**SAFETY INSTRUCTIONS**
1. Do not remove from pressurized lines.
2. Do not exceed maximum temperature/pressure specifications.
3. Do not install/service without following installation instructions (see sensor manual).
4. Wear safety goggles and faceshield during installation/service.
5. Do not alter product construction.
6. Failure to follow safety instructions could result in severe personal injury!

- Pipe fittings **MUST** be installed by a certified welder only. +GF+ SIGNET will not assume liability of any kind for improper fitting installations.

- The 2540 HotTap system’s overall specifications and limitations depend on the lowest maximum rating of the components associated with the system. In other words, the HotTap system is only as strong as its weakest link. For example, a ball valve, a component of the system, is rated at a maximum 100 psi @ 175 °F, limiting the entire system’s maximum pressure/temperature rating to 100 psi @ 175 °F. All higher maximum specifications **MUST** yield to the component with the lowest maximum specification.

**Maximum Operating Pressure/Temperature:**
- 17 bar (250 psi) @ 82 °C (180 °F) with standard Viton® sensor fitting O-rings.
- 17 bar (250 psi) @ 100 °C (212 °F) with optional EPR sensor fitting O-rings.

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**1. Location of Fitting**
Recommended sensor upstream/downstream mounting requirements.

**2. Sensor Mounting Position**
Vertical mounting is recommended for best overall performance. Mount at a maximum of 45° when air bubbles are present. **DO NOT** mount on the bottom of the pipe when sediments are present.

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**3. Sensor Wiring**

**+GF+ SIGNET Instruments**
- 1/2 in. NPT conduit port
- Black (5 to 24 VDC)
- Red (signal out)
- Silver (DC return)
- Blk, sensor power
- Red, freq. input
- Shld, Gnd

**Other Brands**
- Black
- Silver (DC return)
- Red

- **Use 2-conductor shielded cable for cable extensions up to 300 m (1000 ft).**
- **Maintain cable shield through splice.**
4. Installation

The following items are required to properly install +GF+ SIGNET 2540 Standard and HotTap Sensors.

4.1 Hardware, Standard Sensor

- Female pipe fitting (weld-on or saddle) with 1.5 in. NPT or ISO 7/1-Rc 1.5 threads
- 32 mm (1.25 in.) diameter drill
- Pipe thread sealant
- Tape measure

4.2 Hardware, Hot-Tap Sensor

The Hot-Tap sensor requires all the standard sensor items plus:
- HotTap drilling machine (e.g. Mueller drilling machine or equivalent)
- Female ball or gate valve (full port only) with 1.5 in. NPT or ISO 7/1-Rc 1.5 threads
- Male pipe nipple, 32 x 50 mm (1.5 x 2 in.) with 1.5 in. NPT or ISO 7/1-Rc 1.5 threads
- HotTap installation tool (purchased separately)

4.3 Standard Fitting Installation

A. Depressurize and drain pipe.

B. Wearing safety face protection, drill a 32 mm (1.25 in.) diameter hole in the pipe.

C. Install the pipe fitting on the outside of the pipe according to the manufacturer's instructions. Failure to follow these instructions may result in serious bodily injury and/or product failure.

D. Remove sensor fitting from sensor assembly.

E. Thread sensor fitting into pipe fitting. (Fig. 1)

4.4 Hot-Tap Fitting Installation

A. Install the pipe fitting on the outside diameter of the pipe according to the manufacturer's instructions. Failure to follow these instructions may result in serious bodily injury and/or product failure.

B. Install the pipe nipple and isolation valve (ball or gate valve) onto the external pipe fitting using pipe sealant on the threads. (Fig. 2)

C. Wearing safety face protection, install an appropriate hole cutting tool per manufacturer's instructions (e.g. Mueller drilling machine) with a 32 mm (1.25 in.) drill onto the top of the isolation valve, ensuring a tight fit. Use the recommended drill bit size or damage to the isolation valve may occur.

D. Open the isolation valve and insert the drill through the valve and cut the sensor clearance hole. After the hole is cut, withdraw the drill from the isolation valve and close the valve. Remove the drilling machine per manufacturer's instructions. (Fig. 3)

E. Install the sensor fitting/bleed valve into the top of the isolation valve. Make sure the bleed valve clears the handle of the isolation valve during operation.
4.5 Calculating the H Dimension
Before installing the sensor some critical dimensions must be established (for HotTap installations, we assume the pipe dimensions are known). The rotor shaft must be located 10% inside the pipe I.D. to ensure accurate calibration capability. To accomplish this, the "H" dimension is measured from the outside surface of the pipe to the bottom of the sensor flange.

Nominal "H" dimensions for standard pipes are listed in section 9. For non-standard pipe dimensions, calculate the "H" dimension using the formula listed below. Your pipe's wall thickness and inside diameter (I.D.) is required for the "H" dimension calculation.

The 6 inch ruler (included) may be used to measure your pipe I.D. and wall thickness up to 5 inches (standard sensors only).

Pipe wall thickness: __________  Pipe I.D.: __________

**Standard Sensors**

\[ H = 5.23 - \text{pipe wall thickness} - (0.10 \times \text{I.D.}) \]

Example:
3.0 inch schedule 80 wrought steel;
Wall thickness = 0.3 in. / Inside diameter = 2.9 in.

\[ H = 5.23 - 0.3 - (0.10 \times 2.9) / H = 117.86 \text{ mm (4.64 in.)} \]

Record your sensor's "H" dimension for future reference:
\[ H = \underline{\text{____________}} \]

**Hot-Tap Sensors**

\[ H = 15.39 \text{ in.} - \text{pipe wall thickness} - (0.10 \times \text{I.D.}) \]

Example:
10 inch schedule 40 wrought steel;
Wall thickness = 0.365 in. / Inside diameter = 10.02 in.

\[ H = 15.39 - 0.365 - (0.10 \times 10.02) / H = 356.18 \text{ mm (14.023 in.)} \]

Record your sensor's "H" dimension for future reference:
\[ H = \underline{\text{____________}} \]

After correct dimensions are calculated and recorded, the sensor can be installed in the fitting. The Standard and HotTap versions require substantially different procedures.

4.6 Standard Sensor Installation

A. Thread one hex nut onto each of the three threaded rods included in package. Install threaded rod with a lock washer onto the sensor fitting. Secure rods in place by tightening each hex nut against the sensor fitting. (Fig. 4)

B. Thread one jam nut and lower hex nut onto each threaded rod so that the top surface of each nut is at the proper "H" dimension for your pipe. Secure each hex nut with a jam nut. (Fig. 5)

C. Insert the flow sensor into the sensor fitting, making sure the alignment hole on the sensor flange is pointing downstream.

Fig. 4  Fig. 5
D. Place the alignment rod in the alignment hole on the sensor flange. Align the flange so rod is parallel to the process pipe. (Fig. 6)

E. Thread upper hex nuts with lock washers until they contact the sensor flange and tighten. Check for proper "H" dimension and readjust if necessary. (Fig. 7)

4.7 Hot-Tap Sensor Installation

A. Thread one hex nut onto each of the three threaded rods included in package. Install threaded rod with a lock washer onto the sensor fitting. Secure rods in place by tightening each hex nut against the sensor fitting. (Fig. 8)

B. Thread one jam nut and lower hex nut onto each threaded rod so that the top surface of each nut is 359 mm (14.14 in.) from the top surface of the sensor fitting. Secure each hex nut with a jam nut. (Fig. 9)

CAUTION: This setting is critical to ensure an adequate sensor seal and to prevent the rotor from hitting the isolation valve orifice during installation.

C. Wipe the sensor body with a dry, clean cloth. Orient the alignment hole on the sensor flange to point downstream. Place the slotted flange over the threaded rods. Lower the sensor into the fitting until the sensor flange rests on the lower hex and jam nuts.

D. Secure the sensor with lock washers and upper hex nuts on the top of the flange. Before tightening, align the sensor flange so that the alignment rod is parallel and level with the process pipe. (Fig. 10 & Fig. 11)

E. Make sure the bleed valve is closed (full clockwise position).

F. Thread protector plate hex nuts onto each of the three threaded rods. Adjust each hex nut to a height of approximately 25 mm (1 in.) from the top of each rod. Remove the black plastic cable grommet in top of sensor with a screwdriver. Slide the grommet up the cable away from sensor. (Fig. 12)
Hot-Tap Sensor Installation - Continued

G. Position the installation tool bearing plate by rotating it so that it is approximately 40 mm (1.6 in.) from the swivel mount. Mount the installation tool by placing the threaded rods through the holes in the tool's bearing plate, resting the bearing plate on top of the protector plate hex nuts. Make sure the swivel mount's ears are mounted between the threaded rods (not over the rods). Install the bearing plate cap nuts. Tighten the bearing plate cap nuts to secure the installation tool in place. (Fig. 13)

H. Align the sensor cable with the swivel mount cable port to prevent cable pinching. Use a 3/8 inch wrench or socket to turn the installation tool shaft clockwise until it is seated in the hole at the top of the sensor flange.

I. Wearing safety face protection, **slowly open the isolation valve to the full open position**. Loosen the lower hex and jam nuts and move them to the proper "H" dimension. Turn the installation tool shaft **clockwise** until the sensor flange contacts the lower hex and jam nuts. Thread the upper hex nuts down until they contact the sensor flange. Tighten the upper hex nuts to secure the sensor. (Fig. 14)

J. Remove cap nuts and withdraw the installation tool. Be careful to not damage cable. Snap cable grommet into top of sensor and replace protector plate and cap nuts. (Fig. 15)

5. **Standard Sensor Removal**

To remove the sensor from a depressurized empty pipe, simply remove the cap nuts and upper hex nuts located above the sensor flange. Pull up on sensor flange with twisting motion.

6. **Hot-Tap Sensor Removal**

To remove the HotTap sensor safely from a pressurized active pipe, the entire installation process must be reversed.

A. Remove the cap nuts, protector plate, protector plate hex nuts, and sensor cable grommet. (Fig. 16)

B. Thread installation tool in place and secure bearing plate in place of sensor protector plate. (Fig. 17)

C. Turn shaft of installation tool **clockwise** to lower tool into opening in sensor flange. Guide cable into the port to prevent damage.
6. Hot-Tap Removal - Continued

D. Wearing safety face protection, loosen the upper hex nuts and raise to 372 mm (14.6 in.) from top of sensor fitting to bottom of upper hex nuts/lock washers. CAUTION! This measurement is critical to maintain watertight seal in sensor while allowing clearance to close the isolation valve.

E. Wearing safety face protection, turn the installation tool shaft counterclockwise to withdraw sensor until the sensor flange contacts the upper hex nuts. (Fig. 18)

F. Raise one lower hex and jam nut to bottom of sensor flange.

G. Close isolation valve, remove bearing plate and tool.

H. Wearing safety face protection, cover the bleed valve with suitable protection (rag, towel, etc.) and open the bleed valve (ccw rotation) to relieve internal pressure. Pull sensor up until bleed valve purges some fluid (indicating sensor is past 1st o-ring seal inside sensor fitting).

CAUTION: In case of a leaky isolation valve, the sensor will be under a slight amount of pressure. Care should be taken when removing the sensor. Use the bleed valve to relieve this pressure taking care not to spray fluid on yourself or others.

Sensor can now be safely removed. When reinstalling the sensor: leave one lower hex nut in position to guide sensor to proper isolation valve clearance height before opening isolation valve. Return to "H" dimension height after valve is opened.

7. Maintenance

Your sensor requires little or no maintenance of any kind, with the exception of an occasional sensor/paddlewheel cleaning.

8. Sensor Parts

<table>
<thead>
<tr>
<th>Order no.</th>
<th>Sensor type</th>
<th>Fitting type</th>
<th>Code</th>
<th>Accessories</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-2540-1</td>
<td>Standard</td>
<td>1.5 in. NPT</td>
<td>198 840 035</td>
<td></td>
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<td>3-2540-2</td>
<td>Standard</td>
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<td>198 840 036</td>
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<td>Hot-Tap</td>
<td>ISO 7/1-R 1.5</td>
<td>198 840 038</td>
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</table>

9. H Dimensions, Standard & Hot-Tap Sensors

### Standard Sensors

- **Wrought Steel Pipe Per ANSI B36.10**
  - NPS | SCH 40 | SCH 80 | STD | XS
  - 1/2 | 4.924  | 4.880  | 4.924 | 4.880 |
  - 2   | 4.880  | 4.869  | 4.880 | 4.869 |
  - 2 1/2 | 4.870  | 4.860  | 4.870 | 4.860 |
  - 3   | 4.869  | 4.860  | 4.869 | 4.860 |
  - 4   | 4.859  | 4.850  | 4.859 | 4.850 |
  - 5   | 4.847  | 4.837  | 4.847 | 4.837 |
  - 6   | 4.834  | 4.824  | 4.834 | 4.824 |
  - 8   | 4.810  | 4.800  | 4.810 | 4.800 |
  - 10  | 4.786  | 4.776  | 4.786 | 4.776 |
  - 12  | 4.750  | 4.740  | 4.750 | 4.740 |
  - 14  | 4.714  | 4.704  | 4.714 | 4.704 |
  - 16  | 4.680  | 4.660  | 4.680 | 4.660 |
  - 18  | 4.640  | 4.620  | 4.640 | 4.620 |
  - 20  | 4.600  | 4.580  | 4.600 | 4.580 |

### Hot-Tap Sensors

- **Wrought Steel Pipe Per ANSI B36.10**
  - NPS | SCH 40 | SCH 80 | STD | XS
  - 1/2 | 15.084 | 15.044 | 15.084 | 15.044 |
  - 2   | 15.044 | 14.998 | 15.044 | 14.998 |
  - 10  | 14.023 | 13.988 | 14.023 | 13.988 |
  - 24  | 11.950 | 11.915 | 11.950 | 11.915 |

### Conversion: mm = inches X 25.4
### 10. K-Factors (Stainless Steel, Wrought Steel & Plastic Pipe)

<table>
<thead>
<tr>
<th></th>
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<td>1-1/2 in.</td>
<td>3-1/2 in.</td>
<td>2-1/2 in.</td>
<td>3 in.</td>
<td>4 in.</td>
<td>5 in.</td>
<td>6 in.</td>
<td>8 in.</td>
<td>10 in.</td>
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<tr>
<td>1/2 in.</td>
<td>3-1/2 in.</td>
<td>2-1/2 in.</td>
<td>3 in.</td>
<td>4 in.</td>
<td>5 in.</td>
<td>6 in.</td>
<td>8 in.</td>
<td>10 in.</td>
</tr>
</tbody>
</table>

If the serial number on your sensor looks like this, use the data on this page.

If the serial number on your sensor looks like this, divide the values on this page by 0.9253.

### K-Factors and A-Factors are listed in U.S. gallons and in liters. Conversion formulas for other engineering units are listed below.

- **K = 60/A**

The K-factor is the number of pulses generated by the 2540 paddlewheel per unit of liquid in a specific pipe size.

- **A = 60/K**

The A-factor is the flow rate (per minute) represented by 1 Hz output from the 2540 sensor in a specific pipe size.
11. Specifications

General Data
Flow velocity range: 0.1 to 6 m/s (0.3 to 20 ft/s)
Linearity: ±1% of full range
Repeatability: ±0.5% of full range
Pipe range:
• Standard version: 38 to 610 mm (1.5 to 24 in.)
• Hot-Tap version: 38 to 914 mm (1.5 to 36 in.)
Sensor fitting options: 316 SS with 1.5 in. NPT threads, OR 316 SS with ISO 7/1-R 1.5 threads
Cable length: 7.6 m (25 ft.), can splice up to 300 m (1000 ft.)
Cable type: 2-conductor twisted-pair with shield

Fluid Conditions
Maximum operating pressure/temperature:
• Sensor with standard Viton® sensor fitting O-rings:
  17 bar (250 psi) @ 82 °C (180 °F)
• Sensor with optional EPR sensor fitting O-rings:
  17 bar (250 psi) @ 100 °C (212 °F)

Wetted Materials
Sensor body: 316 stainless steel
Sensor fitting: 316 stainless steel
Sensor fitting O-rings: Standard Viton®, optional EPR
Rotor: CD4MCu stainless steel
Rotor shaft: Tungsten carbide (standard)
Shaft retainers (2): 316 stainless steel (option)
Rotor bearings (2): Fluoroloy B®

Electrical Data
Supply voltage: 5 to 24 VDC
Supply current: 1.5 mA max.
Output type: Open collector, sinking
Output current: 10.0 mA max.

Caution: The 2540 Hot-Tap system's overall specifications and limitations depend on the lowest maximum rating of the components associated with the system. In other words, the Hot-Tap system is only as strong as its weakest link. For example, a ball valve, a component of the system, is rated at a maximum 100 psi @ 175 °F, limiting the entire system's maximum pressure/temperature rating to 100 psi @ 175 °F. All higher maximum specifications MUST yield to the component with the lowest maximum specification.

Note: Pressure/temperature specifications refer to sensor performance in water. Certain chemical limitations may apply. Chemical compatibility should be verified.

Standard Sensor Dimensions:
• 2540-1 = 1.5 in. N PT fitting
• 2540-2 = ISO 7/1-R 1.5 fitting

Hot-Tap Sensor Dimensions:
• 2540-3 = 1.5 in. N PT fitting
• 2540-4 = ISO 7/1-R 1.5 fitting