Turbine Flow Sensors...The BEST Choice For Liquid Flow Measurement.

This article describes a unique type of flow sensor - the Pelton turbine sensor. It features extreme accuracy, excellent repeatability, no zero drift, fast response, and unsurpassed reliability.

- ✓ Miniature Pelton Turbine wheel essentially "floats" in liquid to eliminate particle shedding
- ✓ Best concept for low-viscosity liquid flow measurement on a cost vs. Performance basis (Initial & Long-Term)
- ✓ Capable of accurately measuring liquid flows ranging from 15 mL/minute up to 50 L/minute

One of the most popular types of liquid flow sensors in commercial usage today is the turbine sensor. Why is it so popular among those skilled in the art of liquid flow measurement? There are a number of major reasons, but the main reason is that the turbine technology represents the most accurate type of liquid flow sensor available. On a cost versus performance basis, no other type of flow measuring device can approach a turbine sensor.

The correctness of this assessment is driven home by the following quotation taken from a recent publication of the Instrument Society of America entitled *Flow Measurement**. It states:

*edited by D.W. Spitzer, second printing, January 1996, page 373.

"Turbine flow meters are designed to accurately measure the flow of liquids and gases in pipes. They are volumetric flow measuring devices and have been commercially available since the late 1940s...Turbine meters are applicable to all clean fluids.

The turbine meter is perhaps the ***most accurate type of meter available.*** *It is capable of repeating to 0.025% of reading with accuracy and traceability to 0.05% of reading for liquid service. A turbine meter has only one moving part - the rotor. Components can be selected for compatibility with most fluids, such as corrosive chemicals, ... water, etc."*

From this same publication we can discern

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Robert D. McMillan was awarded his Masters degrees in Mechanical Engineering and Electrical Engineering from the University of Houston and Southern Methodist University respectively. He is president of McMillan Company located in central Texas. During the past 35 years, he has been awarded five patents in the field of instrumentation for flow measurement and control, gas calibration equipment and digital hydraulic actuation equipment. Under his direction, McMillan Company has developed a range of flow products and is noted as a leader in very low flow measurement and control. Mr. McMillan has authored a number of published technical papers. For more information, please contact McMillan Company (see back side for contact information).

why turbine sensors are so popular. 100 to 1 turndown ratios (readings down to 1% of rated flow) can be achieved even while possessing good repeatability. Additionally, turbine sensors possess excellent long term stability. Since the output signal is always zero when the turbine wheel (rotor) is not rotating, they have no zero drift problems at all.

During the 1990s, refinements in the design of turbine sensors took place in a number of manufacturing and research centers. One such specialized design concept originated at McMillan Company and resulted in a number of patents because of its unique features.

The McMillan Company's turbine wheel technology utilizes the Pelton turbine wheel concept. This type of turbine wheel was selected for a variety of reasons. One of the key reasons was that this type of design allows usage of a sub-miniature turbine wheel about the size of a quarter in both diameter and thickness. The turbine wheel can then be supported on a very small sapphire shaft held in position by two sapphire bearings. Because of the very light weight of both the wheel and shaft, **the turbine wheel virtually "floats" in the liquid**. This floatation effect causes the turbine wheel to be suspended in the middle of the bearings and thus virtually **eliminates shaft and bearing wear.**

A very desirable benefit of this design is that the rotating turbine wheel and its bearing supports have no detectable particle shedding or bearing wear as determined by extensive tests. Of course, such a flow sensor is manufactured using all corrosion resistant materials so that extremely corrosive liquids can still be reliably measured.

In the semiconductor industry, manufacturers are striving to achieve very accurate and repeatable flow measurements of the many very costly liquids in use. This, of course, is a very desirable goal, since expensive waste of these chemicals can result in millions of dollars of lost profit annually - such as in a large fab manufacturing facility. Therefore, flow sensor accuracy becomes a major feature when a user is trying to determine what type of flow sensor to select. Secondly, the user in the semiconductor industry desires that the selected flow sensor not emit any detectable level of particles. Since there are dozens of turbine flow sensors available on the market today, the end user may naturally be confused as to the desirability of using a turbine flow sensor. Some big paddle wheel flow sensors have heavy rotors and therefore shed particles as the rotor shaft wears. Also, large axial turbine sensors create frictional pressure on their bearing surface and can shed particles. Hence, some may question usage of these types of turbine sensors in critical applications where a moving part is in the flow system.

The McMillan Company Model 106 Series Flo-Sensor is in fact unique, with an advanced design that eliminates particle shedding. We invite prospective users to request technical data that shows its operation in liquid streams with particle free operation.

SUMMARY: Users should be aware that the highest accuracy of low-viscosity liquid flow measurement available today on a commercial basis is by means of using turbine flow sensors. Further, there exists a special Pelton turbine wheel flow sensor that has virtually zero bearing/shaft wear in liquid flow systems and generates no detectable particles.

R.D.McMillan, President
McMillan Company

McMillan
C•O•M•P•A•N•Y

P.O. Box 1340
Georgetown, Texas
78627-1340 U.S.A.

Phone: (512) 863-0231
Toll-free: (800) 861-0231
Fax: (512) 863-0671

www.mcmillancompany.com