

9909 Multi-Element Averaging Bulb

Highly accurate temperature measurement of liquid inventories in storage tanks



Applications

The 9909 Averaging Temperature Sensor is a multiple element resistance temperature device designed to provide the average product temperature in bulk liquid storage tanks. The 9909 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, gasolenes and liquid gases. Overall efficiency can be increased, whether the facility is a refinery, chemical plant tank farm or distribution terminal.

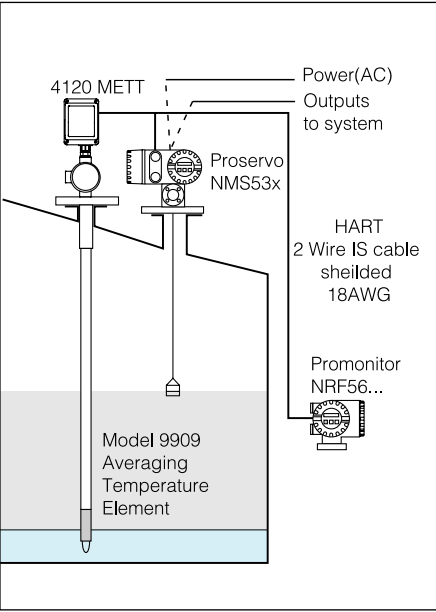
Features

- Multiple element resistance temperature sensor
- Provides overall average tank product temperature
- Superior temperature accuracy in stratified service, $\pm 0.14\text{ }^{\circ}\text{C}$ ($\pm 0.25\text{ }^{\circ}\text{F}$)
- Operating temperature ranges to $+200\text{ }^{\circ}\text{C}$ ($+392\text{ }^{\circ}\text{F}$)
- Suitable for pressurized tanks up to 50 psi (344 kPa)
- Fixed, floating and covered floating roof kits
- Flexible 316 S.S. or monel sheath over copper elements

Measuring System

The 9909 Multi-Element Averaging Bulb assembly hangs vertically in the product from the roof of the tank. Each element within the model 9909 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 (Endress+Hauser 4120 Multi-Element Temperature Transmitter). As the temperature transmitter needs to know the product level in order to select the correct element, Endress+Hauser recommend the 9909 as one part of an overall inventory management system, please see below.

Example 9909 measuring 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 provides the flexibility to be used with the older 'T' systems and newer devices.

Installation

The 9909 may be installed on fixed roof, internal or external floating roof storage tank 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

Endress+Hauser recommend fixing/weighing the end of the averaging bulb to reduce its movement in the tank and so provide more accurate readings. For in-service installations a weight may be attached to the bottom of the averaging bulb using a 7 mm (9/32") 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 76 mm (3") in diameter.

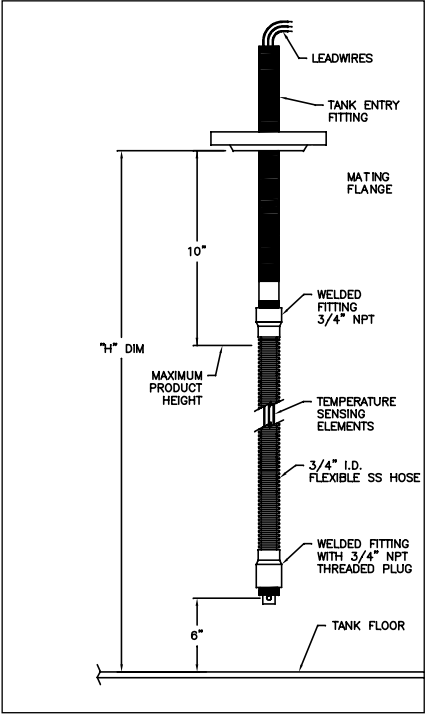
Standpipes and Thermowells

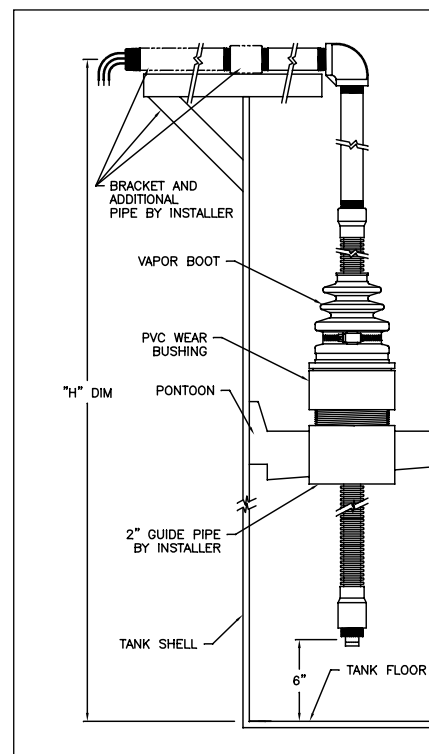
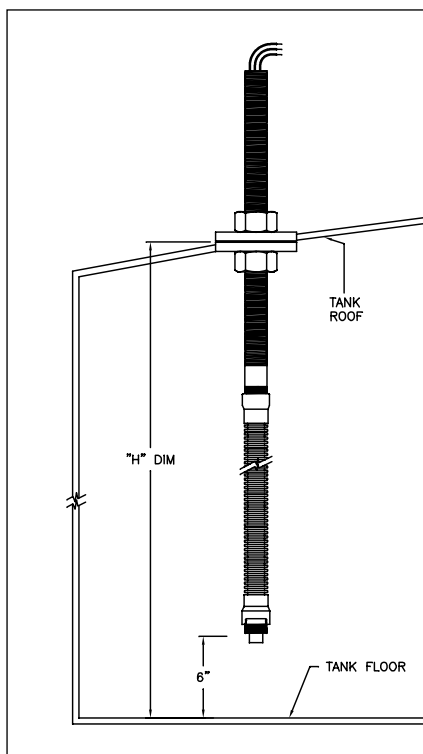
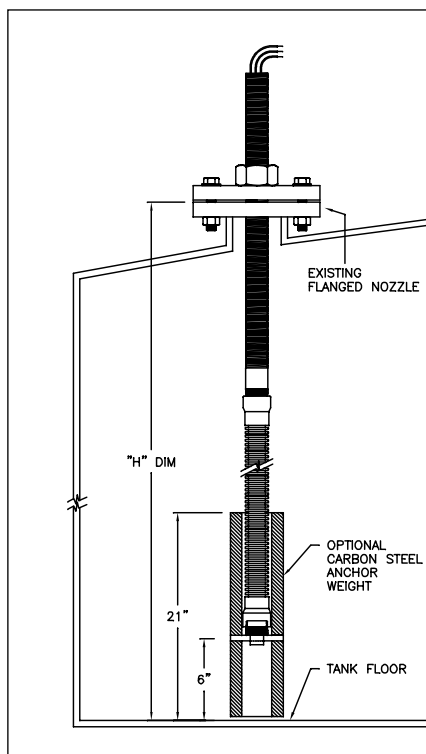
Floating roof tanks may utilise a perforated standpipe to house the 9909. If a thermowell is to be used with the 9909, Endress+Hauser suggest the use of a 2" (51 mm) schedule 40 thermowell. A non-perforated thermowell is generally oil filled to improve thermal response to product temperature changes.

Mounting the Model 9909

Two 100 mm (4 ") diameter MSS flanges with gaskets are installed, one on each side of the tank roof. The averaging bulb 19 mm (3/4 ") 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 are available up to 100 mm (4"). The standard lead length of a flange is 1.5 m (4.9 ft), please consult the factory for any non-standard lead lengths. For use with floating roof tanks an additional nylon bush may also be required.

Model 9909





Left: Existing nozzle cone roof installation, Center: Cone roof installation, Right: Open floating tank installation

Technical Data

The sensor consists of between six and 10 graduated lengths of loop wound resistance elements, housed in a flexible 316 S.S. or Monel sheath. Each copper element, regardless of length, has a resistance of 100 Ohms at +25 °C (+77 °F).

Technical Specifications

Manufacturer	Endress+Hauser Systems & Gauging, Atlanta, USA
Instrument designation	9909 Multi-Element Averaging Bulb
Function	Average temperature measurement

Accuracy	Type I: ± 0.14 °C (± 0.25 °F) Type II: ± 0.28 °C (± 0.5 °F)
Operating Temperature Ranges	Type I: -17 °C to 100 °C (0 °F to 212 °F) Type II: -17 °C to 200 °C (0 °F to 392 °F)
RTD Change/Degree C	0.2155 Ohms/°F (32 °F to 212 °F) 0.3879 Ohms/°C (0 °C to 100 °C)
Number of elements	10 max.
Insulation Test	1000 V _{dc}
Housing Pressure Test	125 psig (861 kPa)
Outer Sheath Material	Type 316 S.S. or Monel
Sheath Dimensions	Internal 19 mm ($\frac{3}{4}$ ") Ø - External 25.4 mm (1") Ø
Top Connection	$\frac{3}{4}$ " NPS
Tank Floor Connection	7mm (9/32") Ø

9909 Multi-Element Averaging Bulb

Bulb Length

20 6.1 m (20ft.) six elements
26 7.9 m (26ft.) seven elements
32 9.8 m (32ft.) eight elements
40 12.2 m (40ft.) nine elements
50 15.2 m (50ft.) ten elements

Housing Material

- 1 Housing material 316 SS
- 2 Housing material monel

Service

H High Temp.: -17 to +200°C (0 to 392°F)
S Standard: -17 to +100°C (0 to 212°F)

Element Material

- 1 100 Ohm wire wound copper
- 2 DIN platinum characterized copper

Mounting Hardware

- 1 Cone roof tank
- 2 Cone roof with internal pan tank
- 3 Open floating roof tank
- 4 Pressure vessels up to 50 psi (344 kPa)
- 5 Cone roof tank with CS/RF flange

Options

0 none additional option
1 Condulet Box 3/4" Entries
3 Anchor Weight 76 mm diameter (3")
4 Condulet Box 3/4" Entries and Anchor Weight 76 mm (3")

Tank Height Stainless Steel 0 to 17 m (0 to 50ft)
SF SS height adder in feet, 0 to 50

Tank Height Stainless Steel 0 to 305 mm (0 to 12")
SI SS height adder in inches, 0 to 12

Tank Height Monel 0 to 17 m (0 to 50ft)
MF Monel height adder in feet, 0 to 50

Tank Height Monel 0 to 305 mm (0 to 12")
MI Monel height adder in inches, 0 to 12

N9909M-

product designation

Locations

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