Introduction to a revision of OIML R139 to accommodate hydrogen metering systems for motor vehicles

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Current situation and future plan of FCV and HRS in Japan

The government expects the market of **FCV** (Fuel Cell Vehicles) to expand with support of a network of **HRSs** (Hydrogen Refueling Stations). The HRSs utilize renewable energy which also contributes to reducing the total amount of CO_2 emission.

Achievements:

Feb. 2002	The first HRS was demonstrated for operation.
July 2014	The first commercial HRS became in service.
Dec. 2014	The first commercial FCV (Toyota *MIRAI*) was put into the market.
Mar. 2016	Eighty-two HRSs are running in the four metropolitan areas.
Mar. 2016	New FCV (Honda *CLARITY FUEL CELL*) went on sale.
May 2016	Japan Industrial Standard B8576 (Hydrogen metering system for motor vehicles) was published.

Future:

by 2025	The industry plans a new scenario to realize a sustainable market of FCV and HRS (320 HRSs and 0.2 million FCVs).

Japan Industrial Standard(JIS) B8576:2016

“Hydrogen metering system for motor vehicles”

Published on May 20, 2016

Scope: Measuring systems

- for refueling of motor vehicles with compressed hydrogen gas
- installed at hydrogen refueling stations
- used for transaction or certification

New technical aspects:

1. Four accuracy classes of MPE from 2% to 10%
2. Compensation of de-pressurization loss
3. On-site inspection

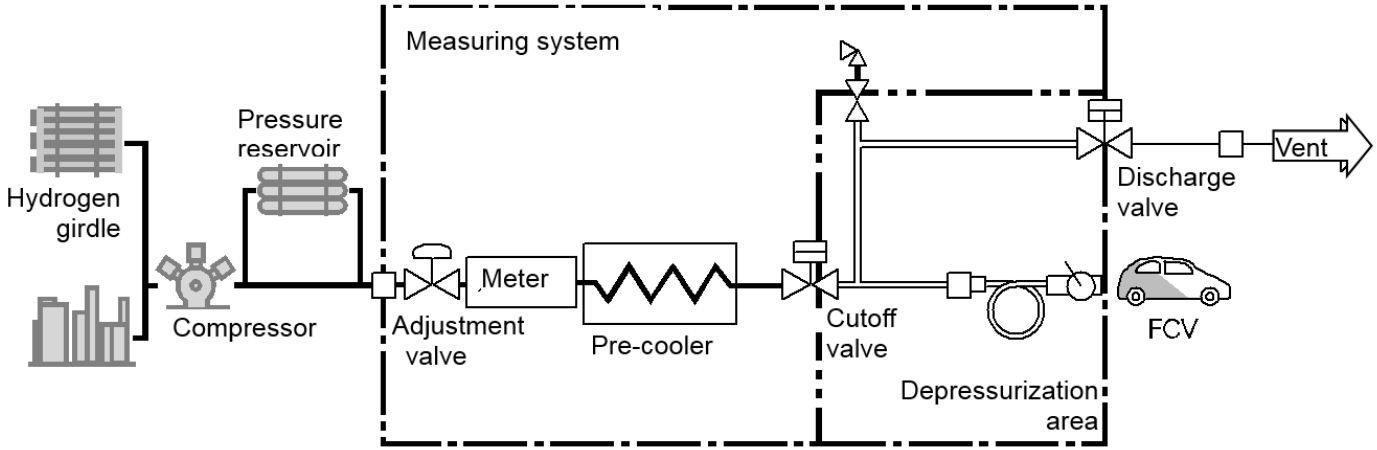
New technical aspects in JIS B8576:2016

1. Accuracy classes of MPE

MPE and Scale interval			
Accuracy class	MPE	MPE in service	Scale interval
2	1.5 %	2 %	0.001 – 0.005 kg
3	2 %	3 %	0.005 – 0.01 kg
5	4 %	5 %	0.01 – 0.02 kg
10	8 %	10 %	0.01 – 0.02 kg

New technical aspects in JIS B8576:2016

2. Compensation for hydrogen de-pressurization loss

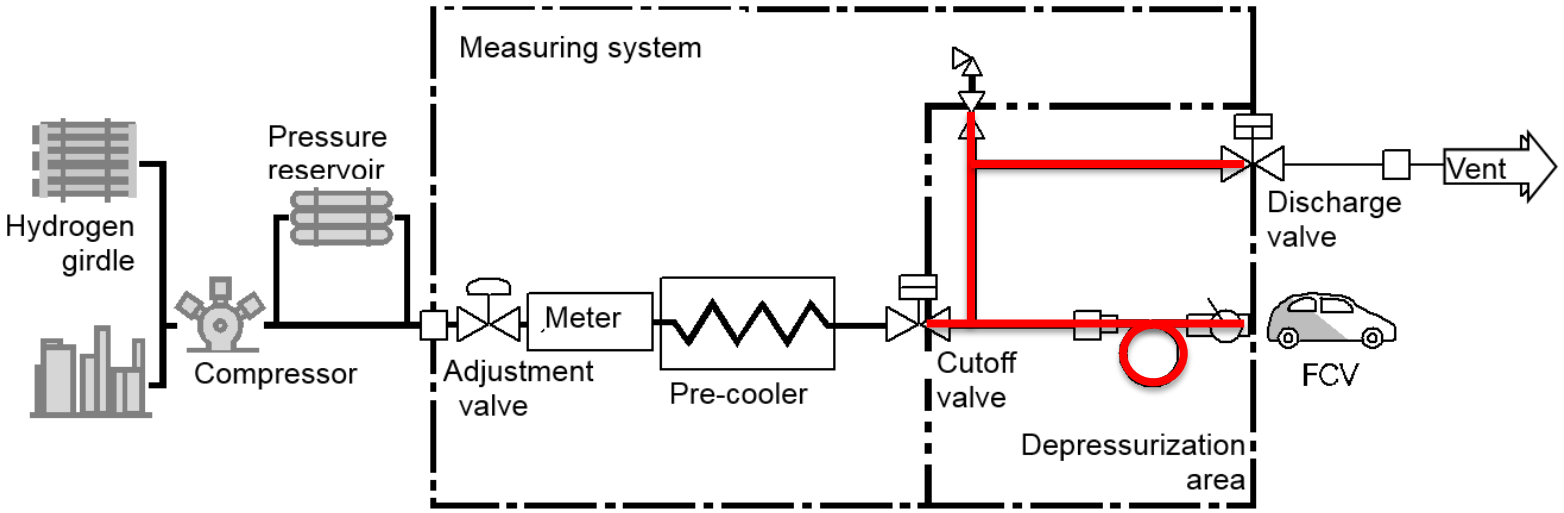


$$C = M \sum \left(\frac{PV}{R f T} \right)$$

Where,

C: Amount of hydrogen loss due to de-pressurization (g)
M: Hydrogen molecular mass (g/mol). In this standard, 2.016 shall be used.
Σ : Summation over the depressurization area
P : Normal operation pressure of hydrogen(MPa)
V : Inner volume of the hydrogen conduit in the depressurization area (cm^3)
R: Gas constant (J/K·mol). In this standard, 8.31446 is used.
f: Compressibility factor (-)
T: Temperature of hydrogen in the depressurization area(K)

De-pressurization loss



- At the end of re-fueling, the pressure in the measuring system reaches up to 82 MPa.
- For safety reason, the pressure in “Depressurization area” must be reduced before decoupling the nozzle from the vehicle by releasing the hydrogen to atmosphere.
- The amount of the discharged hydrogen is called “de-pressurization loss”. It is already measured by the meter but is not supplied into the vehicle.
- In Japan, the typical value of this loss is 10 to 50 g, which is not negligible.

3. On-site inspection for complete measuring system

- Measurement method: Gravimetric
- Test sequence
  1. Fill the empty tank to maximum pressure (*P*v)
  2. Compare the indication with the measured mass
  3. Depressurize the tank down to 0.7*P*v
  4. Fill the tank up to *P*v
  5. Compare the indication with the measured mass
- Interval: Two years

Proposal for revising R139

Why is current R 139 not sufficient for hydrogen?

- Differences in some physical/technical characteristics between CNG and hydrogen dispensers
  - High pressure up to 82 MPa.
  - Low temperature down to minus 40 deg C.
  - Significant de-pressurization loss

R 139 should be revised adding an annex or an amendment for hydrogen dispensers.

Approved at CIML meeting

- The proposal was approved at the 51st CIML meeting in October 2016 as a new project.

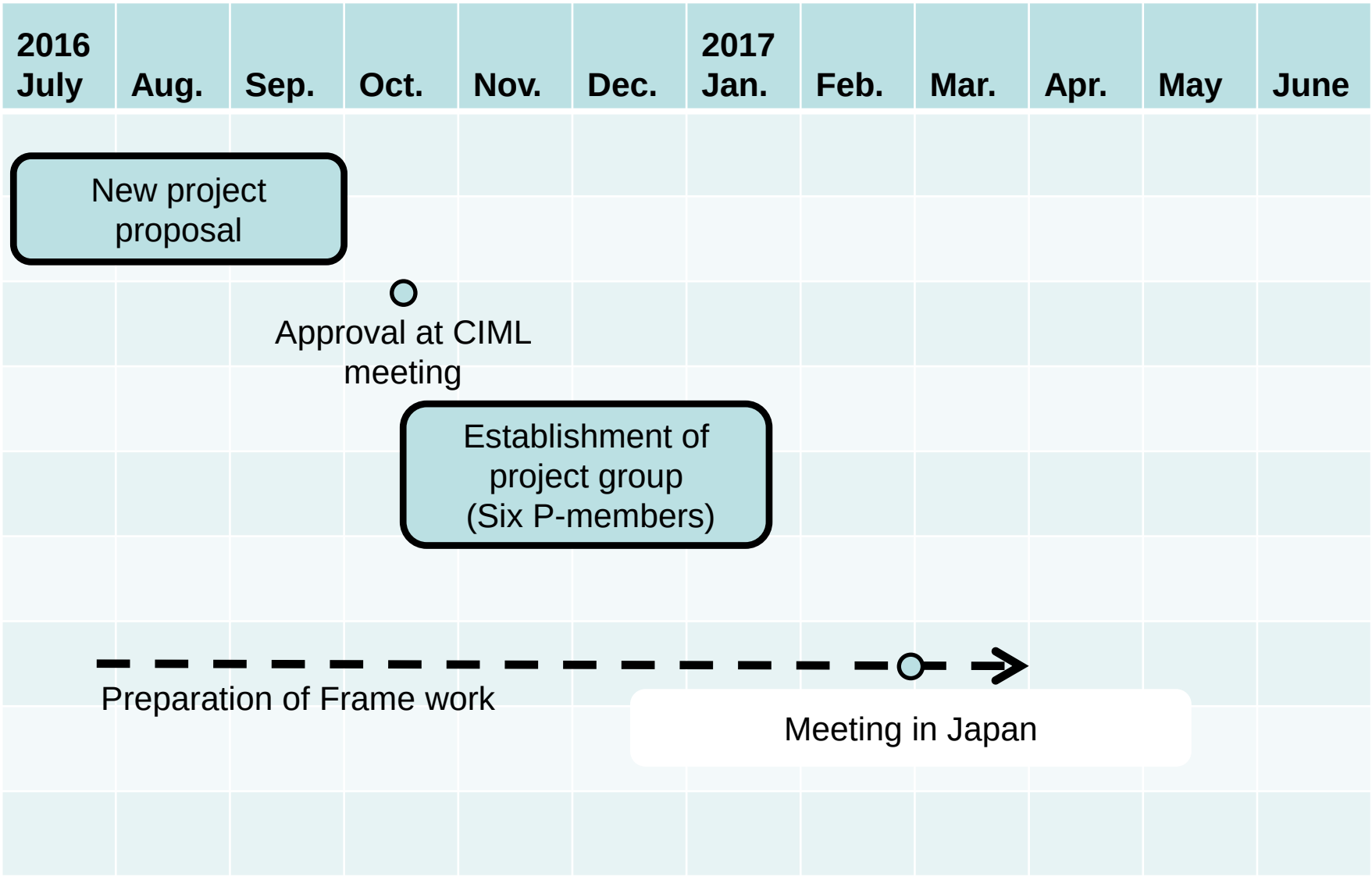
- Japan and Netherlands have indicated to become the co-conveners of this revision project under TC 8 / SC 7.

- A questionnaire has been posted on the OIML TC 8/SC 7 workspace to collect and organize some technical information in advance.

Accuracy classes to be proposed to the revision

Accuracy class	MPE	MPE in service
2	1.5 %	2 %
3	2 %	3 %
5	4 %	5 %
~~10~~	~~8 %~~	~~10 %~~

Tentative plan



OIML TC 8/SC 7: Gas metering

TC 8/SC 7: Gas metering

BIML Contact

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NETHERLANDS

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Participating members (25)

AUSTRALIA
AUSTRIA
BELGIUM
CANADA
CZECH REPUBLIC
DENMARK
FRANCE
GERMANY
IRAN
JAPAN
KOREA (R.)
NETHERLANDS
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TURKEY
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Observer members (10)

ARGENTINA
CROATIA
CUBA
FINLAND
HUNGARY
IRELAND
LIBERIA
NORWAY
SLOVENIA
TANZANIA

TC 8/SC 7/p 7 Workspace

TC 8/SC 7/p 7 Workspace

Revision of R 139
Proposal phase: Project Approved; project group forming
Comment: Revise OIML R 139 to address fuel dispensers used to provide compressed gaseous hydrogen fuel for motor vehicles. CIML Members have until 3 February 2017 to confirm or request to the BIML a P-member status on this PG.

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Contact List

- (•) Current files and documents
- ( ) Archived files and documents
- ( ) Information for meetings

Add document Add subgroup Send email to the participants

Document No	Uploaded	Deadline	Status	Download	Action	Result
TC8_SC7_P7_N001	2016-11-03		Open	Cover letter Questionnaire R139	Info only	
TC8_SC7_P7_N002	2016-11-03	2016-11-30	Open	Questionnaire R139	Comment	Result
TC8_SC7_P7_N003	2016-11-03		Open	Information on project proposal	Info only	
TC8_SC7_P7_N004	2016-11-07		Open	Questionnaire N002 in Word format	Info only	

Thank you for your attention.