



Installasjonskrav ved fiskal gassmåling

Hvorfor anbefales stadig de mest konservative løsningene?

Ultralyd gassmåler

- Vært på markedet siden siste del av nittitallet
- Befestet sin posisjon i det norske markedet
- God nøyaktighet
- Langtidsstabilitet
- Diagnosefunksjoner som varsler irregularitet

Leverandørindustrien

- Leverandørindustrien bruker enorme summer på utviklingen og prosesseringskraften øker nærmest fra måned til måned
- Kravet til rettstrekk er en av mange drivende krefter i utviklingen
- De forskjellige standardene gjennomgår ikke samme utvikling, og i samme tempo

Utdrag fra konsulentrapport:

Applicable standards for gas metering by ultrasound meters are:

- NORSOK I-104 Rev. 3
- AGA Report No. 9, 2007
- ISO 17089-1:2010

AGA 9 requires a pipe section upstream of the meter: 10D + flow conditioner + 10D. Some manufacturers claim shorter upstream pipe sections, but supporting test documentation may not be available. Deviations from recognized national or international standards in this matter are not recommended, because the approval process may become difficult or impossible.

Hvorfor stoppe med 20 ID?

AGA Report No. 9, 7.2.2 (utdrag):

Research has demonstrated that asymmetrical velocity profiles may persist for 50 pipe diameters or more downstream from the point of initiation. Swirling velocity profiles may persist for 200 pipe diameters or more.



NORSOK STANDARD I-104

Rev. 3, november 2005

5.2.2.3 Meter runs and header design

Ultrasonic:

The ultrasonic meter runs shall be designed in accordance with AGA 9 with the following clarifications:

- The meter shall, either by its own design or by necessary piping arrangements always be available for necessary maintenance;
- For the meter run, the minimum straight upstream length shall be 15 ID. The minimum straight downstream length shall be 3 ID. Flow conditioner of a recognized standard shall be installed. If it is documented that the ultrasonic meter is not influenced by the layout of the piping upstream in such a way that the overall uncertainty requirements are exceeded other designs based on computerized flow modelling can be allowed.
- Ultrasonic meters may be used bi-directionally. In this case both ends shall be considered as upstream.

NORSOK STANDARD I-104

Rev. 3, november 2005

5.2.2.3 Meter runs and header design

Ultrasonic:

The ultrasonic meter runs shall be designed in accordance with AGA 9 with the following clarifications:

- The meter shall, either by its own design or by necessary piping arrangements always be available for necessary maintenance;
- For the meter run, the minimum straight upstream length shall be 15 ID. The minimum straight downstream length shall be 3 ID. Flow conditioner of a recognized standard shall be installed. **If it is documented that the ultrasonic meter is not influenced by the layout of the piping upstream in such a way that the overall uncertainty requirements are exceeded other designs based on computerized flow modelling can be allowed.**
- Ultrasonic meters may be used bi-directionally. In this case both ends shall be considered as upstream.

AGA Report No. 9

Paragraf 7.2.2

“...The amount of meter error will be dependent on the type and severity of the flow distortion produced by the upstream piping configuration and the meter’s ability to compensate for this distortion... ..To ensure that the UM, when installed in the operator’s piping system, will perform within the specified flow rate measurement accuracy limits defined in Sections 5.1, 5.1.1 and 5.1.2, the manufacturer shall do one of the following, as directed by the designer/operator:

- 1. Recommend at least one upstream and downstream piping configuration, without a flow conditioner or one configuration with a flow conditioner, as directed by the designer/operator, that will not create an additional flow rate measurement error, after calibration adjustment, of more than $\pm 0.3\%$ due to the installation configuration. This error limit should apply for any gas flow rate between q_{min} and q_{max} . This recommendation shall be supported by test data.*
- 2. Specify the maximum allowable flow disturbance (e.g., the limits on swirl angle, velocity profile asymmetry, turbulence intensity, etc.) at the meter’s upstream flange, or at some specified axial distance upstream of the meter, that will not create an additional flow rate measurement error of more than $\pm 0.3\%$ due to the installation configuration. This error limit should apply for any gas flow rate between q_{min} and q_{max} . This recommendation shall be supported by test data...”*

AGA Report No. 9

Paragraf 7.2.2 (utdrag)

- In lieu of following the manufacturers recommendation in 1 or 2 above, the designer may choose to flow calibrate the UM in-situ (where practical), or in a flow calibration facility, in which the test piping configuration is identical to the planned installation or with flow conditioning elements that effectively isolate the meter from upstream piping conditions.
- ...If options 1 and 2 (above) are not available or if in-situ calibration is not feasible, one conservative design is to use 10 nominal pipe diameters (10 ND) between the meter tube inlet and the qualified flow conditioner, 10 ND between the qualified flow conditioner and the meter, and 5 ND between the meter and the first downstream disturbance (See Figure 2)..."

OIML

- OIML R137: Gas meters
- Test report is made by independent 3rd party
- Test report is basis for approval in majority of countries
- Testing includes:
 - Accuracy
 - High voltage test
 - EMC test
 - Climate test
 - Upstream perturbation testing to simulate 'real' installations



**ORGANISATION INTERNATIONALE
DE METROLOGIE LEGALE**

www.oiml.org

Tested upstream distortions

10D, 5D and 5D with flow conditioner

ISO17089

OIML R137

80D

80D

0D

0D

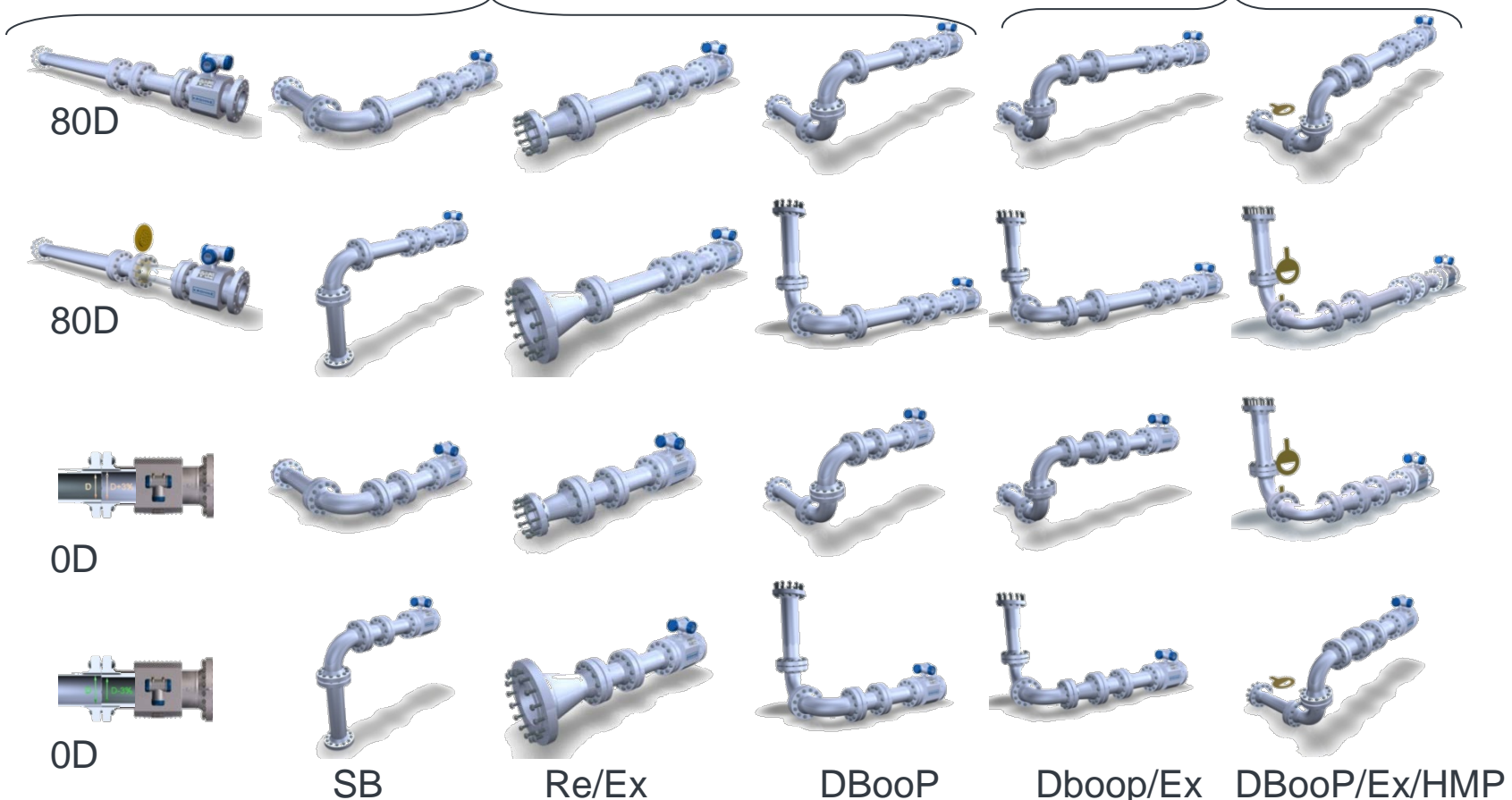
SB

Re/Ex

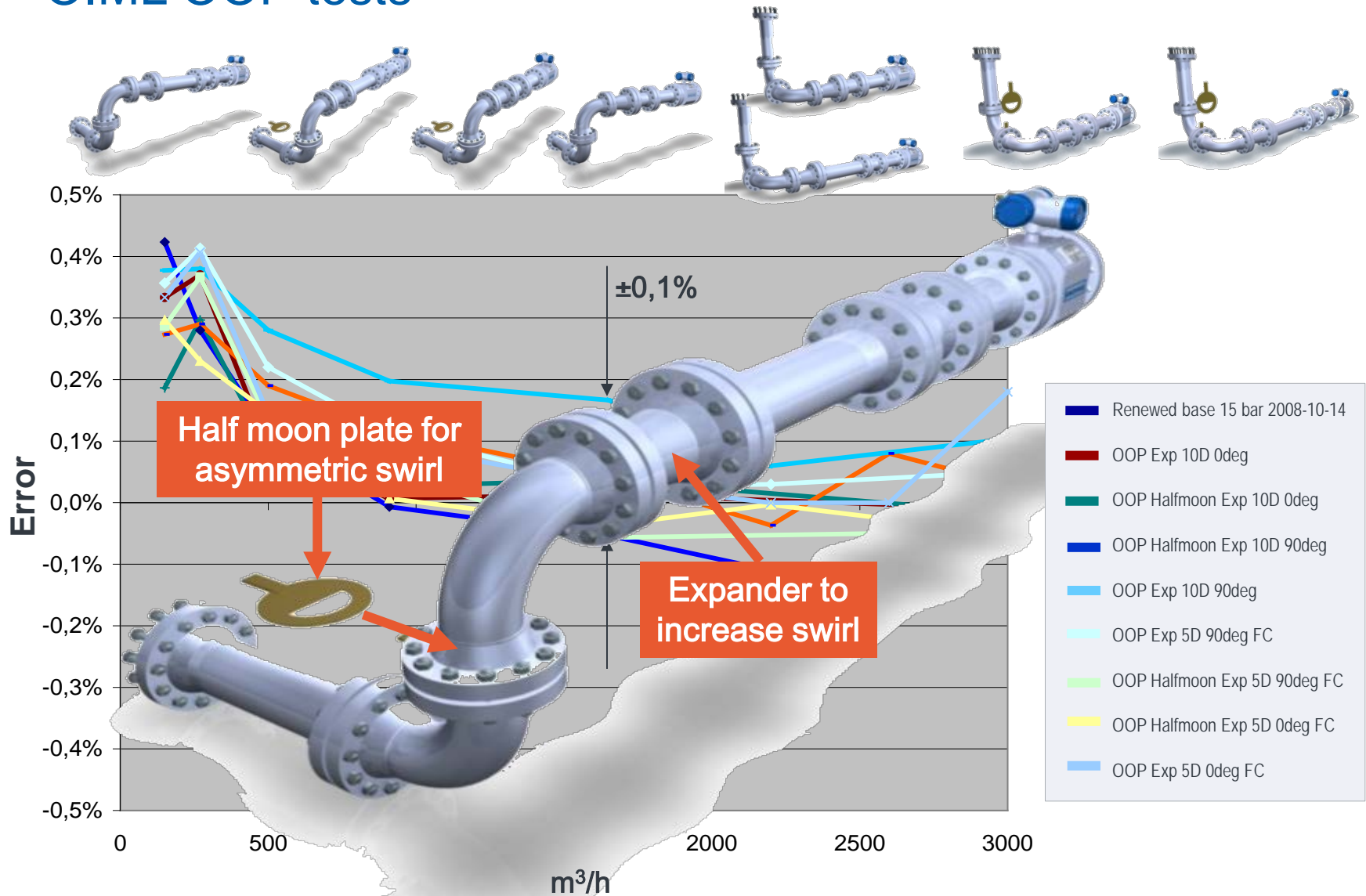
DBooP

Dboop/Ex

DBooP/Ex/HMP



OIML OOP tests



Leverandørenes anbefalinger

OIML R137: Gas meters class 0,5

10 DM – UM – 3 DM	Ingen FC
2 DM – FC – 3 DM – UM – 3 DM	

OIML R137/ AGA9 / ISO17089 class 1,0

5 DM UM 3 DM	Ingen FC
3 DM – FC – 5 DM – UM – 3 DM	
10 DM –UM – 3 DM	Ingen FC

Plass er vekt og vekt er kostnad!

Med mange små felt som knyttes opp mot eksisterende installasjoner, så er plass alltid et spørsmål ...

... så HVORFOR anbefales stadig den mest konservative løsningen?



KROHNE

► *achieve more*

► Takk for oppmerksomheten



Frode Endresen