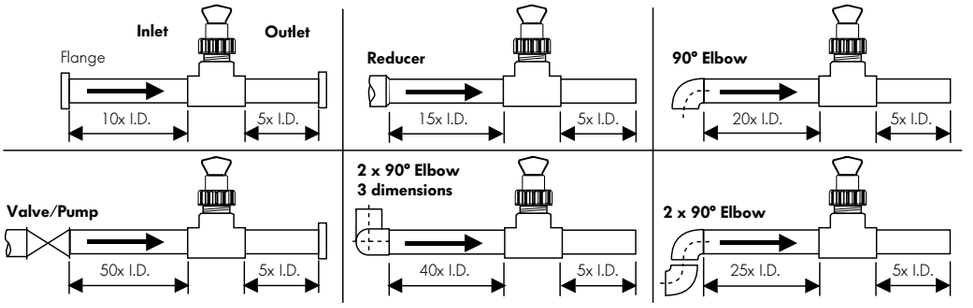
Installation of Flow Sensors: Paddlewheel

I. Piping Location

- The correct location of the sensor in the piping system helps to ensure a proper flow profile in the pipe. It is highly recommended to have sufficient straight pipe immediately upstream of the sensor to create "fully developed turbulent flow." Such a flow profile provides the stability required for the paddlewheel to measure accurately.
- The diagrams below illustrate the minimum distances that are recommended to mount plastic and metal paddlewheel sensors.
- In all scenarios, it is recommended to choose a location with as much straight, uninterrupted pipe length upstream of the sensor as possible.



Flow Installation Tips:

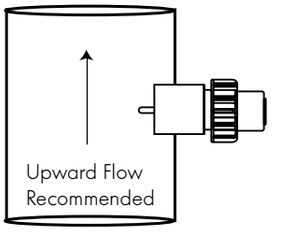
- *Use +GF+ SIGNET fittings for proper insertion into the process flow.*
- *Recommended upstream distances are stated as a multiplier of the I.D. (inner diameter) dimension of the pipe. Note that these multipliers are different for each example and depend upon the upstream obstruction.*
- *Paddlewheel sensors can be used for all water-like fluids with little or no particulates (<100 micron in diameter/length), and non-ferrous, non-fouling in nature.*
- *Always use these sensors in full pipes.*
- *Always maximize the distance between sensors and pump sources.*

II. Mounting Angle

Paddlewheel sensors are affected by the mounting angle due to the effect of gravity increasing the friction between rotor and bearing surfaces. Air entrapment and sediments within the pipe may also adversely affect sensing accuracy and/or impede operation.

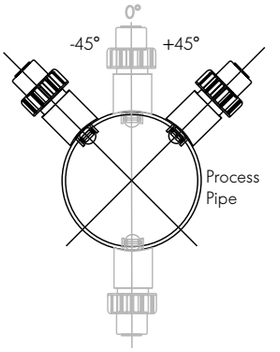
Paddlewheels in Vertical pipes:

- Mount the sensor in a pipe with an upward flow. This position is recommended for all scenarios, as it provides an absolutely full pipe, and any effects of upstream obstructions are mitigated by gravity.
- Vertical installations with downward flow are generally not recommended.



Paddlewheels in Horizontal pipes:

- ±45° from vertical is the recommended sensor mounting angle to avoid air bubbles (pipe must be full). With the sensor at greater angles, the drag created by the rotor resting against the sensor body may compromise performance at the lower end of the operating range.
- Straight up installations may experience interference from entrained air at the top of the pipe.
- Inverted installations are often subject to blockage due to sediments in the pipe. Mounting sensors in the bottom of the pipe is NOT recommended if sediments are likely to be in the pipe.



K-Factors

K-Factors are calibration values (pulses per unit of volume) used to convert flow sensor output frequencies to flow rates. +GF+ SIGNET publishes K-factors for water only in gallons (pulses per gallon) and liters (pulses per liter) for all sensors, in all applicable pipe sizes and materials, and/or all applicable installation fitting sizes and materials. K-factors for fluids other than water must be determined empirically, typically on-site using a secondary standard.

Note that K-factors are published for pipe sizes of DN 15 to DN 300 (0.5 in. to 12 in.). For other pipe sizes, statistical K-factors may be available. Contact Technical Support for more information.

Installation of Flow Sensors: Paddlewheel

Flow Installation Tips:
- *Ensure that all wetted materials are chemically compatible with the process liquid.*
- *Pressure and temperature ratings are reduced when plastic flow sensors are mounted in metal piping systems.*
- *The flow sensor is designed to fit tightly into the fittings. Lightly lubricate o-rings with a non-petroleum based lubricant to ease the installation.*
- *Cut the cable to the desired length if too long. Do not coil extra cable.*

III. Installation Fittings

515 and 2536 Rotor-X

- This section outlines the installation fittings available from +GF+ SIGNET for the 525 and 2536 Rotor-X family of flow sensors. The fitting controls the location of the paddlewheel inside the pipe, which in turn determines the calibration constant (K-factor).
- Refer to the fittings section on page 180 of this catalog for a complete listing of part numbers.

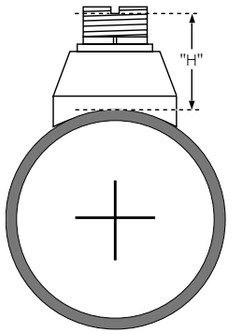
Type	Description
Plastic Tees	• 0.5 to 4 in. versions • PVC or CPVC • Available with or without pipe extensions
PVC Glue-on Saddles	• Available in 10 and 12 in. sizes only • Cut 2.5 in. hole in pipe • Weld in place using solvent cement
Clamp-on Saddles	• 2 to 4 in., cut 1-7/16 in. hole in pipe • 6 to 8 in., Cut 2-1/8 in. hole in pipe
PP Clamp-on Saddles	• Available in 10 and 12 in. sizes only • Cut 2.25 in. hole in pipe
Iron Strap-on Saddles	• 2 to 4 in., cut 1-7/16 in. hole in pipe • Over 4 in., Cut 2-1/8 in. hole in pipe • 2 inch to 8 in. PVDF insert • > 8 in. PVC insert

Type	Description
Iron, Carbon Steel, 316 SS Threaded Tees	• 0.5 to 2 in. versions • Mounts on threaded pipe ends • Wetted PVDF insert
Carbon steel & stainless steel Weld-on Weldolets	• 2 to 4 in., cut 1-7/16 in. hole in pipe • Over 4 in., Cut 2-1/8 in. hole in pipe • 1.5 in. to 8 in. PVDF insert • > 8 in. PVC insert
Fiberglass tees & saddles	• 1.5 in. to 8 in. PVDF insert • > 8 in. PVC insert • Special order over 12 in.
Metric Wafer Fitting	• For pipes DN 65 to 200 mm • PP, PVDF, PVC
Metric Union Fitting	• For pipes DN 15 to 50 mm • PP or PVDF • Socket fusion equipment required

525 Metalex

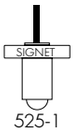
- This section outlines the installation fittings available from +GF+ SIGNET for the 525 Rotor-X family of flow sensors. The fitting controls the location of the paddlewheel inside the pipe, which in turn determines the calibration constant (K-factor).
- Refer to the fittings section page 180 through 192 of this catalog for a complete listing of part numbers.

Fixed Depth
The insertion depth of a paddlewheel in a flow stream is critical and must be achieved and maintained to ensure accurate flow measurements. +GF+ SIGNET installation fittings for Rotor-X and Metalex paddlewheel flow sensors set this depth automatically and facilitate the use of convenient K-factors (calibration values) published in individual sensor instruction manuals.



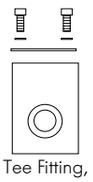
The H-dimension controls the insertion depth and they are critical for proper seating of the flow sensor into the pipe. These dimensions can be found listed in the flow sensor instruction manuals.

<u>525-1 Metalex Flow Sensor</u>
The smallest Metalex Flow Sensor (525-1) must be installed into a specially constructed tee fitting with socket-weld piping connections.



525-1 Sensor

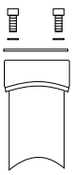
Wetted fitting materials:
316 SS (1.4401)


Tee Fitting, hardware included

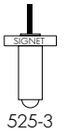
<u>525-2 Metalex Flow Sensor</u>
Use the 525-2 and one of these weld-on fittings for stainless steel pipes from DN 32 (1 .25 inches) up to DN 300 (12 inches) in diameter.

525-2 Sensor

Wetted fitting materials:
316 SS (1.4401) & 347 SS

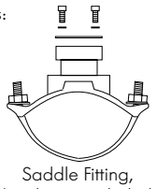

Mini-Tap Fitting, hardware included

<u>525-3 Metalex Flow Sensor</u>
The 525-3 is the longest metalex flow sensor. It requires one of the strap-on saddles for pipes from 2 inches up to 12 inches in diameter.



525-3 Sensor

Wetted fitting materials:
Ductile Iron, 347 SS,
Carbon steel,
Buna-N/Neoprene


Saddle Fitting, hardware included

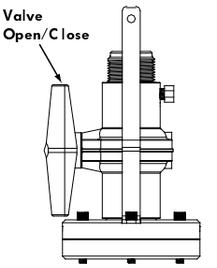
Consult a qualified welder to install metalex fittings.
Use of saddle fittings reduces the pressure rating for the 525 sensor.

Installation of Flow Sensors: Paddlewheel

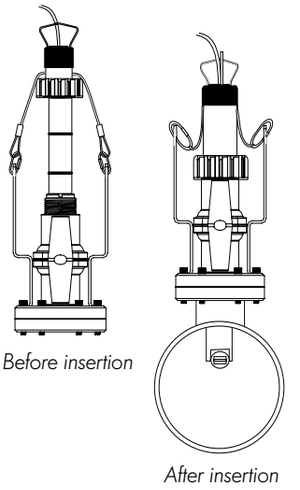
IV. Wet-Tap and Hot-Tap Installation

3519 Wet-Tap Valve

- The 3519 Wet-Tap consists of a flange and support plate that threads onto the pipe fitting insert, and a PVC ball valve through which an extended length, wet-tap style sensor is inserted into the pipe.
- The +GF+ SIGNET 3519 Wet-Tap Valve mounts directly onto standard +GF+ SIGNET installation fittings for the 515 and 2536 flow sensors. The wet-tap sensors are identified in their part number as -P3, -P4 and -P5, depending on the pipe size.
- No special tools are required to install the 3519.
- The 3519 Wet-Tap valve can only be installed in an empty pipe. Once installed, the sensor can be removed and re-inserted while the process is active.



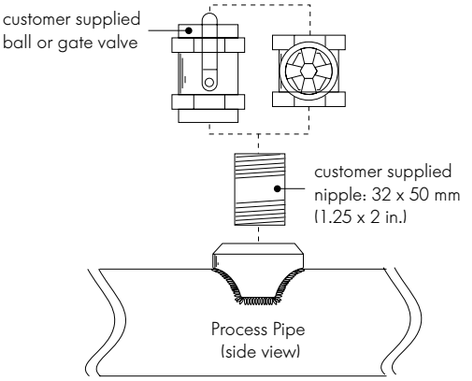
3519 Wet-tap Valve

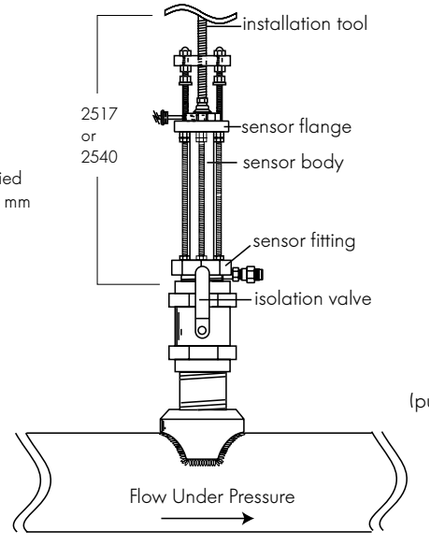


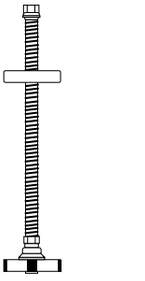
3719 Wet-Tap valve with a 515 Paddlewheel Sensor

2517 and 2540 Hot-Tap

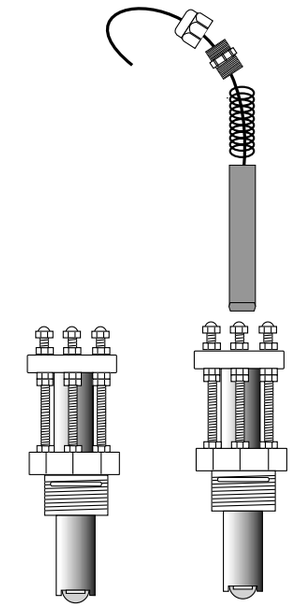
- The +GF+ SIGNET 2517 and 2540 Metal High performance flow sensors accommodate hot-tap installations. Because these sensors are adjustable, there is only one extended length sensor used for all pipe sizes
- The valve for Hot-Tap sensors can be installed while the pipe is full if a hot-tap drill is used. Consult with your piping supplier for information regarding drills.
- To install the 2540 or 2517 Hot-tap sensors, you will need a hot-tap drilling machine, a ball or gate valve, a pipe nipple with 1.25 inch threads and the +GF+ SIGNET Hot-Tap installation tool.
- The necessary valve and pipe nipple are <u>not</u> available from +GF+ SIGNET. You can purchase these standard hardware items from any local supplier.
- Hot-Tap sensors can be installed and removed without process shutdown. Care must be taken while removing sensor under process conditions. The Installation tool serves to hold the sensor against the line pressure as it is retracted or inserted into the pipe.
- The Hot-Tap installation fitting has a bleed valve to relieve the pressure when retracting the sensor.







Installation tool
3-1500.663
(purchased separately)



2517 *2540*

Installation of Flow Sensors: Paddlewheel

IV. Wet-Tap and Hot-Tap Installation, continued

Similarities between the 2517 and the 2540 Flow Sensors:

- Both include a fitting with 1.5 in. NPT or ISO 7/1-R1.5 male threads.
- Both sensors install into standard 1.5 inch pipe fittings. No custom fittings are required.
- Both sensors are available in extended-length versions to accommodate Hot-Tap installations.
- Both require the installer to measure and secure the sensor at a specified height for accurate operation.

Differences between the 2517 and the 2540 Flow Sensors:

- The 2540 is a radio frequency sensor which requires 5 to 24 VDC while the 2517 is a self-powered flow sensor, so no power is required for operation.
- The 2540 is constructed of 316 Stainless Steel (1.4401), while the 2517 is constructed of CuZn38Pb1 free cutting brass.
- The 2540 has a minimum operating flow rate of 0.1 m/s (0.3 ft/s) while the 2517 has a minimum operation flow rate of 0.5 m/s (1/6 ft/s).
- The 2540 features removable electronics, so the sensor can be completely replaced without removing the steel housing from the pipe while the 2517 is a completely encapsulated product, with no serviceable parts except for the rotor and pin options.

V. Cable glands and conduit adapter kits

Cable Glands and Conduit adapter kits are available to install on Models 515, 2536, 525, and 2517 when used in wet environments. These items protect against moisture entering the back end of the sensor. Follow these simple instructions to prolong the life of the sensor. Conduit adapters are included with the 2540 sensors.

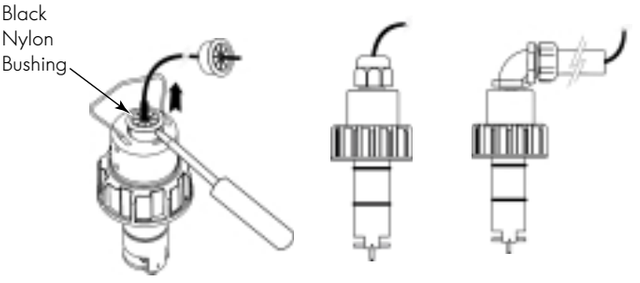
1) Remove the black Nylon® bushing to expose the female threads at the back end of the flow sensor. Use a standard medium size screwdriver to pry the bushing up and out of the port. Slide it up and off the entire length of the cable, or cut it away carefully so as not to knick the cable jacket.

2) Thread the gland or conduit adapter over the cable and screw the 1/2 in. NPT male threads into the top of the sensor in place of the bushing.

3) For liquid-tight glands, tighten the compression fitting onto the fitting sufficiently to achieve a seal around the cable.

4) For conduit adapters, thread the cable through the adapter and tighten the adapter into the sensor fitting.

Cable Gland
(Liquid Tight Connector)



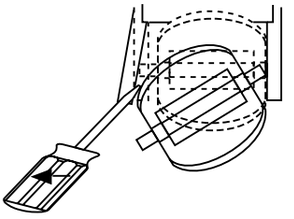
Conduit Adapters
(suitable for all plastic and metal Paddlewheel Sensors)

Installation of Flow Sensors: Paddlewheel

VI. Rotor Replacement

Procedure for plastic paddlewheel sensors

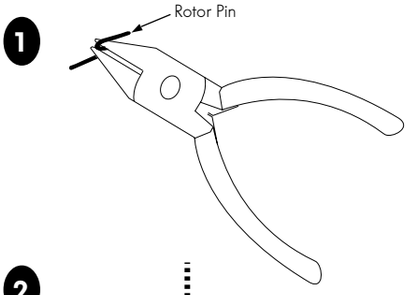
1) Hold the sensor upside down and hold the rotor still.
2) Place the tip of a medium blade screwdriver between the rotor and the sensor body.
3) Turn the screwdriver blade 90° to flex the "ear" back just enough to angle the rotor pin out of one side.



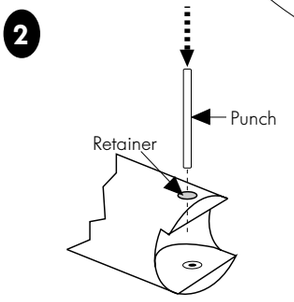
NOTE:
Do not flex the ear more than required to remove the pin. If it cracks, it cannot be repaired!

Procedure for metal paddlewheel sensors

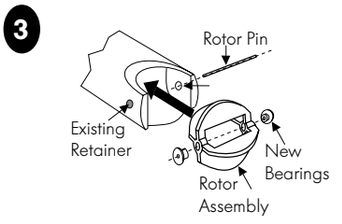
1) With a small pair of needle-nose pliers, firmly grip the center of the rotor pin (shaft) and with a twisting motion, bend the rotor pin into an "S" shape. This should pull the ends of the pin out of the retainers and free the rotor assembly.



2) Remove retainer from each side by gently tapping it inwards using a punch. Install a new retainer with its rotor pin clearance hole inward. Only install one retainer at this time.



3) Insert the new rotor assembly and bearings into the rotor housing of the sensor and place the new rotor pin (shaft) through the open end of the rotor housing, through the rotor and bearings, and into the previously installed retainer.



4) Tap the second retainer (rotor pin clearance hole inwards) into the hole while lining up the rotor pin with the center of the retainer hole. This completes the rotor replacement procedure.