Worksheet A.80.2

Suitability and Compatibility for Hydrogenous Natural Gas

Ultrasonic Flowmeter

The USM GT-400 is generally applicable and designed for the use with hydrogenous natural gas up to 30 mole% hydrogen.

For custody transfer measurements, the USM GT-400 is suitable and approved for the use with natural gas up to a maximum hydrogen content of 30 mole% in accordance with the German TR-G19. The reason for this general restriction in the TR-G19 is that there are currently no officially approved test rigs in Germany for calibrating meters with hydrogenous gases.

For secondary metering, the ultrasonic meter USM GT-400 from nominal size DN 200 can be used to measure natural gas up to a maximum hydrogen content of 30 mole%. Here, adapted measuring ranges as well as a deviating measuring uncertainty compared to the pure natural gas measurement have to be considered. The expected performance data can be calculated for the desired conditions of use.

Device type	max. permissible H_2 concentration technically	max. permissible H_2 concentration custody transfer	Manufacturer's declaration for H_2 operation available?	Remarks
USM GT400	30% unrestricted; up to 100% depending on the operating data	30%	yes	A clearance certificate from PTB according to TRG-19 for up to 30% H_2 is available.
USZ 08	30% unrestricted; up to 100% depending on the operating data	10%	no	There is no clearance certificate from PTB according to TRG-19.

We reserve the right for technical changes

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Turbine Gas Meter

The TRZ03 (-K) is generally applicable and designed for the use with hydrogenous natural gas up to pure hydrogen.

For custody transfer metering, the TRZ03 is suitable and approved for the use with natural gas up to a maximum hydrogen content of 10 mole% in accordance with the German TR-G19. The reason for this general restriction in the TR-G19 is that there are currently no officially approved test rigs in Germany for calibrating meters with hydrogenous gases.

When using turbine meters of type TRZ03 and TRZ 03-K for secondary metering, adjusted measuring ranges as well as a deviating measurement uncertainty compared to pure natural gas measurement must be considered. The expected performance data can be calculated for the desired conditions of use.

Device type	max. permissible H_2 concentration technically	max. permissible H_2 concentration custody transfer	Manufacturer's declaration for H_2 operation available?	Remarks
TRZ-03 from YOM 2008	100%	30%	yes	A clearance certificate from PTB according to TRG-19 for up to 30% H_2 is available.
TRZ-03 until YOM 2008	30%	10%	yes	Technical area of application limited due to Ex approval (only IIB), area of application for custody transfer is limited, as there is no clearance certificate from PTB.
TRZ-03K from YOM 2008	100%	n.a.	no	not for custody transfer
TRZ-03K until YOM 2008	30%	n.a.	no	Technical area of application limited due to Ex approval (only IIB), not for custody transfer.
TME 400-VM, all YOM	100%	n.a.	scheduled	not for custody transfer
TME 400-VC, all YOM	10%	n.a.	scheduled	Technical area of application limited by the maximum permissible H_2 concentration of the pressure transducer, not for custody transfer
TME 400-VMF, all YOM	100%	10%	scheduled	Area of application for custody transfer is limited, as there is (yet) no clearance certificate from PTB.
TME 400-VCF, all YOM	10%	10%	scheduled	Technical area of application limited by the maximum permissible H_2 concentration of the pressure transducer

Process Gas Chromatograph

The PGCs of the 930X series are approved and designed for the custody transfer analysis of hydrogenous natural gas containing different portions of hydrogen.

The PGCs built from 2016 are safety-approved for operation with up to pure hydrogen. Older units of the 930X series can be retrofitted if required.

The PGC 9304 is approved for hydrogenous natural gas up to a hydrogen content of 20 mole%. The PGC 9303 and PGC 9302 are each approved for natural gas or for biogas with up to 5 mole% hydrogen. The PGC 9301 is not approved for the analysis of hydrogenous gases.

Device type	H_2 compatibility	Remarks
PGC 9301	0%	no approval for hydrogenous natural gas
PGC 9302	5%	PGC 9302 is approved for biogas up to a hydrogen content of 5 mole%
PGC 9303	5%	PGC 9303 is approved for hydrogenous natural gas up to a hydrogen content of 5 mole%
PGC 9304	20%	PGC 9304 is approved for hydrogenous natural gas up to a hydrogen content of 20 mole%

Compact Corrector

Device type	max. permissible H_2 concentration technically	max. permissible H_2 concentration custody transfer	Remarks
Primus 400	10%	10%	Is currently still being examined
EC 900	10%	10%	Is currently still being examined

Flow Computer

<table>
<tr><th>Device type</th><th>H_2 compatibility</th><th>Remarks</th></tr>
<tr><td>ERZ 2000-NG</td><td>100%</td><td>100% possible with Beattie Bridgeman method - only pure gases - admixture of up to 10% with: AGA 8, GERG 88S</td></tr>
<tr><td>ERZ 2000-DI</td><td>100%</td><td>GERG2004 or GERG2008 are compatible up to 100%;
full analysis required. -
Admixture of up to 10% with: AGA 8, GERG 88S</td></tr>
<tr><td>Pressure transmitter Rosemount</td><td>100%</td><td>
<table>
<tr><th>Item</th><th>Process medium / conditions</th><th>Stainless steel separating membrane</th><th>gold coated stainless steel separating membrane</th><th>Transmitter / diaphragm seal decision</th></tr>
<tr><td>1</td><td>Hydrogen gas (< 69 bar)</td><td>ja</td><td>ja</td><td>2088, 2051, 3051, 3051S, 1199</td></tr>
<tr><td>2</td><td>Hydrogen gas (> 69 bar)</td><td>not recommended</td><td>ja</td><td>3051C, 3051S_C, 1199</td></tr>
<tr><td>3</td><td>Hydrogen gas (< 176°C)</td><td>ja</td><td>ja</td><td>2088, 2051, 3051, 3051S, 1199</td></tr>
<tr><td>4</td><td>Hydrogen gas (> 176°C)</td><td>not recommended</td><td>ja</td><td>3051C, 3051S_C, 1199</td></tr>
<tr><td>5</td><td>Hydrogen gas with H2S (NACE MR01-75)</td><td>not recommended</td><td>ja</td><td>3051C, 3051S_C, 1199</td></tr>
</table>
</td></tr>
<tr><td>Pressure transmitter E+H</td><td>100%</td><td>100% H_2 up to 10 bar, 20% H_2 up to 60 bar, 10% H_2 without restriction</td></tr>
<tr><td>Thermowells for the T. transmitter</td><td>100%</td><td>Thermowells are made of stainless steel, material: 1.4571 Material is mentioned in the final report_DVGW_240714 on page 12.</td></tr>
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This worksheet was made based on the current state of knowledge within the framework of sound engineering practice. Liability can only be derived from this if individual or all statements in the worksheet have been made falsely with intent or by gross negligence.