Cleaning RealShear™ Sensors

Guidelines for cleaning Lenterra's RealShear™ sensors.

Mind the Gap

Lenterra's line of RealShear™ sensors enable the direct measurement of wall shear stress in pipes and mixers. In these sensors, a floating element at the tip of the sensor is attached to a cantilever beam which deflects in response to shear stress applied to the floating element surface. This deflection is detected with a fiber-optic transducer and is proportional to the shear stress applied. To allow these small deflections of the floating element, a circular gap is present between the edges of the element and the inner wall of the threaded cylindrical housing of the sensor. Nominally this gap is 100 microns wide.

This gap allows material to pass into the sensor. While the sensor is designed to operate normally when it is filled with fluid, it is often the case that after use it is necessary to clear this material out of the sensor. For example if the fluid has solids content that precipitates inside the sensor or in the gap it can affect calibration during subsequent use. Also, material remaining in the sensor can potentially contaminate future batches if not cleared out.

RealShear sensors have a circular floating element that moves within a rigid threaded cylindrical housing. A thin gap separates the two.

Cleaning Configurations

To facilitate cleaning out of the interior of the sensor, RealShear™ sensors are equipped with a threaded hole through which cleaning fluids can flow. Optionally, a matching hose adapter can be used (see photo).

Using this flushing port, fluid can be pushed through the sensor and out through the gap at the face (“outward flow” configuration), or alternatively fluid can be pulled up through the gap (“inward flow” configuration). For the latter it is necessary for there to be cleaning fluid already in the tank or pipe. A combination of these two methods can also be employed in which flow is reversed once or repeatedly during a cleaning cycle.

A variety of pumping equipment can be used to perform the cleaning:

- Manual - The simplest method is to use a squeeze bulb or bottle to manually push or pull cleaning fluid through the sensor. If the frequency of cleaning is low, this can be a simple and convenient solution.
- Pressurized Source - If a pressurized water source is available, this can be connected to the sensor, typically with an in-line valve. Only outward flow can be used in this case, but in many situations this is adequate.
- Mechanical Pump – A pump, either unidirectional or reversible, along with a reservoir of cleaning fluid can also be used for either outward or inward flow.

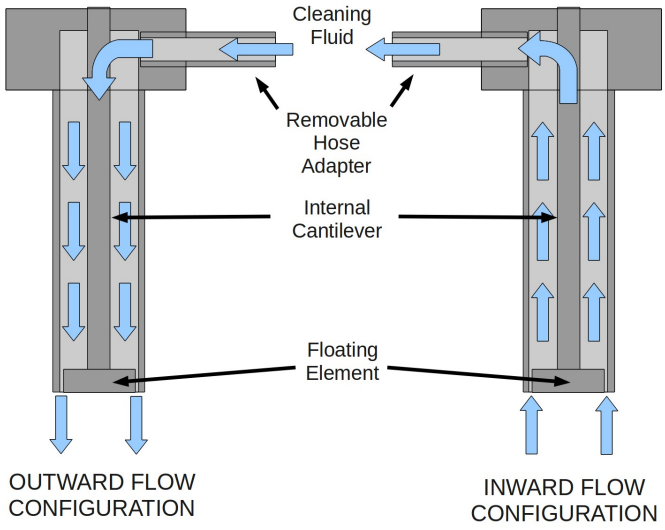
A RealShear™ F-Series sensor with hose adapter.

Cleaning Fluids

The choice of cleaning fluid will depend on the nature of the test material. The following is a partial list of solvents for which the sensor is designed to withstand without damage to its internal components[1]:

- Water
- Ethanol
- Isopropyl Alcohol

The maximum temperature of the cleaning fluid should not exceed the specified operating temperature of the particular model of sensor being used (currently 100 °C for standard sensors, and 200 °C for high temperature models). In general, extremely strong acids or bases should be avoided if possible.



Choosing the Right Method

Ultimately the best cleaning method to use will depend on a number of factors unique to each process, including the type of material under test, the conditions of testing, and stringency of cleaning requirements. A Standard Operating Procedure (SOP) should be developed by the user for each situation. The following are some rough guidelines:

- Highly soluble material (e.g. glycerol, shampoo) with no solids content

  For these type of fluids, either inward or outward flow can be used. Depending on the flow rate of the cleaning fluid, as little as 30 seconds of cleaning can be sufficient.

- Material with insoluble solids content (e.g. toothpaste, slurries)

  When the test material contains solids, outward flow can, in some cases, lead to a buildup of material at the gap which can constrict motion of the floating element. In these cases it is recommended to use inward flow to pull material away from the gap, up through the sensor, and out through the flushing port.

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1 This list is not exhaustive, if you would like to use a different solvent please contact Lenterra.