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Trigas FI
Flow Measurement & Calibration

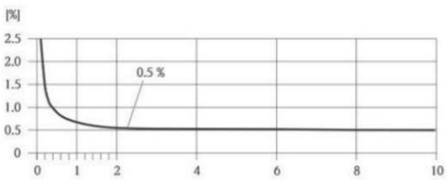
The no-pressure loss flowmeter fallacy

In the thermodynamic design of vehicles, precise measurement of the cooling water flow is critical, but at the same time the influence of the flowmeter on the cooling circuit must be close to negligible. Therefore, automotive engineers demand accurate flow measurement and low pressure loss with coolant temperatures ranging from -40 ° C and up to 130° C or higher.

This also was in the minds of the development engineers at a large German truck manufacturer, who sought a solution for monitoring coolant flow. In order to obtain useful results from development testing, the monitoring must be precise and very responsive to changing conditions. For this application, it should also fit into a very crowded engine compartment and produce as low a pressure drop in the cooling system as possible.

Searching for such a device, at first a magnetic inductive flow meter was selected, as it promised in the specification "no pressure loss" - understandable, since this device has an almost free internal cross-section, without any internal obstructions. In addition, outside diameter was a match to that of the cooling water hose, not to create any pressure drop by pipe reductions.

"But we didn’t think far enough," recalls the development engineer today, "the selection of the device based on this information, was unfortunately only a part of the solution."
Due to the size of the measuring device, the magnetic inductive flowmeter (MID) could not be installed in the approximately 20 cm long space available between the engine outlet and the radiator inlet. "To install the MID in the limited space available, four 90° elbows had to be used. The resulting pressure loss was all of a sudden significant. "



Furthermore, the Magnetic flowmeter size was such that in this application it would be used in the in the far low end of its specified range. Below 1 m/s, mostly due to zero-shift characteristics, the error curve of these devices diverges rapidly.

As a result, measurement accuracy was unsatisfactory and, despite of specifications, an undesirable pressure loss was introduced.

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In order to overcome these limitations, a TrigasDM turbine was tested as an alternative, even though its specification showed some increase in pressure loss compared to Magnetic flowmeters.
"The inner diameter of the turbine is exactly the same as that of the cooling water hose, and TrigasDM has a high-performance ball bearing and a special rotor blade construction. Due to these features and that fact that its compact and lightweight construction make it possible to install without the four 90° elbows, the pressure loss was far below that of the Magnetic flowmeter" explains Wolfgang Färber, Quality Manager at TrigasDM.
Of course, turbine meters also need inlet and outlet flow straightening sections if they are expected to measure with an accuracy of 0.1%. But due to this high inherent accuracy, even in the lower measuring range, a compromise could be found here, which still provided the required measuring accuracy for this application.

"The TrigasDM turbine has a measuring range of 130:1, in which it can measure accurately," explains Wolfgang Färber. "Most comparable flowmeters demonstrate rapidly deteriorating accuracy outside the 10:1 range.

So, the measurement values were still very accurate even at the low flow rates, so it was not so important that the inlet and outlet flow straightening requirements could not be fully met."

The decision was finally made in favor of the TrigasDM turbine also because of the much faster response characteristics (less than 10 ms, compared to at least 2-3 s for a Magnetic flow meter).
A special calibration for different viscosities makes it also possible to use the turbine universally, even under conditions of changing temperatures and viscosities, without compromising accuracy - in this case, all good reasons for the customer to decide for the TrigasDM turbine.

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