EMRP
Potential Research Topic

High Pressure and High Temperature flows

A. KEY DATA FOR THIS SESSION

A.1. Targeted Programme

Industry Workshop: call 2017

A.2. Details of chairmen and facilitator

	Name	**Organisation / Affiliation**	**Country**
Chairman	Daniel SCHUMAN	PTB	Germany
Chairman	Rémy MAURY	CESAME (LNE)	France
Facilitator	Petar STOJIC	Measurement Matters Ltd	United Kingdom

A.3. Optional details of participants

	Name	**Organisation / Affiliation**	**Country**
Participant	Dave SHEPHERD	Dnvgl	Norway
Participant	Nishal RAMADAS	Elster	Germany
Participant	Peter RUSSELL	Tesca	United Kingdom
Participant	Andrew HUNT	Coventry university	United Kingdom
Participant	Nikola PELEVIC	VSL	The Netherland
Participant	Jim GRAY	Alderley	United Kingdom
Participant	Corinna KRONER	PTB	Germany
Participant	Mac NAYLOR	Campden bri	United Kingdom
Participant	Emmanuel THIBERT	Edf	France
Participant	Andy HAMMOND	Flexim	United Kingdom
Participant	Andrew FEENEY	Coventry university	United Kingdom
Participant	Michael Tombs	Oxford university	United Kingdom
Participant	Henry Manus	Oxford university	United Kingdom

A.4. Keywords

Traceability, high temperature gas, high pressure gas, industrial gases, gas mixing process, automotive engines, aircraft and rocket engines, underground gas storage, combined heat and power plants (CHP)

B. ABSTRACT:

Gas flow measurement for special applications becomes more and more important for a broad scope of industries such as automotive, aerospace, energy generation, chemical and pharmaceutical industries. Up to day the monitoring and measurement of gas flow in this field of applications – measurement of gas flow at high temperature, under high pressure or the measurement of a broad scope of gases like industrial gases - are carried out by well-known measurement principles in combination with theoretical established correction factors. The development of presently lacking reference devices and procedures for calibration under real conditions beyond the conventional applications will foster the metrological competence and will deliver more accurate and precise measurement values in this field to increase efficiency of power conversion processes and to save costs in production processes.

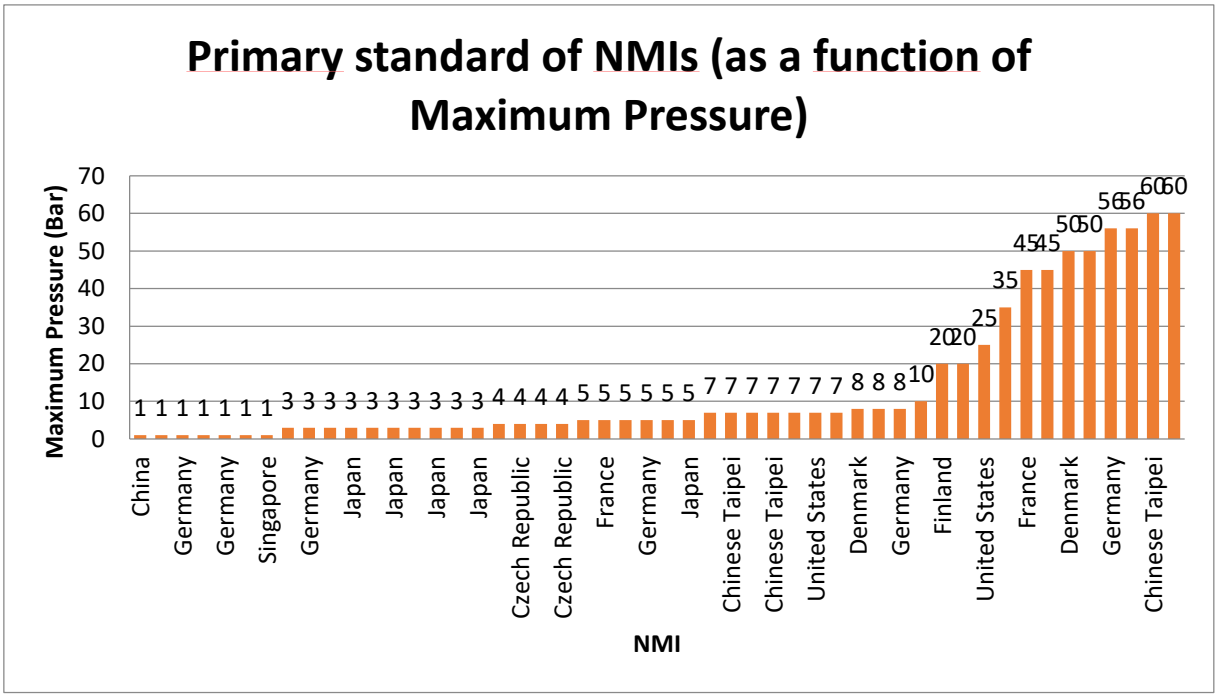
C. DISCUSSION

C.1. Description of industrial needs

During this workshop, two sessions were devoted to the high pressure and high temperatures flows. Each session was two hours in which every participant had the chance to present themselves and their activities in 2-3 minutes.

We had a broaden panel of participants: NMIs, DIs, university and stakeholders.

The chairmen started discussion by showing a summary of the BIPM CMCs on Mass and related quantities, Fluid flow, Fluid flow, Gas flow rate. There is a clear evidence that the capability in terms of pressure / temperature are limited.



This is a brief overview of potential capabilities (i.e. only in Mass and related quantities, Fluid flow, Fluid flow, Gas flow rate) but it is clear that it is not possible to perform calibrations at pressure higher than 60 bars. The temperature is mostly ambient but some facilities can go up to 80 degrees Celsius.

C.2. Feedback from audience:

The audience clearly explained that there is a need for realistic flowmeter calibration. Indeed, in an industrial process, extreme conditions occur (in terms of pressure and temperature). The lack of facility (in correlation with real conditions) is an issue because it is a financial risk for industrial stakeholders. There is also a clear need to shorten the timescale for flowmeter calibration for industry because it often takes 6 months to get an available primary and secondary standard.

We made a summary of specific industry sectors and saw that the pressure / temperature ranges are extremely broaden:

Industry sector	**Activity**	**Pressure**	**Temperature**	**Fluid**
Power plant	Nuclear	60bar	300°C	Water
Aerospace	Spatial	60bar	1900°C	Air / hydrogen
Automobile	Diesel injector	2000bar		
	Refuelling station	1000bar	-40°C	Hydrogen
Gas metering	Flow meter	300bar	700°C	Nitrogen / gas
Aeronautic	Aircraft	400bar	400°C	Air / nitrogen
High pressure processing	Food industry	1000bar	10°C	Air / nitrogen
	Autoclave processing	400bar	50°C	Air / nitrogen

H. OUTCOME:

The uncertainty of gas flow measurements for special applications in the high pressure and temperature range is practically being assumed in the order of 2 % to 5 %. Compared to the importance for the determination of efficiency e.g. in engines or production processes, this value is rather high. A decrease of this uncertainty down to 0.5 % to 1 % would set a new base for technology development as well as higher efficiency and covers the requirement of “EUROMET TC Fluid Flow Roadmap” [1], namely the reduction of the uncertainty of flow measurement in the field and under heavy duty by a factor of 5.

Industry needs to get a traceable test rig to feed the needs and expectation: new primary test rig with different mediums and temperatures. An average range of pressure temperature should be respectively 1000bar, 400°C.

References:

[1] EUROMET 2006: TC-Flow road map