ROTARY METERS AS MASTER METERS

Precision in measuring technology

Test benches for higher volume gas meters like turbine meters and rotary meters are normally equipped with turbine meters as master or standard meters. These meters are ideal for this application due to their excellent measuring behaviour and in particular their repeatability.

For flow rates below 10 – 15 m³/h, other measuring principles are used. Apart from sonic nozzles, the special IRM DUO rotary meters from Elster-Instromet are designed for this application. Rotary meters are characterized by large measuring ranges. However, conventional rotary meters are not suitable for use as master meters due to their measuring principle, which creates pulsations that lead to

1. an impact on the measuring behaviour of the meter to be tested,
2. resonances in their own measuring characteristics, thereby limiting the repeatability.

In the following article the principle of the pulsation-free DUO meter is presented.

Conventional rotary meters are equipped with two 8-shaped pistons which, in conjunction with the housing, form 4 gas chambers per revolution which are periodically filled and emptied. The DUO meter uses two phase-shifted piston pairs which work like two parallel-driven rotary meters.

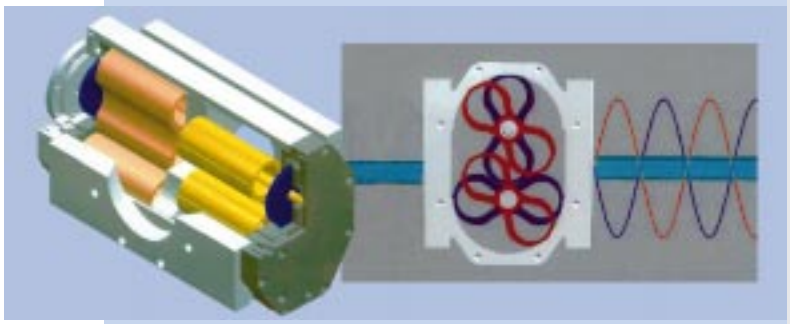


Fig. 1: Principle of the DUO meter

Due to phase shifting, the pulsations of the two meter halves compensate each other. The result is a resonance-free and nearly pulsation-free measuring behaviour.

A typical application of the IRM DUO meter is the operation as a master meter on the Elster-Instromet test bench ITF. Here an IRM G16 usually covers flow rates from 0.5 to 25 m³/h, while for larger flow rates an IRM DUO G650 is used. The ITF test benches are offered for maximum flow rates of 1000, 2500, 4000 and 6500 m³/h, whereby up to six IRM DUO G650 can be operated in parallel.

Fig. 2: Test bench ITF from Elster-Instromet with IRM DUO meters as master meters

For high pressure applications with extremely high accuracy requirements, an advanced device, which totally eliminates residual pulsation, has been developed.

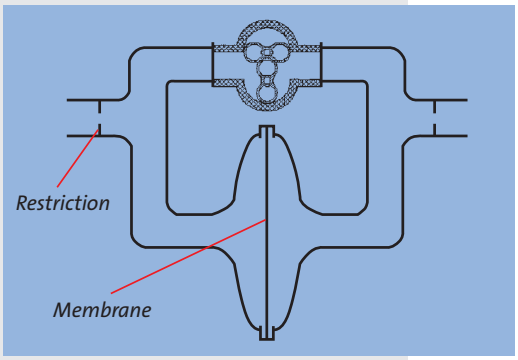


Fig. 3: Rotary meter with external pulsation compensation

The idea sprung from the application of a rotary meter in conjunction with a separate membrane. The membrane, which is connected to the inlet and outlet of the rotary meter, eliminates residual pulsation comparable to the electrical equivalent of a capacitor and a resistor.

The so-called rotary piston prover IRPP consists of an IRM DUO measuring cartridge equipped with a tube-shaped membrane, which is connected to the inlet and outlet side of the cartridge and works like the separate external membrane.

In addition to eliminating residual pulsation, the repeatability is further reduced to a few hundredths of a percent. Thanks to its excellent measuring behaviour, the meter can be used in a wide range from 2 to 400 m³/h and from atmospheric pressures up to a pressure of 70 bar.

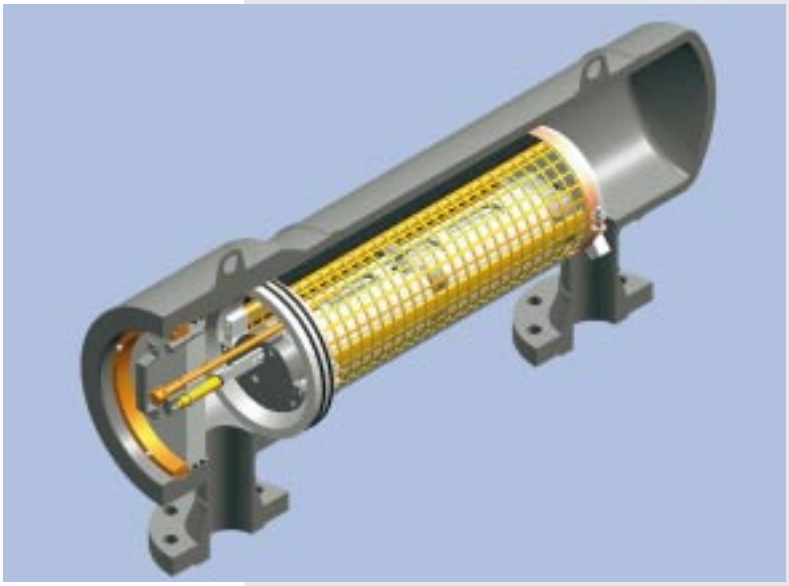
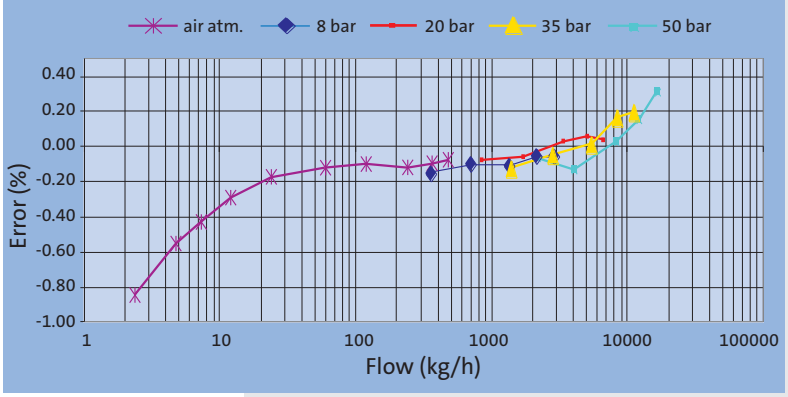


Fig. 4: Setup of an IRPP

The extremely high repeatability of the measuring characteristics has led to these devices being used by the NMI (Netherlands Measurement Institute) for the derivation of high pressure calibration from low pressure measurements.

Fig. 5: Typical error curve of an IRPP



For this, Elster-Instromet has developed a so-called Traceability System ("Trasys") in cooperation with the NMI. Trasys uses 10 IRPP units: 5 at high pressure and 5 at a lower pressure. A pressure regulator and a heat exchanger are installed in-between. Due to the large pressure and flow rate ranges, the measurement can be scaled up from atmospheric pressure to 65 bar in a few steps with an excellent level of accuracy.

Fig. 6: Application of IRPPs at the NMI in Dordrecht (NL)

On the high pressure calibration test bench pigsar in Dorsten the IRPP G250 is used as standard for flow rates between 4 m³/h and 400 m³/h. pigsar is recognized as the "National Standard of the Federal Republic of Germany for High Pressure Natural Gas".

The high pressure test rig of the gas utility company EnBW, also features an IRPP meter as the standard meter. The meter is operated at 5 to 21 bar with operating flow rates between 2 and 400 m³/h.

The applications and solutions illustrated underline the competence in measuring technology at Elster-Instromet.

We look forward to new challenges and requirements in the field of gas measurement.

Thomas Kettner *t.kettner@elster-instromet.com*

Fig. 7: Derivation of high pressure calibration from low pressure

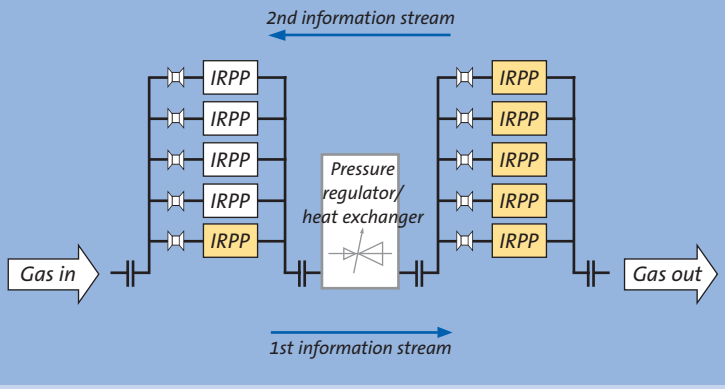


Fig. 8: IRPP as standard meter in Dorsten

Fig. 9: IRPP on high pressure test bench in Stuttgart