CCM WG Pressure and Vacuum: Report to CCM 2017

CCM WG PV

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CCM WG Pressure and Vacuum – Newly formed

To remind:

Until 2014: 4-2 WGs for pressure scale. Merging was not welcome by the members of the two groups due to quite different fields.

Since 2015: CCM WG PV –Agreement with CCM chair to have vice chair and NMI expert in complementary field in the WG.

First meeting of the newly formed WG: May 11, 2017.

New ToR needed, approved at the last meeting.

CCM WG Pressure and Vacuum – ToR

Proposal for new Terms of References (ToR):

The CCM Working Group on Pressure and Vacuum (WGPV) is concerned with the metrology of gauge, differential and absolute pressure as well as very low gas flow related to vacuum and sealing technology.

The main tasks of the group are:

- to advise the CCM on issues related to pressure and vacuum metrology,
- to maintain service categories for the units realized by the WG and used in the BIPM database to register CMCs
- to define and organise the CIPM Key Comparisons for establishing the equivalence of national primary standards for pressure and vacuum and very low gas flow at the highest accuracy level mainly to provide sufficient linkage between RMO and the CCM WGPV,
- to set the technical criteria for establishing and reviewing CMCs in the field

CCM WG Pressure and Vacuum – ToR

Proposal for new Terms of References (ToR) continued

- to organize and perform reviews of CMCs in the field
- to encourage and, if requested, coordinate research and development in the field of pressure and vacuum metrology to cope with the present and future needs of science, industry and society worldwide,
- to harmonize guidelines in the field of pressure and vacuum metrology related to the CIPM-MRA.

CCM: Please confirm

CCM WG Pressure and Vacuum – Membership

Membership WG PV (20 NMI)

AStar (Singapore), CENAM (Mexiko), CEM (Spain), CMI (Czech Republic), INMS-NRC (Canada), INRIM (Italy), KRISS (Korea), LNE (France), METAS (Switzerland), MSL-NZ (New Zealand), NIM (China), NIST (USA), NMIA (Australia), NMIJ (Japan), NMISA (South Africa), NPL-I (India), PTB (Germany), SMU (Slowakia), UME (Turkey), VNIIM (Russia)

Personal member: Dr. Janez Setina (MIRS, Slovenia)

Observer: INMETRO (Brasil), IPQ (Portugal), NIS (Egypt)

In total 35 individuals.

Meetings: Typically every 3 years. Proposed next meeting in May 2020.

CCM WG Pressure and Vacuum – Membership

INMS-NRC (Canada), INRIM (Italy), NMIA (Australia), NPL-I (India), and SMU (Slowakia):

No participation at meetings, no email-replies, no publications, change of staff, unclear capabilities

INMS-NRC (Canada), answer received on May 12: Recently changed staff, rebuilding their capabilities, still want to be member

INRIM (Italy), NMIA (Australia), NPL-I (India): Will be asked about their capabilities, future activities and their will of still being a member. Proposal: No activity, no participation at next meeting, cancellation of membership. NPL-I (India) did not successfully take part in comparison with NIST see later slide.

CCM: Please, confirm this procedure.

CCM WG Pressure and Vacuum – Membership

SMU (Slowakia), discussed 2014, membership provisionally continued until presentation in meeting 2017, answer received from M. Chytil via D. Prazak (CMI): Decision of WG to cancel membership of SMU, because their capabilities are insufficient for the level of WG PV.
CCM: Please comment and approve/disapprove.

NIS (Egypt):

Application for membership was approved by WG PV.

CCM: Please comment and approve/disapprove.

6th CCM International Conference on Pressure and Vacuum Metrology 2017

On agenda of joint meetings of CCM WG HP and LP in 2011 and 2014

2011 METAS member was willing to organise it, confirmed in 2014 after consultation of METAS member with METAS management board.

November 23, 2015: WG chair was informed by Baumann, METAS, that METAS is unable to organise the event.

INM, Colombia, jumped in as replacement (CCM PV-6 to be jointly organised with conference of IMEKO TC16-5)

CCM WG Pressure and Vacuum

6th CCM International Conference on Pressure and Vacuum Metrology 2017

May 7-10, 2017 in Pereira, Colombia

60 submissions

85 participants (+exhibitors)

7 exhibiting companies

Draft 9th SI Brochure, Dec 11, 2015, Section 4

Appearance of unit “bar” and “mm Hg” disappeared

Table 8. Non-SI units accepted for use with the SI Units

Quantity	Name of unit	Symbol for unit	Value in SI units
time	minute	min	1 min = 60 s
	hour	h	1 h = 60 min = 3600 s
	day	d	1 d = 24 h = 86 400 s
length	astronomical unit [a]	au	1 au = 149 597 870 700 m
plane angle	degree	°	$1° = (\pi/180)$ rad
	minute	′	$1′ = (1/60)° = (\pi/10\,800)$ rad
	second [b]	″	$1″ = (1/60)′ = (\pi/648\,000)$ rad
area	hectare [c]	ha	$1\ \text{ha} = 1\ \text{hm}^2 = 10^4\ \text{m}^2$
volume	litre [d]	l, L	$1\ \text{l} = 1\ \text{L} = 1\ \text{dm}^3 = 10^3\ \text{cm}^3 = 10^{-3}\ \text{m}^3$
mass	tonne [e]	t	$1\ \text{t} = 10^3\ \text{kg}$
	dalton [f]	Da	$1\ \text{Da} = 1.660\,538\,86\ (28) \times 10^{-27}\ \text{kg}$
energy	electronvolt [g]	eV	$1\ \text{eV} = 1.602\,176\,565 \times 10^{-19}\ \text{J}$
logarithmic ratio quantities	neper [h]	Np	see text
	bel [h]	B	
	decibel [h]	dB	

The WG PV recommends not to delete “bar” and “mm Hg” from the brochure.

- “bar” is used as convenient reading all over the world
- “mm Hg” is used in medicine (blood pressure) and a change would be a great risk
- There are countries where you are punished when you use not internationally approved units
- Resolution CIPM 79/1948 never abondonded

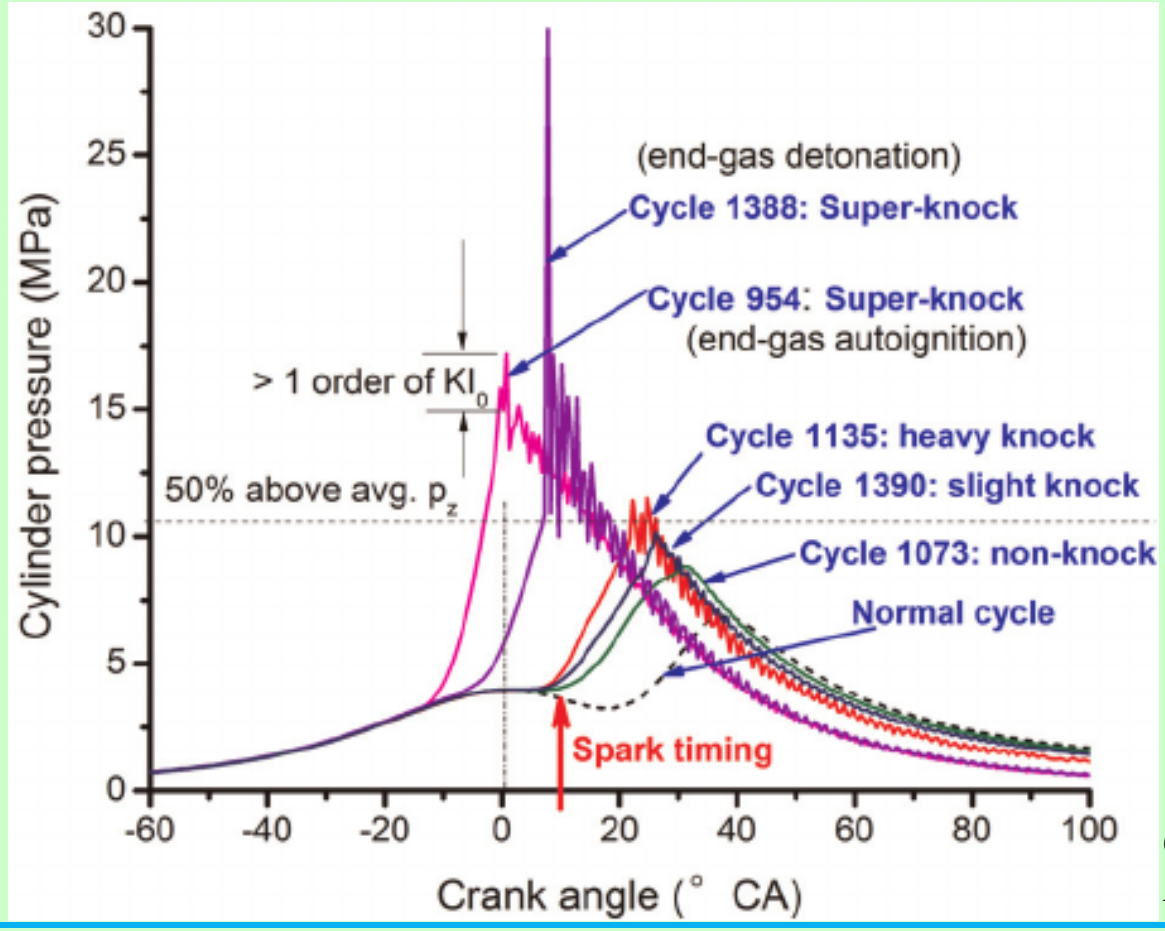
CCM: Please, agree on the corresponding request

In consideration of CIPM resolution 79/1948 and the 8th edition of the SI brochure (2014), Table 8, the CCM recommends not to delete “bar” and “mm Hg” from the new SI brochure (9th edition), Table 8. The two units “bar” and “mm Hg” should appear as in the first line of Table 8 of the 8th edition of the SI brochure (2014).

CCM: Please, support this text for the report of this meeting.

Dynamic pressures (CMCs?, KCs?)

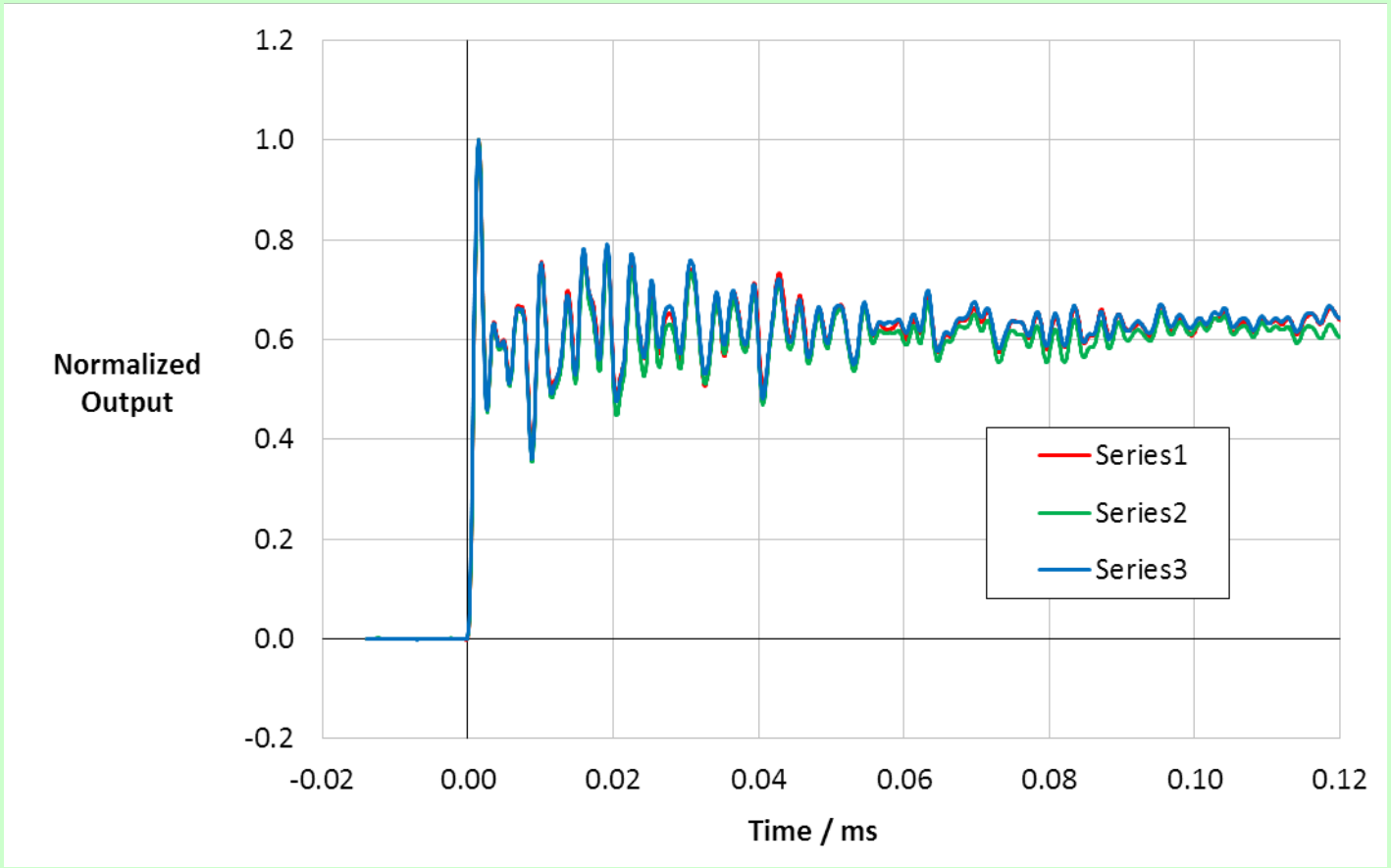
Industrial need
Example:
Pressure in engine cylinders



Courtesy
Andy Knott, NPL

Dynamic pressures (CMCs?, KCs?)

Repeatibility
Normalized output of sensor in shock tube events



Courtesy Andy Knott, NPL

Discussion on CMC and possibly KCs for dynamic pressures

Conclusions from conference and WG meeting:

- Unclear quantity for CMC and comparisons (pressure step, response time, Fourier spectrum, …)
- Community needs still to do “homework”
- No CMC or KC in sight for WG PV

Comparisons

All CCM.P-KCs in pressure field completed, no running one.

List of KCs to support CMCs completed for the whole pressure scale (100 kPa-10 Gpa was still missing) approved; List of schedule of KCs by 2026 agreed.

New KCs decided on meeting:

- P-K3 successor, 1E-9 Pa to 1E-4 Pa (start early 2018, pilot NMIJ)
- Leak rate against atmosphere, R134a, 5 g/a (start 2018, pilot LNE)

Comparisons (continued)

- K1b, K1c, K2 successor (start end of 2017, pilot CENAM) K1a shall not be resumed (effective area by dimensional measurement); K1b: 35 kPa to 350 kPa, gauge mode; K1c: 1 MPa to 7 MPa, gauge; K2: 25 kPa to 200 kPa, absolute

Please, confirm these new CCM KCs.

All RMO KC and SC comparisons are running fine except: SIM.M.P-S1, 100 Pa to 70 kPa: Report in progress, Draft A, time of measurement 2007-2008, bilateral between NIST and NPL/I. Discrepancies appeared, problem on NPL/I side evident. NIST made several attempts to let NPL/I revisit their data, but no reply. Draft B could not completed. Abandon SIM.M.P-S1. In addition: NPL/I and APMP will be asked by WG PV chair to review CMC.

Other activities and documents

Pressure scale – New SI – optical methods

Discussion during conference and PV meeting.

Until now: $$p = \frac{F}{A}$$

Future: $$p = \rho_N k_B T$$

Well accessible by optical methods

$$\frac{\alpha}{2\varepsilon_0}\rho_N = n - 1$$

Other activities and documents

Two statements on selecting CCM.P-KC participants and CMC entries were approved plus one guideline for management of WG PV

End of report