TURBINE METERS – THE NEXT GENERATION

TRZ-IFS2 with new flow guide

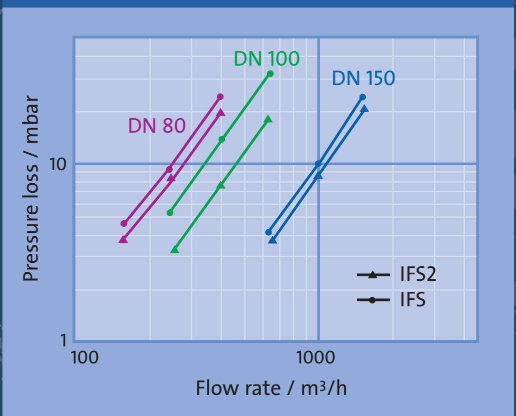
Apart from a few exceptions, even successful and well-tried products can still be improved and further developed. ELSTER turbine meters, either with or without an integrated perforated plate (TRZ-IFS and TRZ), are perfect examples of this.

The improved version of the device has been named TRZ-IFS2 since, from a certification point of view, it corresponds to the TRZ-IFS and it is the second IFS generation. It will be launched with diameters of DN 80-150.

The external appearance and the installation specifications have not changed. The main difference can be found in the design of the new flow guide, which no longer has a perforated plate. In its place, you will find an orifice ring, which mainly contributes to straightening the flow (patent pending).

Just like its predecessor, the TRZ-IFS2 generally only needs an inlet pipe length of twice the diameter but has a much lower pressure loss (Fig. 1.), which of course is within the limits laid down by the European Standard for turbine meters, EN12261.

Fig. 1: Pressure loss of the IFS2 and the IFS



Perhaps we should go into more detail concerning inlet pipes and flow disturbances as this can influence the metering behaviour quite considerably. It is well known that all turbine meters show metering errors if the flow profile is disturbed, i.e. it is not fully developed and symmetrical. But how do these errors occur?

TRZ-IFS2 with the new flow guide

The following two flow characteristics play the most important roles.

First of all, asymmetry, or rather an asymmetric distribution of the axial velocity over the cross section. This disturbance always results in a plus deviation of the metering error because the turbine wheel integrates the square of the velocity over the cross section.

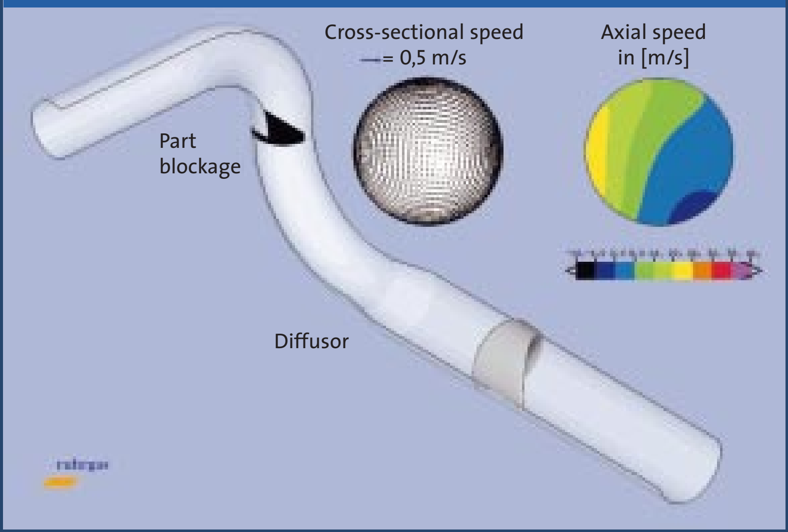
Secondly, we have swirl, or the tangential velocity components. In this case, the swirl causes a positive or negative deviation of the metering error, depending on whether the swirl direction is with or against the turbine rotation.

Based on the recommendation of the International Organisation of Legal Metrology (OIML), R-32/89, the technical guidelines TR-G13 and EN12261 describe a standardised procedure for monitoring metering errors caused by flow disturbances.

Using this procedure, it is possible to analyse the behaviour of a turbine meter when confronted with flow disturbances of varying intensity. After determining the error curve with a straight and undisturbed inlet flow (basic error curve), different inlet pipe configurations are installed in several steps.

These configurations produce asymmetry of different intensities superimposed by a swirl with different rotational directions. The diagram shows the results of a numerical simulation of these disturbances (Fig. 2).

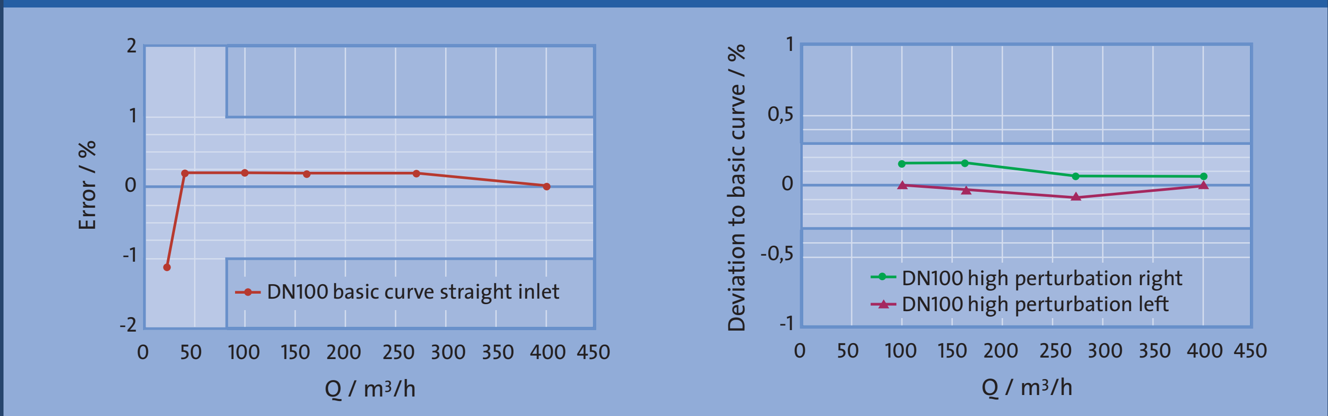
Fig. 2: Flow profile in accordance with OIML R-32/89 'strong inlet disturbance to the left'



The deviation between the disturbed error curve and the basic error curve must not exceed $^1/_3$ of the calibration error limits.

The standards also define two geometrical ratios, or key indicators. The ratio of the channel height to the diameter is h/d and the distance between the blades to the length is s/l (Fig. 3). These ratios are indicative of the straightening capacity of a flow guide. If we look at some extreme proportions, this becomes more apparent.

Fig. 4: Typical error curve and OIML measurement

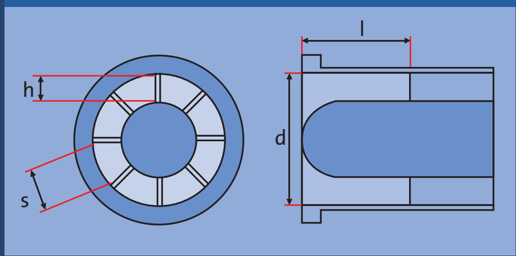


The quotient h/d is related to the correction of asymmetry. If the channel height h reaches its minimum, the impact of this geometry is comparable to a perforated plate with a minimum relative aperture, which results in maximum correction of the asymmetry. Conversely, when the relative aperture reaches its maximum (h–> $^1/_2$d), there is no correction of the asymmetry.

The ratio s/l concerns the correction of the swirl. In this case, an analogy can be drawn to a pipe bundle. The ratio approaches zero when, for example, the distance between the blades also approaches zero. One can imagine an infinite number of tiny tubes where the swirl would be erased perfectly. On the other hand the quotient becomes infinite if the length of the blades approaches zero. Arbitrary short pipes have no effect on swirl compensation.

Taking these relationships into consideration, it appears to be simple to straighten a flow. However, optimising one parameter will always end up with a pressure loss. So, the art lies in trying to optimise a complex system which is influenced by a large number of other parameters. With the new flow guide in the TRZ-IFS2, the specially adjusted orifice ring ensures that the asymmetry and swirl are well corrected whereas the pressure

Fig. 3: The geometrical significance of h, d, s and l



loss is comparatively low. The metering errors shown clearly illustrate this (Fig. 4). In the new design, the noise level has also been reduced by more than 12 dBA.

One can assume that even with the TRZ-IFS2, development will not stop. After all, we're not talking about paper clips or jelly babies.

VOLKER LÖTZ-DAUER, ELSTER GERMANY *loetz@elster.com*
AND DR. HARALD DIETRICH *dietrich@elster.com*