D3.1 Analysis of existing EU and national regulation & standards for gaseous fuel dispensing

REPORT

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Introduction & scope of tasks

This document serves as a reporting for the deliverable *"D3.1 Analysis of existing EU and national regulation & standards for gaseous fuel dispensing"* as part of the HyAC project.

Results of the following project tasks are reported in this document:

- T3.1.1: Analysis of requirements, processes & structures MID & OIML
- T3.1.2: Analysis of requirements, processes & structures in EU countries
- T3.1.3: Formulation of overall requirements, processes & structures for H2 accuracy

Aim of the analyses has been to understand the requirements, processes and structures for accuracy & metering of gaseous fuel dispensing in the existing MID directive and OIML directive and in selected EU member countries where early market introduction of FCEV's may be expected.

Based on these analyses overall requirements, processes and structures has be formulated for hydrogen accuracy. This approach may help ensure widest possible consistency with existing regulation in the recommendations for hydrogen.

Please note that scope of results have been impacted by a general delay in project activities, which could not be recovered as an extension of the project period was not granted by the FCH-JU.

1. Analysis of requirements, processes & structures MID & OIML

Legal metrological control is applied for correct and traceable measurements in areas such as consumer protection, public health, safety and order, protection of the environment, of levying taxes and duties and of fair trading. Measurement of “quantities of fuel” is an area generally subject to legal metrology.

Within the European Union, the quality infrastructure for legal metrology is specified through a Directive issued by the European Parliament and Council. This Directive, MID, short for Measuring Instrument Directive 2004/22/EC (to be replaced by 2014/32/EU) is then implemented by national regulations. The result is common application and practices of requirements on several types of Measuring Instruments, when placing these on the market.

MID specifies that Member States should, as a general rule, prescribe legal metrological control. It also specifies that performance requirements that the measuring instruments must meet, should provide a high level of protection and that conformity assessment should provide a high level of confidence.

MID includes e.g. requirements on “Measuring systems for the continuous and dynamic measurement of quantities of liquids other than water”, in Annex MI-005. This also includes fuel dispensers for liquefied gases under pressure (temperature below – 10 °C) and measuring system for cryogenic liquids (temperature below –153 °C.
MID also include requirements on “Gas meters and volume conversion devices”, in Annex MI-002. Its application is on gas meters and volume conversion devices, intended for residential, commercial and light industrial use.

MID does thus include measuring instruments for similar areas of use as the dispensing of Hydrogen, including aspects such as Accuracy classification and maximum permissible errors (MPEs) for such instruments and systems. MID does however currently not cover measuring systems for compressed gaseous fuel such as Hydrogen, nor does MID include requirements on accuracy of measuring instruments when in use.

The intent of MID is the technical harmonization of requirements and free movement of measuring instruments for Legal Metrology, facilitated by CE-marking, throughout the Community. It establishes the essential requirements that the measuring instruments will have to satisfy if they are subject to legal metrological control in a Member State and the conformity assessment that they have to undergo before being placed on the market and put into use.

The essential requirements are defined in the Annexes to the directive. Annex I establishes the essential requirements which must be met by all measuring instruments, followed by the specific annexes that describe the particular requirements which are applicable to the specific type of instrument.

For the practical implementation of MID, a list of harmonized European standards is also published in the Official Journal. This means that standards with further detailed descriptions can be applied for the practical application of MID. This is e.g. the case for some types of Gas Meters.

According to Article 13.2 of MID, also normative documents by the "Organisation Internationale de la Métrologie Légale" (OIML) may be identified as giving presumption of conformity with the essential requirements of the Directive, after an advisory vote in the Measuring Instruments Committee. The references to normative documents are then published in the Official Journal.

The objective for this project is that also compressed gases such as Hydrogen are included in future revisions of MID, but this can be expected to be a long process. Other alternative ways are therefore needed, e.g. via EN-standardization or OIML, to provide practical basis and a common level for the application of legal metrology to compressed Hydrogen gas.

The MID directive and existing normative OIML documents for metering could act as a basis for considerations on requirements on hydrogen metering. The table below outlines examples from the MID directive and OIML documents for metering of various Medias, and the accuracy requirement.

		Approval *		Verification
Document	Description	MPE System, ± %	MPE Meter, ± %	MPE ± %
OIML R139	**Compr. gaseous fuel M/S**	**1,5**	**1**	**2**
OIML R140	M/S for gaseous fuel	0,9 - 2		
MID MI-002	Gas Meters…		1 - 1,5 (2 – 3)	
MID MI-005	Liquids other than water	0,3 – 2,5	0,2 – 1,5	
OIML R81	Dyn M/S Cryogenic liquids	2,5	1,5	2,5
OIML R105	Direct Mass Flow liquids - when liquified gases	0,3 - 0,5 0,6 - 1		0,5 1
OIML R117	Liquids other than water - liquefied gases under pressure, temp < -10 ºC	0,5 – 1,5 1,5	0,3 – 1,0	
OIML R137	Gas Meters		0,5 – 1,5 (1 – 3)	1 – 3 (1 – 6)
CCR proposal	Proposed accuracy classes	2 – 10	1,5 – 5	2 – 10
* accuracy classes depending on application				

There is ongoing standardization work on the safe transfer of Hydrogen. The American SAE J2601 light duty vehicle fueling standard has been developed to meet performance objectives under practical conditions. It defines a fueling protocol and operational fueling parameters that are to ensure that both station and vehicle maintain their safety limits, while delivering optimal fueling performance. Under target conditions this is to allow a representative vehicle to be completely fueled within three minutes.

There is also on-going standardization work for Fuel stations for Gaseous hydrogen (ISO 19880…)

2. Analysis of requirements, processes & structures in EU countries

2.1 United Kingdom

There is currently no national legislation for the measurement of Hydrogen, as a gas, in the UK. Measuring instruments concerned with the measurement of Hydrogen as a liquid would be subject to UK Statutory Instrument 2006 No. 1266 The Measuring Instruments (Liquid Fuel and Lubricants) Regulations 2006 which implement into UK legislation the requirements of Directive 2004/22/EC of the European Parliament and of the Council of 31st March 2004 on measuring instruments relating to ANNEX MI-005 Measuring Systems for the Continuous and Dynamic Measurement of Quantities of Liquids other than Water.

Subject to certain limitations (in the Regulations) , these Regulations apply to a measuring system which is— (a) for use for trade* in the making of a continuous and dynamic measurement of liquid fuel in a quantity equal to or less than 100 litres or 100 kilograms; and first placed on the market or put into use on or after 30th October 2006.

These regulations define the maximum permissible errors dependent upon the designated accuracy class.

***Note :** “use for trade” is defined in the UK Primary legislation – Weights and Measures Act 1985 CHAPTER 72, 7 Meaning of "use for trade":

1. In this Act "use for trade" means, subject to subsection (3) below, use in Great Britain in connection with, or with a view to, a transaction falling within subsection (2) below where-
    a. the transaction is by reference to quantity or is a transaction for the purposes of which there is made or implied a statement of the quantity of goods to which the transaction relates, and
    b. the use is for the purpose of the determination or statement of that quantity.

2. A transaction falls within this subsection if it is a transaction for—
    a. the transferring or rendering of money or money's worth in consideration of money or money's worth, or
    b. the making of a payment in respect of any toll or duty.

3. Use for trade does not include use in a case where—
    a. the determination or statement is a determination or statement of the quantity of goods required for despatch to a destination outside Great Britain and any designated country, and
    b. the transaction is not a sale by retail, and
    c. no transfer or rendering of money or money's worth is involved other than the passing of the title to the goods and the consideration for them.

4. The following equipment, that is to say—
    a. any weighing or measuring equipment which is made available in Great Britain for use by the public, whether on payment or otherwise, and
    b. any equipment which is used in Great Britain for the grading by reference to their weight, for the purposes of trading transactions by reference to that grading, of hens' eggs in shell which are intended for human consumption, shall be treated for the purposes of this Part of this Act as weighing or measuring equipment in use for trade, whether or not it would apart from this subsection be so treated.

5. Where any weighing or measuring equipment is found in the possession of any person carrying on trade or on any premises which are used for trade, that person or, as the case may be, the occupier of those premises shall be deemed for the purposes of this Act, unless the contrary is proved, to have that equipment in his possession for use for trade

2.2 Sweden

SWEDAC is the Swedish authority for regulation of fuel metering accuracy.
The Measurement Instrument Directive is implemented by STAFS 2006:4.

Requirements on gas metering according to MI-002 are regulated by STAFS 2006:6. This does however only apply to transmission gas lines, i.e. in practice to natural gas. There are no specified requirements for the re-verification of gas meters in use.
Requirements on Fuel dispensers (liquids other than water) according to MI-005 are regulated by STAFS 2006:9. A separate decree, STAFS 2007:3 specifies the requirements on re-verification, which for fuel dispensers is bi-annual. The extent of the re-verification is referred to OIML R117.

Hydrogen in gas form is thus not covered by any regulations in Sweden today. The OIML recommendation 139 is probably used by the manufacturers of the metering equipment on a voluntary basis.

2.3 Norway

Justervesenet (JV) is the Norwegian authority for regulation of fuel metering accuracy
Meter accuracy for fuel meters distributing fuel in the state of gas is not covered by any regulations in Norway today. Decisions taken by the Ministry of Trade and Industry during 2011 were not to include legislation for gas metering accuracy.

2.4 Denmark

The Danish Safety Technology Authority is handling regulation of fuel metering accuracy.

The MID-directive Annex MI-002 “Gas meters and volume conversion devices” applies in Denmark and this also includes gas meters for the automotive sector in Denmark.

OIML R 139 “Compressed gaseous fuel measuring systems for vehicles” is also to be applied.

2.5 Germany

Existing regulation for fuel dispensing in Germany has not been analyzed, instead reference is made to the analysis of existing activities and experience on hydrogen accuracy, provided in deliverable 3.2.

3. Formulation of overall requirements, processes & structures for H2 accuracy

Concerning adding hydrogen as an annex to MID and/or standard, this could be based on the OIML recommendations for the "model" national legislation.

During the period that the project work in the HyAC project has been on-going, the OIML R139 has been split in to sub-documents and updated to include also Hydrogen. This is excellent as such, as there will be normative documents available to refer to in national legislations. The HyAC project has however not been in a position to influence the technical contents, which has not been adapted for hydrogen, i.e. the same MPE (maximum permissible error) applies for Hydrogen as for other gases. No consideration is thus taken for the stabile energy content of hydrogen. Neither is any adapted procedure specified, e.g. adapted pressure level when starting measurement.

OIML R139 – Compressed gaseous fuel measuring systems for vehicles
This Recommendation applies to measuring systems intended for the refueling of motor vehicles, small boats, and aircraft with compressed natural gas, hydrogen, biogas, gas blends or other compressed gaseous fuels. They may also be applicable to other vehicles, for instance trains. The MPE of mass indication is +/- 2 % at verification. At approval the MPE is +/- 1,5% for the system (+/- 1% for the meter). This is independent of gas, i.e. the same for hydrogen as for e.g. CNG. Re-verification period if applied, is set to 5 years.

Other OIML documents that can be of interest concerning the structure and content are e.g.:

OIML R140 - Measuring systems for gaseous fuel
This Recommendation applies to measuring systems for gaseous fuel: with a designed maximum flowrate Qmax equal to or greater than 100 m3/h at base conditions and for operating pressures equal to or greater than 200 kPa (2 bar) absolute. This recommendation includes:

- Metrological requirements
  Accuracy classes
  Maximum permissible errors (MPE)
- Technical requirements
  Rated operating conditions
  Ancillary devices
  Indications
- Markings
- Sealing
- Type evaluation tests
  Test procedures
- Initial verification
- Subsequent verification

OIML R137 - Gas meters

This Recommendation applies to gas meters based on any measurement technology or principle that is used to measure the quantity of gas that has passed through the meter at operating conditions. The quantity of gas can be expressed in units of volume or mass. This Recommendation applies to gas meters intended to measure quantities of gaseous fuels or other gases. It does not cover meters used for gases in the liquefied state, multi-phase, steam and compressed natural gas (CNG) used in CNG dispensers. This recommendation includes:

- Metrological requirements
  Rated operating conditions
  Accuracy classes and maximum permissible errors (MPE)
- Technical requirements
  Construction
  Ancillary devices
  Power sources
- Inscriptions
  Markings and inscriptions
- Sealing
  Verification marks and protection devices
- Type evaluation tests
  Test procedures

- Initial verification and subsequent verification