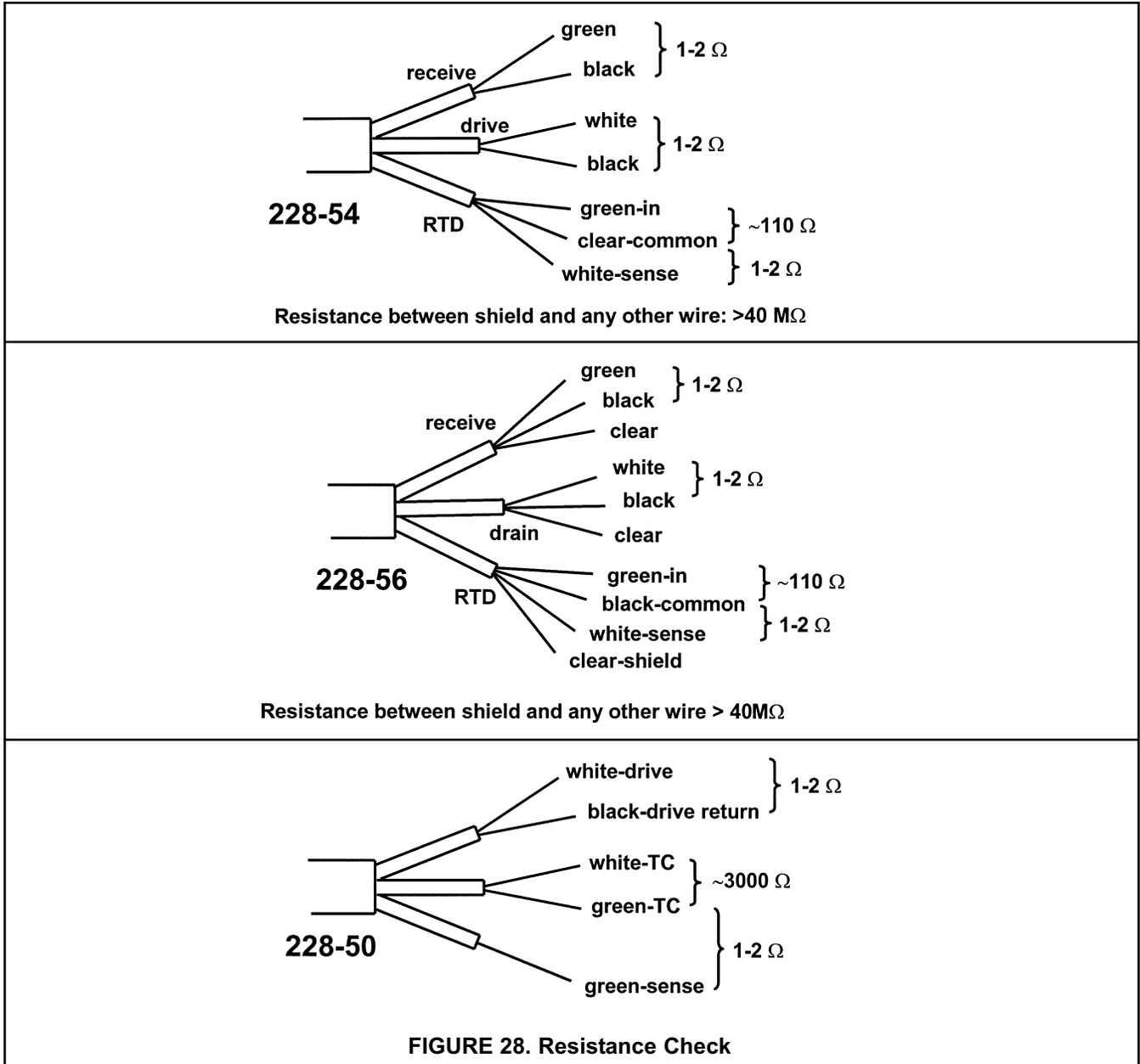


Use a calibrated toroidal sensor to measure the conductivity of the grab sample. Submerge the sensor so that the top of the toroids are at least one inch (25 mm) below the surface of the standard solution. Be sure to maintain at least one inch (25 mm) clearance between the sensor and the walls and bottom of the beaker. Allow adequate time for temperature equilibration before making final readings. For more information, refer to the Calibration section of the analyzer manual.

MAINTENANCE

Generally, the only maintenance required is to keep the opening of the sensor clear of deposits. Cleaning frequency is best determined by experience.

Most Rosemount Analytical analyzers and transmitters continuously monitor the sensor and analyzer for faults and display error messages if a problem is detected. Sensor related messages, for example, "Sensor Open", "Sensor Shorted", or "RTD Failure" can be caused by miswiring as well as by sensor failure. To check for sensor failure, measure the resistance between the lead wires as shown in Figure 28. Be sure to disconnect the leads from the analyzer before measuring.



The resistance between the temperature sensor leads depends on temperature.

Temperature	228-54 and 228-56	228-50
10°C	103.9 Ω	2802 Ω
20°C	107.8 Ω	2934 Ω
25°C	109.7 Ω	3000 Ω
30°C	111.7 Ω	3066 Ω
40°C	115.5 Ω	3198 Ω
50°C	119.4 Ω	3330 Ω



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the right answers,
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