Technical Protocol

Bilateral comparison in the field of liquid (water) flow (0.5 to 30 $m^3.h^{-1}$)

1. Introduction

The comparison is organised within ASEAN Metrology HUB Program. Two National Metrology Institutes take part in this comparison: Research Center for Metrology (RCM)-LIPI (Indonesia) and National Metrology Institute Japan (NMIJ-Japan). RCM-LIPI is acting as the pilot laboratory and in this function is responsible the evaluation of the measurement results and the final report. The comparison will be accomplished in accordance with the APMP Guidelines on Conducting Comparisons and CCEM Guidelines for Planning, Organising, Conducting and Reporting Key, Supplementary and Pilot Comparisons.

2. Travelling standards

The travelling standards are turbines provided by RCM-LIPI covering the range of 0.5 $m^3.h^{-1}$ to 30 $m^3.h^{-1}$ (about 8 $dm^3.min^{-1}$ to 500 $dm^3.min^{-1}$).
Their specifications are as the following:

Manufacturer	FTI	FTI
Model	FT-12AEU3-LEA-0	FT-24AEU3-LEA-0
SN	12013288	2407168
Nominal range	7.57 – 75.71 dm^3/min	56.78 – 567.81 dm^3/min
Output	Pulses	Pulses

3. Quantities to be measured

The following quantity should be measured for each flow rate:

- Output (Pulses) of the standard

4. Measurement instructions

The measurements should be performed according to the following planning:

- September 2016: RCM-LIPI
- October 2016: NMIJ
- November 2016: RCM-LIPI

The measurements should be performed under the following conditions:

- Pressure: 1 bar abs
- Water temperature: 23°C ± 2°C
- Ambient temperature: 23°C ± 2°C

The following flow rate should be reached:

- Turbine FTI Model FT-12AEU3-LEA-0 (SN 12013288)
  - 0.5, 1, 2, 3.5 and 4.5 $m^3.h^{-1}$(8.3, 16.7, 33.3, 58.3, 75 $dm^3.min^{-1}$)
- Turbine FTI Model FT-24AEU3-LEA-0 (SN 2407168)
  - 3.5, 4.5, 10, 20 and 30 $m^3.h^{-1}$(58.3, 75, 166.7, 333.3, 500 $dm^3.min^{-1}$)

5. Reporting of results

A report should be sent to the pilot laboratory within one month after the measurements are completed. The report should include:

- Description of the measurement method
- The reference standard
- The traceability to the SI
- The results of the quantities to be measured (list of section 3)
- The associated standard uncertainties, the effective degrees of freedom and the expanded uncertainties.

The measurement of the air parameter (temperature, pressure and humidity) of the environment must also be recorded and reported (maximum, minimum and mean value).

6. Uncertainty of measurement

The uncertainty must be calculated following the ISO "Guide to the expression of uncertainty in measurement" (GUM) and the complete uncertainty budget must be reported.

7. Transportation

The travelling standard must be transported in a suitable case to protect them from mechanical loads, vibration etc. for transport by plane.
The transportation costs as well as customs clearance are supported by each laboratory when in charge for shipping the standards.

The travel box contains the following items:

- Liquid flow travelling standards with their pipe straightener with flange adapter and rf pickoff for pulses output
- Operating instructions of the travelling standards (this document)

8. Contact

Pilot Laboratory	RCM-LIPI
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Participating Laboratory	NMIJ
Delivery Address	Research Institute for Engineering Measurement (RIEM), National Metrology Institute of Japan (NMIJ) National Institute of Advanced Industrial Science and Technology (AIST) 1-1-1 Umezono, Tsukuba, IBARAKI, 305-8563 Japan
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