# 9909 Average Temperature Sensor

## Highly accurate temperature measurement of liquid inventories in storage tanks

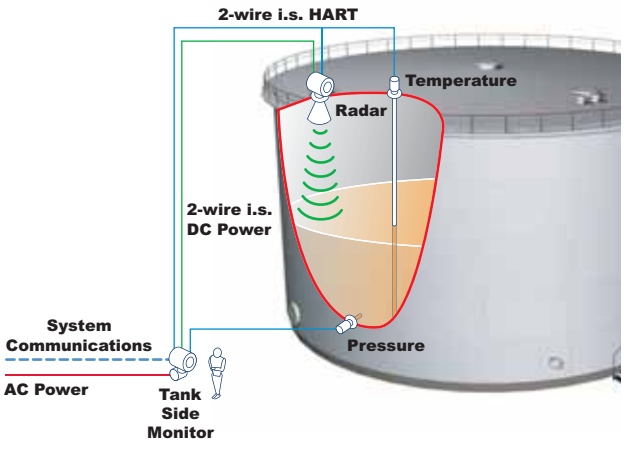
### Features

- Multiple element resistance temperature sensor
- Superior temperature accuracy in stratified service
- Provides overall average tank product temperature
- Suitable for most low and medium pressure tanks
- Fixed, floating and covered floating roof kits
- Operating temperature ranges to +392 °F (+200 °C)
- Flexible 316 S.S. or monel sheath over copper elements
- Accurate to +/- 0.25 °F (+/- 0.14 °C)

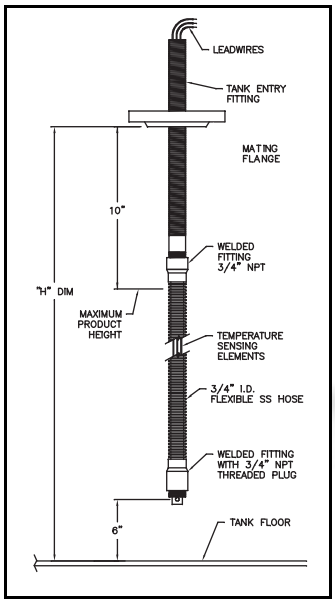
### Applications

The 9909 Averaging Temperature Sensor (ATS) is a multiple element resistance temperature device designed to provide the average product temperature in bulk liquid storage tanks. The 9909 ATS provides an accurate means of measuring the temperature of the product in accordance with API2543 standard.

A combined level and temperature instrumentation solution improves management of your inventory, such as crude oils, fuel oils, diesel fuels, gasolines and liquid gases. Overall efficiency can be increased, whether the facility is a refinery, chemical plant tank farm or distribution terminal.



# Function and System Design




The 9909 Average Temperature Sensor (ATS) assembly hangs vertically in the product from the roof of the tank. Each element within the model 9909 ATS measures resistance as it varies with the change in product temperature. The longest totally submerged element gives the best average temperature and is selected by the connected temperature transmitter (4120 Multi-Element Temperature Transmitter). As the temperature transmitterneeds to know the product level in order to select the correct element, Varec recommends the 9909 ATS as one part of an overall inventory management system.

### Element Selection

Selection can be accomplished mechanically or electronically. Older transmitters and servo gauges utilized a device known as the 'T' Feature ('T' for temperature). This was a switch with gold plated contacts that operated on a cam. As the level changed, the cam rotated and the contact wiped a circuit board. Each element was connected to the board and each element was selected by position. While this method was adequate, problems could occur due to corrosion and wear. The majority of devices today use electronics for increased accuracy for averaging bulb selection while increasing safety with integral intrinsically safe barriers. The model 9909 ATS provides the flexibility to be used with the older 'T' systems and newer devices.

| Spot RTD Quantity | Standard Spacing of elements |
|---|---|
| 1 | 0-3 Feet |
| 2 | 0-5 Feet |
| 3 | 0-7 Feet |
| 4 | 0-10 Feet |
| 5 | 0-14 Feet |
| 6 | 0-20 Feet |
| 7 | 0-26 Feet |
| 8 | 0-32 Feet |
| 9 | 0-40 Feet |
| 10 | 0-50 Feet |

# Installation Guidelines

The 9909 ATS may be installed on fixed roof, internal or external floating roof storage tanks and pressurized tanks, such as spheres and bullets, up to a maximum working pressure of 50 psi (344 kPa).

### In-Service and Out-of-Service Installations

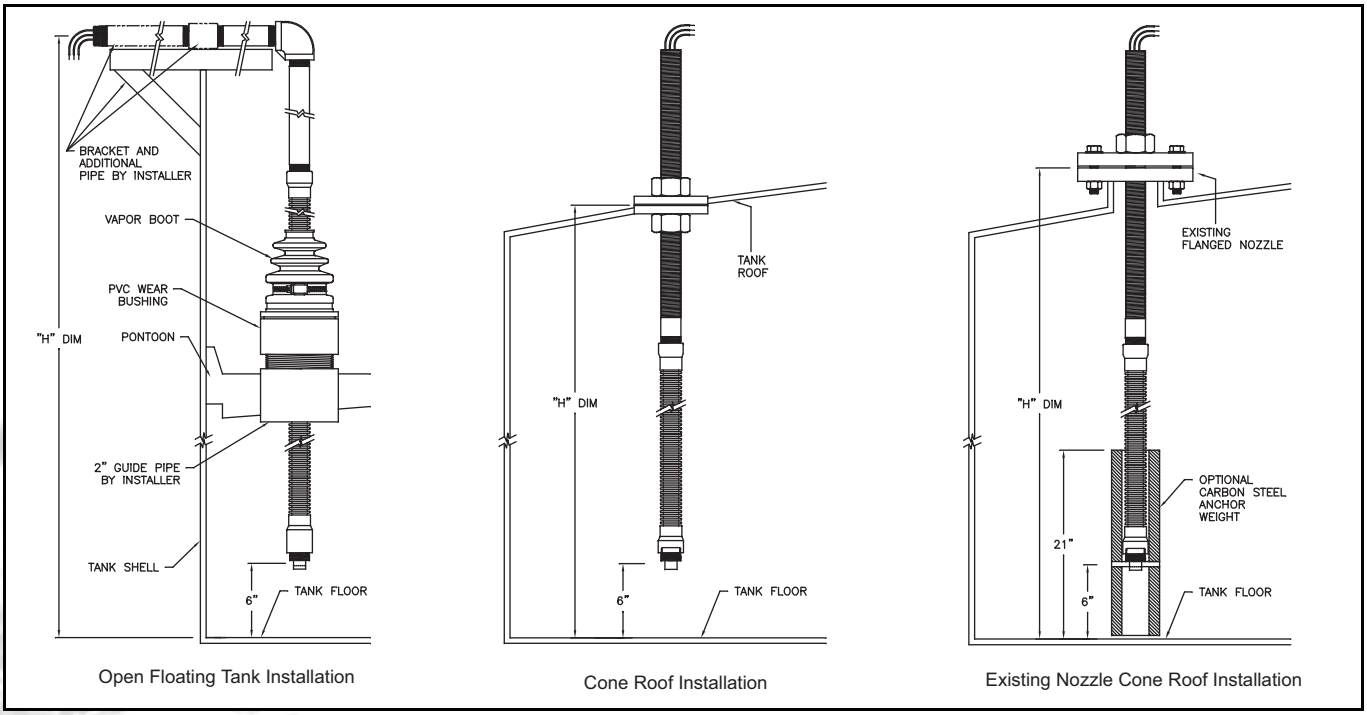
Varec recommends fixing/weighing the end of the averaging bulb to reduce its movement in the tank resulting in more accurate readings. For in-service installations, a weight may be attached to the bottom of the averaging bulb using a 9/32" (7 mm) diameter connector. For out-of-service installations, this connector may also be used to attach to a bracket that is welded to the bottom of the tank. The weight is 3" (76 mm) in diameter.

### Standpipes and Thermowells

Floating roof tanks may utilize a perforated standpipe to house the 9909 ATS. If a thermowell is to be used with the 9909 ATS, Varec suggests the use of a 2" (51 mm) schedule 40 thermowell. A non-perforated thermowell is generally oil filled to improve thermal response to product temperature changes.

### Mounting the 9909 ATS

Two 4" (100 mm) diameter MSS flanges with gaskets are installed, one on each side of the tank roof. The averaging bulb ¾" (19 mm) threaded tube is then screwed into the MSS flange. This method requires access to the inside of the tank. An alternate method is to order the unit with an ANSI flange, which is available up to 4" (100 mm). The standard lead length of a flange is 4.9 ft (1.5 m); please consult the factory for any non-standard lead lengths. For use with floating roof tanks, an additional nylon bush may also be required.




Example installations

# Technical Specifications

The sensor consists of between six and ten graduated lengths of loop wound resistance elements housed in a flexible 316 S.S. or Monel sheath.

## General Information

| | |
|---|---|
| **Manufacturer** | Varec, Inc. |
| **Instrument designation** | 9909 Average Temperature Sensor |
| **Function** | Average temperature measurement |

## Functional

| | |
|---|---|
| **Number of elements** | 6 min. - 10 max. |
| **Insulation test** | 1000 $V_{dc}$ |
| **RTD change/ degree** | 0.2155 Ohms/°F (32 °F to 212 °F)<br>0.3879 Ohms/°C (0 °C to 100 °C) |
| **Element resistance** | 100 Ohms at +77 °F (+25 °C). |
| **Operating range** | Type I: 0 °F to 212 °F<br>(-17 °C to 100 °C)<br>Type II: 0 °F to 392 °F<br>(-17 °C to 200 °C) |

## Physical

| | |
|---|---|
| **Housing pressure test** | 125 psig (861 kPa) |
| **Outer sheath material** | Type 316 S.S. or Monel |
| **Sheath dimensions** | Internal ¾" (19 mm) Ø - External 1" (25.4 mm) Ø |
| **Top connection** | ¾" NPS |
| **Tank floor connection** | 9/32" ( 7mm) Ø |

## Environmental

| | |
|---|---|
| **Operating temperature** | -40 °F and +185 °F<br>(-40 °C and +85 °C) |
| **Operating humidity** | 0 to 95% relative humidity<br>non-condensing |

## Performance

| | |
|---|---|
| **Accuracy** | Type I: ±0.25 °F (±0.14 °C)<br>Type II: ±0.5 °F (±0.28 °C) |

# Order Codes

## 9909 Average Temperature Sensor

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **10** | **Housing Material** | | | | | | | | |
| | 1 | Housing material 316 SS | | | | | | | |
| | 2 | Housing material Monel | | | | | | | |
| **20** | | **Service** | | | | | | | |
| | | 1 | High Temp.: -17 to +200°C (0 to 392°F) | | | | | | |
| | | 2 | Standard: -17 to +100°C (0 to 212°F) | | | | | | |
| **30** | | | **Element Type** | | | | | | |
| | | | 1 | 100 Ohm wire wound copper | | | | | |
| | | | 2 | DIN platinum characterized copper | | | | | |
| **40** | | | | **Process Connection** | | | | | |
| | | | | 0 | 2" 150 lb RF Flange C.S. | | | | |
| | | | | 1 | Type 1 3/4" NPS Hex Nut/Washers | | | | |
| | | | | 9 | Other, please sepcify | | | | |
| **50** | | | | | **Anchor Weight** | | | | |
| | | | | | 0 | none | | | |
| | | | | | 1 | Standard, Steel (3" min. flange) | | | |
| | | | | | 2 | Reduced size, Steel (2" min. flange) | | | |
| | | | | | 3 | Reduced, Steel (2" min. flange) | | | |
| | | | | | 4 | Standard, Stainless Steel (3" min. flange) | | | |
| **60** | | | | | | **Leadwire Length, Connection Head** | | | |
| | | | | | | 1 | 5 ft Leadwire | | |
| | | | | | | 3 | NEMA VII connection to head & terminal strips | | |
| | | | | | | 5 | Other, please sepcify | | |
| **70** | | | | | | | **Tank Height in Feet (0 to 50 ft / 0 to 17 m)** | | |
| | | | | | | | SF | Height in feet, SS | |
| | | | | | | | MF | Height in feet, Monel | |
| **80** | | | | | | | | **Tank Height in Inches (0 to 12 in/ 0 to 205 mm)** | |
| | | | | | | | | SI | Height in inches, SS |
| | | | | | | | | MI | Height in inches, Monel |
| **N9909M-** | | | | | | | | | Complete product designation |

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Your Official Representative

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