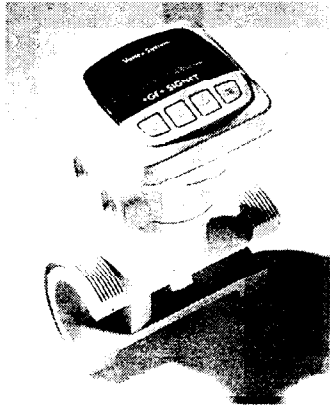


# Vortex Measurement with All the Right Connections.

by Nora Witt, +GF+ SIGNET Flow Product Manager

Vortex flow-sensing technology is gaining popularity in applications from drinking water to industrial chemicals. The reasons: cost-effectiveness, accuracy and low maintenance. When sensor bodies are made of injection-molded plastics, (Fig. 1) the benefits list also includes chemical compatibility, corrosion resistance, and versatility in piping and electrical connections.



(Fig. 1) Vortex sensor bodies made of injection-molded plastics offer benefits including chemical compatibility, corrosion resistance, and versatility in piping and electrical connections.

Plastic-bodied vortex sensors, available in several materials, offer a wide variety of connections to common plastic piping materials including polyvinyl chloride (PVC), polypropylene (PP) and polyvinylidene fluoride (PVDF)

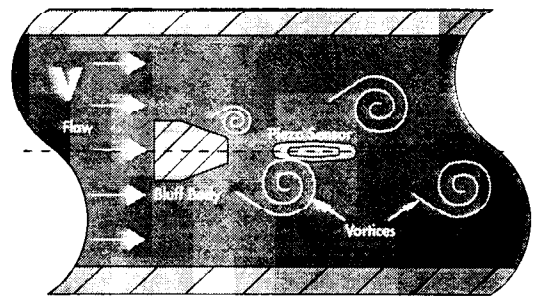
## **Vortex flow sensing basics**

When a fluid moves past an obstacle, boundary layers of slow-moving fluid form along the outer surfaces of the obstacle. If the obstacle has broad, flat surfaces—a “bluff” body—the flow won’t follow the contours of the body on the downstream side. Separated flow layers will develop.

The separated layers of fluid create eddies—vortices—in the low-pressure area

behind the body. Within each vortex, velocity is higher and pressure is lower than in the main stream. The vortices periodically detach themselves from the body and move downstream with the fluid flow. This is called “vortex shedding.” (Fig. 2)

Vortices are shed alternately from each side of the body. In a stable fluid flow, this vortex shedding is very regular and the shedding frequency is directly proportional to the velocity of the fluid past the bluff body.



(Fig. 2) Vortex shedding - measuring flow rate by detecting vortices.

Vortex sensors detect the vortices with a piezoelectric sensor that is isolated from the fluid by a thin layer of PVDF. As the vortices move by the sensor, pressure differentials make the piezo element flex. That generates a sinusoidal frequency proportional to flow rate. Internal electronics convert the sinusoidal piezo signal to a digital pulse train or a standard 4mA - 20mA current loop signal.

## **Vortex sensing provides reliability and accuracy**

Lack of moving parts gives vortex sensors long, maintenance-free life. You get good

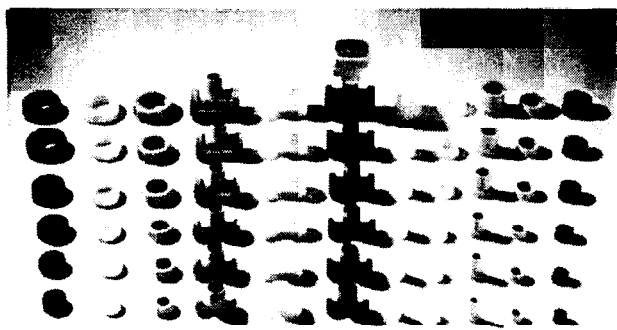
tolerance for suspended abrasive particles.

Vortex flow sensors provide high accuracy at moderate cost—if they're carefully designed. In superior designed devices, the piezoelectric sensor shape only allows for side-to-side movement, which provides a more accurate signal. High measurement accuracy provides excellent process control, improved product quality, increased efficiency and long-term calibration stability.

Vortex sensors give you low pressure drops when fluid is flowing. That can reduce pumping energy, and extend pump life.

### **Look for material options**

If you're shopping for vortex flow instruments, look for a supplier with many material options. A wide range of material choices, and connection options will allow you to match the sensor to your specific piping system. (Fig. 3)



(Fig. 3) A wide range of material choices, and connection options will allow you to match the sensor to your specific piping system

When you're working with precision plastic piping systems, you'll want to match your sensor to the piping material. The most common plastic piping materials include: polyvinyl chloride (PVC), polypropylene (PP) and polyvinylidene fluoride (PVDF).

In any application, base your final materials selection on working temperature, pressure, and chemical environments. Here are a few working characteristics of the frequently used plastics.

### **Polyvinyl chloride (PVC)**

PVC is a lightweight thermoplastic that's easy to join either with mechanical connections or solvent cements. It's resistant to acids and caustic substances. PVC vortex sensors withstand working temperatures up to 60°C (140°F).

### **Polypropylene (PP)**

PP offers outstanding chemical resistance, high thermal resistance and good fatigue strength. PP vortex sensors can withstand operating temperatures above 90°C (200°F) and give economical resistance to many solvents and aggressive fluids. PP has a lower density than most other common thermoplastics.

PP is easily fused with heat utilizing socket fusion and IR/butt fusion joining methods.

In outdoor installations, PP (especially natural PP) should be protected from the intense ultraviolet (UV) radiation in direct sunlight. An opaque insulation or a UV-absorbing coating will do the job.

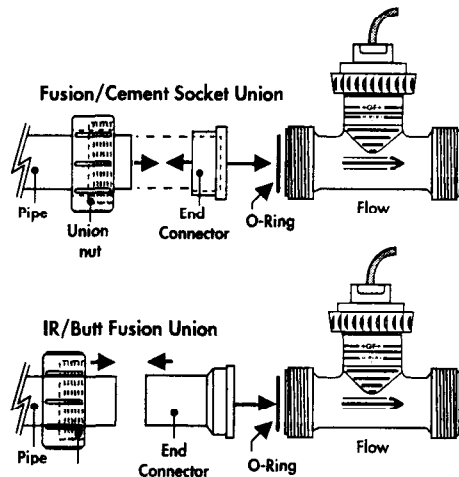
### **Polyvinylidene fluoride (PVDF)**

PVDF offers outstanding mechanical, physical and chemical properties. It has a highly crystalline structure providing excellent durability and high thermal stability. PVDF withstands working temperatures up to 100°C (212°F). Fatigue strength curves are very flat, showing only very slight loss of strength with prolonged internal pressure,

load and temperature stresses. Abrasion resistance is very high. Impact strength remains good at low temperatures.

PVDF has very high UV resistance. It can be used outdoors. However, unpigmented PVDF is translucent and transmits UV. In outdoor applications UV components of direct sunlight may penetrate pipe walls and react with the chemical being transported.

PVDF piping systems are used in the automotive, chemical, electroplating, paper and cellulose industries. Like PP, PVDF is normally joined with socket or IR/butt fusion joining techniques. (Fig. 4)



(Fig. 4) A wide range of connection options will allow you to match the sensor to your specific piping system.

### Piping system connections

When you have selected a sensor material that matches your application, you need to think about piping connections. Some well designed vortex sensing units feature true-union couplings for superior sealing and simplified maintenance.

In a true-union joint, the union coupling nut pulls two flat faces together to compress an o-ring set into one of the faces. The union nut can be hand tightened to close the fitting. You get easy, reliable sealing. True-union

couplings can be opened and sensors removed without spreading or disturbing connecting piping. This simplifies maintenance.

True-union end connectors can be attached to your system piping by solvent cement or fusion methods, depending on the material.

### System flexibility

When you have selected a vortex flow sensor that's compatible with your piping, you still need to display the output. Here's a checklist of options that can simplify system design and installation:

- Look for output options that include digital pulse train and/or 4 - 20 mA current loop signals.
- Do you need local indication, in addition to a remote output? Make sure it's available.
- If you do go for an instrument-mounted display, look for the ability to orient it for convenient reading, no matter which direction the pipe—or the fluid flow—goes. Your operators will thank you.
- Similarly, you'll want conduit connectors that are easy to re-orient to accept conduit from a convenient direction. Your installers will thank you too

No single flow measurement technology covers every application. When you're comparison shopping, be sure to start with your functional requirements. If you do, you're apt to find plastic-bodied vortex sensors on your short list for a wide range of tasks. □

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