Michell Natural Gas Moisture Analyzers Are Hydrogen Ready

Plans are underway to utilize existing natural gas infrastructure for the transportation and storage of hydrogen. Current government environmental initiatives across Europe require 20% of EU energy from renewables. Biomethane injection into natural gas distribution networks is commonplace in Europe and North America. Hydrogen injection is a further phase in reducing the proportion of fossil fuel within natural gas supplies. Progress towards up to 20% H_2 injection, produced via electrolysis of water powered from excess solar and wind generated electricity, is envisaged within networks across EU countries.

Michell Instruments' existing installed fleet of moisture, water dew point and hydrocarbon dew-point analyzers are suitable for natural gas with up to 20% hydrogen, without any modifications being required.

OptiPEAK TDL600 TDLAS moisture analyzer

TDL600 applies tuneable diode laser absorption spectroscopy, detecting a specific moisture absorption peak within the near infrared region. Advanced spectroscopy algorithms automatically compensate for variation in background gas composition. Hydrogen does not interfere with the spectrum captured by this analyser. This is supported within independent testing conducted by DBI Gas- und Umwelttechnik in Leipzig where 10mol% H_2 added into natural gas showed no adverse effect on the accuracy and overall measurement performance of the TDL600.

This DBI report is available to download in original German language and English translation.

QMA401/601 QCM moisture analyzer

The quartz crystal microbalance (QCM) principle is commonly used for moisture measurement in both natural gas and hydrogen. The oscillation frequency of the sensing piezoelectric quartz crystal varies proportionate to the mass of moisture vapor adsorbed by a hygroscopic coating on the surface of the crystal. This principle is independent of the background gas composition. QMA401 analyzers provide trace moisture measurement in pure H2 supplied for automotive fuel cells. In oil refineries, QMA601 analysers monitor recycle gas within catalytic reforming processes. Typically, this gas contains 75% volume H_2 and 25% mixed hydrocarbons.

Promet IS/EExd ceramic metal-oxide water dew-point analyzer

Moisture molecules within the flowing gas sample equilibrate into the porous hygroscopic dielectric of these capacitance/impedance Ceramic metal-oxide dew-point sensors. The sensors exhibit response to the partial pressure of water vapour, explicitly linked to water dew-point temperature, enabling calibration to that parameter and measurement of water dew point directly at process pressure condition. This principle is unaffected by background gas composition including the concentration of H_2. Michell Ceramic metal-oxide technologies fulfil diverse applications for gases and liquids across manufacturing and process industries. Examples of hydrogen applications include metal annealing furnaces and generator cooling systems in electricity power stations.

Condumax II hydrocarbon dew-point analyzer

Condumax II applies an adaptation of the fundamental cooled-mirror dew-point measurement principle. The 'Dark Spot' optical technique detects formation of low-surface tension hydrocarbons condensing at the HC dew-point temperature. Condumax II will correctly measure the HC dew point of the overall gas composition inclusive of injected H_2. Injection of H_2 into natural gas will proportionately dilute the concentrations of all hydrocarbons present, hence the HC dew point will reduce. Equation of state estimations predict that the change in HC dew point will be relatively small, less than 1°C reduction with 20mol% H2 injection, as shown in the example below.

Predicted influence of hydrogen injection on hydrocarbon dew point						
			0%H2	5%H2	10%H2	20%H2
Helium	He	mol	0.01460	0.01387	0.01314	0.01168
Carbon dioxide	CO2		0.13560	0.12882	0.12204	0.10848
Nitrogen	N2		0.82180	0.78071	0.73962	0.65744
Argon	Ar		0.01350	0.01283	0.01215	0.01080
Hydrogen	H2		0.00000	5.00000	10.00000	20.00000
Methane	CH4		92.54680	87.91946	83.29212	74.03744
Ethane	C2H6		3.95710	3.75925	3.56139	3.16568
Propane	C3H8		1.91310	1.81745	1.72179	1.53048
i-Butane	C4H10		0.26870	0.25527	0.24183	0.21496
n-Butane	C4H10		0.25350	0.24083	0.22815	0.20280
neo-Pentane	C5H12		0.00170	0.00162	0.00153	0.00136
i-Pentane	C5H12		0.02370	0.02252	0.02133	0.01896
n-Pentane	C5H12		0.01380	0.01311	0.01242	0.01104
Benzene	C6H6		0.00240	0.00228	0.00216	0.00192
Hexane	C6H14		0.01700	0.01615	0.01530	0.01360
Toluene	C7H8		0.00130	0.00124	0.00117	0.00104
Heptane	C7H16		0.00950	0.00903	0.00855	0.00760
m-Xylene	C8H10		0.00050	0.00048	0.00045	0.00040
Octane	C8H18		0.00270	0.00257	0.00243	0.00216
Nonane	C9H20		0.00150	0.00143	0.00135	0.00120
Decane	C10H22		0.00070	0.00067	0.00063	0.00056
Undecane	C11H24		0.00040	0.00038	0.00036	0.00032
Dodecane	C12H26		0.00010	0.00010	0.00009	0.00008
Pressure		BarG	27	27	27	27
HCDP (GL equation)	Temp	(C)	4.4	4.3	4.2	3.8

Do these analysers carry Ex certification permissible for hydrogen atmosphere?

Yes, all the analysers considered above carry ATEX, IECEx and NEC505 certifications for gas group IIC or IIB+H2 together with NEC500 Ex for gas group A or B.