

# Sensors for the SOLA Hydronic Control

**INSTALLATION INSTRUCTIONS**



## FEATURES

- NTC resistive 10KOhm  $\pm$  1% at 25°C temperature sensors.
- Sensor  $\beta=3950$  for 25°C to 66°C ( $\beta$ =thermistor material constant relative to its resistance versus temperature)
- Single element sensors for boiler Inlet, Header and Outdoor temperature sensing functions.
- Dual element sensors for boiler Outlet, Domestic Hot Water and Stack operation and limit temperature sensing functions.
- 32003971-003 sensor kit contains sensor and hardware for strap-on or outdoor mounting of sensor.
- Some models have Molex splice connectors for quick field connection.
- Sensors may be used for either strap-on or insertion type applications.
- Compatible immersion wells and accessories available. Refer to Honeywell form number 68-0040 for more information.

## APPLICATION

Both single and dual element 10KOhm resistive temperature sensors are used with the Honeywell SOLA Hydronic Boiler Controls. Single element sensors provide only operation temperatures to the SOLA control. Dual element sensors may provide both the operation and/or redundant limit temperatures to the controller. Sensors may be used with compatible Honeywell immersion wells.

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## SPECIFICATIONS

Honeywell offers a variety of sensor types for the SOLA Hydronic Control. Bare leadwires and Molex splice connectors are available. Sensors may be used for either insertion (into a well) or strap-on applications.

Complementary parts such as immersion wells, mounting clamps and spring clips can be found in form number 68-0040, Immersion Wells and Compression Fittings. The immersion wells and other complementary parts must be ordered separately.

**Table 1. SOLA Hydronic Control Sensors**

Sensor Function	Description	Temperature Range	Termination	Part Number	Installation Information
Inlet Header Outdoor	Single Element NTC 10KOhm ± 1% at 25°C β=3950 for 25°C to 66°C	-40°F to +266°F -40°C to +130°C	6 in. leads with female Molex 0039013029 splice connector <sup>1</sup>	<b>32003971-002</b>	<ul style="list-style-type: none"> <li>• 2.620 ± 0.015 in. insertion</li> <li>• 0.375 ± 0.002 in. bulb diameter</li> <li>• Bulb material copper</li> </ul>
Inlet Header Outdoor	Single Element NTC 10KOhm ± 1% at 25°C β=3950 for 25°C to 66°C	-40°F to +266°F -40°C to +130°C	42 in. leads, wires skinned and retained	<b>198799Z</b>	<ul style="list-style-type: none"> <li>• 2.620 ± 0.015 in. insertion</li> <li>• 0.375 ± 0.002 in. bulb diameter</li> <li>• Bulb material copper</li> </ul>
Header Outdoor	Single Element NTC 10KOhm ± 1% at 25°C β=3950 for 25°C to 66°C	-40°F to +266°F -40°C to +130°C	42 in. leads, wires skinned and retained	<b>32003971-003</b> Kit includes sensor, anchors, mounting screws, wire nuts, clip, tie straps	<ul style="list-style-type: none"> <li>• 2.620 ± 0.015 in. insertion</li> <li>• 0.375 ± 0.002 in. bulb diameter</li> <li>• Bulb material copper</li> </ul>
Outlet DHW Stack <sup>3</sup>	Dual Element NTC <sup>4</sup> 10KOhm ± 1% at 25°C β=3950 for 25°C to 66°C	-40°F to +266°F -40°C to +130°C	6 in. leads with female Molex 0039014037 splice connector <sup>2</sup>	<b>50001464-006</b>	<ul style="list-style-type: none"> <li>• 1.181 ± 0.015 in. insertion</li> <li>• 0.370 ± 0.005 in. bulb diameter</li> <li>• Bulb material brass</li> </ul>
Outlet DHW Stack <sup>3</sup>	Dual Element NTC <sup>4</sup> 10KOhm ± 1% at 25°C β=3950 for 25°C to 66°C	-40°F to +266°F -40°C to +130°C	42 in. leads, wires skinned and retained	<b>50001464-007</b>	<ul style="list-style-type: none"> <li>• 1.181 ± 0.015 in. insertion</li> <li>• 0.370 ± 0.005 in. bulb diameter</li> <li>• Bulb material brass</li> </ul>

<sup>1</sup> Mating connector and terminals: Molex 0039013028 and 0039000039. Mating connector and terminals must be purchased by customer.

<sup>2</sup> Mating connector and terminals: Molex 0039014031 and 0039000039. Mating connector and terminals must be purchased by customer.

<sup>3</sup> Sensors may be used for Stack limit sensor if the temperature specifications are not exceeded for the sensor.

<sup>4</sup> The dual element sensor common is the marked lead. Leads A and B are interchangeable.

**Table 2. Control Sensor Wire Sizes**

Application	Recommended Wire Size	Recommended Part Number(s)	Maximum Leadwire Distance
Inlet Header Outdoor	22 AWG two-wire twisted pair, insulated for low voltage.	Belden 8443 or equivalent	50 feet 15.24 meters
Outlet DHW Stack	22 AWG two-wire twisted pair with ground.	Belden 8723 shielded cable or equivalent	50 feet 15.24 meters

## GENERAL INFORMATION

For detailed information regarding available immersion wells and complementary parts as well as complete selection, installation and other information, refer to form number 68-0040, Immersion Wells and Compression Fittings.

### Immersion Wells

An immersion well consists of a metal tube, called the well shell, closed on one end. A well spud externally threaded to fit standard boiler tapings is welded or brazed on the open end. The well is inserted into the tank and the temperature sensing bulb is inserted into the well. The sensing bulb never touches the controlled medium. Because the well conducts heat rapidly, the bulb responds quickly and accurately to temperature changes in the controlled medium.

An immersion well protects the temperature sensing bulb from mechanical damage or damage due to chemical interaction with the controlled medium. Also, a well permits removal of the sensing bulb for testing or control replacement without draining the system.

For faster heat transfer or if the well is not a snug fit on the sensor, the use of heat conductive compound is suggested. Refer to form number 68-0040, Immersion Wells and Compression Fittings.

### Immersion Well Material Selection

The immersion well material must conduct heat readily and resist corrosive and electrolytic action (especially in brine solution and when the well is a different material than the container). The material must also resist fluid contamination from chemical reaction with the well and withstand high temperatures. Most Honeywell immersion wells are copper because of its high conductivity. Stainless steel and mild steel wells are also available for applications requiring higher maximum temperature and pressure rating or greater corrosion resistance.

### Immersion Well Sizing

Major factors in selecting well size are:

- Size of the boiler tapping
- Bulb diameter
- Insulation depth
- Insertion length

Immersion wells are available to fit standard 1/2-14 NPT and 3/4-NPT tapings. Sensing bulbs are 3/8, 1/2 or 11/16 inches in diameter with well shells designed to fit these diameters. The bulb should fit snugly in the shell. If the bulb fits loosely, fill the space between the shell and bulb with heat-conductive compound to ensure maximum heat transfer.

The nominal length of the spud, including the full length of the threads and the hex, defines the insulation depth. Depending on the characteristics of the tapping, 1/8 to 1/2 inch of the threaded end of the spud can extend into the controlled medium. Consider this additional length when determining how far the well extends in to the controlled medium.

The length of the well shell starting at the end of the spud defines the insertion length. This is the active part of the well where the fastest heat transfer occurs. The bulb should be the same length as the well shell; however, the well shell can be longer, but no shorter, than the length of the bulb. Longer shells require inserting the bulb until the end touches the well bottom. Shorter shells do not expose the full length of the bulb to the temperature of the controlled medium, inhibiting proper control operation.

### Securing Bulb in the Immersion Well

#### Remote Bulb Applications

Securing the wire at the spud with a spring clip or a mounting clamp holds the sensing bulb securely in place. Use the spring-loaded clip on well spuds with no mounting flange. Slip it over the wire and snap it in place in the end of the spud. The mounting requires sizing to fit both the spud and the wire diameter. The mounting clamp requires wells with a mounting flange at the spud end. Wells are available with and without the matching spring clip or mounting clamp. This mounting hardware is also available separately.

## INSTALLATION

### When Installing this Product...

1. Read these instructions carefully. Failure to follow them could damage the product or cause a hazardous condition.
2. Check the ratings given in the instructions and on the product to make sure the product is suitable for your application.
3. Installer must be a trained, experienced service technician.
4. After installation is complete, check out product operation as provided in these instructions and the product instructions for which the sensors are used.
5. Follow local codes for installation and application.

### WARNING

#### Severe Scalding Hazard.

**Contact with hot liquid can cause severe injury or death.**

Drain system before beginning immersion well installation.

### WARNING

#### Electrical Shock Hazard or Equipment Damage Hazard.

**Can cause severe injury, death or short equipment circuitry.**

Disconnect all power supplies before beginning installation to prevent electrical shock or equipment damage.

Most equipment manufacturers provide a tapping for temperature controller sensing element insertion. The tapings usually allow well to be mounted horizontally so

boiler water of average temperature can circulate freely over the well. The tapping should be located to measure average system temperature.

**IMPORTANT**

*Always install the sensing element away from hot or cold water inlets, steam coils, and locations where the well pressure rating will be exceeded.*

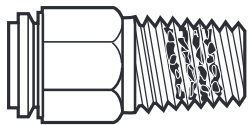
1. Turn off all power.
2. If the system is filled, drain it to a point below the boiler tapping or sensing element location.
3. If no tapping is provided, prepare a properly sized and threaded tapping at the desired location.

**Immersion Well Mounting**

1. Coat immersion well threads with a moderate amount of pipe dope, leaving two end threads bare. See Fig. 1.

NOTE: Teflon® tape can also be used.

2. Screw the immersion well into the tapping and tighten securely.
3. Refill boiler and check for water leakage.



APPLY A MODERATE AMOUNT OF PIPE COMPOUND (LEAVE TWO END THREADS BARE).

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**Fig. 1. Proper application of pipe dope.**

**Insert Sensing Bulb in Well**

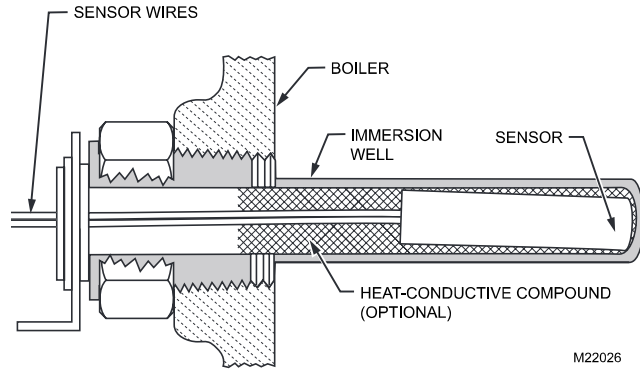
For good temperature response, the immersion well must fit the sensing element or bulb tightly and the bulb must rest against the bottom of the well. Refer to Fig. 2. Use a well of correct length and bend the wiring or tubing, if necessary, to hold the bulb against the bottom of the well.

**IMPORTANT**

*Any bends made in the piping must be gradual to prevent breaks in the tubing and subsequent loss of fill.*

For faster heat transfer or if the well is not a snug fit on the sensor, use the heat conductive compound suggested in form number 68-0040, Immersion Wells and Compression Fittings. The heat conductive compound must fill the space between the bulb and the well. Use the following procedure when installing the compound:

1. Fill the well with compound.
2. Coat the bulb generously before inserting it into the well.
3. Move the bulb up and down inside the well to ensure even distribution of the compound.
4. Wipe excess compound from the outer end of the well.



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**Fig. 2. Sensor Installation.**

**Securing Bulb with Mounting Clamp or Spring Clip**

For information regarding securing the sensing bulb with a mounting clamp and/or spring clip, refer to form number 68-0040, Immersion Wells and Compression Fittings.

**Boiler Inlet Sensor**

The ideal boiler inlet sensor mounting location is in a well in the boiler shell. The boiler inlet sensor may also be mounted on the main supply pipe as follows:

1. Mount the sensor 3 feet (1 meter) downstream from the main or primary circulator to ensure adequate water mixing. If the circulator is on the boiler return, mount the sensor after the first elbow away from the boiler circulator outlet.
2. Follow the Strap-On Mounting instructions below.

**Strap-On Mounting**

Some applications require the sensing bulb to be strapped to the outside of a pipe, such as the boiler header. The 32003971-003 sensor kit includes hardware for mounting the sensor to a pipe.

External mounting of the sensor produces a slight offset in the temperature control point. Typically, the control temperature increases as much as 5°F (2.8°C) with a bare sensor strapped to the discharge pipe. Applying insulation (such as foam rubber or fiberglass) around the sensor and pipe decreases the offset. Insulation must be used if large fluctuations in ambient temperature occur near the pipe.

Mount the bulb on the pipe as follows:



**CAUTION**

**Significant Calibration Shift Hazard.**  
**Over-tightening tie straps distorts bulb calibration.**  
 Do not over-tighten tie straps.

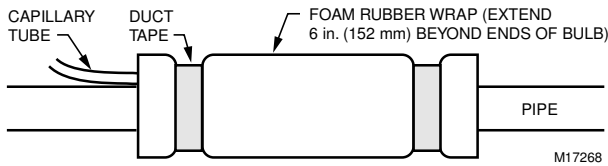
1. Sand and/or clean the pipe surface as necessary in preparation for sensor mounting.
2. Secure the bulb to the pipe with the tie straps.

3. If necessary, cover the bulb with insulation, making sure it extends at least 6 inches (152mm) beyond both ends of the bulb. See Fig. 3.

**IMPORTANT**

*Do not allow the tape to come into contact with the pipe.*

4. Secure insulation with duct tape or foil tape. See Fig. 3.



**Fig. 3. Covering bulb and pipe with insulation.**

**Outdoor Sensor Mounting**

The 32003971-003 sensor kit includes hardware for mounting the sensor outdoors.

**Locate the sensor:**

- In a shady location out of direct sunlight.
- At least three feet from building vents.
- Above expected snow line where ice and debris cannot cover it.
- On the North side of the building.

**To mount the outdoor sensor:**

1. Place the sensor in the plastic mounting clamp provided.
2. Insert the screw provided through the hole in the mounting clamp and fasten the sensor in place.
3. Run an extension wire from the sensor lead wires to the control.
4. Insulate all connections and strain relief wires.

**IMPORTANT**

*Do not run sensor wires parallel or close to telephone or power cables. Cross all power and telephone wiring at right angles. If sensor wires are located in an area with strong sources of electromagnetic interference, use twisted pair, shielded cable, or run wires in a grounded metal conduit. When using shielded cable or conduit, connect the shield wire to earth ground ONLY at the SOLA control panel. DO NOT connect the shield (or conduit if used as a shield) to earth ground at any other location or electromagnetic shielding will be ineffective.*

*Connect 22 AWG (or larger) wire to the two sensor wires using the wire nuts provided.*

**CHECKOUT**

**General**

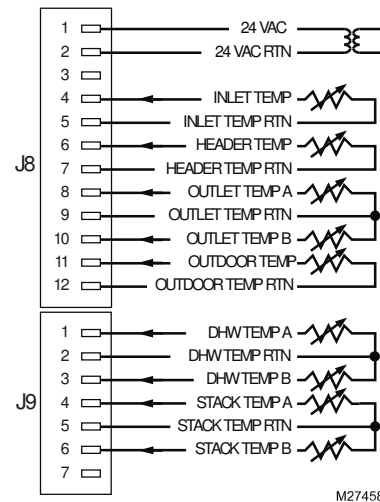
When sensor installation is complete, check it as follows:

1. Visually inspect the fittings in hydronic applications for leakage.
2. If necessary, tighten these fittings.
3. Ensure proper operation by observing the system through at least one complete cycle.

**Wiring and Testing**

For control installation, reference, programming, wiring and testing information, refer to the SOLA Product Data sheets, form number 66-1171 for commercial versions and form number 68-0290 for residential versions. Figure 4. shows the commercial and residential SOLA Hydronic Control sensor connections for reference.

**NOTE:** The dual element sensor common is the marked lead. Leads A and B are interchangeable.



**Fig. 4. Commercial and Residential SOLA Hydronic Control Sensor Connections.**





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