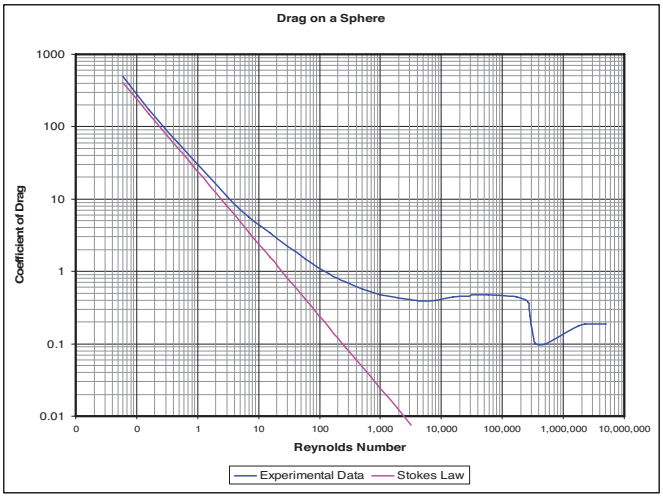
Valve Clogging

All mechanical systems are subject to contamination. HVAC systems frequently contain material too small to be separated by strainers that can cause valves to fail. The Mesurflo® is the exception to this rule due to its' unique design containing no sliding parts.

Applicability
The testing used to create this Technical Tip was done specifically to evaluate the capability of the subject valves to operate in a system with a strainer present. Larger particulates that would reach the valve in a system without a strainer were not evaluated.

Even when large particulates are plentiful they tend not to circulate as far or as quickly through HVAC systems. The drag force that pushes particulates around a system is a function of the Reynolds Number based on the hydraulic diameter of the particulate. Stoke's Law predicts that the Coefficient of Drag will increase inversely proportional to the Reynolds Numbers when the Reynolds number is 1 or below. This agrees well with experimental data.

The higher drag force of the smaller particles allows them to be circulated through the system at velocities where larger particulates will fall out.

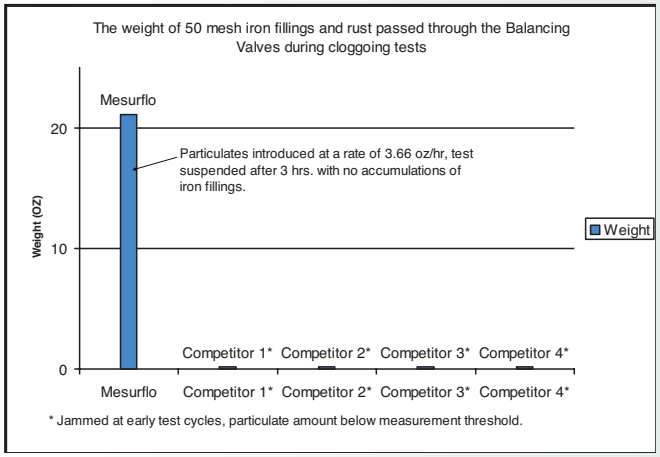


Details
A test apparatus was developed to introduce material (iron filings, and iron oxides) into a flow stream at a controllable rate. The system was designed as an open loop system with particulates caught in a filter at the outlet. The rate of addition of particulates was controlled to either 0.8 or 3.6 oz/hr in a water flow of 1 gpm. The valve under test was connected to the outlet of the system and valve inlet pressure was varied from 5 to 30 psid. Water flow was measured and failure was taken to occur when the valve no longer controlled flow to a constant rate for more than 2 cycles.

The predominant mode of failure for all of the metal spring valves was jamming of sliding members. Quantitatively, as few as one foreign particle can jam the sliding member due to the small clearances required to operate these valves at high pressures. Every one of the spring loaded devices jammed. They jammed during the first cycles of the tests, the amounts of the iron fillings that jammed those devices were below the measurement threshold. The most predominant mode of failure was the foreign object (iron particulates in our test) jammed in the gap between the sliding and fixed components as shown to the left.

When the tests were run for longer periods (in spite of the valves not functioning) additional material would accumulate in the narrow portions of the opening on the flow control. Since the openings are small and do not open up at lower pressures the particulates would jam in the opening, further restricting flow to relatively low values.

Mesurflo technology does very well with small particulates. The iron filings accumulate in the low velocity area around the base of the Mesurflo. As long as the opening between the orifice and diaphragm is large enough these particles pass through during the low pressure portion of the test, freeing the valve from contamination. A picture of the Mesurflo after the test at 0.8 oz/hr is provided to the left. The Mesurflo was still controlling flow!



Spring Valve Jammed by 1 Particle

Mesurflo still works with many particles