

November 2015



The Versatile WORM mounts anywhere a temperature measurement is needed.

Featuring Moore Industries' innovative WORM Flexible Sensor, these versatile temperature assemblies mount directly to reactors, wells or anywhere a temperature measurement is needed, and eliminates errors caused by influences external to the process. Precise engineering and solid, sturdy construction allow these assemblies to endure the harshest plant conditions and field environments.

Delivering simple installation and removal, our versatile, spring-loaded, flexible sensor trims-to-length providing quick and easy installation in a wide range of temperature measurement applications. With other sensors, such as straight sensors, you have to remove the connection head, and sometimes assembly components, to install the sensor. The WORM slides right through the connection head port, and into the assembly, without removing any assembly components. The WORM bends to accommodate awkward mounting positions and locations. Because the solid sheath portion of the WORM is only 1-1/2" long, it is totally embedded in the thermowell and ensures that no outside influences are affecting the temperature measurement.

Note: *The instructions on the following pages apply to retrofitting assemblies in the field. If you buy the completed assemblies all assembly is done at the factory.*

Features

- **Multiple mounting possibilities.** Anywhere a temperature measurement is needed.
- **Universal temperature transmitter options.** Ready-to-install assemblies come with a choice of our universal PC-Programmable, Smart HART®, and Fieldbus Temperature Transmitters (assemblies without transmitters are also available).
- **High accuracy measurements.** These temperature assemblies keep the spring-loaded sensor in place to maintain good thermal conductance.
- **Solid, sturdy construction.** High-impact connection heads (sensors without connection heads also available) combined with stainless steel mounting accessories allow our temperature assemblies to withstand the most rigid plant environment.
- **WORM Sensor trims to desired length.** There's no need to stock an expensive array of different sensor lengths, one size fits most every thermowell application.
- **Popular RTD and thermocouples.** Available standard sensor types include 100 and 1000 ohm, platinum RTDs; plus J, K, T and E-type thermocouples (others are available on request).
- **Faster response time.** The WORM delivers step response times 13% faster than solid sheath sensors.

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Flexible Sensor Temperature Assemblies

Exposed Air Thermowell (-EXP) Protection Tube (-PTB)

The **Exposed Air Thermowell (-EXP)** option is perfect for measuring both indoor and outdoor ambient temperatures. The perforated tube allows the sensor to have access to the open air while reducing the unwanted measurement fluctuations caused by air circulation. The top is equipped with a 1/2-inch NPT connection for mounting to a transmitter, field-mount enclosure or pipe. The spring loaded WORM Flexible Sensor can be easily installed and removed without the enclosure, making calibration quick and painless. The Exposed Air Thermowell's durable, stainless steel construction is corrosion-resistant and can weather the harshest plant conditions while delivering fast response.

The **Protection Tube (-PTB)** is a sealed tube. Like the -EXP, it's top is also equipped with a 1/2-inch NPT connection for mounting to a transmitter, field-mount enclosure or pipe. The spring loaded WORM Flexible Sensor can be easily installed and removed without the enclosure, making calibration quick and painless. The Protection Tube's stainless steel construction is corrosion-resistant and can weather the harshest plant conditions while delivering fast response. With it's thinner wall, you can also use it for penetration in a low-impact process with low velocities or low pressure when you want faster response than a thermowell can deliver.

Installation

1. Cut the WORM's spring to be between 1 and 1½-inches longer than the combined length of the EXP mount and conduit entry port of the connection head (this will provide the necessary pressure to securely hold the sensor probe against the skin surface).
2. Ensuring that the uncut portion of the spring is facing the sensor probe, slide the spring over the sensor wires and onto the end of the sensor probe.
3. Then slide cap/clip combination (or just cap by itself depending on connection head being used) over the sensor leads and onto the top of the spring.
4. Insert sensor assembly (sensor tip first) through the top of the EXP mount. Screw connection head onto the 1/2-inch NPT threads at top of the Exposed Air Thermowell. Install the transmitter into place.
5. Connect each sensor wire to the appropriate temperature transmitter terminal. Re-insulate if necessary.

-EXP and -PTB Model Number Examples:

TRX / CL24 / D25 / S316 / -WSPT14 - EXP [LH1NS]
TRX / CL24 / D25 / S316 / -WSPT14 - PTB [LH2NS]

Figure 1. Dimensions for Exposed Air Thermowell and Protection Tube options.

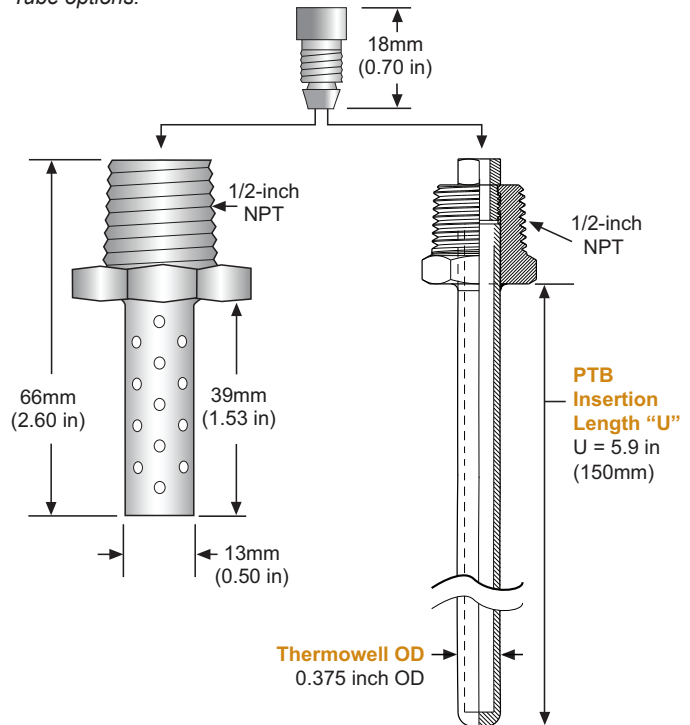
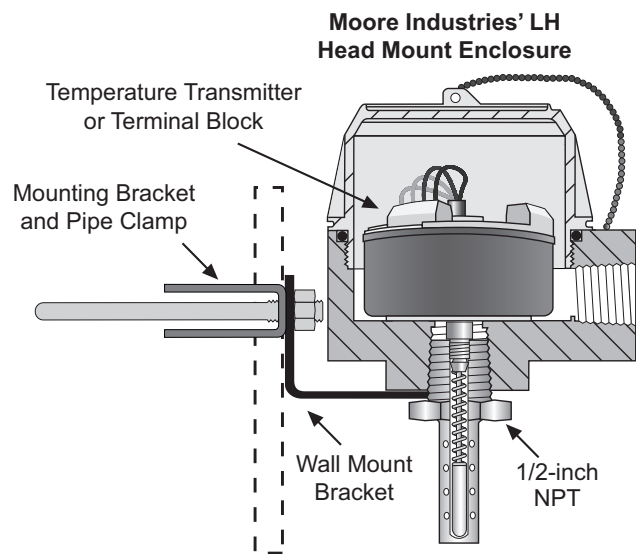


Figure 2. Exposed Air option with connection head assembly.



WORM Nose

If you have a 40' tank and want to measure the product temperature near the bottom of the tank, you can obtain a 40' sensor a couple of ways. We could build a 40' assembly, but the shipping costs for that size container are quite high. The alternative is to employ the WORM Nose and build the assembly on site. Here is how you could put together your assembly:

1. Specify and purchase these components:

A. WORM Nose
(1/2-inch Female NPT)
(P/N 231-201-31)



B. Connection Head, model [LH2NS]:



C. TB6 Terminal Block
(P/N 803-821-27)



D. **WORM Sensor**
SEN / CL36 / D25 / S316 /-WSPT14-LL492-30G [SEN]

2. Build or assemble a 40' pipe with 1/2" MNPT threads on both ends. Be sure your pipe material is suitable for the product in the tank (like SS, PVC, galvanized).

3. Feed the WORM temperature sensor down the pipe until it comes out the other end. Insert the sensor into the WORM Nose and then thread the Nose onto the pipe. You may want to seal this fitting appropriately. The sensor will be a snug fit in the Nose. The spring adds some weight to help keep the sensor seated in the Nose.

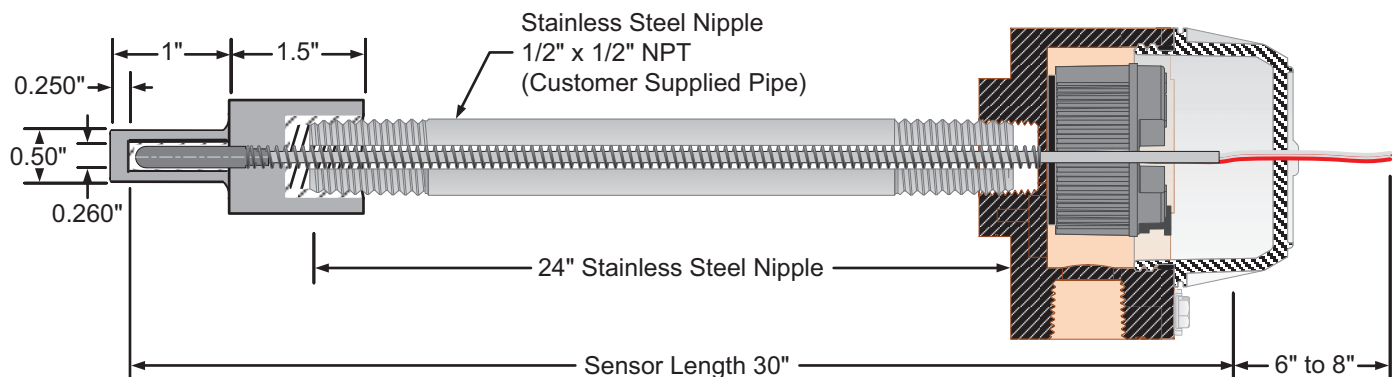
4. At the leadwire end of the pipe, pass the leadwire into the bottom of the LH head and thru the center of the terminal block. Thread the LH head onto the end of the pipe. Land the wires on the terminal block.

5. Drop the pipe assembly into the tank and attach to your holder.

Figure 3. WORM Nose mounted on a pipe with 1/2" MNPT threads.



Figure 4. WORM Nose assembled with a connection head, and a user supplied pipe.



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Flexible Sensor Temperature Assemblies

Remote-Mounted Sensor with Terminal Block (-RM)

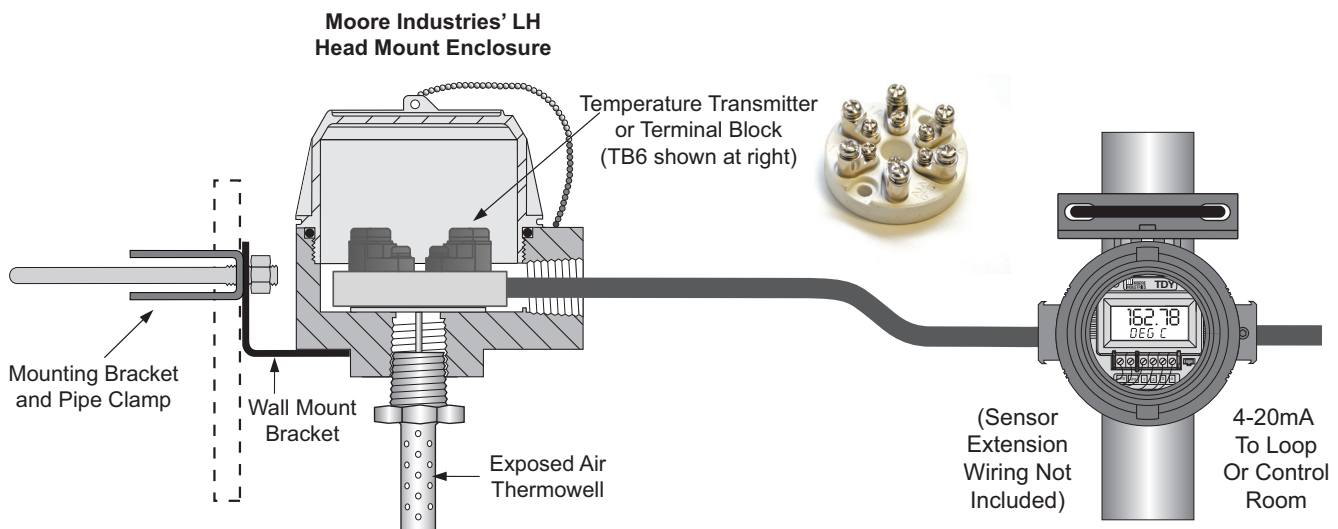
Remove the Display From the Process (See Figure 5). Position your sensor in the heart of your process while keeping your transmitter in an easily accessible area with our *Remote Terminal Block* (-RM) option. Add the **-RM** option to your temperature assembly and receive two housings: a transmitter in the specified

connection head, and a terminal block enclosed in an additional connection head with your selected sensor and fittings attached. Sensor extension wiring (not included; available upon request) connects the terminal block to the transmitter.

Model Number Example:

TDY/CL36/D25/S316/-WSPT14-EXP-RMLH2NS [BH2NGP]

Figure 5. Exposed Air Thermowell option with remote mount connection head assembly.



Note: Cabling between connection head and remote display, and cabling to the control room is customer-supplied.

Sensor Specifications

Lead Wire Materials:

Standard WORM (WS) Sensors: Teflon insulated, hermetically sealed;
High Temperature (WH) Sensors: Braided fiberglass

Sensor Sheath Material: Stainless Steel 316

Accuracy: RTD: $\pm 0.12\%$ at 0°C . Consult the factory for thermocouple tolerances

Stability: RTD: 0.2°C after 10,000 hrs. at maximum temperature (1 year, 51 days, 16 hrs. continuous)

Response Time: RTD: <5 seconds to 63.2% temperature change; Thermocouple, 4.5 sec. for ungrounded, typical; 2.0 sec. for grounded to 63.2% temperature change

Humidity: Standard WORM (WS) Sensors: Excellent moisture resistance for condensing environments; High Temperature (WH) Sensors: Specify for non-condensing atmospheres

Pull Force: Wires will withstand at least 20 lbs. of pull force before separating from sensor head

Transmitter Certifications



ANZEx

IECEX

Approvals for Hazardous 'Classified' Areas including Explosion-Proof/Flameproof, Intrinsically-Safe, Non-Incendive Type "n" and Functional Safety IEC 61508 are available. Consult the individual temperature transmitter data sheets for specific information for each certifying agency.

NOTE: Certifications apply to the temperature transmitter and connection head combination. Sensor and sensor assembly components are not included in the certifications.

Select one from each category to order a WORM Sensor with Mounting Accessory:

Universal Temperature Transmitter (See TDY, THZ³/TDZ³, STZ and TRY/TRX Data Sheets for Specifications)

- TDY** Isolated, PC-Programmable Temperature Transmitter with Display (Specify with BH2NG or D2LC Housing)
- TDZ³** Isolated, Dual Input Smart HART[®] Temperature Transmitter with Display (Specify with BH2NG or D2LC Housing)
- STZ** Isolated, Functional Safety Dual Input Smart HART[®] Temperature Transmitter (Specify with LH2NS or BH2NG Housings Only)
- TFZ** Isolated, Programmable, FOUNDATION Fieldbus™ Temperature Transmitter with Display (Specify with BH2NG or D2LC Housing)
- THZ³** Isolated, Dual Input Smart HART[®] Temperature Transmitter (Specify with LH1NS or LH2NS Housing)
- TPZ** Isolated, PC-Programmable PROFIBUS PA Temperature Transmitter with Display (Specify with BH2NG or D2LC Housing)
- TRY** Isolated, PC-Programmable Temperature Transmitter (Specify with LH1NS or LH2NS Housing)
- TRX** Non-Isolated, PC-Programmable Temperature Transmitter (Specify with LH1NS or LH2NS Housing)
- SEN** Sensor Only; No Transmitter

Sensor Length

- CL1.5** 1.5-Inch Standard WORM Capsule Length
- CL2** 2-Inch Length (Required for -FLEX and -SSB Options and Iconel Sheath with WHTCK)
- CL24** 24-Inch Wire Jacket and Spring Length plus 6-8" Lead Wires (Specify for Total Sensor Insertion Lengths of 22-inches and Under)
- CL36** 36-Inch Wire Jacket and Spring Length plus 6-8" Lead Wires (Specify for Total Sensor Insertion Lengths of 34-inches and Under)
- CL?** Special Wire Jacket and Spring Length plus 6-8" Lead Wires - Replace "?" with Length up to 120" (Specify in 0.25-inch Increments)

Sensor Sheath Diameter

- D25** Appropriate for 0.25-Inch and 6mm Diameter Applications

Sensor Sheath Material

- S316** Stainless Steel 316
- INC** Inconel 600; Only with WH* Type "K" Sensor up to 1093°C (2000°F)

Sensor Type (See Page 4 for Specifications)

RTD SENSORS:

- WSPT14** Standard Temp., Pt 385 RTD; 4-Wire; 100 ohm (450°F maximum)
- WS2PT14** Standard Temp., Pt 385 RTD; 4-Wire; 100 ohm (Dual Sensor, 450°F maximum)
- WSPT104** Standard Temp., Pt 385 RTD; 4-Wire; 1000 ohm (450°F maximum)
- WHPT14** High Temp., Pt 385 RTD; 4-Wire; 100 ohm (800°F maximum)
- WH2PT13** High Temp., Pt 385 RTD; 3-Wire; 100 ohm (Dual Sensor, 800°F maximum)
- WHPT104** High Temp., Pt 385 RTD; 4-Wire; 1000 ohm (800°F maximum)
- WSN1204** Nickel RTD; 4-Wire; 120 ohm (450°F maximum)
- WSCU4** Copper RTD; 4-Wire; 10 ohm (450°F maximum)

THERMOCOUPLE SENSORS:

- WSTC?G** Standard Temp., Replace "?" with J, K, T or E T/C, Grounded (450°F maximum)
- WS2TC?G** Standard Temp., Replace "?" with J, K, T or E T/C, Grounded (Dual Sensor, 450°F maximum)
- WSTC?U** Standard Temp., Replace "?" with J, K, T or E T/C, Ungrounded (450°F maximum)
- WS2TC?U** Standard Temp., Replace "?" with J, K, T or E T/C, Ungrounded (Dual Sensor, 450°F maximum)
- WHTC?G** High Temp., Replace "?" with J, K, T or E T/C, Grounded
- WH2TC?G** High Temp., Replace "?" with J, K, T or E T/C, Grounded (Dual Sensor)
- WHTC?U** High Temp., Replace "?" with J, K, T or E T/C, Ungrounded
- WH2TC?U** High Temp., Replace "?" with J, K, T or E T/C, Ungrounded (Dual Sensor)

IMPORTANT NOTE

Specify Standard Temperature WS* WORM sensors for measurements up to 232°C (450°F)

Specify High Temperature WHPT* WORM sensors for measurements up to 427°C (800°F).

Specify High Temperature WHTC* WORM Sensors for measurements up to 760°C (1400°F).

For temperatures up to 1093°C (2000°F), specify WHTCKG or WHTCKU with a CL2 Sheath Length and Inconel Material.

T/C IDENTIFICATION

Type	Wire Color	
	+	-
E	Purple	Red
J	White	Red
K	Yellow	Red
T	Blue	Red

Continue on next page

THZ3 / CL36 / D25 / S316 / -WSPT104 -PTB -.06 -VTB -RMLH2NS [LH2NS] (Ordering Number Example)

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Flexible Sensor Temperature Assemblies

Select one from each category to order a WORM Sensor with Mounting Accessory:

Assembly Options

- EXP Exposed Air Thermowell for Measurements Indoor and Outdoor
- PTB Protection Tube
- LL? Special Wire Jacket Length Plus 6-8" Lead Wires - Replace "?" with Length up to 120" (Specify in 0.25-inch Increments)
- .5NPT 1/2-inch NPT Fitting
- FLEX? Flex Armor (Requires CL2 Sensor Length) Replace "?" with Length in Inches
- SPR? Special Spring Length - Replace "?" with Length up to 120" (Specify in 0.25-inch Increments)
- GRIP Cord Grip to Secure Sensor Wires to Enclosure
- BOOT Boot Provides Protection for the Lead Wire Jacket and Secure Positioning of the Cord Grip
- SSB? Stainless Steel Braided - Replace "?" with Length in Inches; Do Not Combine with Option -LL? (Requires CL2 Sensor Length)
- SSF11 0.25-inch ID by 1/2-inch NPT Male Thread Compression Fitting
- SSF15 0.375-inch ID by 1/2-inch NPT Male Thread Compression Fitting (803-984-27)

Sensor Options

- .04 1/3 DIN High Accuracy RTD Sensor (.04%)
- .06 Class "A" High Accuracy RTD Sensor (.06%)
- 10G 10G Low-Intensity Vibration Sensor (See Sensor Specifications)
- 30G 30G High-Intensity Vibration Sensor (See Sensor Specifications)
- WW Wire Wound Option Required for Temperatures Below -10°F (RTDs Only)
- ETR Extended Temperature Required Above +800°F (RTDs Only)
- VTB High Accuracy Temperature System Calibration with NIST Test Data Report
- VTD Standard Factory Calibration with NIST Test Data Report
- TB6 6-Position Terminal Block (Mounted in Enclosure) LH1NS, LH2NS, CH19 or CH21 Head Type
- TB8 8-Position Terminal Block (Mounted in Enclosure) LH1NS, LH2NS, CH19 or CH21 Head Type

Enclosure Options

- RMLH1NS* Remote-Mounted Terminal Block in LH1NS Connection Head Any Complete Assembly Model Number
- RMLH2NS* Remote-Mounted Terminal Block in LH2NS Connection Head Any Complete Assembly Model Number
- RMCH19 Remote-Mounted Terminal Block in CH19 SS Connection Head Any Complete Assembly Model Number
- FS Functional Safety (Yellow) LH2 Housing. Can Only be Ordered with LH2* Connection Head or with STZ and -RMLH2* Option

Connection Head/Enclosure

- LH1NS* Aluminum Body with Velox Cap, NEMA 4X, IP66 TRY, TRX, THZ³ or T2X Transmitter; SEN with TB6
- LH2NS* Aluminum Body with Aluminum Cap, Explosion-Proof TRY, TRX, THZ³, STZ or T2X Transmitter; or SEN with TB6
- BH2NG Aluminum Body with Clear Glass Cover, Explosion-Proof TDY, TDZ, STZ, RIY or TIY Transmitter
- D2LC* 2 Hub, Low Base, Clear Cover, NEMA 4X, IP66 TDY, TDZ, RIY or TIY Transmitter
- CH6 Polypropylene Body and Cap, NEMA 4X TRY, TRX, THZ3/THZ2 or T2X Transmitter; or SEN
- CH3 Polypropylene Body and Cap, NEMA 4X with Integral Terminal Block for SEN (TB6/8 not required)
- CH21 Stainless Steel 316 Body and Cap, NEMA 4X TRY, TRX, THZ3/THZ2 or T2X Transmitter; or SEN
- CH19 Stainless Steel 316 Body and Cap, NEMA 4X No Transmitter; with TB6 or TB8 Option
- SEN Sensor Only; No Transmitter

Note: Add "P" Suffix to Enclosure (i.e., LH1NSP) for 2-inch Pipe-Mount Hardware.

See Previous Page for
detailed information

THZ3 / CL36 / D25 / S316 / -WSPT104 -PTB -.06 -VTB -RMLH2NS [LH2NS] (Ordering Number Example)

Flexible WORM Sensor with Flex Armor Cable for a Threaded Thermowell

The WORM sensor with Flex Armor cable cover and fittings mount easily into a standard threaded thermowell, providing both flexibility and protection of the wiring.

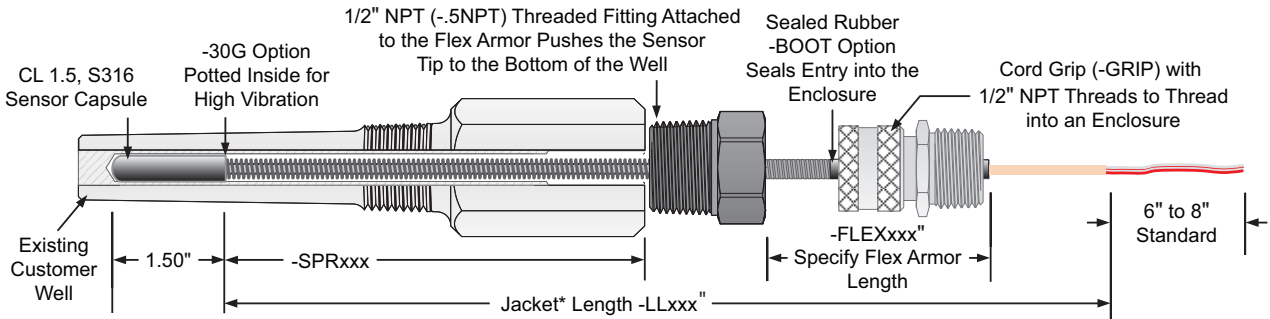
1. Pull the wire out of the Flex Armor and remove the spring.
2. Insert only the spring into the well.

3. Cut the spring about 1.5 to 2-inches longer than the well.
4. Discard the excess spring.
5. Re-assemble it by putting the spring back onto the lead wires.
6. Insert the loose lead wires into the 1/2 inch fitting attached to the Flex Armor.
7. Insert the sensor tip into the well and thread it into the 1/2 inch fitting.

Figure 6. Flexible WORM Sensor attached with Flex Armor Cable to a threaded fitting and threaded into a thermowell.

Model Number Example:

SEN / CL1.5 / D25 / S316 / -WSPT14 -30G -SPR12 -.5NPT -FLEX84 -BOOT -GRIP -LL114 [SEN]



Additional WORM Sensor Options

Multiple WORM Sensor configurations are available. Pictured here are those which are the most commonly used, along with the mounting options covered throughout in this data sheet.

Figure 7. Standard WORM Sensor; Lead Length with Overall Jacket* and Cord Grip.

Model Number Example: **SEN / CL1.5 / D25 / S316 / -WSPT14 -LL120 -GRIP [SEN]**

Uses: Surface measurements where lead wire protection is not needed. Non-abrasive environment.

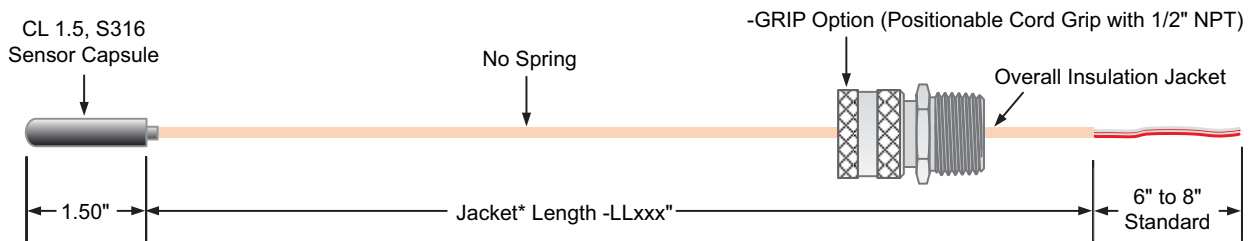
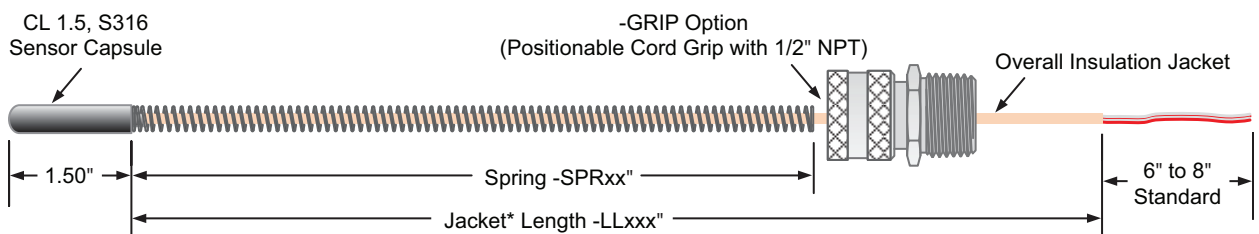


Figure 8. Standard WORM Sensor; Lead Length with Overall Jacket* and Spring and Cord Grip.

Model Number Example: **SEN / CL1.5 / D25 / S316 / -WSPT14 -LL120 -SPR24 -GRIP [SEN]**

Uses: Anytime you want the compressed spring to keep the sensor in contact with the well or hot surface. When used with the WORM Nose the spring adds weight to keep the sensor in the Nose. Increased protection of the lead wire against abrasion.



*Jacket material is Teflon or Braided Fiberglass

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Flexible Sensor Temperature Assemblies

Figure 9. Standard WORM Sensor; Lead Length with Overall Jacket* and SS Braid and Cord Grip.

Model Number Example: **SEN / CL2 / D25 / S316 / -WSPT14 -SSB120 -BOOT -GRIP [SEN]**

Uses: The SS Braid provides excellent abrasion protection while maintaining flexibility of the lead wire. The braid and wire can easily round bends and should be used any time you need to pull the lead wire in adverse conditions.

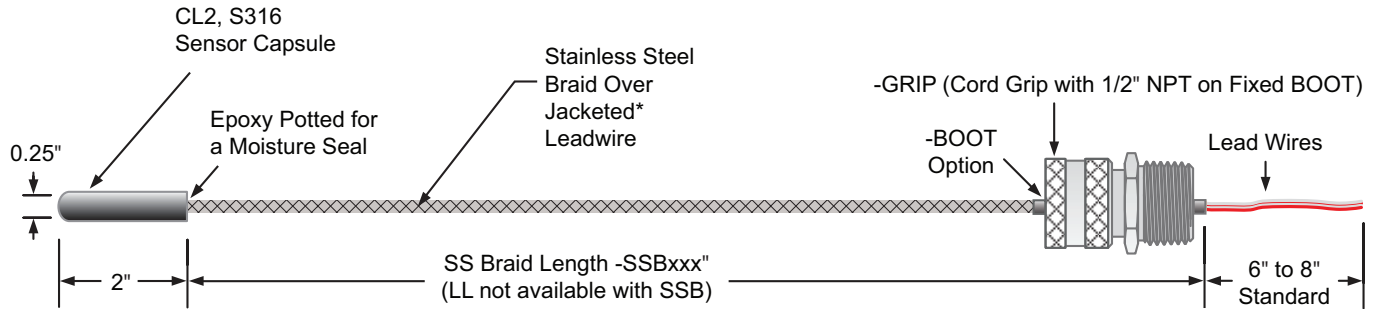


Figure 10. Standard WORM Sensor; Lead Length with Overall Jacket* and Flex Armor and Cord Grip.

Model Number Example: **SEN / CL2 / D25 / S316 / -WSPT14 -FLEX84 -BOOT -GRIP -LL36 [SEN]**

Uses: The Flex Armor provides mechanical protection for the lead wire. Used most often with surface mount fittings or when conduit or Panduit are not available for the lead wire. Protects against anything striking the lead wire.

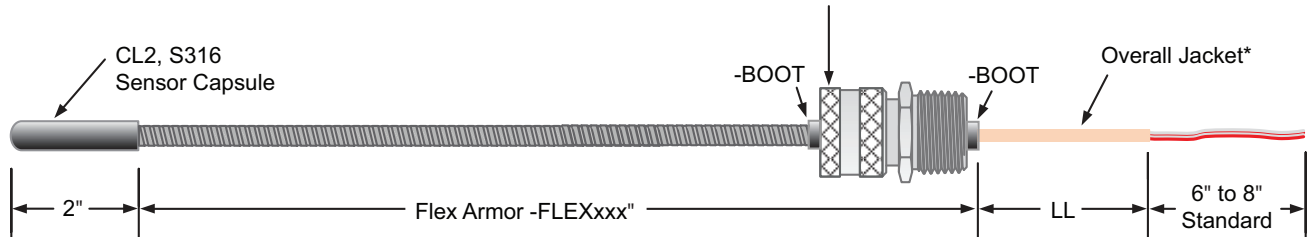
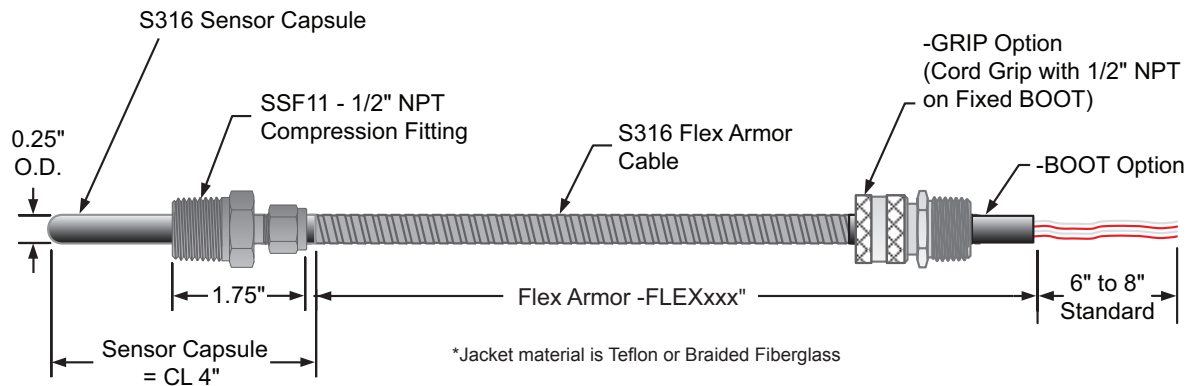


Figure 11. Direct Immersion of WORM Sensor with Flex Armor Cable and Cord Grip.

Model Number Example: **SEN / CL4 / D25 / S316 / -WSPT14 -FLEX24 -SSF11 -GRIP [SEN]**

Uses: This compression fluid seal fitting allows you to set the depth of the sensor and then lock it in. The same Flex Armor as above is used to protect the wires.



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